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Ref.

Proposed Site Treatment Plan (PSTP)

STP Reference Document

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SAVANNAH RIVER SITE

MIXED WASTE

PROPOSED SITE TREATMENT PLAN (PSTP) (U)

Reference Document

FEBRUARY 22, 1995

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INTRODUCTION

The Department of Energy (DOE) is required by Section 3021(b) of the Resource Conservation and Recovery Act (RCRA), as amended by the Federal Facility Compliance Act (FFCAct), to prepare a plan describing the development of treatment capacities and technologies for treating mixed waste (hazardous/radioactive waste).

DOE decided to prepare its site treatment plan in a three phased approach.

The first phase, called the Conceptual Site Treatment Plan (CSTP), was issued in October 1993. At the Savannah River Site (SRS) the CSTP described mixed waste streams generated at SRS and listed treatment scenarios for each waste stream utilizing an onsite, offsite DOE, and offsite or onsite commercial or vendor treatment option.

The CSTP is followed by the Draft Site Treatment Plan (DSTP), due to be issued in August 1994. The DSTP, the current activity, will narrow the options discussed in the CSTP to a preferred treatment option, if possible, and will include waste streams proposed to be shipped to SRS from other DOE facilities as well as waste streams SRS may send offsite for treatment.

The SRS DSTP process has been designed to address treatment options for each of the site's mixed waste streams.

The SRS Proposed Site Treatment Plan (PSTP) is due to be issued in February 1995. The compliance order would be derived from the PSTP.

The regulators are required by the FFCAct to then approve, approve with modifications, or disapprove each plan within six months and to issue an order requiring compliance with the approved plan.

This document, STP Reference Document which is a supplement to the "Savannah River Site PSTP," supports the third phase of the site's plan.

The purpose of STP Reference Document is to provide the engineering analysis documentation used to develop the waste stream treatment options and selection of *Preferred Options* (PO). The POs are a SRS determination/recommendation and are subject to change based upon state and public comment.

STP Reference Document contains five main sections that make it easy for the reader to understand the process used as well as locate the information being sought.

Section 1.0 describes the methodology and assumptions used to determine POs.

Section 2.0 describes the different treatment facilities and treatment technologies.

Section 3.0 contains the SRS waste stream options analysis. This section is organized numerically by waste stream.

Section 4.0 contains the evaluation for offsite waste streams being treated at SRS.

Section 5.0 contains summary information.

Section 6.0 contains a list of abbreviations and acronyms.

Section 7.0 contains references used in the development of this document.

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Summary of Revisions

Page	Revision No.	Date of Revision
Signature Page	0	02/22/95
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Volume I – Compliance Plan		
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1.0 OPTIONS EVALUATION PROCESS

This section contains three subsections. Subsection 1.1 presents an overview of the three-step process used to identify Preferred Options (POs). Subsection 1.2 presents detailed descriptions of each process step. Subsection 1.3 presents assumptions used in determining POs.

1.1 Process Methodology Overview

This section describes step by step in general terms the evaluation process used to determine POs.

Step 1 Identify Feasible Options

Purpose

To identify existing treatment facilities, existing production facilities with waste treatment capabilities and planned treatment facilities that are technically feasible options for treating the SRS waste streams.

It is assumed that facility modifications, permit modifications, etc., would be achievable.

Performed by

Technical personnel from each treatment and processing facility along with the engineers and scientists assigned to the technical group who developed the Proposed Site Treatment Plan (PSTP).

Step 2 Perform Initial Screening

Purpose

To reduce the number of feasible options by assessing the option's probability of technology success.

The technology success assessment addresses the maturity and complexity of a feasible option to determine "viable" treatment options.

By assigning a Technology Success Factor (TSF) score to each feasible option, the feasible options are ranked. Those feasible options that received a high score become viable options requiring further analysis. Those feasible options that received a low score were rejected.

Performed by

Technical personnel from each treatment and processing facility along with the engineers and scientists assigned to the technical group who developed the PSTP.

Step 3 Perform In-depth Options Analysis

Purpose

To identify a PO for each waste stream.

Performed by

Technical personnel from each treatment and processing facility along with the engineers and scientists assigned to the technical group who developed the PSTP.

1.2 Process Methodology Detailed Explanation

For those low-level mixed waste streams requiring In-Depth Options Analysis (IDOA) to determine the preferred treatment option, the in-depth analysis considered five types of treatment:

- Existing onsite treatment facilities (e.g., F-Area and H-Area Effluent Treatment Facility [ETF]) and facilities under construction (e.g., Consolidated Incineration Facility [CIF])
- Existing production facilities with some potential capability to treat waste or available floor space that could be refurbished to accommodate installation of treatment processes under the "Containment Building" provision of 40 CFR 265
- Planned treatment facilities (e.g., Hazardous Waste/Mixed Waste Treatment Building [HW/MW-TB])
- Vendor processes operated either onsite or at the vendor's facility
- Waste treatment processing available from other DOE sites

Initial Screening

Technology Risk Assessment & Technology Success Factor

Westinghouse Savannah River Company (WSRC) uses a methodology for assessing technology risk of a process or facility based upon *Risk Management Concepts and Guidance* written by the Analytical Sciences Corporation for the Defense Systems Management College. The methodology was originally developed by the Department of Defense (DOD) to assist with evaluation of new weapons systems.

The "risk" assessed in a technology risk assessment is the possibility that a process under consideration may be too new and too complex to perform as expected. This type of assessment is biased in favor of simple and well-established technology. According to the WSRC *Conduct of Engineering Manual E7* Procedure 2.16, some questions to help determine technology risk indicators include:

- Are state-of-the-art advances in technology being used in the design?
- Is the equipment exposed to a harsh or unique environment?
- Does the design require complex integration of control systems or computer software?
- Is the design based on research and development, or does it use mathematical models for prediction?
- Is the cost of recovery from system failure high?
- Is the design evolving as construction is going on?
- Is the design new or an extension of successful existing designs?
- Are familiar components being used in new, non-standard ways?
- Does the facility or process stand alone, or must it interface with other facilities or processes?

Technology risk does not look directly at whether the system is safe. Special analyses done in the design phase of a project ensure that new processes pose no hazard to workers, the public, or the environment.

No process or facility can be simpler than its most complex part or more mature than its newest part. Thus, a technology risk assessment begins with an examination of the whole process or facility to identify the crucial part that has the most complex and the least mature technology. While the interaction of numerous parts and features may result in an overall

process that is even more complex and untried than each individual piece, the identification of this key part is the first step in assessing the probability of a technology's failing.

The probability of failure (Pf) is assigned a "magnitude" based on guidance in Table 1. When engineering assessment indicates the factors fall between the extremes noted, intermediate magnitudes can be assigned.

Table 1 – Probability of Failure

Magnitude	Maturity Factor (Pm)	Complexity Factor (Pc)
0.1	• Components exist. • Performance requirements are specific. • Design is not based on numerous, wide-ranging assumptions.	• Design is simple. • Design is complete before installation begins. • New process or facility has few interfaces with other facilities, or processes.
0.5	• Components are used in non-standard ways. • Requirements are changing. • Design is based on major assumptions that have a significant impact on the design output.	• Design has many interconnected facets. • Construction has begun on some parts of the process or facility without the whole design being finalized. • Process or facility must interface with other process or facilities to achieve overall objectives.
0.9	• Design is state-of-the-art. • Research is still on-going. • Functional processes have not been built. • Requirements are undefined. • Design is based largely on assumption instead of fact.	• Design is very complex. • Design and construction are proceeding almost at the same time. • Process or facility depends on new and extensive software. • Process or facility is a vital part of an interdependent group of other facilities.

Next, a magnitude is assigned to the consequence of failure (Cf). Such consequences range from minor inconveniences from which recovery is quick and inexpensive to technical catastrophes from which recovery, if possible at all, is prolonged and costly. Table 2 provides guidance for assigning the consequence of failure magnitude.

Table 2 – Consequences of Failure

Magnitude	Consequence of Failure (Cf)
0.1 (low)	Minimal, or no consequences, unimportant
0.3 (minor)	Small reduction in technical performance
0.5 (moderate)	Some reduction in technical performance
0.7 (significant)	Degradation in technical performance
0.9 (high)	Technical goal cannot be achieved

For all assessments of the technology risk of the waste treatment options a Cf was chosen equal to 0.7. Should a preferred treatment option suffer a technical failure, it was postulated that the result would be a costly and time-consuming redesign to develop another process that could meet requirements. Until the redesign was complete and implemented, waste treatment performance would be significantly degraded.

The maturity and complexity factors are combined with the consequence factor in an equation to give the risk factor (RF):

First the maturity and complexity factors are averaged:
$(Pm + Pc)/2 = Pf$

Then, the risk factor (RF) can be calculated:
$RF = (Pf + Cf) - (Pf \times Cf)$

The resulting risk factor (RF) is a number between 0.19 and 0.99.
If $Pf = 0.1$ and $Cf = 0.1$, then $RF = (0.1 + 0.1) - (0.1 \times 0.1) = 0.19$
If $Pf = 0.9$ and $Cf = 0.9$, then $RF = (0.9 + 0.9) - (0.9 \times 0.9) = 0.99$

As can be seen from the above, the closer the RF is to 0.99 the greater the technology risk.

In the model used to screen and evaluate waste treatment options, numbers ranging from 0 to 100 were assigned to treatment option attributes, with high numbers representing more desirable features. To make technology risk assessment scores work the same way (high numbers indicating a low technology risk), the risk factor (RF) was converted arithmetically to a number between 0 and 100, called the Technology Success Factor (TSF). The nearness with which a TSF score approaches 100 indicates the degree of simplicity and maturity of a treatment option.

In the initial screening of treatment options, those with low (less than 50) TSF scores were discarded. This does not mean that promising, but immature, technologies will not be considered for treatment of SRS waste. It means only that at this time such technologies remain unproved and cannot be recommended in the Site Treatment Plan. Other departments at SRS are investigating and encouraging such innovative waste treatment technologies. When these technologies mature, the SRS waste management approach will allow incorporating them into the Site's waste treatment program.

In-Depth Options Analysis

After the elimination of those treatment options with a low possibility for technological success, most waste streams still had several viable treatment options. It became necessary to choose the "best" treatment for each waste stream. To determine the best option, all viable treatment options were subjected to an "In-Depth Options Analysis" (IDOA). Comparison among treatment options for a given waste stream is facilitated when each option can be assigned a number that reflects the degree to which the option satisfies a set of criteria or requirements. Such a number aids with the engineering assessment by which one option is chosen over others. The method of developing a numerical ranking of treatment options is known as the **IDOA model.**

The IDOA process took several steps:

1. Attributes by which all treatment processes would be analyzed were determined
2. The relative importance of the attributes was determined.
3. The **IDOA model** was applied to each viable treatment option
4. Engineering assessment took the **IDOA model** results into account with other factors to determine the Preferred Option to treat a given waste stream.

Categories and attributes analyzed were:

Process Parameters
- Volume alteration
- Secondary waste generation
- Destruction, removal, and demobilization efficiency
- Flexibility
- Ability to be shipped
- Final wasteform

Engineering Parameters
- System implementability
- Availability
- Scalability
- Remedial measures
- Schedule for treatment of waste

Personnel Parameters
- Consequences of unmitigated accident scenarios
- Non operational worker potential exposure
- Operational worker potential exposure
- Transportation potential exposure

Regulatory Parameters
- Need for a variance
- Ability to obtain a permit
- Waste disposal

Public Acceptance
- Public acceptance

Cost Considerations
- Life-cycle cost
- Funding availability

Industry Involvement
- Market for technology
- Private sector involvement

"Enabling statements" were provided for clarifying the above attributes to assist with the process experts' evaluation of treatment options. The "enabling statements" appear in Table 3. The attributes and enabling statements formed the basis with which "viable" treatment processes were assessed and compared.

To evaluate a viable treatment option, a team of waste treatment process experts applied the enabling statements to each option. They assigned a number from 0 (low) to 100 (high) to each attribute. The score reflected the experts' assessment of how well the process satisfied the requirement posed by the attribute.

For example, consider the attribute of "Secondary Waste Generation." If the process produced a small quantity, all of which could be handled by existing technologies, the process experts would give the process a "high" numerical rating (median 80). If the process produced as much as 10% additional waste that existing technologies could handle, the process experts rated it "medium" (median 50). If the process produced large amounts of secondary waste, or if existing technologies could not handle the secondary waste, the experts rated it "low" (median 20). If the experts felt a score other than the median better reflected conditions, they could assign another number, provided they gave an explanation for the variation (e.g., in the preceding case, if the process produced 20% additional secondary waste, the evaluation would include a statement such as "subtract 10 points because of additional waste generation").

For the "cost attribute" a team of cost estimators instead of process experts determined the life-cycle cost. The estimators developed:

- **Pre-operating cost** to design and prepare initial documentation for the facility
- **Facility cost** to build and equip a new treatment facility, or modify an existing one

- **Operating and maintenance cost** for the life of the facility
- **Disposal cost** of all final wasteforms in compliance with the Land Disposal Restrictions (LDRs)
- **Decontamination and decommissioning cost** to return the facility to a safe and environmentally benign condition at the end of its useful life.

The process experts' evaluation resulted in a raw *technical* score for each attribute, and inclusion of the cost estimators' life-cycle cost data resulted in a raw *total* score. Nevertheless, these raw scores did not reflect the relative importance of the attributes. The Technical Advisory Committee (TAC), a group of experienced technical experts with backgrounds in engineering design, environmental protection, process technology, safety, and health, appointed to oversee the treatment selection process, recognized that not applying a weighting factor to each attribute assigned the **same weight** to all of them. So, the Technical Advisory Committee assessed the attributes extensively to propose a weight for each factor. The weighting factors were then reviewed and modified by independent reviewers, regulators, and a citizens' focus group. The final weights appear in Table 3.

The weighted technical scores were summed. The total fell between 0 (least preferable) and 100 (most preferable). The sums enabled the treatment option to be ranked according to the **technical weighted score.** Then, the weighted life-cycle cost data were added to the technical weighted score in a way that ensured that the cost of a treatment facility was equitably apportioned among the waste streams that would be processed using that facility. Inclusion of the weighted life-cycle cost data resulted in a **total weighted score.** The IDOA model generated the technical and total weighted scores for each treatment option. These IDOA model scores were useful tools to narrow the entire population of options.

- The IDOA model ensured that the same attributes were analyzed for every process or facility.
- The IDOA model provided some guidance to help make analyses consistent among the facilities.
- The IDOA model enhanced the engineering assessment by incorporating consistent structure and logic.

The application of the IDOA model assures a certain level of consistency and completeness in performing the in-depth analysis of the potential treatment options associated with each waste stream. The primary function of the model is to narrow down the entire universe of possible treatment options to a more manageable number for further analysis and review. The model was not developed to provide a clear PO winner, and the reader is cautioned against believing that the treatment option having the best model score is the PO. On the contrary, the application of the model results in a smaller set of options that may have model scores within a 10% to 15% range of each other that serve as the focus of further analysis. It was not expected, and in practice has not always been the case, that the treatment with the best model score is the PO.

Several of the waste streams also have treatment options proposed by outside vendors. Many of these vendors' options, however, remain unproven technologically. The vendors have primarily offered to perform studies to demonstrate that their technology can produce a wasteform that will meet Land Disposal Restrictions. A separate task team is working with the vendor proposals to determine which technologies appear worthy of further investigation. As rapidly as procurement rules allow, and as completely as budgetary constraints permit, contracts are being made with vendors to pursue the most promising innovative treatment methods.

Nonetheless, the technical viability of these technologies has been assumed and vendor processes have been hypothesized to permit application of the IDOA model and development of a comparison of the potential vendor processes with other treatment options.

In the months ahead, successful vendors' studies will be translated into actual process designs that can be compared with the preferred options selected. This comparison will solidify the conclusions drawn from the hypothetical vendors' processes, and may reveal a vendor treatment technology for a waste stream that is preferable to the option previously favored.

Table 3 – Attributes and Enabling Statements For Options Analysis

Wt.	Attribute	High Score Median 80	Medium Score Median 50	Low Score Median 20
22%	PROCESS PARAMETERS			
5%	Volume Alteration	A factor of 5 reduction of waste occurs.	The volume is maintained at 1:1 after processing.	The volume is increased by a factor of 2 or more after processing.
4%	Secondary Waste Generation	A small quantity is produced, all of which can be handled by existing technologies.	An additional amount of waste, in the range of 10%, is generated, which can be handled by existing technologies.	Large quantities are produced or existing technologies are not available for treatment.
2%	Destruction Removal, and Demobiliza-tion Efficiency	All applicable LDR standards are met.	Additional LDR treatment is required for some of the constituents; technology exists.	Additional treatment is required to meet requirements, and technology does not exist, or requires modification.
3%	Flexibility	The process can treat waste streams of similar compositions to that assumed as a design basis without producing a final wasteform that fails to meet requirement. The process does not need to be reconfigured or monitored with special care to meet throughput specifications.	The process can treat waste streams of similar compositions to that assumed as a design basis without producing a final wasteform that fails to meet requirement; but the process must either be reconfigured or monitored with special care to meet throughput specifications.	The process cannot treat waste streams of compositions that differ from that assumed as a design basis. Special care must be taken to monitor influent streams to ensure that they conform to the composition assumed as a design basis.
2%	Ability to be Shipped	Treatment residuals meet shipping requirements without any additional treatment.	Treatment residuals require simple physical treatment to meet shipping requirements.	Treatment residuals require extensive treatment to meet shipping requirements or technologies do not exist.
6%	Final Wasteform	Wasteform meets the expected disposal WAC.	Final forms require additional treatment to meet disposal WAC; technologies exist.	A significant additional treatment is required before disposal or technologies do not exist.

Table 3 – Attributes and Enabling Statements For Options Analysis (contd)

Wt.	Attribute	High Score Median 80	Medium Score Median 50	Low Score Median 20
19%	ENGINEERING PARAMETERS			
13%	System Implement-ability	Most of the elements and processes have been previously demonstrated on similar uses and applications.	50% or fewer of the elements have been previously demonstrated on similar uses and applications.	Few or none of the elements have been demonstrated.
3%	Availability	Key components arranged in similar systems have resulted in availability greater than 80%.	Process is expected to be available about 50% of the time.	Process is expected to be available about 20% of the time or large uncertainties exist in ability to predict availability.
1%	Scalability	Process can be easily expanded to take advantage of economies of scale. Also, process goes from laboratory-scale directly to plant-scale.	Process can accept a range of input but has limitations for expansion. Also, pilot-scale tests are required before plant-scale design.	Process cannot be expanded to take advantage of economies of scale. Also, laboratory or pilot-scale testing would be impractical or not yield meaningful results. Plant-scale design must come directly from engineering calculations.
1%	Remedial Measures	Process failure or malfunction does not create a waste that cannot be treated by other means; alternative treatment methods for the original waste exist and can be implemented within three months of recognition of need.	Process failure or malfunction creates other wastes that must be characterized to determine treatability; alternative treatment methods must be developed to treat new waste created by the process malfunction.	Process failure or malfunction creates other wastes for which there is no known treatment; no alternative methods for treatment of original waste exist.
1%	Schedule For Treatment of Waste	A schedule for addressing and processing waste can be determined with high confidence.	Some technology issues can produce uncertainty in schedule development. System complexities may prolong schedule.	Availability, technology, or flexibility issues severely limit confidence in developing schedules. Extensive training and system and operational complexity may also create problems.

Table 3 – Attributes and Enabling Statements For Options Analysis (contd)

Wt.	Attribute	High Score Median 80	Medium Score Median 50	Low Score Median 20
20%	PERSONNEL PARAMETERS			
6%	Consequence of Unmitigated Accident Scenarios	There are little or no facility emissions for routine operations or under all but the most catastrophic accidents.	There are little or no emissions for routine operations but significant releases occur under most accident scenarios.	There are marginally acceptable releases under routine operations or extensive releases under most accident scenarios.
6%	Non operational Worker Potential Exposure	Significantly fewer workers required to construct and decommission a facility with the proposed process as compared to other technologies. There is lower than average non-routine maintenance.	Average number of workers and non-routine maintenance required.	The process is more complex than average facility construction. Non-routine maintenance and decommissioning is required.
6%	Operational Worker Potential Exposure	There are significantly fewer workers potentially exposed or the potential exposure is much lower than average.	There are an average number of workers and potential exposure levels.	There are a greater than average number of workers or there is a greater than average potential exposure to the work force.
2%	Transporta-tion Potential Exposure	No transportation of treated or untreated waste is required.	Limited additional characterization is required to support transportation, no new packaging/ certification facilities required, and limited number of waste transports are required.	Significant additional waste characterization is required for transportation, new packaging/ certification facilities are required, a large number of waste transports are needed, or a large number of miles are required for each waste shipment.
14%	REGULATORY PARAMETERS			
4%	Need For Variance	Processes are in full compliance will all applicable regulations with little or no difficulty or with no process modifications.	Processes are in partial compliance will all applicable regulations with little or no difficulty. Full compliance may be achieved through requests for variances or with limited modifications to the process.	Majority of the applicable regulations cannot be met without vast modifications to the process or other extensive variances.

Table 3 – Attributes and Enabling Statements For Options Analysis (contd)

Wt.	Attribute	High Score Median 80	Medium Score Median 50	Low Score Median 20
6%	Ability To Obtain A Permit	Permitting process is well-defined and relevant precedents for success have been established. Similar processes have been previously permitted by the regulatory agencies (primarily SCDHEC) with little or no difficulty.	Process or key elements have been permitted elsewhere, but some key differences may exist (for example, differences in waste streams or waste stream characterization). Similar processes have been previously permitted by the regulatory agencies (primarily SCDHEC) with moderate difficulty.	The process is unproved technology or a new arena of application or the need for multiple permits builds in substantial permitting barriers. Similar processes have been previously permitted by the regulatory agencies (primarily SCDHEC) with extreme difficulty or have never been previously permitted.
4%	Waste Disposal	80% of both primary and secondary wastes have been rendered non-hazardous. The other 20% remain hazardous.	50% of both primary and secondary wastes have been rendered non-hazardous. The other 50% remain hazardous.	80% of both primary and secondary wastes remain hazardous. The other 20% have been rendered non-hazardous.
Wt.	Attribute			
15%	COST CONSIDERATIONS			
14%	Life-cycle Cost ***Costs Developed According To DSTP Cost Guidance Rev. 1.*** Costs are estimated for • pre-operating costs • facility costs • operating and maintenance costs • disposal cost • decontamination and decommissioning costs The SUM of the above costs is assigned a score in proportion to where it falls between $1 and $35 million, the higher the cost, the lower the score. Any cost totaling more than $35 million receives a score of zero.			
Wt.	Attribute	High Score Median 80	Medium Score Median 50	Low Score Median 20
1%	Funding Availability	Life-cycle costs can be supported within target budget.	Life-cycle costs can be supported with less than 10% increase in target funding levels.	Line item funding required at high levels.

Table 3 – Attributes and Enabling Statements For Options Analysis (contd)

Wt.	Attribute	High Score Median 80	Medium Score Median 50	Low Score Median 20
1%	INDUSTRY INVOLVEMENT			
0.5%	Market For Technology	Numerous markets are identified within and outside DOE; more than three DOE and commercial nuclear facilities have similar wastes.	More than one market is identified within and outside DOE; two DOE and commercial nuclear facilities have similar wastes.	No markets or needs are identified; SRS waste is unique.
0.5%	Private Sector Involvement	Private sector technology company is identified with experience and interest and the company has experience in permitting activities; a vendor has submitted a proposal and has permitting experience.	A private sector party has expressed an interest; however, has little or no experience in this type of activity or permitting process; a vendor with non-technical experience has submitted a proposal.	No private sector companies have expressed an interest or a need for the technology.

Engineering Assessment

The last step in the IDOA was to perform an engineering assessment, taking into account the score generated by the IDOA model. While application of the IDOA model analyzed the degree to which the treatment option satisfied the requirements of the prescribed attributes, engineering assessment took a broader perspective. The engineering assessment considered other less tangible factors without which any decision making process would be shallow and superficial. The engineering assessment identified the preferred option.

1.3 Assumptions

This section contains assumptions made in the development of the SRS PSTP.

DOE Assumptions

All sites used the following assumptions to provide a degree of consistency in the preparation of the PSTP. The assumptions were developed as a part of the "Draft Site Treatment Plan Development Framework" and reflect review and comment from the states and EPA.

- High-level waste (HLW) will continue to be managed according to current plans at each site (i.e., Hanford, West Valley, Savannah River, Idaho National Engineering Laboratory). Primarily due to safety concerns, HLW will not be transported offsite except as a treated, stable waste that is ready for disposal.

- Regarding defense-related transuranic (TRU) waste, the PSTPs will reflect DOE's current strategy on the Waste Isolation Pilot Plant (WIPP) opening and receiving a No Migration Variance (NMV). A NMV is approved if the disposal facility can be shown to protect the environment. Wastes disposed in such a unit are not required to meet the LDR treatment standards. The PSTPs will identify characterization, processing, and treatment of TRU waste to meet the WIPP Waste Acceptance Criteria

(WAC). Consistent with this policy, treatment of mixed TRU waste to meet LDR standards will not be included in the PSTP.

The STPs will recognize that DOE's policy regarding WIPP is under review and may change in the future. The STPs will provide the flexibility to modify activities and milestones regarding TRU waste to reflect potential future changes in DOE policy.

Under current DOE policy, non defense-related TRU waste will not be disposed at WIPP. PSTPs should reflect LDR treatment of non-defense mixed TRU waste.

- DOE recognizes some states' preference for treatment of all wastes onsite. Where appropriate, existing onsite capacity will be utilized before new facilities are constructed. When onsite treatment or use of commercial or mobile facilities is not feasible, the use of existing offsite capacity, as well as the construction of new facilities, will be considered.

- Sites in the same state will investigate the practicality of consolidating treatment facilities.

- Mixed waste resulting from Environmental Restoration (ER) and Decontamination and Decommissioning (D&D) activities will be factored into planning activities and equity discussions to the extent known, particularly where utilization of facilities in the PSTP are being considered for managing ER and D&D mixed waste streams. The PSTP will propose a strategy for the inclusion of ER and D&D mixed waste streams and other future waste streams into the site treatment plans or compliance order.

- The PSTP will address all wastes in the updated Mixed Waste Inventory Report (MWIR). Any changes /corrections to the MWIR waste streams and treatment facility information will be explained in the PSTP.

- On a volume basis, most of DOE's mixed waste will be treated onsite. Because of transportation concerns and costs, this includes process wastewater, some explosives, and remotely handled waste. In addition, other large volume waste streams generally will be treated onsite. At a minimum, Richland (RL), Oak Ridge (OR), Idaho (ID) and Savannah River (SR) will have onsite facilities to treat the majority of their wastes.

- The Programmatic Environmental Impact Statement (PEIS) is being performed in parallel with the development of the STPs. The PSTP process will provide information to the PEIS. Each site will prepare any necessary specific National Environmental Policy Act (NEPA) documentation before proceeding with a given project or facility required by the state or EPA as a result of the STP process.

- In support of DOE's cradle to grave waste management philosophy, disposal site location and criteria will be factored into state equity discussions, waste treatment facility designs, and the characteristics of the final wasteforms.

In addition to the general DOE complex-wide assumptions, SRS developed site-specific assumptions for use in developing the PSTP.

General Assumptions

- To the extent possible, all waste streams in the Mixed Waste Inventory Report will have a preferred treatment option identified and/or option analysis complete in the PSTP. Those waste streams without a preferred treatment option will have a schedule for the development of the preferred option.

- All Savannah River Site high-level mixed waste will be treated onsite.

- ER, Transition, and D&D waste streams will be addressed in the PSTP to the extent that they are known. The site treatment plan does not address corrective action or remedial action pursuant to RCRA, Hazardous and Solid Waste Amendments, or CERCLA that do not involve the land disposal of hazardous waste (e.g., the placement of remediation wastes into or within a corrective action management unit). Corrective action or remedial action issues shall be addressed by the CERCLA Section 120 Federal Facility Agreement (FFA) effective August 16, 1993, and any hazardous waste permits issued or to be issued by the State of South Carolina and EPA or other actions under CERCLA. Methodology for modifying the PSTP for new ER, Transition, and D&D waste streams will be incorporated into the text of the document. SRS is negotiating the classification of Investigation Derived Waste (IDW). Treatment for the IDW waste streams is not anticipated to be selected in the Proposal Site Treatment Plan. However, the IDW waste streams are discussed in Volume 2, Chapter 6, and they are listed in the Reference Document.

- If existing onsite treatment capacity is available for a particular waste stream, no further analysis will be performed for that waste with the exception of waste streams going to the CIF. To be responsive to stakeholders, alternatives to incineration were addressed. Existing mixed waste treatment facilities are those facilities at Savannah River Site that are either presently operating or under construction (i.e., having been issued regulatory operating or construction permits). Existing mixed waste treatment facilities at the Savannah River Site include Savannah River Laboratory High Activity and Low Activity Treatment Tanks, M-Area Liquid ETF, F- and H-Area ETF, and Z-Area Processing Facility, DWPF, and CIF. Existing non-RCRA disposal facilities include the E-Area Vaults and the Z-Area Saltstone Disposal Vaults.

- Treatment options analysis has not been performed in the DSTP or the PSTP for the six original streams which served as a design basis for treatment by the M-Area Vendor Treatment Process. Options analysis was conducted previous to site treatment plan preparation and resulted in the selection of this treatment process which produces a superior wasteform. Other SRS waste streams for which this technology is appropriate treatment will be considered. For purpose of this PSTP, M-Area Vendor Treatment Process is considered to be a new facility because of the anticipation that permits that have been submitted will be issued.

- Treatment schemes such as treatment in containers or containment buildings, privatization, mobile treatment, and others have been and will be investigated.

- The PSTP will not address moratorium waste in the preferred option analysis process.

- The level of detail for option analysis will vary in the PSTP from waste stream to waste stream.

- The five-year window for waste forecasting will continue to be used as established in the Final MWIR (1995 through 1999).

- In all relevant PSTP flow diagrams, after the waste has been removed from the containers, the containers will be considered "empty" according to R61-79.261.7 of South Carolina Hazardous Waste Management Regulations (SCHWMR), thus requiring no treatment.

- Cost and schedule analyses will be performed for the viable options only. Viable options are those which in-depth technical analysis have determined to present a reasonable potential to become the preferred treatment option for that waste stream.

- Determination of viable options for in-depth option analysis to determine the preferred option will be limited to options which meet the Land Disposal Restriction requirements.

- For the flow diagrams, after the waste has been removed from the containers, the containers will be considered "empty" according to 40 CFR 261.7 thus requiring no treatment.

In-Depth Options Analysis Assumptions

1. For the purpose of this analysis, the CIF will be defined as including incineration, neutralization, and stabilization of a waste stream. The waste feed stream will either consider liquid feed incineration, solid feed incineration, liquid feed stabilization or solid feed stabilization. The resultant wasteform of each incineration feed stream will be stabilized.

2. For Waste Stream SR-W013, Low-Level Waste (LLW) Lead – to be Decontaminated, it is assumed that 50% of the waste stream volume can be recycled while the remaining 50% will require disposal.

Estimating Assumptions

1. Moderate hazard HW/MW building (approx. 12,500 ft^2 primarily to handle tritiated waste) cost = $9,000,000.

2. Low hazard HW/MW building (approx. 100,000 ft^2) cost = $27,000,000.

3. Refurbishment of a containment building = $4,000,000.

4. Containment building renovation cost $400/$ft^2$; area for a containment building = 10,000 ft^2 (q.v. Assumption #6). Renovation required not only to make building useful but also to meet DOE order requirements.

5. As many as four processes can occupy the same containment building.

6. Refurbishment costs include:

   - Installation of process equipment
   - All utilities
   - Decontamination as needed
   - Equipment in common use (e.g., fork lifts, ventilation)
   - Bringing building up to 6430.1A specifications

7. Tritium containment refurbishment cost = $1,000,000.

8. Operations and Maintenance (O&M) costs based on:

   - Vendor or SRS operation of the process
   - If vendor processing, amount of SRS support needed for vendor
   - Complexity of the process

9. Disposal cost is based on the expected volume and type of waste. Vendor disposal costs based on expected volume derived from knowledge of the vendor process and the final wasteform. LLW disposal cost $17/ ft^3, based on the volume and capital cost of the low activity vaults and HW/MW disposal cost $215/$ft^3$, based on information on p. 38 of *FY 1993 SRS Waste Cost Analysis (U)* (document WSRC-RP-93-942, Revision 1).

10. RCRA Part B permit cost = $2 million, including the cost of developing a compliance demonstration under South Carolina R.61-104.

11. RCRA Part A permit cost = $125,000

12. Wastewater Permit Cost = $125,000

13. Resource recovery requires no processing permit.

14. Containment building modifications to a canyon (i.e., SR-W009) = $500,000.

15. Tankage etc. will be added to M-Area acid treatment of cadmium coated filter frames to cover miscellaneous expenses.

16. On waste stream SR-W034, the vendor will require a space to be provided, but SRS can install the process in a laboratory, which is inaccessible to a vendor. Thus SRS building costs are less than the vendor's.

17. SR-W051 waste filter cartridges are contaminated with mercury. A space exists onsite in which the cartridges can be transferred from storage boxes to cardboard boxes for incineration without incurring additional building refurbishment costs.

18. The type of RCRA disposal (Sub-part C or Sub-part D) has little or no impact on the assumed disposal costs in a preliminary planning estimate.

19. Floor space exists at tritium to install a mercury still in a glove box, and connect the glovebox to existing tritium control system = $1 million.

20. Decommissioning and decontamination costs = 80% of capital cost.

21. Closure and post-closure costs = 5% of disposal costs.

22. Additional waste streams sent to CIF for incineration will not increase the cost of decommissioning and decontamination either of the incinerator, or the ashcrete facility.

23. For those waste streams for which IDOAs were done, when the cost of a small volume waste was "included with" the cost of a large volume, the small volume waste's prorated share of the total cost was so small that it was for practical purposes assumed to be zero.

PSTP cost estimates and assumptions were based on information that appears in these documents:

1. "M-Area Waste Disposal Alternative Economic Evaluation," EWR 867173 WSRC SE, B. J. Collins, January 1991.

2. "Economic Study of M-Area Waste Disposal Alternatives (U)," NMP-RMT-91-0108, H. L. Martin & J. B. Pickett, April 22, 1991.

3. "Waste Preparation Facility Planning Estimate Capital and Operating Cost," WSRC-RP-91-631, D. K. Noller, June 6, 1991.

4. *Cost Guide, Economic Analysis: Methods, Procedures, Life-cycle Costing, and Cost Reviewing/Validating*, DOE/MA-0063, Volume 1. January 1982.

5. "Hazardous Waste/Mixed Waste Treatment Building Throughput Study (U)," WSRC-RP-91-1220, J. L. England and J. P. Kanzleiter, December 18, 1991.

6. *SRS Mixed Waste Characterization Catalog for the HW/MW DF*, WSRC-TR-90-226, M. S. Hay, et al., May 31, 1990.

7. *A Perspective of Hazardous Waste and Mixed Waste Treatment Technology at the SRS (U)*, WSRC-MS-91-117, J. L. England et al., June 28, 1991.

8. "Preliminary Planning Cost Estimate for Vitrification Alternatives of Mixed Waste (U)," WSRC-RP-92-1209, J. L. England, October 15, 1992, Rev. 0.

9. "Feasibility Study for the Evaluation of Leachate Treatment at Existing Wastewater Treatment Facilities at SRS (U)," WSRC-RP-91-811, October 15, 1991, J. L. England, et al., Rev. 0.

10. "Life-cycle Cost Analysis Changes Mixed Waste Treatment Program at the SRS, WSRC-MS-92-346, J. B. Pickett, et al.

11. "F/H Area Seepage Basins Abandoned Process Sewer Lines Outside the Security Fence Preliminary Screening Treatment Alternatives Study (U)," WSRC-RP-92-839, J. L. England, June 30, 1992, Rev. 0.

Various Costs For Treatment Options

This section contains equipment costs, fees, and building modifications for input into cost estimates.

	(Cost x $1,000)
SR-W009	
Containment Building or HW/MW – Stainless Steel Box	
Drum opener	5
Remote drum handling equipment/crane	200
Welding equipment	0
Health protection equipment	350
Containment Building – Metathesis	
Drum opener	5
Remote drum handling equipment/crane	200
Welding equipment	0
Health protection equipment	350
Reactor vessel and piping	500
Vendor – Polymer	
1/2 containment building	2,000
Vendor fee	4,000
Vendor – Cement	
Cement stabilization will require 1/2 containment building	2,000
SR-W011	
M Area	
Tankage	100
Material handling equipment	100
1/2 of cost to restart M Area after completion of original contract	1,000

Containment Building or HW/MW – Stainless Steel Box	
Welding equipment	50
Material handling equipment	100
1/4 containment building	1,000
HW/MW	
Welding equipment	50
Material handling equipment	100
1/4 low hazard HW/MW	7,000

SR-W012

CIF Incineration	
Repackaging area 400 ft^2 @ \$400/ft^2	400
Material handling equipment	50
Secondary containment 100 ft^2 @ 1000/ft^2	100
Shredder/packager	150
Incineration (per S. R.. Crook's cost estimate of 5/3/94) \$30/ft^3 x 71000 ft^3 Labor = 6000 mhr/yr	2130
Disposal 2000 ft^3 @ \$215/ft^3	430

SR-W013

Containment Building – Decontamination	
Material handling equipment	100
Tankage	200
Precipitation system	500
Filter system	100
Stab. system	100
Pumps and piping	150

SR-W014

Containment Building – Distill/Reuse	
Material handling equipment	100
Assay equipment	350
Still/condenser	200
Pumps and piping	150
Connection with tritium offgas system	200
Nitrogen purge system	150
Glovebox	100
Tritium containment building refurbishment	1,000
Containment Building or HW/MW – Amalgamation	
Material handling equipment	100
Assay equipment	350
Still/condenser	200
Pumps and piping	150
Connection with tritium offgas system	200
Amalgamation equipment	200
Tritium containment building refurbishment	1,000
1/3 moderate hazard HW/MW	3,000

SR-W015

Containment Building		
Size reduction equipment	25	
Material handling equipment	50	
Welding equipment	50	
Building refurbishment 2500 ft^2 @ \$400/ft^2	1,000	
Containers 253.3 ft^3 x 2 packing factor = 500 ft^3 500 ft^3 /96 ft^3 = 6 containers @ \$2000	assume nil	
Labor 4 people for 1 yr.	8000	Mhrs
Disposal 500 ft^3 x \$215 =	150	
Containment Building – Roast and Retort		
Size reduction equipment	25	
Glove box	50	
Waste handling equipment	50	
Hg oven and condenser	300	
Assay equipment	300	
Piping	150	
Connection with tritium control system	200	
Building refurbishment 5000 ft^2 x \$400 ft^2	2,000	
Labor 2 people for 4 years	16,000	Mhrs
Disposal	150	
In Situ Macro 90-Day Generator		
Size reduction equipment	25	
Material handling equipment	50	
Welding equipment	50	
Containers	assume nil	
Labor 2 people for one year	4,000	Mhrs
Disposal	150	
ICPP		
253,000 lt x 2.2 #/kg x 7.86 spgr x .5 Packing factor x \$7.5/#	16,500	
Transportation 2200 mi @ \$4/mi	10	

SR-W018

M Area – Vitrification		
Saw	5	
Glovebox	25	
Vitrification overheads (electricity)	100	
Work prep area	100	
Vendor fee (70k gal x \$10/gal)	700	
CIF – Ashcrete		
Shredder	100	
Material handling equipment	100	
Packaging equipment	100	
1/4 containment building for shredder	1,000	
Containment Building or HW/MW – Stainless Steel Box		
Welding equipment	50	
Material handling equipment	100	
1/4 containment building	1,000	
1/4 low hazard HW/MW	7,000	

CIF – Incineration

Shredder	100
Material handling equipment	100
Packaging equipment	100
1/4 containment building for shredder	1,000

SR-W031

Vendor – Polymer & Cement

No containment building overhead cost assigned to this waste because of its small volume.

Containment Building – In-Drum Stabilization

1/2 refurbish in-drum stabilization equipment (see SR-041 aqueous Pb)	50
1/2 health protection equipment	175

M Area – Vitrification

Vendor fees	10
Work area preparation	100

SR-W034

Containment Building – (Lab) Oxidation

Material handling equipment	50
Reactor	50
Pumps and piping	50
Lab refurbishment	100

Vendor – Oxidation

1/4 containment building refurbishment	1,000
Vendor fee	250

M Area – Acid Leaching

Tankage	100
Material handling equipment	50
Pumps and piping	100

Vendor – Encapsulation

1/4 containment building refurbishment	1,000
Vendor fee	4,000

SR-W036

Storage and Incineration

Equipment = 5,000 gal x $4.10/gal	20	
Labor = 8 mhrs/drum x 90 drums	720	Mhrs
Storage = 65 years at $25K/yr	1,625	
Escalation = 3%/yr to the mid-point of a 65-year span	3	
Disposal = 5,000 gal x 0.13 ft^3/gal x 0.2 volume reduction factor x $45/$ft^3$	6	

Mobile Unit		
Labor = 8 mhrs/drum x 90 drums	720	Mhrs
Treatment = 5,000 gal x 6.6 lbs/gal x $5.50/lb	200	
Disposal = 5,000 gal x 0.13 ft^3/gal x 0.2 volume reduction factor x $45/$ft^3$	6	
Equipment and construction to prepare for arrival of mobile unit	300	
Variance		
Cost to obtain variance	200	
Disposal = 5,000 gal x 0.13 ft^3/gal x $45/$ft^3$	50	
SR-W041 Aqueous Lead		
Vendor – Precipitation		
Vendor fee	250	
1/4 containment building	1,000	
Containment Building – In-Drum Stabilization		
1/2 refurbish in-drum stabilization equipment (see SR-W031)	50	
1/2 health protection equipment	175	
SR-W042		
CIF – Incineration		
Material handling equipment	50	
SR-W047		
M Area – Wastewater Treatment and Vitrification		
Work area prep	100	
Tankage	100	
Pumps and piping	100	
Clarification/filtration system	500	
Vendor fee	1,000	
Electricity	100	
M Area – Vitrification		
Work area preparation	100	
Tankage	100	
Pumps and piping	100	
Vendor fee	3,000	
Electricity	300	
CIF – Recycle to Ash Tank		
Piping	100	
SR-W048		
M Area – Vitrification		
Material handling equipment	100	
Electricity	50	
Vendor fees	50	
Work area preparation	100	
1/2 of cost to restart M Area after completion of original contract	1,000	

Vendor – Cement	
Vendor fee	1,500
Entire containment building	4,000
Vendor – Polymer	
1/2 containment building	2,000
Vendor fee	750
Vendor – Soil Washing	
Vendor fee	2,500
1/2 containment building	2,000
Vendor – Chelation	
Vendor fee	1,500
1/2 containment building	2,000
HW/MW – Soil Washing	
Material handling equipment	100
Tankage	300
Settlers/clarifiers	300
Pumps and piping	300
Agitators	100
Size reduction equipment	100
Stabilization equipment	200
1/4 low hazard HW/MW	7,000
SR-W049	
CIF – Ashcrete	
Material handling equipment	100
Size reduction equipment	100
1/4 containment building	1,000
SR-W055	
CIF – Incineration	
Material handling equipment	100
Storage building - no cost	
SR-W060	
Containment Building (Tritium) – In Situ Roast and Retort	
Hot tap equipment	10
Glovebox	25
Electric heaters	100
Electrical	150
Condenser	100
Piping	100
Connection with tritium offgas system	150
Containment building refurbishment	2,000
Materials handling equipment	150
Assay equipment	50
Containment Building (Tritium) – Roast and Retort	
Drum opening equipment	50
Glovebox	50
Mercury oven and condenser	300

Electrical	50
Condenser	150
Piping	100
Connection with tritium offgas system	150
Containment building refurbishment	2,000
Materials handling equipment	200
Assay equipment	100

SR-W061

Containment Building – Distill Reuse	
Glovebox	50
Mercury still and condenser	100
Materials handling equipment	50
Assay equipment	100
Containment building refurbishment	150
Containment Building – Amalgamation	
Glovebox	50
Mercury still and condenser	100
Amalgamation equipment	200
Materials handling equipment	50
Assay equipment	100
Containment building refurbishment	150
HW/MW-TB – Amalgamation	
Glovebox	50
Mercury still and condenser	100
Amalgamation equipment	200
Materials handling equipment	50
Assay equipment	100
HW/MW-TB construction	150

SR-W062

In Situ/Containment Building – Macroencapsulation	
Welding equipment	100
Materials handling equipment	50
Assay equipment	100
Containment building refurbishment @ $400/square foot x 3,000 square feet	1,200
2,200 m^3 of waste/50% packing factor = 4,400 m^3 of ss containers @ $2,000/2.8 m^3	3,200
2,200 m^3 of waste/50% packing factor = 4,400 m^3 of temporary containers @ $400/2.8 m^3	650
Labor = 4,000 manhours/year for encapsulation not including D&D time	
HW/MW Treatment Building – Macroencapsulation	
Welding equipment	100
Materials handling equipment	50
Assay equipment	100
Treatment building construction @$300/square foot x 3,000 square feet	900
2,200 m^3 of waste/50% packing factor = 4,400 m3 of ss containers @ $,000/2.8 m^3	3,200
2,200 m^3 of waste/50% packing factor = 4,400	650

m^3 of temporary containers @ \$400/2.8 m^3
Labor = 4,000 manhours/year for encapsulation not including D&D time

SR-W068

Containment Building – Distill/Reuse		
Material handling equipment	100	
Assay equipment	50	
Still/condenser	200	
Pumps and piping	150	
Ventilation system	200	
1/4 containment building refurbishment	1,000	
Containment Building or HW/MW – Distill/Amalgamate		
Amalgamation equipment	200	
Material handling equipment	100	
Assay equipment	50	
Still/condenser	200	
Pumps and piping	150	
Ventilation system	200	
1/4 containment building refurbishment	1,000	
1/3 cost of moderate hazard	3,000	

SR-W069

Containment Building – Macroencapsulation		
Material handling equipment	100	
Polymer storage, transfer, extruder, evaporator	3,500	
HW/MW – Macroencapsulation		
Material handling equipment	100	
Polymer storage, transfer, extruder, evaporator	3,500	
1/4 low hazard building cost	7,000	

SR-W070

CIF Incineration		
Equipment = 633 gallons x \$4.10/gallon	3,000	
Labor = 8 manhours/drum	100	Mhrs
CIF Ashcrete		
Equipment = \$187 x 24 drums of solidified waste	5,000	
Labor = 12 manhours/drum of solidified waste	300	Mhrs
Vendor – Stabilization		
Building = 1,000 square feet x \$400/square foot	400	
Labor = 12 manhours/drum of solidified waste	300	Mhrs

SR-W071

CIF Incineration		
Equipment = 4,226 gallons x \$4.10/gallon	18	
Labor = 8 manhours/drum	614	Mhrs

CIF Ashcrete

Equipment = $187 x 24 drums of solidified waste	29	
Labor = 12 manhours/drum of solidified waste	1,844	Mhrs

Vendor – Stabilization

Building = 1,000 square feet x $400/square foot	400	
Labor = 12 manhours/drum of solidified waste	1,844	Mhrs

SR-W072

Containment Building – Assume no reduction in Volume Due to Onsite Segregation

Size reduction equipment (saw)	100
Secondary containment equipment	500
Material handling equipment	200
1,000 m^3 of waste/50% packing factor = 2,000 m^3 of stainless steel containers at $2,000/2.8 m^3	1,500
Disposal = 35,000 cubic feet waste at 50% packing = 70,000 cubic feet disposal x two-thirds @ $45/cubic feet and one-third @ $215/cubic feet	7,100
Welding equipment	150

HW/MW-TB – Assume no reduction in Volume Due to Onsite Segregation

Size reduction equipment (saw)	100
Secondary containment equipment	500
Tankage	500
Material handling equipment	500
Building (incremental cost) 1,000 square feet at $300/square foot	300
1,000 m^3 of waste/50% packing factor = 2,000 m^3 of stainless steel containers at $2,000/2.8 m^3	1,500
Disposal = 35,000 cubic feet waste at 50% packing = 70,000 cubic feet disposal x two-thirds @ $45/cubic feet and one-third @ $215/cubic feet	7,100
Welding equipment	150

ICPP

2,000 m^3 = 2,000,000 lt x 2.2 kg/lb x 7.86 (spgr of iron) x .8 (bulk density ratio) = (approximately) 27,600,000 lb of waste at $7.50/lb	10,300
Disposal = 35,000 cubic feet waste at 50% packing = 70,000 cubic feet disposal x two-thirds @ $45/cubic feet and one-third @ $215/cubic feet	7,100

SR-W073

CIF Repackaging

Repackaging area 400 square feet @ $400/square foot	16
Secondary containment 400 square feet @ $1,000/square foot	400
Materials handling equipment	150
Labor 2,000 manhours in one year	
CIF incineration costs essentially zero	

Containment Building – Polymer Encapsulation

Materials handling equipment	150
Contractor services	200
Labor = 500 manhours in one year	

2.0 TREATMENT FACILITIES AND TREATMENT TECHNOLOGIES

2.1 Existing Facility Descriptions

This section describes existing SRS facilities considered in options analysis. It should be noted that the contract for M-Area Vendor Treatment Process has been awarded, so it is considered "existing" even though the equipment has not been installed.

2.1.1 M-Area Liquid Effluent Treatment Facility (LETF)

Facility Description

The M-Area Liquid Effluent Treatment Facility (LETF) consists of three closely related processes:

1. Chemical Transfer Facility (CTF)
2. Process Waste Interim Treatment/Storage Facility (PWIT/SF)
3. Dilute Effluent Treatment Facility (DETF)

Chemical Transfer Facility (CTF)

CTF treated concentrated spent process solution from reactor materials production facilities. The only part of CTF now in use is a slurry tank and pumps, in which DETF filtercake is mixed with caustic and pumped to PWIT/SF. CTF operates under a South Carolina Department of Health and Environmental Control (SCDHEC) Industrial Wastewater Treatment Permit.

Process Waste Interim Treatment/Storage Facility (PWIT/SF)

PWIT/SF is a SCDHEC Interim Status Hazardous Waste Treatment and Storage facility. The facility employs six 35,000 gallon storage tanks and four 500,000 gallon storage tanks. These tanks contain waste slurry that has separated into a thick sludge and a clear supernatant liquid. Supernatant liquid is treated in the DETF, and the sludge is treated by vitrification (see below).

Dilute Effluent Treatment Facility (DETF)

DETF is an industrial wastewater treatment facility using the Environmental Protection Agency's (EPA's) Best Demonstrated Available Technology (BDAT) for metal finishing and aluminum forming industries. This treatment precipitates metal ions from dilute wastewater and separates the precipitate by filtration. The filtercake is transferred to PWIT/SF via CTF, where it is stored awaiting vitrification. The filtrate is collected and analyzed. If it meets National Pollution Discharge Elimination System (NPDES) release specifications, it is discharged to a surface stream.

Capacity

LETF is permitted to release 86,000 gallons per day to surface water. The facility throughput depends on the amount of suspended solids in the stream feeding the filters. Currently, the amount of filtrate released while processing the supernatant liquid from PWIT/SF is 38,000 gallons per day.

2.1.2 M-Area Vendor Treatment Process

A contract has been awarded to a subcontractor to design, build, and operate a vitrification process, which will transform M-Area wastes into a form meeting the land disposal

restrictions (LDR). M-Area wastes that make up the design basis for the vitrification process are:

- M-Area plating line sludge from supernatant treatment (PWIT/SF sludge)
- M-Area high nickel plating line sludge (PWIT/SF sludge)
- M-Area treatability test samples
- Filtercake from the Mark 15 filters
- Nickel plating line solution
- Plating line sump material

Facility Description

The above wastes will be blended into a homogeneous mixture in existing tanks in M Area. Stabilizing chemicals and glass-forming materials will be added to the mixture to make vitrifier feedstock. The feedstock will be pumped into a melter at a temperature of 1150°C. The glass-forming materials chemically bond and microencapsulate the constituents of concern into a matrix of borosilicate glass. The glass is placed into containers for storage and disposal. The entire operation takes place in a structure that has secondary confinement apparatus and air emission control equipment.

Capacity

The vitrifier is sized to treat the entire volume of design-basis waste in one year. It has a nominal glass output of five tonnes per day and a maximum production of 7.5 tonnes per day. While the vitrifier is treating the design basis waste, it has no excess capacity. Nevertheless, after the design-basis waste is treated, the vitrifier will have about one additional year of service life left. The remaining service life could be used to treat other waste streams, provided such arrangements can be made with the vendor and M Area remains operational.

2.1.3 Consolidated Incineration Facility (CIF) and Ashcrete Stabilization Facility

CIF receives both solid and liquid wastes from several generators around the Savannah River Site (SRS). One of CIF's primary design-basis waste streams is benzene from the Defense Waste Processing Facility (DWPF). Liquid waste can arrive by container or by pipeline. Solid waste arrives packaged in a cardboard box 21 inches on each side.

Facility Description

CIF is a rotary kiln incinerator with a secondary combustion chamber. The liquid waste is fed into the rotary kiln's primary combustion chamber and the secondary combustion chamber. Solid wastes are fed into the primary combustion chamber. Organic materials are combusted to water and carbon dioxide. Offgas is quenched, scrubbed, and released to the atmosphere.

Non-combustible materials (ash) are captured, mixed with Portland cement, and other stabilizing additives, and cast into stable solid wasteforms (ashcrete). The ashcrete system also stabilizes blowdown liquid from the quench and scrubber (blowcrete). The ashcrete system could be used to encapsulate other small-sized wastes, which could be mixed directly with the ash.

Capacity

The CIF thermal capacity of 18.1 million BTU/hr is based on the design estimate of wastes expected to be in inventory at the time of CIF startup and wastes expected to be generated annually after CIF startup (OPS-WPM-90-4140). To maximize the flexibility and utilization of the CIF, the material handling systems for feeding solid and liquid waste were sized for a greater throughput than the average annual requirement for each system. The instantaneous capacity of each system is:

- Solid waste to rotary kiln 2025 lbs/hr
- Organic liquid waste to rotary kiln 385 lbs/hr
- Aqueous liquid waste to rotary kiln 950 lbs/hr
- Organic liquid waste to secondary combustion chamber 302 lbs/hr

The CIF can generally treat any combination of liquids and solids up to the rates listed above provided that the thermal capacity and other operational limits are not exceeded.

In 1993, the CIF utilization was reestimated in the CIF Mission Need and Design Capacity Review. Utilization in 1996 was predicted to be 60% for solid waste and 20% for organic liquid waste. Outyear utilization was estimated to increase as the scope of the SRS Environmental Restoration (ER) and Decontamination and Decommissioning (D&D) missions increase. Starting in the year 2001, annual utilization was predicted to occasionally approach 75% for solids and 100% for organic liquids. However, a varying amount of spare capacity is expected to be available for the treatment of other DOE incinerable mixed wastes. The schedule for treating other wastes at CIF will be established based on several key factors including:

- Available thermal capacity
- Concentrations of waste constituents (e.g., hazardous metals) that are controlled by the various CIF environmental permits
- Concentrations of waste constituents (e.g., chlorides and noncombustibles) that directly influence the amount of bottom ash and offgas scrubber blowdown generated. When wastes that generate significant ash or blowdown are incinerated, the demand on the spare ashcrete unit capacity could become the factor that limits waste feed rates.

2.1.4 Savannah River Technology Center Ion Exchange Treatment Probes for Low and High Activity Waste Streams

Savannah River Technology Center (SRTC) ion exchange treatment probes treat wastes that are captured in laboratory waste storage tanks located in the laboratory complex.

Facility Description

The treatment probes remove chromium (III), lead, mercury, and benzene from low level and high-level mixed waste. The entire probe, developed by SRTC, is placed in the waste tank and the waste solution pumped through it. The probes contain ion exchange resins that adsorb the constituents of concern.

After the probes remove the hazardous characteristics, the decontaminated solution is sent to another low-level waste treatment facility for volume reduction, and disposal as a low-level waste. The constituents of concern are bound so tightly to the resins that studies indicate the resin will pass a toxicity characteristic leachate procedure (TCLP) so the spent resin also becomes a non-hazardous low-level waste.

Capacity

The RCRA Part A permit modification, under which the probes operate, limits the throughput of the mixed waste storage tank treatment process (both low-level and high-level waste streams) to 457,229 gallons per year. The treatment capacity of the probes in low-level waste service is 396,300 gallons per year.

2.1.5 Defense Waste Processing Facility (DWPF)

The Defense Waste Processing Facility (DWPF) will receive high-level waste from tank farms in the defense materials production areas. High-level defense waste is as radioactive as material from reprocessing spent nuclear fuel. This waste includes liquids, sludge, and precipitated materials in slurry. High-level waste contains transuranic elements and fission products.

Facility Description

DWPF has two treatment processes:

1. A chemical process hydrolyzes the precipitate slurry into a low radioactivity, organic liquid (primarily benzene) and a high radioactivity aqueous stream.

2. A vitrification process treats the aqueous stream and high radioactivity sludge to remove mercury, mixes the streams with additives and glass-forming materials, and continuously feeds into a high temperature melter in which the materials fuse into borosilicate glass.

The organic liquid goes to CIF for incineration. The borosilicate glass, which bonds with and encapsulates the constituents of concern, is placed in a stainless steel canister for storage.

Capacity

According to the Mixed Waste Inventory Report (MWIR), the maximum technical capacity for the system is approximately 2 million pounds per year.

2.1.6 Effluent Treatment Facility (ETF)

The Effluent Treatment Facility (ETF) is a multi-purpose plant for treating highly dilute aqueous wastes. Waste arrives at ETF by pipeline. Plans are also underway to provide a station at which liquid waste in containers can be unloaded. The treatment option of interest for treating mixed waste streams is the ion exchange process.

Facility Description

A treatability study determines the compatibility of the constituents of concern in the waste with the ion exchange resin that will be used for adsorbtion. The waste is pumped from the feed tank to the ion exchange beds. The constituents of concern are bound so tightly to the ion exchange resins that studies indicate the resin will pass toxicity characteristic leaching procedure (TCLP), so the spent resin also becomes a non-hazardous low-level waste. Decontaminated liquid effluent is collected in check tanks for analysis, which confirms the liquid meets release specifications. Liquid that meets specifications is released to a surface outfall. In the unlikely event that the treated effluent fails to meet release specification, it can easily be recycled to the feed system for reprocessing. Nothing is released from ETF without passing a final assay.

Capacity

Demonstrated maximum throughput of ETF is about 130 gallons per minute (gpm). At present, ETF is processing about 40-50 gpm average. Acceptance of waste streams at ETF must be on a case-by-case basis, depending on the quantity of waste and concentration of the constituent of concern. ETF's waste treatment capacity requires the influent to be almost pure water or in small quantities.

2.1.7 Saltstone Manufacturing and Disposal Facility

The Saltstone Manufacturing and Disposal Facility (Saltstone or Z Area) receives liquid waste by pipeline directly from Tank 50 in the tank farm. The contents of Tank 50 are analyzed before transfer to ensure they meet Z-Area's stringent waste acceptance criteria (WAC).

Facility Description

In Z-Area liquid waste is blended with Portland cement and other additives to form grout. The grout slurry is transferred to engineered underground disposal vaults. In the vaults, the grout solidifies into a stable final wasteform, which meets land disposal requirements. The constituents of concern are immobilized by the grout and rendered non-hazardous. Although manufacturing grout causes Z Area to be defined as a "treatment facility," the strict WAC preclude its use to treat any but the specific waste in Tank 50. Z Area is better regarded as a "disposal facility."

Capacity

According to the Mixed Waste Inventory Report (MWIR), Z Area has a design feed rate of approximately 22 million gallons per year. Permitted feed rate is approximately 15 million gallons per year. Normal operating rates are approximately 2.5 million gallons per year. Each vault has a capacity of approximately 11 million gallons.

2.2 Process Descriptions

This section contains descriptions of the treatment technologies considered in the options analysis.

2.2.1 Acid Leaching

The acid leaching process is designed to solubilize heavy metal contamination. The prepared and sorted waste is placed in a series of tanks containing acid solution. The waste is agitated to ensure thorough mixing and saturation. After a specified contact period, the leachate and solids are separated. The solids are washed to remove soluble metals, followed by dewatering, required for final disposal. The leachate stream is sent to the wastewater treatment process where the dissolved metal is precipitated as an insoluble hydroxide. The detoxified material is repackaged in containers for final disposal.

2.2.2 Amalgamation

Amalgamation is a process applicable to radioactive wastes containing mercury and particularly to wastes containing radioactive mercury isotopes. Mercury compounds are converted into a solid alloy with mercury and the amalgamating material, which is more easily managed and less mobile than solutions containing radioactive mercury. Amalgamation provides a change in mobility from liquid.

2.2.3 Carbon Adsorption

Carbon adsorption is a technology used to treat wastewaters containing dissolved organics at concentrations less than about 5% and some dissolved metal and other inorganic containments. The two most common carbon adsorption processes are the granular activated carbon (GAC), which is used in packed beds, and the powdered activated carbon (PAC), which is added loosely to wastewater.

2.2.4 Chemical or Electrolytic Oxidation

Chemical or electrolytic oxidation uses the following oxidizing agents either alone or in combination to destroy organic constituents of concern: hypochlorite (e.g., bleach);

chlorine; chlorine dioxide; ozone or ultraviolet light (UV) assisted ozone; peroxides; persulfates; perchlorates; permanganates; and/or other oxidizing agents of equivalent efficiency. Chemical oxidation specifically includes what is commonly referred to as alkaline chlorination.

2.2.5 Chemical Reduction

Chemical reduction is a process using the following reducing agents either alone or in combination: sulfur dioxide and sodium, potassium, or other alkali salts of sulfites, bisulfites, metabisulfates, and polyethylene glycols. Chemical reduction is commonly used for the reduction of hexavalent chromium to the trivalent state.

2.2.6 Filtration

Filtration is removal/separation of particles from a mixture of fluid and particles by a medium that permits the flow of the fluid but retains the particles. Usually, the larger the particles, the easier they are to remove from the fluid.

2.2.7 Immobilization

Immobilization is treatment of waste through macroencapsulation, microencapsulation, or sealing to reduce surface exposure to potential leaching media or to reduce the leachability of the hazardous constituents.

2.2.8 Incineration

Incineration is a controlled thermal destruction process by which combustible solid, liquid, or gaseous wastes are changed into noncombustible gases and solid ash.

2.2.9 Ion Exchange

Ion exchange uses a resin to replace certain specific ions in a solution with other ions that are innocuous. Ion exchange is used to separate a mixed waste into its radioactive and hazardous constituents if the radioactive constituents are ionic. It will also concentrate the radioactive ionic species into a small volume, leaving a nonradioactive aqueous phase. The principal mixed waste application of this process is to recover metallic radionuclide from wastewaters or acid leach liquids. Ion exchange also may be used to remove specific hazardous ion(s) from aqueous media containing radioactive ions in solution without removing the radioactive ions.

2.2.10 Macroencapsulation

Macroencapsulation is immobilization by application of surface coating materials such as polymeric organics (e.g., resins and plastics) or a jacket of inert inorganic materials to substantially reduce surface exposure to potential leaching media.

2.2.11 Metals Recovery

Recovery of metals or inorganics employs one or more of the following direct physical/removal technologies: ion exchange; resin or solid (i.e., zeolites) adsorption; reverse osmosis; chelation/solvent extraction; freeze crystallization; ultrafiltration and/or simple precipitation (i.e., crystallization). Note: This does not preclude the use of other physical phase separation or concentration techniques such as decantation, filtration (including ultrafiltration), and centrifugation when used in conjunction with the above listed recovery technologies. Metallic compounds are separated from aqueous streams or aqueous/organic streams.

2.2.12 Microencapsulation

Microencapsulation is immobilization of debris with these materials such that the leachability of the hazardous contaminants is reduced; Portland cement or lime/pozzolans (e.g., fly ash and cement kiln dust). Additives (e.g., iron salts, silicates, and clay) enhance the set/cure time and/or compressive strength or reduce the leachability of the hazardous constituents.

2.2.13 Decontamination of Lead

Lead waste, which is unmixed with plastic, paper, or leather, may be decontaminated by immersion in an acid bath. The acid dissolves the surface of the lead, which has been contaminated with radionuclides. The decontaminated lead can then be washed and reused. The acid solution is neutralized and the dissolved lead is precipitated. The precipitate is removed and stabilized for disposal. The neutralized solution can be further treated for reuse or recycle.

2.2.14 Neutralization

Neutralization uses the following chemicals either alone or in combination; acids, bases, or water (including wastewaters), resulting in a pH greater than two but less than 12.5 as measured in the aqueous residuals.

2.2.15 Precipitation

Precipitation removes metals and other inorganics by forming insoluble compounds of oxides, hydroxides, carbonates, sulfides, sulfates, chlorides, fluorides, or phosphates. The following precipitants are typically used alone or in combination: lime (i.e., containing oxides and/or hydroxides of calcium and/or magnesium; caustic (i.e., sodium and/or potassium hydroxides; soda ash (i.e., sodium carbonate); sodium sulfide; ferric sulfate or ferric chloride; alum (potassium or ammonium aluminum sulfate); or sodium sulfate. Additional chemicals for flocculating and coagulating precipitates enhance sludge dewatering may also be used.

2.2.16 Preparation for Treatment Process

Preparation for treatment processes (e.g., shredding, grinding, physical separation, etc.) are processes that make the waste amenable to the treatment process that ultimately destroys, removes, or immobilizes the hazardous contaminants or characteristics.

2.2.17 Process Wastewater Treatment

There are nine steps in the process wastewater treatment: collection in equalization tank, lime/pH adjustment, flocculent addition, parallel plate clarifier, filter press, final pH adjustment, sand filtration, carbon absorption, and evaporation.

2.2.18 Roasting/Retorting

Roasting and retorting mercury from radioactive contaminated process equipment has two major components.

Mercury Oven (Roaster)

The mercury oven is electrically heated to approximately 400°C with a mechanical vacuum pump providing the required vacuum or negative pressure.

Condenser/Decanter (Retort)

The condenser is connected to the offgas system from the oven to condense the mercury vapor and vaporized organic compounds. The mercury is drawn off the bottom of the condenser receiver and condensed. Liquid organics are decanted at the supernatant interface and go to the CIF. The mercury goes to an amalgamation unit. The gas coming out of the condenser is exhausted through the offgas system.

2.2.19 Soil Washing

Soil washing involves the following steps. Soil contaminated with listed or characteristic wastes is first sifted to remove oversized material. The large pieces are milled to manageable size and mixed with the finer materials. The soil is then mixed with water, which contains additives to adjust the pH and remove other constituents of concern. The washed soil requires no additional stabilization or treatment but still requires disposal in a RCRA landfill or a HW/MW vault if it contains low-level radionuclides. The wash water must be further treated by an effluent treatment facility before it is released.

2.2.20 Stabilization

Stabilization comprises treatment processes that immobilize hazardous constituents in a waste. For treatment of metals in low-level mixed wastes, stabilization technologies will reduce the leachability of the hazardous metal constituents (regardless of whether the metals are radioactive) in nonwastewater matrices.

2.2.21 Steam Stripping

Steam stripping removes volatile organic compounds by heating the contaminated waste directly with high-temperature steam. The contaminated waste is usually liquid, but could be a solid. Organics are concentrated in the steam from which they can be recovered or incinerated.

2.2.22 Thermal Destruction

Thermal destruction involves processing hazardous waste in a device that uses elevated temperatures as the primary means to change the chemical, physical, or biological characteristics or composition of the hazardous waste. Examples of thermal destruction processes are incineration, pyrolysis, calcination, wet air oxidation, and microwave.

2.2.23 Vitrification

Vitrification is a waste treatment process in which waste is mixed with glass forming materials and fused into a solid mass. The resultant mass is expected to remain a stable and insoluble form for long time periods. (Vitrification with borosilicate glass is the best demonstrated available technology (BDAT) for high-level waste (HLW) and certain mixed waste streams.)

2.3 Planned/Proposed Facilities

This section contains descriptions of planned or proposed facilities considered in the options analysis.

2.3.1 Containment Building

In the August 18, 1992 *Federal Register* (57 FR 37194), EPA promulgated standards for a new hazardous waste management unit: a "containment building." 40 CFR 264 Subpart DD, 264.1101 and the analogous sections of Part 265 describe design and operating criteria. Design features of a containment building include:

- Walls, floor, and roof to prevent exposure to the elements
- Primary barrier such as the floor, a process area, or process tankage that is resistant to the hazardous materials contained
- Secondary containment system beyond the primary barrier for hazardous liquid materials (The containment building itself can act as the secondary containment to tanks inside.)
- Leak detection system between two barriers
- Liquid collection and removal systems

The design of the containment building submitted with the permit application must be certified by a registered professional engineer.

The owner or operator of the containment building must:

- Ensure that the containment building is maintained free of cracks, corrosion, or other defects that could allow hazardous materials to escape

- Control the inventory of hazardous material within the containment walls so that "the height of any containment wall is not exceeded"

- Provide a decontamination area for personnel and equipment to prevent spreading hazardous materials outside the containment building

- Control fugitive emissions

The owner or operator must promptly repair any condition that may have resulted in a release of a hazardous waste. The owner or operator also is tasked with monitoring, inspection, recordkeeping, and reporting requirements.

The August 18, 1992 *Federal Register* (57 FR 37194) also amended 40 CFR 262.34, which specifies the requirements governing accumulation of hazardous waste, to allow generators to hold hazardous waste onsite in a containment building for 90 days or less without a permit or interim status. According to *RCRA Regulations and Keyword Index 1993 Edition* (McCoy and Associates, Inc.):

> A generator accumulating waste in a containment building for less than 90 days in compliance with 40 CFR 262.34 and 40 CFR Part 265, Subpart DD... may treat these hazardous wastes in a containment building without obtaining a permit or interim status as long as thermal treatment is not involved.

2.3.2 Hazardous Waste/Mixed Waste Treatment Building (HW/MW-TB)

The Hazardous Waste/Mixed Waste Treatment Building (HW/MW-TB) would provide a RCRA-permitted facility for the treatment of hazardous and mixed wastes in accordance with Land Disposal Restrictions (LDR) which cannot be treated in other existing or planned facilities at SRS. The HW/MW-TB would also provide a hazardous and mixed waste facility in which the waste is processed into environmentally stable wasteforms for disposal. The HW/MW-TB would also repackage some waste streams for shipment to other treatment facilities such as the Consolidation Incineration Facility (CIF). Some waste streams would be size or volume reduced in the HW/MW-TB to increase treatment and/or disposal efficiency.

It should be noted that although this facility was considered as a treatment facility in the options analysis, it **was not chosen** as a preferred option for any waste stream.

Currently the HW/MW-TB processes are likely to be constructed or installed in existing site structures under containment building regulations. The HW/MW-TB project has been placed on hold pending the outcome of the Site Treatment Plan (STP).

2.3.3 *TRU Waste Certification and Characterization Facility (TWCCF)*

The TWCCF is a proposed facility that will provide capabilities to assay, open, sort, size reduce, characterize, treat, and repackage >100 nCi/g and 10-100 nCi/g mixed and nonmixed wastes. The waste types include job control waste (wipes, shoe covers, etc.), process equipment (gloveboxes, pumps, HEPA filters, etc.), and miscellaneous debris (concrete, metal, etc.) from production, D&D, and ER activities. The TWCCF is in the pre-conceptual phase of development.

The TWCCF will process wastes contaminated with alpha-emitting transuranic radionuclides (half-lives greater than 20) for final disposal. The TWCCF will receive wastes from TRU pads, waste generators, or other waste storage areas. The TWCCF will size reduce (30%) some waste before further processing (i.e., assay, gas sampling, sorting, treatment, and repackaging). After assay and characterization, 10 to 100 nCi/g wastes will be classified as low-level or low-level mixed waste, treated (if required), and disposed in onsite facilities. Wastes greater than 100 nCi/g will be further processed (if required) for shipment and disposal in the Waste Isolation Pilot Plant.

2.3.4 *Alpha Vitrification Facility (AVF)*

The AVF is a proposed facility that will provide capabilities to vitrify greater than 10 nCi/g alpha contaminated mixed and non mixed wastes. This includes newly generated waste, stored waste, and soils. The AVF also will provide capabilities to treat secondary waste gases and liquids that are generated during the vitrification process. The AVF is in the pre-conceptual phase of development and is unfunded.

The AVF will treat solid, liquids, sludge, and soil wastes contaminated with alpha-emitting transuranic radionuclides (half-lives greater than 20 years) for disposal. This includes preparing the waste for vitrification, vitrifying the waste, and treating secondary waste gases and liquids. The AVF will receive waste from the TRU Waste Certification/Characterization Facility (TWCCF). This waste will enter the AVF in drums. Furthermore, the AVF will require a greater level of containment than the non-alpha vitrification facility. Vitrified and low temperature stabilized wasteforms will be routed through the Waste Certification/Characterization Facility for final certification. After certification, these wasteforms will be sent for final disposal to a RCRA disposal facility, Shallow Land Disposal Facility, or the Waste Isolation Pilot Plant (WIPP).

2.4 Evolving Technologies

As part of the PSTP process, SRS has developed a list of evolving technologies. These are technologies that are not recommended in the PSTP. As these technologies mature, they may offer waste treatment alternatives superior to the process treatment methods currently recommended by the PSTP.

As more emerging technologies are identified they will be included in future revisions/updates of the Site Treatment Plan. Only technologies that are directly applicable to SRS mixed low-level waste streams are discussed here. A more extensive summary of over 80 radioactive waste treatment technologies may be found in WSRC-RP-95-116.

Mixed Waste Focus Area

At the direction of the Assistant Secretary for Environmental Management (EM), Tom Grumbly, a new approach has been formulated to focus the Department of Energy's environmental research and technology development activities on key environmental management problems. Integral to this new approach is the teaming of technology development and technology users. The concept is for DOE, DOE production site

contractors, national labs, universities and commercial companies to team up to create integrated R & D plans, avoid redundancy and reduce lead time to field testing of new technology. Five major remediation and waste management problem areas, known as focus areas, have been identified to date. These problem areas have been targeted for action on the basis of risk, prevalence, or need for technology development to meet environmental requirements and regulations. The five focus areas are:

1. Groundwater Plume Containment and Remediation
2. Buried Waste Retrieval Stabilization
3. Radioactive Waste Tank Remediation
4. Mixed Waste Characterization, Treatment, and Disposal
5. Facility Transitioning, Decommissioning and Final Disposition

SRS was designated as the lead site for the Groundwater Plume Containment and Remediation Focus Area. Idaho National Engineering Laboratory (INEL) has been designated the lead site for the Mixed Waste Characterization, Treatment and Disposal Focus Area. The stated mission of the Mixed Waste Treatment, Storage and Disposal Focus Area is to develop, demonstrate and deliver technologies and treatment systems for treating and disposing of mixed low-level waste and mixture transuranic waste in a safe, timely, and cost-effective manner. It is anticipated that the Focus Area will incorporate elements of existing mixed waste R & D programs funded through the DOE-Headquarters Office of Technology Development (OTD).

The MWFA will identify applicable baseline technologies, opportunities for modifying existing technologies, develop new technologies, and implement technology transfer opportunities to solve major problems for retrievably-stored and newly generated mixed low-level waste (MLLW) and mixed transuranic wastes for buried wastes after retrieval.

A primary objective of the MWFA is to ensure that emerging technologies and future mixed waste technology development are considered and evaluated within the FFCA process. It is anticipated that site treatment plans and resulting consenting orders will have the flexibility to evolve with time to include new management options offered by advances in technology.

The MWFA plans to coordinate three pilot-scale demonstrations of mixed waste treatment system sin the areas of waste destruction (plasma hearth, waste stabilization (vitrification), and characterization and material handling (robotics)). The demonstration systems will have potential for treating up to 90% of the current MLLW inventory in the DOE Complex.

The MWFA will build on and incorporate elements of existing mixed waste R&D programs funded through the DOE-Headquarters Office of Technology Development (OTD). Two significant ongoing R&D programs are the Mixed Waste Integrated Program and the Integrated Thermal Treatment Study.

Vitrification

Vitrification produces a non-leaching stabilized wasteform of high integrity and minimal secondary waste.

SRS technical expertise in vitrification technology includes characterization of waste streams, development and characterization of glass formulations, demonstration of waste vitrification using laboratory and pilot-scale melters, and development of large-scale integrated facilities for comprehensive vitrification processing. The analytical capabilities of SRS include a full spectrum of techniques for characterizing waste streams and glasses ranging from chemical analysis to microstructural characterization.

SRS developers were responsible for development of the Product Consistency Test, which is the DOE-specified High-Level Waste glass leach test for durability, and for the EPA's declaring

glass the Best Demonstrated Available Technology (BDAT) for High-Level Waste (HLW). Process control software has been developed by SRS that contains very robust composition-property models for predicting glass durability, viscosity and liquidus temperature. This software has been used successfully to predict glass properties for numerous simulated HLW glasses in crucible studies, on a pilot-plant scale at the Integrated Defense Waste Processing Facility Melter System (IDMS) at TNX and on a large scale at the Defense Waste Processing Facility (DWPF), and for actual HLW glasses on a small scale in the High Level Caves facility of the Savannah River Technology Center (SRTC). In addition, SRS has been responsible for coordinating all in situ glass testing at the Waste Isolation Pilot Plant (WIPP) in New Mexico.

Status: SRS is developing vitrification process limits for joule-heated (cold-trap and stirred) melters for processing of low-level mixed waste (LLMW). This effort is being funded by DOE-Headquarters through the Office of Technology Development. The current plans are to (1) demonstrate vitrification on an actual LLMW using a transportable vitrification system in a field demonstration; (2) provide an up front de-listing petition; (3) demonstrate vitrification of actinide elements for safe permanent storage; (4) demonstrate high temperature vitrification on various waste types; and (5) demonstrate vitrification of ashes and reclamation of noble metals from electronic components.

This technology might potentially apply to the following waste streams:

SR-W025, Solvent/TRU Job Control Waste < 100 nCi/g
SR-W026, Thirds/TRU Job Control Waste
SR-W027, Solvent/TRU Job Control Waste
SR-W033, Thirds/TRU Job Control Waste < 100 nCi/g
SR-W046, Consolidated Incineration Facility (CIF) Ash
SR-W048, Soils from Spill Remediation
SR-W049, Tank E-3-1 Clean Out Material
SR-W056, Job Control Waste with Enriched Uranium and Solvent Applicators
SR-W064, IDW Soils/Sludges/Slurries
SR-W067, IDW Personnel Protective Equipment (PPE) Waste

Plasma Hearth

Plasma technologies use a flowing gas between two electrodes to stabilize an electrical charge or arc. As an electric current flows through the plasma, energy is dissipated in the form of heat and light, resulting in Joule heating of the process materials and forming a leach-resistant slag that can be modified by adding such materials as soil. The plasma hearth process relies on a stationary, refractory-lined primary chamber to produce and contain the high temperatures necessary for producing the slag.

The plasma hearth process begins with the waste being fed into a primary plasma chamber where the heat from the plasma torch allows the organic compounds in the waste to be volatilized, oxidized, pyroyzed, and decomposed. The remaining inorganic material is then fed to the secondary combustion chamber for high temperature melting, producing a molten slag. Cooling and solidification of the slag produce a non-leachable, high-integrity wasteform. Offgas volumes are lower than those from conventional incineration units.

Advantages of the plasma technologies include the ability to feed high amounts of metal-bearing wastes, including whole drums. The resulting slag requires no additional stabilization. The technology is extremely robust and can accept various wasteforms such as papers, plastics, metals, soils, liquids, and sludges. Based on these characteristics minimal characterization data are need. In non-plasma vitrification technologies, combustion of paper and plastics can produce soot and result in offgas problems.

Status: The plasma hearth process has undergone bench-scale testing by DOE at Argonne National Laboratories West (INEL) and is currently undergoing demonstration-scale testing

Ukiah, California, to evaluate potential treatment of solid mixed wastes. Ongoing projects for the plasma hearth process involve major hardware development and the determination of the level of characterization required of mixed waste prior to processing.

This technology might potentially apply to the following waste streams:

SR-W025, Solvent/TRU Job Control Waste < 100 nCi/g
SR-W026, Thirds/TRU Job Control Waste
SR-W027, Solvent/TRU Job Control Waste
SR-W033, Thirds/TRU Job Control Waste < 100 nCi/g
SR-W046, Consolidated Incineration Facility (CIF) Ash
SR-W048, Soils from Spill Remediation
SR-W049, Tank E-3-1 Clean Out Material
SR-W056, Job Control Waste with Enriched Uranium and Solvent Applicators
SR-W064, IDW Soils/Sludges/Slurries
SR-W067, IDW Personnel Protective Equipment (PPE) Waste
SR-W072, Supernate or Sludge Contaminated Debris from High-Level Waste (HLW) Operations

Plasma Arc

The plasma arc centrifugal treatment furnace uses the plasma arc process with an internal rotating drum to treat hazardous, mixed, and transuranic wastes. In this process, the waste is fed into a molten bath created by a plasma arc torch. The feed material and molten slag are held in the primary chamber by centrifugal force. Within the plasma furnace, all water and organic waste material are volatilized. The organic material is also fully oxidized to carbon dioxide, water vapor and acid gases, including sulfur dioxide and hydrochloric acid vapor. Offgas requires treatment by scrubbing system. Non-volatile waste material fully oxidized and uniformly melted by the high power electric arc and collected as molten slag which is discharged as a non-leachable homogeneous glass residue.

This technology has been demonstrated to be applicable for the treatment of various waste types and forms, including hazardous, mixed and TRU wastes containing heavy metals and organic containments. Demonstration results show a minimum destructive removal efficiency greater than 99.9%, organic and inorganic concentrations that meet toxicity characteristic leaching procedure (TCLP) standards, and offgas treatment that exceed regulatory standards.

Status: A full-scale plasma arc demonstration is being planned for the INEL to remediate soils and debris contaminated with transuranic radionuclides. SRS has been funded by OTD to demonstrate a small-scale arc melter vitrification system that would meet all regulatory low-level mixed waste disposal requirements. The system provided will be used to establish operating costs and offgas/secondary waste stream characteristics for further evaluation and analysis. The operating temperatures of the plasma arc system are expected to allow a variety of low-level mixed waste streams to be vitrified in a way that minimizes secondary waste generation and allows regulatory approved disposal of resulting glassy slag.

This technology might potentially apply to the following waste streams:

SR-W025, Solvent/TRU Job Control Waste < 100 nCi/g
SR-W026, Thirds/TRU Job Control Waste
SR-W027, Solvent/TRU Job Control Waste
SR-W033, Thirds/TRU Job Control Waste < 100 nCi/g
SR-W046, Consolidated Incineration Facility (CIF) Ash
SR-W048, Soils from Spill Remediation
SR-W049, Tank E-3-1 Clean Out Material
SR-W056, Job Control Waste with Enriched Uranium and Solvent Applicators

SR-W064, IDW Soils/Sludges/Slurries
SR-W067, IDW Personnel Protective Equipment (PPE) Waste

Acid Digestion

The Chemical and Hydrogen Technology Section of SRTC is conducting a research and development program to develop a closed-loop wet chemical process for the complete oxidation of combustible solid waste and decontamination of noncombustible solids. Acid digestion results in byproducts of water, carbon dioxide, and acidic gases. Scrubber systems may be required based on wastes being treated. Following bench-scale development, other goals include assessing the feasibility of a production-scale process and development of a preliminary flowsheet with projected throughputs.

Tests on a number of materials have been conducted, both with and without a palladium (Pd) catalyst. Pd facilitates conversion of the CO offgas to CO_2 for more complete oxidation. The results show that essentially complete (96%+) oxidation of nitromethane, neoprene, EDTA, cellulose, tartaric acid, tributylphosphate (TBP) using air destructive oxidation and high density polyethylene (HDPE) using microwave-heated oxidation. The air destructive oxidation tests were conducted with 0.1 M nitric acid/concentrated phosphoric acid at temperatures ranging from 140 to 170°C. Benzoic acid was successfully treated at 190°C, atmospheric pressure, and polyethylene and polyvinylchloride (PVC) at 200°C, 10-15 psig. Microwave digestion tests of benzoic acid in nitric/phosphoric acid at 100-120W power for 75-150 minutes were also conducted with fair results. Parametric studies were also conducted with water-soluble Trimsol oil. Preliminary materials of construction tests have also been conducted. Acceptable materials of construction resistant to nitric/phosphoric acid corrosion include tantalum, teflon- and glass-lined vessels. Other materials evaluated include 304L, 316L and 317L stainless steels, Alloy20 and Hastelloy. Results to date on this R & D effort is summarized in WSRC-TR-94-0471, "Progress Report on Nitric-Phosphoric Acid Oxidation".

Status: Plans are to obtain general oxidation rates for representative organics under different processing conditions and to determine the effects of several nitric-phosphoric acid compositions on reaction kinetics. Other areas needing development include elucidation of metal solubilities, precipitation chemistry and solid-liquid separation characteristics.

This technology might potentially apply to the following waste streams.

SR-W025, Solvent/TRU Job Control Waste < 100 nCi/g
SR-W026, Thirds/TRU Job Control Waste
SR-W027, Solvent/TRU Job Control Waste
SR-W033, Thirds/TRU Job Control Waste < 100 nCi/g
SR-W036, Tritiated Oil with mercury
SR-W056, Job Control Waste with Enriched Uranium and Solvent Applicators
SR-W067, IDW Personnel Protective Equipment (PPE) Waste

Delphi Wet Oxidation Process

Delphi Research, Inc. (Albuquerque, NM) has developed a DETOX^{SM} Wet Oxidation Waste Treatment Process that uses a catalyzed wet oxidation process to destroy organic compounds while containing and concentrating many metals. The process utilizes a patented combination of homogeneous metal catalysts in an acidic water solution. It is currently at the bench-scale level of development in a one gallon oxidation reactor vessel. Organic compounds introduced into the solution are claimed to be oxidized with great efficiency (99.99%+). Many toxic metals are dissolved and concentrated in the solution and can eventually be recovered. Some toxic metals are converted to insoluble forms which may be recoverable, depending on the composition of the waste stream. The DETOX^{SM} process is distinguished from other types of wet oxidation by good organics destruction efficiencies at

relatively low temperature (150-250°C) and pressure (20-200 psig). Process efficiency is enhanced by the presence and action of the catalysts.

The DETOX[SM] process is claimed to be highly tolerant of waste composition, form, water content, and particle size. Because DETOX[SM] is a low temperature process, and can be operated as a closed or confined system, there is less concern with the possible escape of toxic materials in exhaust gases from the process. However, to be implemented routinely, DETOX[SM] will need to successfully address the potential formation of flammable gases such as hydrogen. In most applications, the DETOX[SM] process produces no NO_X or SO_X emissions and no dioxins or furans. Mercury, cadmium and lead are oxidized to ionic form and are not expected to be present in exhaust gases. The cited positive environmental attributes of this process should make regulatory permitting of this operation less time consuming and costly.

The status of the technology is that the DOE Morgantown (W. Va) Office has funded Delphi to conduct a demonstration at SRS and Weldon Springs Site, Mo. The initial portion involving a demonstration at SRS is anticipated to last about nine months. It is planned to commence around September 1995. The equipment will be installed at TNX and tests will be conducted using hazardous, but non-radioactive wastes or surrogates. Equipment check out is scheduled for February 1996 completion. The tests are expected to be completed July 1996, and the equipment moved to Weldon Springs by August 1996. Treatment of up to 50,000 lbs of contaminated tri-butyl-phosphate and other hazardous wastes will be carried out.

This technology might potentially apply to the following waste streams:

SR-W014, Tritium-Contaminated Mercury
SR-W025, Solvent/TRU Job Control Waste < 100 nCi/g
SR-W026, Thirds/TRU Job Control Waste
SR-W027, Solvent/TRU Job Control Waste
SR-W033, Thirds/TRU Job Control Waste < 100 nCi/G
SR-W036, Tritiated Oil with Mercury
SR-W044, Tri-Butyl-Phosphate & n-Paraffin-TRU
SR-W045, Tri-Butyl-Phosphate & n-Paraffin
SR-W056, Job Control Waste with Enriched Uranium and Solvent Applicators
SR-W067, IDW Personnel Protective Equipment (PPE) Waste

Molten Metal Catalytic Extraction Processing (CEP)

Molten Metal Technology (Providence, Rhode Island) has developed a proprietary Catalytic Extraction Process (CEP) technology that can be used to destroy and recycle a number of mixed wastes. Molten Metal Technology has formed a limited partnership with Martin Marietta, M4 Environmental, L.P. M4 has been licensed by Molten Metal to use the CEP technology to treat a variety of radioactive and mixed waste streams known to exist at SRS and other federal facilities.

The Catalytic Extraction Process was derived from standard steel making technologies that introduced carbon, oxygen and fluxing materials into the bottom of the molten iron pool. Using this same idea, gaseous, liquid, sludge and particulate solid feed streams can be introduced into a sealed molten metal reactor. The catalytic properties of the liquid metal, at temperatures in the 1315-1750°C range, cause the wastes to dissociate to their atomic elements, destroying hazardous and toxic components in the process. Due to the robustness of the process, diverse materials such as metals, ceramics/soils and organics can all be treated. Also, by controlling process variables and adding reactant chemicals, the process can re-arrange the liberated atomic elements into recoverable products such as high-quality industrial gases, specialty inorganic and metals. This concept is known as environmental recycling.

The status of the technology is that L'Air Liquide, du Pont and Rollins are among companies that have formed alliances with Molten Metal. Agreements for CEP units include Clean Harbours Environmental Services, Martin Marietta, Hoechst Celanese and Scientific Ecology Group of Westinghouse. At SRS, Joint Work Statements for two CRADAs have been drafted. This include the destruction of tritiated oil wastes, including provisions for subsequent recovery of the liberated tritium.

This technology might potentially apply to the following waste streams:

SR-W014, Tritium-Contaminated Mercury
SR-W025, Solvent/TRU Job Control Waste < 100 nCi/g
SR-W026, Thirds/TRU Job Control Waste
SR-W027, Solvent/TRU Job Control Waste
SR-W033, Thirds/TRU Job Control Waste < 100 nCi/g
SR-W036, Tritiated Oil with Mercury
SR-W046, Consolidated Incineration Facility (CIF) Ash
SR-W048, Soils from Spill Remediation
SR-W049, Tank E-3-1 Clean Out Material
SR-W056, Job Control Waste with Enriched Uranium and Solvent Applicators
SR-W061, DWPF Mercury
SR-W062, Toxic Characteristic (TC) Contaminated Debris
SR-W064, IDW Soils/Sludges/Slurries
SR-W066, IDW Steel and Metal Debris
SR-W067, IDW Personnel Protective Equipment (PPE) Waste
SR-W068, Elemental (Liquid) Mercury
SR-W072, Supernate or Sludge Contaminated Debris from High-Level Waste (HLW) Operations

Tritiated Oil Characterization and Treatment

R&D needs for dealing with Waste Stream SR-W036, (Tritiated Oil with Mercury) deserve a special discussion. These needs are documented in detail in SRT-HTS-94-0235, July 11, 1994. A successful R&D effort may lead to improved disposal methods for two other waste streams: Tritium-Contaminated Mercury (SR-W014) and Tritiated Water with Mercury (SR-W060).

The Tritiated Oil with Mercury waste stream is created as a result of historical SRS use of mercury transfer pumps and oil-based vacuum pumps in the SRS Tritium Facilities (TF). New TF pumps are oil-less and no longer use mercury, but some oil pumps remain in operation. Tritium and mercury bearing vapors flowing through these pumps contaminate the pump oil with tritium to varying degrees. When the oil is removed from the pumps for replacement, the oil is declared waste and must be dispositioned. The waste oil may be divided into four groups according to trigger levels of mercury and tritium activity. Incineration is the preferred treatment for low activity, non-RCRA mercury oil (<0.2 mg Hg/L). Incineration is also the RCRA IMERC specific technology for both high and low tritium activity RCRA oils. There is currently no identified technology for high tritium activity (>5000 nCi/cc) non-RCRA oil. Two fundamental issues need to be addressed in disposing of this waste stream: characterization of the waste oil and containment of tritium off-gas from any proposed treatment process.

Many of the high tritium activity oil samples are poorly characterized due to tritium activity limitations placed on the analytical lab facilities. The levels of both mercury and tritium were often estimated using process knowledge. All types of TF oils need to be reliably characterized to ensure that (1) the oils are classified and handled properly, (2) processes can be designed to treat these oils, and (3) disposal restrictions on the residual waste are not exceeded. Experience indicates that a standard analytical procedure which gives consistent tritium activity results for high-tritium oil samples needs to be developed and tested by the different lab groups. A more reliable analysis of mercury is also necessary for high tritium samples

which have to be diluted for sequential analysis of tritium and mercury under the present procedure.

A potential treatment strategy is to remove mercury from the oil samples to allow the waste stream to exit RCRA. The low-tritium waste oil can then be either incinerated or disposed of as low-level waste in the E-Area Vaults. The high-tritium oil can be processed to remove tritium or stored to allow tritium to decay. Potential mercury-removal technologies include activated carbon treatment, amalgamation with zinc powder and filtration (Pantex Plant), amalgamation with gold/silver/zinc/copper/tin supported on silica/zeolite/alumina substrates. Potential tritium treatment technologies include:

- Incineration or oxidation
- Solidification with macro-encapsulation
- Radiolytic decay to take advantage of the relatively short tritium half life of 12.3 years
- Supercritical oxidation
- Microbial oxidation
- Plasma technology
- Liquid phase catalytic exchange
- Catalytic organic decomposition.

Two other technologies that may hold promise are the Molten Metal CEP technology and the acid digestion process described earlier.

An R&D program is necessary to reliably characterize oil samples (mercury and total organic carbon) and to develop an acceptable treatment process to address both the mercury and tritium components of the waste. There is currently no funding in the FY95 SRS operating budget to address this need. A joint CRADA project is being proposed with Molten Metal Technology (M4) to adapt the CEP technology for treating this RCRA radioactive oil as an alternative to incineration.

This technology might potentially apply to the following waste streams:

SR-W014, Tritium-Contaminated Mercury
SR-W036, Tritiated Oil with Mercury

Integrated Thermal Treatment Study

The Integrated Thermal Treatment Study was begun in 1993 to establish information on the technical performance and costs of various options for thermal treatment of waste. When the study is completed, DOE will be able to evaluate incineration, incineration variations and incineration alternatives on a comparable scientific basis, using a consistent yard stick. The most significant or outstanding advantage of incineration is the potential for waste volume reduction. Nineteen (19) incineration variations and alternatives are being explored, including:

Rotary Kiln with Air
Rotary Kiln with Oxygen (for flue gas volume reduction)
Rotary Kiln with Air and Wet Air Pollution Control
Rotary Kiln with Oxygen & Carbon Dioxide Retention Option
Rotary Kiln with Air & Polymer Stabilization
Rotary Kiln with Air & Maximum Recycling (volume reduction)
Slagging Rotary Kiln
Indirectly Heated Pyrolyzer
Plasma Furnace
Plasma Furnace with Carbon Dioxide Retention
Plasma Gasification
Fixed Hearth Pyrolyzer with Carbon Dioxide Retention

Rotary Kiln with Air and Thermal Desorption
Molten Salt Oxidation
Molten Metal Waste Destruction
Steam Gasification
Joule-heated vitrification
Thermal Desorption and Mediated Electrochemical Oxidation
Thermal Desorption and Supercritical Water Oxidation

DOE is pursuing design studies and/or pilot-scale demonstrations for the following units:

- Jule-heated Vitrification
- Molten Metal Destruction
- Molten Salt Oxidation
- Plasma Furnace with Air & Secondary Combustion Chamber

The first two technologies were discussed in detail earlier. DOE will study and document the low level waste volume reduction capability of each unit demonstrated. Baseline cost and effectiveness (including volume reduction) data from these studies/facilities will be documented and compared to similar data obtained from conventional existing incinerators.

3.0 SAVANNAH RIVER SITE WASTE STREAM OPTIONS ANALYSIS

This section contains the Options Analyses for the SRS waste streams. The section is arranged numerically by waste stream number.

For each waste stream, information is provided that:

- *Describes the waste stream*
- *Summarizes the Options Analysis Process*
- *Justifies option selection or rejection*

3.1 User's Guide Site Treatment Plan Reference Document

Section 3.0 compiles the results of analyses used to assess a wide variety of treatment options and to select the one preferred. The information on the waste streams and assessment of treatment options is recorded using two basic formats:

- A ***short form*** for waste streams for which a preferred option was easily identified without an in-depth analysis because:
  - The waste is part of the design basis of a treatment facility (e.g., CIF).
  - The waste is being treated or could be treated in an existing facility.
  - The waste treatment is controlled by the TRU Waste Management Plan.
  - The waste was combined with another waste stream.
  - The waste was recharacterized and was no longer a low-level mixed waste.
- A ***long form*** for waste streams requiring an in-depth analysis to capture all the option assessment documentation.

Both formats begin with the waste stream name and an identifying number assigned by SRS.

Both formats next have **Background Information.** The Background Information includes:

- A description of the waste and its origins
- Volume – both the amount of waste currently in storage and the five-year projected future generation.
- Waste stream composition – the physical form of the waste
- Waste code – the Resource Conservation and Recovery Act (RCRA) waste type identifier
- Land Disposal Restrictions (LDR) Treatment Standards – RCRA regulatory requirement for treatment of the hazardous constituent (identified by the waste code). Treatment standard is either "concentration based" (the concentration of the hazardous constituent in the leachate generated by a toxicity characteristic leaching procedure (TCLP) performed on a sample of the treated waste) or a "specified technology" (specified by the Environmental Protection Agency (EPA)) to treat the waste.
- Waste Characterization – a description of the waste and the way information about the waste was acquired.
  - Basis: process knowledge or sampling and analysis

  - Confidence level with which the waste characterization information is regarded:

    - High: information based on extensive sampling and analysis, process specification, and mass balance calculations; extensive documentation available for review

    - Medium: information based on analyses of samples that may not be representative of the entire waste volume or test methods that have an inherently wide range of error. Available documentation is less extensive than that needed for high confidence.

    - Low: no sampling and analysis, or tests yield uncertain data due to chemical or radiological interferences; little or no documentation about the waste. (Few waste streams at SRS have a low confidence level. Those that do are addressed very conservatively.)

  - Waste concentration data (if available)

- Radiological Characterization:

  - Isotopes (if available)
  - How the waste must be handled (contact or remote)
  - Type of waste (mixed low-level, mixed transuranic, high-level waste)
  - Activity level (if available)

The ***short form*** then lists:

- **Preferred Option:** a statement of the technology chosen to treat the waste

- **Treatment Justification:** a detailed description of the decision-making process and reasoning that resulted in the choice of the preferred option.

- **Cost Estimate Sheet:**
  The cost estimate sheet is a form prescribed by DOE Headquarters in "DSTP Cost Guidance Revision 1." It breaks the costs into eight main elements and numerous sub-elements. The term "WBS Element," which refers to "work breakdown structure element," and the method of numbering the elements is based on DOE Order *4700.1 Project Management System.* "Escalation" is the factor provided by DOE that reflects the growth in the cost of a project due to inflation.

The ***long form*** follows **Background Information** with:

- **Initial Screening:**

  The "Rejected Options" table lists treatment methods initially eliminated and the reasons for rejection. This table documents the first culling of treatment methods from a wide range of options.

  The options that passed the initial screening and underwent further analysis are listed in the "Feasible Options" table. This table identifies the preferred option and lists the Technology Success Factor (TSF), In-Depth Options Analysis (IDOA) score, and the preliminary planning life-cycle cost estimate.

- **Options Rejected Due To Low Technology Success Factor (TSF):**

  This part gives the reasons that some feasible options scored low on TSF and were eliminated from further consideration.

- **Engineering Assessment:**

  This part documents:
  - Reasons the preferred option was selected – Preferred Option Justification
  - Any treatability studies needed to confirm the technical viability of the preferred option – Treatability Study Requirements. Not every preferred option requires treatability studies, so this part does not always appear.
  - Reasons other options were not selected – Options Rejected During IDOA

- **Treatment Cycle Flow Diagram:**

  Each option (except treatment at DOE offsite facilities) that underwent an in-depth analysis has been represented with a block diagram that traces the waste through each major step of the treatment process and identifies principal secondary waste streams. (For DOE offsite facilities, a technology description replaced the flow sheet.)

- **Pros and Cons:**

  Pros and cons identify the best and worst features of the treatment option depicted in the flow diagram.

- **In-Depth Analysis Score Sheet:**

  Each feasible option that had a TSF score greater than 50 underwent in-depth analysis in a highly formalized way. Part of the assessment assigned numerical scores to various attributes of the treatment methods. (See Section 1.2.) Numerical results of the assessment and the reasons for assigning those numbers are recorded on the score sheet.

- **Cost Estimate Sheet:**

  The Cost Estimate Sheet in the *long form* is the same as the one in the *short form.*

3.2 Waste Stream Location Identification

Listed below are the STP waste streams listed in numerical order. Each waste stream is followed by its location in Volume I, Volume II, and the STP Reference Document.

Waste Stream No.	Waste Stream Name	Volume I Section Location	Volume II Section Location	Reference Document Location
SR-W001	Rad-Contaminated Solvents	3.1.1.1	3.1.1.1.A	3-7
SR-W002	Rad-Contaminated Chlorofluorocarbons	N/A	*	3-11
SR-W003	Solvent Contaminated Debris (LLW)	3.1.1.1	3.1.1.1.B	3-13
SR-W004	M-Area Plating Line Sludge from Supernate Treatment	3.1.2.1	3.1.2.1.A	3-17
SR-W005	Mark 15 Filtercake	3.1.2.1	3.1.2.1.B	3-21
SR-W006	Mixed TTA/Xylene - TRU	4.1.1	4.1.1.1.A	3-25
SR-W007	SRL (SRTC) Low Activity Waste	N/A	3.1.1.3.A	3-27
SR-W008	SRL (SRTC) High Activity Waste	N/A	3.1.1.3.B	3-31
SR-W009	Silver Coated Packing Material	3.1.3.1	3.1.3.1.A	3-35

Waste Stream No.	Waste Stream Name	Volume I Section Location	Volume II Section Location	Reference Document Location
SR-W010	Scintillation Solution	N/A	*	3-59
SR-W011	Cadmium-Coated HEPA Filters	3.1.2.1	3.1.2.1.C	3-61
SR-W012	Incinerable Toxic Characteristic (TC) Material	3.1.1.1	3.1.1.1.C	3-89
SR-W013	Low-Level Waste (LLW) Lead – to be Decontaminated	3.1.4.1	3.1.4.1.A	3-93
SR-W014	Tritium-Contaminated Mercury	3.1.5.1	3.1.5.1.A	109
SR-W015	Mercury/Tritium Contaminated Equipment	N/A	3.1.1.7.A	3-127
SR-W016	221-F Canyon High Level Liquid Waste	5.1.1	5.1.1.1.A	3-147
SR-W017	221-H Canyon High Level Liquid Waste	5.1.1	5.1.1.1.B	3-151
SR-W018	Filter Paper Take Up Rolls (FPTUR)	3.1.1.1	3.1.1.1.D	3-153
SR-W019	244-H RBOF High Activity Liquid Waste	N/A	*	3-177
SR-W020	In-Tank Precipitation (ITP) and Late Wash (LW) Filters	N/A	3.1.1.4.A	3-179
SR-W021	Poisoned Catalyst Material	N/A	*	3-183
SR-W022	DWPF Benzene	3.1.1.1	3.1.1.1.E	3-185
SR-W023	Cadmium Safety/Control Rods	N/A	3.1.1.7.B	3-189
SR-W024	Mercury/Tritium Gold Traps	N/A	3.1.1.6.A	3-199
SR-W025	Solvent/TRU Job Control Waste <100 nCi/g TRU	3.3.1	3.3.1.1.A	3-207
SR-W026	Thirds/TRU Job Control Waste	4.1.1	4.1.1.1.B	3-227
SR-W027	Solvent/TRU Job Control Waste	4.1.1	4.1.1.1.C	3-229
SR-W028	Mark 15 Filter Paper	3.1.1.1	3.1.1.1.F	3-231
SR-W029	M-Area Sludge Treatability Samples	3.1.2.1	3.1.2.1.D	3-257
SR-W030	Spent Methanol Solution	N/A	*	3-259
SR-W031	Uranium/Chromium Solution	3.1.2.1	3.1.2.1.E	3-261
SR-W032	Mercury Contaminated Heavy Water	N/A	3.1.1.5.A	3-285
SR-W033	Thirds/TRU Job Control Waste <100 nCi/g	3.3.1	3.3.1.1.B	3-287
SR-W034	Calcium Metal	3.1.5.2	3.1.5.2.A	3-303
SR-W035	Mixed Waste Oil – Sitewide	3.1.1.1	3.1.1.1.G	3-325
SR-W036	Tritiated Oil with Mercury	3.2	3.2.1.1	3-329
SR-W037	M-Area High Nickel Plating Line Sludge	3.1.2.1	3.1.2.1.F	3-343
SR-W038	Plating Line Sump Material	3.1.2.1	3.1.2.1.G	3-347
SR-W039	Nickel Plating Line Solution	3.1.2.1	3.1.2.1.H	3-351
SR-W040	M-Area Stabilized Sludge	N/A	*	3-355
SR-W041	Aqueous Mercury and Lead	3.1.1.2	3.1.1.2.A	3-357
SR-W042	Paints and Thinners	3.1.1.1	3.1.1.1.H	3-379
SR-W043	Lab Waste with Tetraphenyl Borate	N/A	*	3-393
SR-W044	Tri-Butyl-Phosphate & n-Paraffin – TRU	N/A	*	3-395
SR-W045	Tri-Butyl-Phosphate & n-Paraffin	3.1.1.1	3.1.1.1.I	3-397

Waste Stream No.	Waste Stream Name	Volume I Section Location	Volume II Section Location	Reference Document Location
SR-W046	Consolidated Incineration Facility (CIF) Ash	N/A	3.1.1.1.J	3-409
SR-W047	Consolidated Incineration Facility (CIF) Blowdown	N/A	3.1.1.1.K	3-411
SR-W048	Soils from Spill Remediation	3.1.2.1	3.1.2.1.I	3-413
SR-W049	Tank E-3-1 Clean Out Material	3.1.5.1	3.1.5.1.B	3-451
SR-W050	Mixed Waste to Support High-Level Waste (HLW) Processing Demonstrations	N/A	5.1.2.1.A	3-463
SR-W051	Spent Filter Cartridges and Carbon Filter Media	3.1.1.1	3.1.1.1.L	3-465
SR-W052	Cadmium Contaminated Glovebox Section	N/A	*	3-485
SR-W053	Rocky Flats Incinerator Ash	4.2.1	4.2.1.1.A	3-487
SR-W054	Enriched Uranium Contaminated with Lead	N/A	*	3-497
SR-W055	Job Control Waste Containing Solvent Contaminated Wipes	3.1.1.1	3.1.1.1.M	3-499
SR-W056	Job Control Waste with Enriched Uranium and Solvent Applicators	3.2	3.2.2.1	3-517
SR-W057	D-Tested Neutron Generators	N/A	*	3-519
SR-W058	Mixed Sludge Waste with Mercury from DWPF Treatability Studies	N/A	5.1.2.1.B	3-521
SR-W059	Tetrabutyl Titanate (TBT)	N/A	*	3-523
SR-W060	Tritiated Water with Mercury	N/A	3.1.3.1.B	3-525
SR-W061	DWPF Mercury	N/A	3.1.5.1.C	3-539
SR-W062	Toxic Characteristic (TC) Contaminated Debris	3.1.3.1	3.1.3.1.C	3-553
SR-W063	Macroencapsulated Toxic Characteristic (TC) Waste	N/A	3.1.1.6.B	3-567
SR-W064	IDW Soils/Sludges/Slurries	N/A	6.1	3-569
SR-W065	IDW Monitoring Well Purge/Development Water	N/A	6.1	3-571
SR-W066	IDW Steel and Metal Debris	N/A	6.1	3-573
SR-W067	IDW Personnel Protective Equipment (PPE) Waste	N/A	6.1	3-575
SR-W068	Elemental (Liquid) Mercury	3.1.5.1	3.1.5.1.D	3-577
SR-W069	Low-Level Waste (LLW) Lead –to be Macroencapsulated	3.1.3.2	3.1.3.2.A	3-591
SR-W070	Mixed Waste from Laboratory Samples	3.1.1.1	3.1.1.1.N	3-615
SR-W071	Wastewater from TRU Drum Dewatering	3.1.1.1	3.1.1.1.O	3-629
SR-W072	Supernate or Sludge Contaminated Debris from High-Level Waste (HLW) Operations	N/A	3.1.1.7.C	3-643
SR-W073	Plastic/Lead/Cadmium Raschig Rings	3.1.1.1	3.1.1.1.P	3-661

* Waste stream eliminated or consolidated with other steams. See Volume II, Section 2.6.1.

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Summary Page

Waste Stream Number & Name: SR-W001 Rad-Contaminated Solvents

Background Information

This waste stream is radioactively contaminated solvent and solvent mixtures used in applications such as cleaning equipment in the Separations or Reactors Areas, degreasing solvents for depleted uranium fines used to assure unhindered adsorption of water in the tritium process, organic solutions used in bioassay analysis, and catalyst material for an incinerator which is no longer operational. The non-halogenated solvents in storage are wastes that used carbon (C^{14}) and tritium (H^3) labeled materials as tracers or mixtures of waste scintillation counter calibration standards. The halogenated solvents are degreasing solvents contaminated with tritium. This waste steam is a consolidation of SR-W001, SR-W002, SR-W010, SR-W030, and SR-059 listed in the Draft Site Treatment Plan.

Volume
- Current volume through 09/30/94 is 8.4 m^3.
- Expected 1995-1999 volume will be 5.0 m^3.

Waste Stream Composition
- Organic liquid

Waste Code
- D001A (ignitable high TOC)
- D006A (TCLP Cd)
- D010A (TCLP Se)
- D018 (benzene)
- D019 (carbon tetrachloride)
- D022 (chloroform)
- F001, F002, F003, F005A (halogenated and nonhalogenated spent solvents)

LDR Treatment Standard
- D001 = specified technology = Recovery of Organics or Combustion
- D006 = concentration based standard = 1.0 mg/l
- D010 = concentration based standard = 5.7 mg/l
- D018* = concentration based standard = 10 mg/kg
- D019* = concentration based standard = 6.0 mg/kg
- D022* = concentration based standard = 6.0 mg/kg
- F001 = concentration based standard = 6.0-30 mg/l
- F002 = concentration based standard = 6.0-30 mg/l
- F003 = concentration based standard = 2.6-180 mg/kg
- F005 = concentration based standard = 10-170 mg/kg except 2-Ethoxyethanol and 2-Nitropropane = Incineration

*D012-D043 nonwastewaters must be treated to meet the Universal Treatment Standards (UTS) for any underlying constituents that may be present.

Waste Characterization
- Process knowledge and sampling and analysis have been used to characterize waste stream.
- Confidence level is high based upon the known composition of the solvents used in the processes and of sample analyses for some of the organics.

Radiological Characterization
- Sampling and analysis results indicates tritium present up to 2.9 nCi/g.
- Beta/gamma emitters
- U^{238} alpha present in solvent from the tritium facility

- Waste is contact handled.
- Mixed low-level waste

Preferred Option

The preferred treatment option for the Rad-Contaminated Solvents waste stream is Incineration followed by Stabilization in the Consolidated Incineration Facility (CIF).

Treatment Justification

In-depth options analysis (IDOA) was not performed for this waste stream.

During development of the Consolidated Incineration Facility (CIF) design basis, a determination was made of the types and volumes of hazardous, low-level radioactive, and mixed Savannah River Site (SRS) waste streams that would be generated in the future or were in storage for which treatment by incineration would be beneficial. The determination to initiate development of CIF was based on the facts that incineration was recommended or required by environmental regulations and a significant volume or toxicity reduction would be achieved. The wastes amenable to incineration were grouped by physical state, solid or liquid, and type of contamination, hazardous and/or radioactive. Some wastes such as Defense Waste Processing Facility (DWPF) benzene and low-level radioactive job control waste were individually designated as a waste group. The waste groups and current/future volume data were adopted as a design basis for the CIF Functional Performance Requirements (FPR) (OPS-WMP-90-4140). The FPR serves as the baseline design document for the initiation of project development at SRS.

Based on physical and chemical characteristics, the SRS mixed wastes already designated for treatment at the CIF fall into one of the CIF design basis waste groups listed as follows:

FPR Waste Group	SRS Mixed Waste Streams
Beta/Gamma Boxed (Solid)	Solvent Contaminated Debris (LLW) (SR-W003) Incinerable Toxic Characteristic (TC) Material (SR-W012)
High BTU (Liquid)	Scintillation Solution (SR-W010) Mixed Waste Oil – Sitewide (SR-W035)
Chlorinated (Liquid)	Rad-Contaminated Solvents (SR-W001) Rad-Contaminated Chlorofluorocarbons (SR-W002)
DWPF Organic	DWPF Benzene (SR-W022)
Naval Fuel Organic	Spent Methanol Solution (SR-W030)

Some of the CIF design basis waste groups listed in the table are designated in the FPR as nonradioactive hazardous waste. The radioactive nature of the waste does not impact its combustion characteristics. The operation and efficiency of the CIF combustion and air pollution control systems are not influenced by the presence of radioactivity. A mixed waste that meets the chemical and physical criteria of a design basis nonradioactive waste group can be treated in the CIF as effectively as the nonradioactive waste.

The CIF Mission Need and Design Capacity Review (July 7, 1993) and the supporting Alternative Treatment Technologies for SRS Hazardous, Mixed and Job Control Wastes (SWE-CIF-93020, July 29, 1993) reevaluated the treatment of certain existing and future SRS wastes in the CIF. The review was structured to generally reexamine the appropriateness of each FPR design basis waste group and additional mixed waste groups that are not listed in the FPR but are chemically and physically similar to an FPR nonradioactive waste group. The review compared the incineration of each waste group to treatment by other candidate technologies using comparison criteria such as waste volume and toxicity reduction, treatment and disposal costs, and RCRA Land Disposal Restriction requirements. The review program concluded that the waste groups originally designated for CIF and the additional mixed waste groups are most effectively treated by incineration.

Alternative Technologies Investigated

Biological Treatment

Biological treatment requires developing bacteria to metabolize particular hazardous chemicals contained in the waste. Specific bacteria would have to be developed for each predominant constituent in this waste. Biological treatment is most often used in cases where concentrations of the hazardous organic are low (ppm). Biological treatment is not very effective for waste streams containing high concentrations of hazardous constituents. Biological treatment of concentrated organic liquids is not used because high concentrations of organics would be toxic to biological activity. Since this technology has not been demonstrated on concentrated organic liquid wastes, it is not considered a viable treatment alternative.

Chemical Oxidation

Chemical oxidation involves the addition of a chemical oxidizing agent such as ozone to the waste stream. The organic material in the waste is oxidized to carbon dioxide and water vapor. The offgas would be passed through carbon filters to remove volatile organic vapors generated. This process has not been used for concentrated organic waste streams. Formation of incomplete oxidation byproducts would be difficult to prevent. The time required for complete oxidation of the waste could be unacceptably long. Also, this treatment has not been demonstrated or developed for this waste stream. Until such technology development work is completed on this type of waste, this technology is not considered a viable treatment alternative.

Stabilization

A variety of stabilization technologies are capable of solidifying this waste stream. However, developing a solidification process to bind 1,1,1-trichloroethylene and tetrachloroethylene to meet the treatment standards for land disposal is unlikely. Because these materials are not destroyed during this process, they could eventually escape into the environment because organics are difficult to stabilize in commercially available binders. Also, land disposal of large quantities of hazardous organic compounds, even if they can be made to pass treatment standards, is considered an undesirable waste disposal practice. Stabilization increases the overall waste volume, resulting in a significantly higher disposal cost.

Selected Treatment Technology

Since no acceptable alternative treatment technology for this waste was identified, the selected technology is incineration followed by stabilization of the residuals. Incineration destroys organic constituents, generates a residual which is easily stabilized, and significantly reduces the volume of waste placed in permanent disposal facilities. Incineration is the technology typically used for treatment of this waste type.

Waste Stream Number & Name: SR-W001 Rad-Contaminated Solvents

Facility: CIF

Treatment Technology: Incineration/ Stabilization

Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[ ] alpha [√] non-alpha [√] contact handled [ ] remote handled

Module Location: SRS

Module Status: [√] Existing [ ] New [ ] Small generator [√] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 0	
	1.2	Demonstration Costs	$ 0	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 0	
		1.3.2 Safety Assurance Documentation (TEC)	$ 1,227	
		1.3.3 Permitting	$ 22	
		1.3.4 Preparation for Operations	$ 29,400	
		1.3.5 Project Management	$ N/A	
		TOTAL PRE-OPERATIONS		$ 30,649
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 91	
	2.2	Title III Design Support	$ 1,212	
	2.3	Project Management	$ 1,661	
	2.4	Building Construction (inc. fixed price contractor)	$ 3,994	
	2.5	Equipment (engineered)	$ 2,449	
	2.6	Construction Management	$ 1,049	
	2.7	Dedicated Ops, PCAM	$ 3,634	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 14,090
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 218.3	
	3.2	Annual Utilities	$ 10	
	3.3	Annual Materials	$ 130.2	
	3.4	Annual Maintenance	$ 77.1	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 435.6	
		X NUMBER OF YEARS OF OPERATION	1.0	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 436
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 61,900	
	4.2	Closure, Post-Closure, Monitoring	$ N/A	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 61,900
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$ N/A	
	5.2	Mobile Treatment	$ N/A	
		TOTAL CONTRACTED SERVICES		$ 0
6.0	Offsite Treatment (DOE)			$ 0
7.0	Transportation			$ 0
8.0	Disposal (Stabilized blowdown & ashcrete 65 drums)			$ 100
	SUB COST FOR INCINERATION/STABILIZATION MODULE			$ 107,186
		ESCALATION		1.060
		TOTAL COST		$ 113,617

This Cost Estimate sheet includes "to go" (as of 5/31/94) costs for completion of the CIF and processing SR-W001, as well as SR-W003, SR-W012, SR-W022, SR-W035 the CIF base case mixed wastes and stabilizing resultant ashcrete and blowdown (SR-W046 and SR-W047). Note that the of base case mixed wastes comprise less than ten % of the total CIF design basis feed volume. (Low-level waste and hazardous waste will comprise the majority of the CIF feed.) The above costs include those for stabilization SR-W046 and SR-W047 treatment of incinerator ash and blowdown in the ashcrete system. If above numbers do not appear to add correctly, it is the result of computer rounding.

Summary Page – THIS WASTE STREAM HAS BEEN CONSOLIDATED WITH WASTE STREAM SR-W001

Waste Stream Number & Name: SR-W002 Rad-Contaminated Chlorofluorocarbons

Background Information

This waste steam's data has been consolidated and reported under SR-W001, Rad-Contaminated Solvents. This decision to classify this waste as SR-W001 was made during the MWIR inventory update as of 9/30/94. The consolidation of solvent streams SR-W001, SR-W002, SR-W010, SR-W030 and SR-W059, in the mixed waste data reporting, grouped solvents with the same treatment.

SR-W002 was formerly known as waste consisting of chlorofluorocarbon solvents (Freon®-113 and trichlorotrifluoroethane) and degreasing solvents for depleted uranium fines used to assure unhindered adsorption of water in the tritium process.

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Summary Page

Waste Stream Number & Name: SR-W003 Solvent Contaminated Debris (LLW)

Background Information

Spent solvent contaminated rags and wipes are generated sitewide in the clean up of interior spills and for decontamination. The stream is a collection of similar debris whose LDR treatment standards can be met by incineration followed by stabilization. The waste codes indicate the components which may be present in the waste stream as a whole. Waste codes listed in the waste stream would vary depending on where the waste came from within SRS.

Volume

- Current volume through 09/30/94 is 9.3 m^3.
- Expected 1995-1999 volume will be 2.6 m^3.

Waste Stream Composition

- Organic debris

Waste Code

- D004A – D011A (TCLP metals)
- D012 – D017 (organic pesticides)
- D018 –D043 (characteristic organics)
- F001 – F003, F005A (halogenated and nonhalogenated spent solvents)

LDR Treatment Standard

- D004 = concentration based standard = 5.0 mg/l
- D005 = concentration based standard = 100 mg/l
- D006 = concentration based standard = 1.0 mg/l
- D007 = concentration based standard = 5.0 mg/l
- D008 = concentration based standard = 5.0 mg/l
- D009 = concentration based standard = 0.2 mg/l
- D010 = concentration based standard = 5.7 mg/l
- D011 = concentration based standard = 5.0 mg/l
- D012* = concentration based standard = 0.13 mg/kg
- D013* = concentration based standard = 0.066 mg/kg
- D014* = concentration based standard = 0.18 mg/kg
- D015* = concentration based standard = 2.6 mg/kg
- D016* = concentration based standard = 10.0 mg/kg
- D017* = concentration based standard = 7.9 mg/kg
- D018* = concentration based standard = 10 mg/kg
- D019* = concentration based standard = 6.0 mg/kg
- D020* = concentration based standard = 0.26 mg/kg
- D021* = concentration based standard = 6.0 mg/kg
- D022* = concentration based standard = 6.0 mg/kg
- D023* = concentration based standard = 5.6 mg/kg
- D024* = concentration based standard = 5.6 mg/kg
- D025* = concentration based standard = 5.6 mg/kg
- D026* = concentration based standard = 11.2 mg/kg
- D027* = concentration based standard = 6.0 mg/kg
- D028* = concentration based standard = 6.0 mg/kg
- D029* = concentration based standard = 6.0 mg/kg
- D030* = concentration based standard = 140 mg/kg
- D031* = concentration based standard = 0.066 mg/kg
- D032* = concentration based standard =10 mg/kg
- D033* = concentration based standard =5.6 mg/kg
- D034* = concentration based standard = 30 mg/kg
- D035 = concentration based standard = 36 mg/kg

- D036* = concentration based standard = 14 mg/kg
- D037* = concentration based standard = 7.4 mg/kg
- D038* = concentration based standard = 16 mg/kg
- D039* = concentration based standard = 6.0 mg
- D040* = concentration based standard = 6.0 mg/kg
- D041* = concentration based standard = 7.4 mg/kg
- D042* = concentration based standard = 7.4 mg/kg
- D043* = concentration based standard = 6.0 mg/kg
- F001 = concentration based standard = 6.0-30 mg/kg
- F002 = concentration based standard = 6.0-30 mg/kg
- F003 = concentration based standard = 2.6-180 mg/kg
- F005 = concentration based standards = 10-170 mg/kg, except 2-Ethoxyethanol and 2-Nitropropane = Incineration
- Alternate debris technology may be applied

*D012-D043 nonwastewaters must be treated to meet the Universal Treatment Standards (UTS) for any underlying constituents that may be present.

Waste Characterization

- Process knowledge used to characterize the waste stream.
- Confidence level is high based upon known composition of the solvents used in the process generating this waste.

Radiological Characterization

- Alpha emitter, Pu^{238}
- Beta/gamma emitter, Cs^{137}
- Waste is contact handled.
- Mixed low-level waste

Preferred Option

The preferred treatment option for the Solvent Contaminated Debris (LLW) waste stream is Incineration followed by Stabilization in the Consolidated Incineration Facility (CIF).

Treatment Justification

In-depth options analysis was not performed for this waste stream.

During development of the Consolidated Incineration Facility (CIF) design basis, a determination was made of the types and volumes of hazardous, low-level radioactive, and mixed Savannah River Site (SRS) waste streams that would be generated in the future or were in storage for which treatment by incineration would be beneficial. The determination to initiate development of CIF was based on the facts that incineration was recommended or required by environmental regulations and a significant volume or toxicity reduction would be achieved. The wastes amenable to incineration were grouped by physical state, solid or liquid, and type of contamination, hazardous and/or radioactive. Some wastes such as Defense Waste Processing Facility (DWPF) benzene and low-level radioactive job control waste were individually designated a waste group. The waste groups and current/future volume data were adopted as a design basis for the CIF Functional Performance Requirements (FPR) (OPS-WMP-90-4140). The FPR serves as the baseline design document for the initiation of project development at the SRS.

Based on physical and chemical characteristics, the SRS mixed wastes already designated for treatment at the CIF fall into one of the CIF design basis waste groups listed as follows:

FPR Waste Group	SRS Mixed Waste Streams
Beta/Gamma Boxed (Solid)	Solvent Contaminated Debris (LLW) (SR-W003) Incinerable Toxic Characteristic (TC) Material (SR-W012)

High BTU (Liquid)	Scintillation Solution (SR-W010) Mixed Waste Oil – Sitewide (SR-W035)
Chlorinated (Liquid)	Rad-Contaminated Solvents (SR-W001) Rad-Contaminated Chlorofluorocarbons (SR-W002)
DWPF Organic	DWPF Benzene (SR-W022)
Naval Fuel Organic	Spent Methanol Solution (SR-W030)

Some of the CIF design basis waste groups listed in the table are designated in the FPR as nonradioactive hazardous waste. The radioactive nature of the waste does not impact its combustion characteristics. The operation and efficiency of the CIF combustion and air pollution control systems are not influenced by the presence of radioactivity. A mixed waste that meets the chemical and physical criteria of a design basis nonradioactive waste group can be treated in the CIF as effectively as the nonradioactive waste.

The CIF Mission Need and Design Capacity Review (July 7, 1993) and the supporting Alternative Treatment Technologies for SRS Hazardous, Mixed and Job Control Wastes (SWE-CIF-93020, July 29, 1993) reevaluated the treatment of certain existing and future SRS wastes in the CIF. The review was structured to generally reexamine the appropriateness of each FPR design basis waste group and additional mixed waste groups that are not listed in the FPR but are chemically and physically similar to an FPR nonradioactive waste group. The review compared the incineration of each waste group to treatment by other candidate technologies using comparison criteria such as waste volume and toxicity reduction, treatment and disposal costs, and RCRA Land Disposal Restriction requirements. The review program concluded that the waste groups originally designated for CIF and the additional mixed waste groups are most effectively treated by incineration.

Alternative Technologies Investigated

Acid Digestion

An emerging technology for treatment of mixed job control wastes (JCW) is Catalyzed Nitric Acid Oxidation, which is being developed by the Savannah River Technology Center (SRTC). In this developmental process, the solids are processed in a nitric acid bath with a metal catalyst for oxidation of the organics and dissolution of the solids. Preliminary testing indicates that the process successfully dissolves cellulose and neoprene but is unsuccessful in dissolving polyethylene and polyvinyl chloride (PVC). Polyethylene and PVC account for approximately 30% by weight of the JCW. The organic constituents are oxidized to carbon dioxide by the acid, and the metal contaminants are brought into solution. The resulting spent acid solution with dissolved hazardous metals would be treated in a chemical precipitation process to remove the metals and neutralize the solution prior to disposal through a permitted outfall. This technology is only in the development stage and has several safety and environmental issues requiring resolution before large scale uses are employed at SRS.

Thermal Desorption

A possible treatment of this waste is by thermal desorption even through it is not demonstrated for this waste stream. Thermal desorption is typically used for volatilization of organics from soils at lower temperatures than produced by incineration. The desorption unit is equipped with an offgas system containing a carbon bed or organic condensation system to prevent environmental release of volatilized organics. Typical process operating temperatures (350°F-600°F) are below the autoignition temperature of most JCW. The volatile organics would be volatilized and captured, while the treated solids could be compacted or incinerated before disposal. However, the plastics in the JCW begin to melt and volatilize at approximately 250°F (WSRC-TR-93-293). Therefore, this treatment is not practical for SRS JCW. Also, since these wastes contain hazardous metals, the solids would require further treatment prior to disposal.

Other Alternative Technologies

Several other possible alternative technologies are discussed in the CIF Mission Need and Design Capacity Review. These technologies are either in the developmental stage or have not been demonstrated on organic and metal contaminated cellulose and plastic waste. Chemical oxidation processes will react with the cellulose and plastic and generate large volumes of partially oxidized organics. A demonstrated process to separate the hazardous constituents (organics and metals) from the cellulose and plastics has not been identified.

Selected Treatment Technology

Since no acceptable alternative treatment technology for JCW contaminated with organics and heavy metals was identified, the selected technology is incineration followed by stabilization of the residuals. Incineration destroys organic constituents, generates a residual that is easily stabilized, and significantly reduces the volume of waste requiring a disposal. Incineration is the treatment technology currently used by industry for treatment of this waste type.

Cost Estimate: INCLUDED WITH COST INFORMATION FOR TREATING WASTE STREAM SR-W001. SEE COST ESTIMATE SHEET FOR SR-W001.

Summary Page

Waste Stream Number & Name: SR-W004 M-Area Plating Line Sludges from Supernate Treatment

Background Information

This waste stream is a sludge generated from the treatment of the supernate through the Dilute Effluent Treatment Facility (DETF) and stored in the Process Waste Interim Treatment/Storage Facility (PWIT/SF) in M Area.

Volume
- Current volume through 09/30/94 is 850 m^3.
- Expected 1995-1999 volume will be 20 m^3.

Waste Stream Composition
- Inorganic sludge/particulate

Waste Code
- F006 (metal plating line waste without cyanide), nonwastewater

LDR Treatment Standard
- F006 = concentration based standards = 0.19-5.0 mg/l

Waste Characterization

- Sampling and analysis used to characterize the waste stream.
- Confidence level is high based upon knowledge that the process generates a listed hazardous waste.
- TCLP leachate results are Pb <0.09 mg/l, Cr <0.01 mg/l, Ni <0.11 mg/l, and Cd <0.005 mg/l

Radiological Characterization
- Total activity is 0.015 Ci.
- Alpha emitters include U^{234}, U^{235}, and U^{238}.
- Waste is contact handled.
- Mixed low-level waste

Preferred Option

The preferred treatment option for M-Area Plating Line Sludge from Supernate Treatment is Stabilization by Vitrification in the M-Area Vendor Treatment Process.

Treatment Justification

In-depth options analysis (IDOA) is not required for this waste stream because a Preferred Option has been identified utilizing an existing facility with existing treatment technology.

The proposed action is to stabilize the M-Area mixed wastes utilizing a thermal vitrification process. The process facility would be constructed and operated by a subcontractor to the Westinghouse Savannah River Company (WSRC). The vitrification process would result in the lowest volume of stabilized waste for final disposal, provide the most durable final waste form, and could be completed for the lowest cost (including final disposal costs) of all treatment alternatives for wastes needing to be treated in M Area.

The proposed action was evaluated with respect to the technical ability to meet the Land Disposal Restrictions criteria for the final stabilized wasteform and for the overall cost of the treatment activities. The ability to meet the durability requirements, that is, Toxicity Characteristic Leaching Procedure (TCLP) testing requirements, for constituents of concern in the final wasteform was a critical consideration. The total life-cycle cost, including the cost of treating the

waste itself, the cost to treat any effluents generated by the vendor, and the cost to dispose of the final wasteform were also considered. In addition, the environmental impacts, onsite and offsite health effects, and occupational health and safety concerns for this treatment method were evaluated.

Treatability studies were performed on M-Area waste streams to determine the treatment technology most likely to meet the treatment standard required in the land disposal restriction (LDR) standards. The methods determined to be most effective in meeting the treatment standards involved the isolation of the metal contaminants in a cementatious or a glass matrix. Investigation was made into the alternatives for providing such treatment. Treatment options investigated included:

- Onsite treatment by a subcontractor at a temporary facility
- Onsite treatment at a permanent facility located in M Area and operated by SRS
- Onsite treatment at a permanent facility located at some central SRS location and operated by SRS
- Transport to an offsite location for treatment by a vendor
- Taking no action

The no action alternative was rejected because of the land disposal restrictions Federal Facility Compliance Agreement LDR-FFCA requirement for treatment of the M-Area waste streams.

Evaluation of the treatment option was made for both a cement-based stabilization process and a glass/vitrification process. An initial determination was made that vendor processes were cheaper than construction and operation of a permanent, onsite facility by SRS. Cost studies performed in 1991 showed that onsite treatment in facilities constructed at SRS would cost an estimated $46 million if constructed in M Area or $75 million if constructed at a central SRS location. The estimated cost for a vendor operated cementatious waste stabilization treatment process would be $28 million. A request for bids was made to vendors utilizing both cement and glass isolation processes. A stipulation was made in the bid that the vendor must demonstrate that this process was capable of meeting the land disposal restriction treatment standards for the treated waste streams.

The award of a contract for the treatment of M-Area waste was based on demonstration on the part of the bidder of not only a technically valid treatment process but previous treatment experience and adequate company resources to carry-out the work.

Review of the bids received disclosed that the proposal for treating M-Area wastes by vitrification in a temporary facility operated at SRS by a vendor was the lowest cost alternative. This alternative would also result in the least amount of liquid requiring treatment and discharge at the M-Area wastewater treatment facility and produce the lowest volume of treated waste meeting land disposal restriction standards that would require eventual disposal in a RCRA disposal facility.

When blending and treatment of the Intermediate Treatment/Storage Facility sludge is begun, it is projected that approximately 700,000 gallons of F006 listed mixed waste will be in storage in the tanks. This includes an estimated 50,000 gallons of supernate which cannot be separated from the sludge. Waste streams stored in the tanks include SR-W004, M-Area Plating Line Sludges from Supernate Treatment, and SR-W037, M-Area High Nickel Plating Line Sludge. One waste stream (SR-W054 – Enriched Uranium Contaminated with Lead, total volume 35 gallons) has been combined with waste stream SR-W037. SR-W054 is now indistinguishable from SR-W037 and will be treated identically.

Other M-Area mixed wastes to be treated are stored in 55-gallon drums in the Mixed Waste Storage Shed in M Area. These wastes include:

- A Watts Plating bath, California list waste solution, SR-W039, Nickel Plating Line Solution

- Mark 15 sludge filtercake, waste stream SR-W005, Mark 15 Filtercake
- Solid treatability sample residues, waste stream SR-W029, M-Area Sludge Treatability Samples

Two drums of plating line material (SR-W038) are stored in the 645-2N storage facility.

Equipment required for treatment of the M-Area waste would continue to belong to the vendor and, if the equipment could meet Department of Transportation (DOT) shipping criteria for radioactivity, would be removed from SRS. If equipment could not be successfully decontaminated, it would be disposed onsite. The cost of disposal was a part of the total contract cost.

The M-Area Vendor Treatment Process is capable of effectively treating all of these waste streams to meet regulatory requirements. As a result, upon completion of treatment, all listed and characteristically hazardous waste sludges and liquids from M-Area operations will be eliminated.

Waste Stream Number & Name: SR-W004 M-Area Plating Line Sludges from Supernate Treatment

Facility: M-Area Vendor Treatment Process Treatment Technology: Vitrification

Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled

Module Location: SRS

Module Status: [√] Existing [ ] New [ ] Small generator [√] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 35	
	1.2	Demonstration Costs	$ 25	
	1.3	Operations Budget Funded Activities	1,210	
		TOTAL PRE-OPERATIONS		$ 1,270
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$	
	2.2	Inspection	$	
	2.3	Project Management	$	
	2.4	Building Construction (inc. indirect)	$ 750	
	2.5	Equipment (inc. indirect)	$	
	2.6	Construction Management	$	
	2.7	Contingency	$	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 750
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 87.5	
	3.2	Annual Utilities	$ 175	
	3.3	Annual Materials	$	
	3.4	Annual Maintenance	$	
	3.5	Annual Contingency	$	
	3.6	Technical Oversight	$ 125	
		TOTAL ANNUAL O & M	$ 387.5	
		X NUMBER OF YEARS OF OPERATION	4	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 1,550 (1)
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 1,000	
	4.2	Closure, Post-Closure, Monitoring	$	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 1,000
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$ 11,200 (2)	
	5.2	Mobile Treatment	$ N/A	
		TOTAL CONTRACTED SERVICES		$ 11,200
6.0	Offsite Treatment (DOE)			$ 0
7.0	Transportation			$ 52
8.0	Disposal			$ 2,624
		SUB COST FOR VITRIFICATION MODULE		$ 18,446
		ESCALATION		1.06
		TOTAL COST		$ 19,552

(1) Costs averaged over 4 years, 4QFY94-FY97

(2) Includes closure cost

This Cost Estimate sheet includes costs for processing SR-W004, as well as SR-W005, SR-W029, SR-W037, SR-W038, SR-W039. These costs also include processing SR-W054 which has been combined with waste stream SR-W037.

If above numbers do not appear to add correctly, it is the result of computer rounding.

Summary Page

Waste Stream Number & Name: SR-W005 Mark 15 Filtercake

Background Information

This waste stream is filtercake from the precipitation and filtration of slightly enriched uranium solution in M-Area. Waste was generated by treatment and precipitation of etching solution from metal plating operations on slightly enriched uranium slugs.

Volume
- Current volume through 09/30/94 is 15.4 m^3.
- There will be no future generation of this waste because the manufacturing process which generated this waste is no longer operational.

Waste Stream Composition
- Inorganic sludge/particulate

Waste Code
- F006 (metal plating waste sludge without cyanide), nonwastewater

LDR Treatment Standard
- F006 = concentration based standards = 0.19-5.0 mg/l

Waste Characterization
- Process knowledge and sampling and analysis used to characterize the waste.
- Confidence level is high based upon knowledge that the process generated a listed hazardous waste. Primary components are Ni 6.6% by weight, U 50% by weight (1.1% of the U is U^{235}).
- No direct TCLP result was performed on this waste stream but TCLP was performed on a similar waste stream.

Radiological Characterization
- Sampling results indicate total activity is 3.05 Ci.
- Alpha emitters are U^{234}, U^{235}, and U^{238}.
- Waste is contact handled.
- Mixed low-level waste

Preferred Option

The preferred treatment option for Mark 15 Filtercake is Stabilization by Vitrification in the M-Area Vendor Treatment Process.

Treatment Justification

In-depth options analysis (IDOA) is not required for this waste stream since a Preferred Option has been identified utilizing an existing facility with existing treatment technology.

The proposed action is to stabilize the M-Area mixed wastes utilizing a thermal vitrification process. The process facility would be constructed and operated by a subcontractor to the Westinghouse Savannah River Company (WSRC). The vitrification process would result in the lowest volume of stabilized waste for final disposal, provide the most durable final waste form, and could be completed for the lowest cost (including final disposal costs) of all treatment alternatives for wastes needing to be treated in M Area.

The proposed action was evaluated with respect to the technical ability to meet the Land Disposal Restriction (LDR) criteria for the final stabilized wasteform and for the overall cost of the treatment activities. The ability to meet the durability requirements, that is, Toxicity Characteristic Leaching Procedure (TCLP) testing requirements, for constituents of concern in

the final wasteform was a critical consideration. The total life-cycle cost, including the cost of treating the waste itself, the cost to treat any effluents generated by the vendor, and the cost to dispose of the final wasteform were also considered. In addition, the environmental impacts, onsite and offsite health effects, and occupational health and safety concerns for this treatment method were evaluated.

Treatability studies were performed on M-Area waste streams to determine the treatment technology most likely to meet the treatment standard required in the land disposal restriction standards. The methods determined to be most effective in meeting the treatment standards involved the isolation of the metal contaminants in a cementatious or a glass matrix. Investigation was made into the alternatives for providing such treatment. Treatment options investigated included:

- Onsite treatment by a subcontractor at a temporary facility
- Onsite treatment at a permanent facility located in M-Area and operated by SRS
- Onsite treatment at a permanent facility located at some central SRS location and operated by SRS
- Transport to an offsite location for treatment by a vendor
- Taking no action

The no-action alternative was rejected because of the LDR-FFCA requirement for treatment of the M-Area waste streams.

Evaluation of the treatment option was made for both a cement-based stabilization process and a glass/vitrification process. An initial determination was made that vendor processes were cheaper than construction and operation of a permanent, onsite facility by SRS. Cost studies performed in 1991 showed that onsite treatment in facilities constructed at SRS would cost an estimated $46 million if constructed in M Area or $75 million if constructed at a central SRS location. The estimated cost for a vendor operated cementatious waste stabilization treatment process would be $28 million. A request for bids was made to vendors utilizing both cement and glass isolation processes. A stipulation was made in the bid that the vendor must demonstrate that this process was capable of meeting the land disposal restriction treatment standards for the treated waste streams.

The award of a contract for the treatment of M-Area waste was based on demonstration on the part of the bidder of not only a technically valid treatment process but previous treatment experience and adequate company resources to carry out the work.

Review of the bids received disclosed that the proposal for treating M-Area wastes by vitrification in a temporary facility operated at SRS by a vendor was the lowest cost alternative. This alternative would also result in the least amount of liquid requiring treatment and discharge at the M-Area wastewater treatment facility and produce the lowest volume of treated waste meeting land disposal restriction standards that would require eventual disposal in a RCRA disposal facility.

When blending and treatment of the Intermediate Treatment/Storage Facility sludge is begun, it is projected that approximately 700,000 gallons of F006 listed mixed waste will be in storage in the tanks. This includes an estimated 50,000 gallons of supernate which cannot be separated from the sludge. Waste streams stored in the tanks include SR-W004, M-Area Plating Line Sludges from Supernate Treatment, and SR-W037, M-Area High Nickel Plating Line Sludge. One waste stream (SR-W054 – Enriched Uranium Contaminated with Lead, total volume 35 gallons) has been combined with waste stream SR-W037. SR-W054 is now indistinguishable from SR-W037 and will be treated identically.

Other M-Area mixed wastes to be treated are stored in 55-gallon drums in the Mixed Waste Storage Shed in M Area. These wastes include:

- A Watts Plating bath, California list waste solution, SR-W039, Nickel Plating Line Solution
- Mark 15 sludge filtercake, waste stream SR-W005, Mark 15 Filtercake
- Solid treatability sample residues, waste stream SR-W029, M-Area Sludge Treatability Samples

Two drums of Plating Line Sump Material (SR-W038) are stored in the 645-2N storage facility.

Equipment required for treatment of the M-Area waste would continue to belong to the vendor and, if the equipment could meet Department of Transportation (DOT) shipping criteria for radioactivity, would be removed from SRS. If equipment could not be successfully decontaminated, it would be disposed onsite. The cost of disposal was a part of the total contract cost.

The M-Area Vendor Treatment Process is capable of effectively treating all of these waste streams to meet regulatory requirements. As a result, upon completion of treatment, all listed and characteristically hazardous waste sludges and liquids from M-Area operations will be eliminated.

Cost Estimate: INCLUDED WITH COST INFORMATION FOR TREATING WASTE STREAM SR-W004. SEE COST ESTIMATE SHEET FOR SR-W004.

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Summary Page

Waste Stream Number & Name: SR-W006 Mixed TTA/Xylene – TRU

Background Information

This waste stream is defense-related TRU waste, consisting of laboratory waste generated from plutonium extraction analytical procedures at the Savannah River Technology Center (SRTC). It consists of a homogeneous, xylene based, liquid chelating agent. TTA stands for Thenoyl Trifluoroacetone.

Volume
- Current volume through 09/30/94 is 0.1 m^3.
- There will be no future waste generation because a nonhazardous organic was identified for the lab procedure.

Waste Stream Composition
- Organic liquid

Waste Code
- D001A (Ignitable high TOC)

LDR Treatment Standard
- Manage at WIPP through a no migration determination.

Waste Characterization
- Sampling and analysis used to characterize the waste stream.
- Confidence level is high based upon knowledge of the chemicals used in the analytical procedures.

Radiological Characterization
- Total activity is 100 nCi/g.
- Contains transuranic contaminants Pu^{239} and Am^{241}
- Waste is contact handled.
- Mixed transuranic waste (MTRU)

Preferred Option

The preferred option for this waste stream is to assay and characterize the waste stream at the TRU Waste Certification/Characterization Facility (TWCCF), followed by preparation for shipment to, and disposal at, WIPP.

Treatment Justification

In-depth options analysis (IDOA) is not required for this waste stream. For further information on this waste stream, see the "Transuranic Mixed Waste Section," Chapter 4 of Volume II.

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Summary Page

Waste Stream Number & Name: SR-W007 SRL (SRTC) Low Activity Waste

Background Information

A waste stream generated by laboratory research, development, and analytical programs at the Savannah River Technology Center. The waste comes from laboratories and radiobenches with drains that go to the low activity mixed waste storage tanks and have a total activity of less than 1,000 disintegrations per minute per milliliter (d/m/ml).

Volume
- Current volume through 09/30/94 is 58.6 m^3.
- Expected volume 1995-1999 will be 375 m^3.

Waste Stream Composition
- Aqueous liquid

Waste Code
- D002A (corrosive)
- D007A (TCLP Cr)
- D008A (TCLP Pb)
- D009A (TCLP Hg)
- D018 (benzene) nonwastewater

LDR Treatment Standard
- D002 = specified technology = Deactivation
- D007 = concentration based standard = 5.0 mg/l
- D008 = concentration based standard = 5.0 mg/l
- D009 = concentration based standard = 0.2 mg/l
- D018 = concentration based standard = 10 mg/kg

Waste Characterization
- Sampling and analysis used to characterize the waste stream.
- Confidence level is high.
- TCLP results include benzene <5 mg/l, Cr = 0.55 mg/l, Pb = 0.15 mg/l, and Hg = 0.1 mg/l.

Radiological Characterization
- Sampling indicates total activity ≤ 1000 d/m/ml of beta/gamma.
- Alpha emitter is <10 nCi/g.
- Waste is contact handled.
- Mixed low-level waste
- Isotopes present include Cs^{137}, H^3, and U^{235}.

Preferred Option

The preferred treatment option for SRTC Low Activity Waste is Ion Exchange and Neutralization in the SRTC Low Activity Waste Storage Tanks.

Treatment Justification

In-depth options analysis (IDOA) is not required for this waste stream since a Preferred Option has been identified utilizing an existing facility with existing treatment technology.

Since 1952, slightly acidic, dilute sodium nitrate waste from the laboratories in Building 773-A of the Savannah River Technology Center (SRTC) has been discharged into storage tanks at SRTC prior to transfer to the F-Area tank farm for volume reduction via evaporation. The waste streams were not initially hazardous but analysis in recent years disclosed the potential for the waste streams to contain chromium (III), lead, mercury or benzene contamination at levels sufficient

to make the waste streams characteristically hazardous. As a result, it became necessary by 1991 to determine a treatment methodology and apply for an expansion of interim status for the RCRA Part A permit for SRS to comply with hazardous waste regulations for the generation and treatment of hazardous waste in the storage tanks.

In the course of investigation to find an appropriate treatment method for these waste streams, SRTC developed separate resins capable of removing metal contaminants or organics. The resins remove the contaminants with enough efficiency to reduce the contaminant concentration below the treatment standards for the metal and organic constituents.

The regulations recommend Best Demonstrated Available Technology Standards (BDAT) for waste treatment. The BDAT standards are not requirements. The regulations require that the treatment standards be met but do not require that a specific BDAT treatment be used to meet the standards. Because characteristic metals can be accurately sampled and analyzed, treatment standards have been established. As long as the standard is met there is no requirement in regard to treatment by use of the BDAT. Therefore, the use of the ion exchange resins in the Low-Level and High-Level Mixed Waste Storage Tanks at SRTC is an appropriate practice because it enables the waste to be treated to the required standard in the regulations. It is also cost-effective because it allows treatment to occur in existing facilities with minimal equipment addition.

Waste Stream Number & Name: SR-W007 SRL (SRTC) Low Activity Waste
Facility: SRTC Low Activity Waste **Treatment Technology:** Ion Exchange Storage Tanks

Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled
Module Location: SRS
Module Status: [√] Existing [ ] New [ ] Small generator [√] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ N/A	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ N/A	
		1.3.2 Safety Assurance Documentation	$ N/A	
		1.3.3 Permitting	$ N/A	
		1.3.4 Preparation for Operations	$ N/A	
		1.3.5 Project Management	$ N/A	
		TOTAL PRE-OPERATIONS		$ 0
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ N/A	
	2.2	Inspection	$ N/A	
	2.3	Project Management	$ N/A	
	2.4	Building Construction (inc. indirect)	$ N/A	
	2.5	Equipment (inc. indirect)	$ N/A	
	2.6	Construction Management	$ N/A	
	2.7	Contingency	$ N/A	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 0
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor $5,200/tank treated x2	$ 10.4	
	3.2	Annual Utilities	$ 1.0	
	3.3	Annual Materials change resins 1x/5 yrs	$ 2.0	
	3.4	Annual Maintenance change probe 1x/5 yrs	$ 5.25	
	3.5	Annual Contingency	$ 5.0	
		TOTAL ANNUAL O & M	$ 23.65	
		X NUMBER OF YEARS OF OPERATION	5	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 118
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ N/A	
	4.2	Closure, Post-Closure, Monitoring	$ N/A	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 0
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$ N/A	
	5.2	Mobile Treatment	$ N/A	
		TOTAL CONTRACTED SERVICES		$ 0
6.0	Offsite Treatment (DOE)			$ 0
7.0	Transportation			$ 0
8.0	Disposal			$ 0
		SUB COST FOR ION EXCHANGE MODULE		$ 118
		ESCALATION		1.06
		TOTAL COST		$ 125

If above numbers do not appear to add correctly, it is the result of computer rounding.

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Summary Page

Waste Stream Number & Name: SR-W008 SRL (SRTC) High Activity Waste

Background Information

This waste stream is generated by laboratory research, development, and analytical programs at the Savannah River Technology Center (SRTC). The waste comes from cupsinks in radiologically controlled hoods or gloveboxes and usually has a total activity of more than 1,000 disintegrations per minute per milliliter (d/m/ml).

Volume
- Current volume through 09/30/94 is 72.2 m^3.
- Expected 1995-1999 volume will be 375 m^3.

Waste Stream Composition
- Aqueous liquid

Waste Code
- D002A (corrosive)
- D007A (TCLP Cr)
- D008A (TCLP Pb)
- D009A (TCLP Hg)
- D018 (benzene) nonwastewater

LDR Treatment Standard
- D002 = specified technology = Deactivation
- D007 = concentration based standard = 5.0 mg/l
- D008 = concentration based standard = 5.0 mg/l
- D009 = concentration based standard = 0.2 mg/l
- D018 = concentration based standard = 10 mg/kg

Waste Characterization
- Sampling and analysis used to characterize the waste stream.
- Confidence level is high due to availability of TCLP analysis.
- Typical value for mercury is 0.076 mg/l.

Radiological Characterization
- Radioactive isotopes present may include: Pu^{239}, U^{235}, Am^{241}, Co^{60}, Sb^{125}, Cs^{137}, Eu^{154}, Eu^{155}, Cs^{134}, Eu^{154}, and H^3.
- Mixed low-level waste
- Waste is contact handled.

Preferred Option

The preferred treatment option for the SRTC High Activity Waste is Ion Exchange and Neutralization in the SRTC High Activity Waste Storage Tanks.

Treatment Justification

In-depth options analysis (IDOA) is not required for this waste stream since a Preferred Option has been identified utilizing an existing facility with existing treatment technology.

Since 1952, slightly acidic, dilute sodium nitrate waste from the laboratories in Building 773-A of the Savannah River Technology Center (SRTC) has been discharged into storage tanks at SRTC prior to transfer to the F-Area tank farm for volume reduction via evaporation. The waste streams were not initially hazardous but analysis in recent years disclosed the potential for the waste streams to contain chromium (III), lead, mercury or benzene contamination at levels sufficient to make the waste streams characteristically hazardous. As a result, it became necessary by 1991 to

determine a treatment methodology and apply for an expansion of interim status for the RCRA Part A permit for SRS to comply with hazardous waste regulations for the generation and treatment of hazardous waste in the storage tanks.

In the course of investigation to find an appropriate treatment method for these waste streams, SRTC developed separate resins capable of removing metal contaminants or organics. The resins remove the contaminants with enough efficiency to reduce the contaminant concentration below the treatment standards for the metal and organic constituents.

The regulations recommend Best Demonstrated Available Technology Standards (BDAT) for waste treatment. The BDAT standards are not requirements. The regulations require that the treatment standards be met but do not require that a specific BDAT treatment be used to meet the standards. Because characteristic metals can be accurately sampled and analyzed, treatment standards have been established. As long as the standard is met there is no requirement in regard to treatment by use of the BDAT. Therefore, the use of the ion exchange resins in the Low-Level and High-Level Mixed Waste Storage Tanks at SRTC is an appropriate practice because it enables the waste to be treated to the required standard in the regulations. It is also cost-effective because it allows treatment to occur in existing facilities with minimal equipment addition.

Waste Stream Number & Name: SR-W008 SRL (SRTC) High Activity Waste
Facility: SRTC High Activity Waste **Treatment Technology:** Ion Exchange Storage Tanks

Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled

Module Location: SRS

Module Status: [√] Existing [ ] New [ ] Small generator [√] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ N/A	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ N/A	
		1.3.2 Safety Assurance Documentation	$ N/A	
		1.3.3 Permitting	$ N/A	
		1.3.4 Preparation for Operations	$ N/A	
		1.3.5 Project Management	$ N/A	
		TOTAL PRE-OPERATIONS		$ 0
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ N/A	
	2.2	Inspection	$ N/A	
	2.3	Project Management	$ N/A	
	2.4	Building Construction (inc. indirect)	$ N/A	
	2.5	Equipment (inc. indirect)	$ N/A	
	2.6	Construction Management	$ N/A	
	2.7	Contingency	$ N/A	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 0
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor $5,200/tank treated x 2	$ 10.4	
	3.2	Annual Utilities	$ 1.0	
	3.3	Annual Materials $5,000/resin replacement	$ 2.00	
	3.4	Annual Maintenance $5,000/resin replacement	$ 5.25	
	3.5	Annual Contingency	$ 5	
		TOTAL ANNUAL O & M	$ 23.65	
		X NUMBER OF YEARS OF OPERATION	5	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 118
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ N/A	
	4.2	Closure, Post-Closure, Monitoring	$ N/A	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 0
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$ N/A	
	5.2	Mobile Treatment	$ N/A	
		TOTAL CONTRACTED SERVICES		$ 0
6.0	Offsite Treatment (DOE)			$ 0
7.0	Transportation			$ 0
8.0	Disposal			$ 0
		SUB COST FOR ION EXCHANGE MODULE		$ 118
		ESCALATION		1.06
		TOTAL COST		$ 125

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Summary Page – Initial Screening

Waste Stream Number & Name: SR-W009 Silver Coated Packing Material

Background Information

This material is ceramic packing material coated with silver nitrate (silver coated berl saddles) that is used in the offgas systems in the F-Canyon and H-Canyon dissolver operations to bond radioactive iodine^{129} and iodine^{131} emissions to the packing material as silver iodide. Spent packing material is changed out from the process when pluggage occurs or when the iodine level measured at the stack elevate such that levels start to approach the emission limit. Material is too small to meet the 60-mm minimum particle size standard for debris.

Volume
- Current volume through 09/30/94 is 10.2 m^3.
- Expected 1995-1999 volume will be 3.1 m^3.

Waste Stream Composition
- Uncategorized inorganic particulate

Waste Code
- Nonwastewater D011A (TCLP Ag)
- D008C (Elemental Pb)

LDR Treatment Standard
- D011 = concentration based standard = 5.0 mg/l
- D008 = concentration based standard = 5.0 mg/l

Waste Characterization
- No analysis due to ALARA concerns but silver value calculated.
- Process knowledge used to characterize waste stream.
- Confidence level high due to knowledge of silver content on the saddles

Radiological Characterization
- Beta/gamma emitters present.
- Volatile Radionuclides iodine^{129} and iodine^{131} (I^{131} is a short lived isotope) are present.
- Typical Rad Levels include
  - I^{129} = 62.2 nCi/g
  - Cs^{137} = 3080 nCi/g
- Alpha emitters (U^{235}, U^{236}, U^{238}, Pu^{239}, and Pu^{240}) are present.
- Waste is remote handled.
- Mixed low-level waste

Initial Screening

The initial screening identified inappropriate treatment options. These options appear in the Initial Rejections table.

Initial Rejections

Treatment Facility	Treatment Technology	Reasons for Rejection
CIF	Ashcrete Stabilization	Ashcrete does not effectively immobilize the characteristic metal. Resulting wasteform would not meet LDR requirements.
CIF	Incineration Stabilization	CIF does not have the equipment to control I^{129}.
ETF	Ion Exchange	ETF treatment has no equipment to treat I^{129}.
LETF	Ion Exchange	LETF is not designed to treat I^{129}.

Initial Rejections (contd)

Treatment Facility	Treatment Technology	Reasons for Rejection
M Area	Vitrification	Vitrifier cannot control release of I^{129}.
Tritium	Macro-encapsulation	Fission products not allowed in this facility (policy) to avoid contamination problems. This stream has fissile materials mixed in it.
Z Area	Stabilization	Z Area can treat only those wastes that come by pipeline from Tank 50 and meet strict waste acceptance criteria. The Z-Area process lacks flexibility to treat and dispose of a variety of waste streams.

Summary Page – Technology Success Factor (TSF) & In-Depth Options Analysis (IDOA)

Waste Stream Number & Name: SR-W009 Silver Coated Packing Material

Feasible Options

Option No.	Treatment Facility	Treatment Technology	TSF Score	IDOA Scores Tech.	IDOA Scores Total	COST (x 1,000)	PO
SR-W009-1	Cont. Bldg.	Macro-encapsulation	51	53	65	4,725	√
SR-W009-2	Vendor/Onsite	Stabilization	81	56	66	12,162	
SR-W009-3	Vendor/Onsite	Polymer Encapsulation	88	54	64	11,066	
SR-W009-4	HW/MW-TB	Macro-encapsulation	94	52	61	14,497	
SR-W009-5	Cont. Bldg.	Metathesis	26	32	44	7,047	
SR-W009-6	Vendor	Plasma Arc	1				
SR-W009-7	Vendor	Plasma Hearth	1				

Options Rejected Due To Low Technology Success Factor (TSF)

Plasma Arc Centrifugal Treatment Performed By Vendor

Plasma arc centrifugal treatment performed by vendor was rejected because:

- Plasma arc centrifugal incineration is currently still in the laboratory with no units in the field, hence, Pm=0.9.
- Control of the process requires sophisticated computerized instrumentation, hence, Pc=0.9.
- It is not expected for this technology to reach a level of reliability suitable for industrial application for 5-10 years.

Plasma Hearth Process Performed By Vendor

Plasma hearth process performed by vendor was rejected because:

- Plasma hearth incineration is currently still in the laboratory. While prototypes may exist, they have no record of continuous reliable operation in industrial settings, hence, Pm=0.9.
- Control of the process requires sophisticated computerized instrumentation, hence, Pc=0.9.
- It is not expected for this technology to reach a level of reliability suitable for industrial application for 5-10 years.

Metathesis Performed In A Containment Building

Metathesis performed in a containment building was rejected because:

- Metathesis (the reaction of elemental silver on the waste with hydrogen bromide (HBr) has been demonstrated only at laboratory scale on nonradioactive simulated waste, hence, Pm=0.9.
- Scale-up from bench scale to field scale would result in many uncertainties. The need to handle the waste remotely adds to the complexity, hence, Pc=0.5.
- It should be noted that an IDOA was conducted on this treatment option only because of a specific request to include it as an option.

Engineering Assessment

Preferred Option Justification

The preferred treatment option for Silver Coated Packing Material is Macroencapsulation in a stainless steel box in one of the existing canyon facilities by means of a treatability variance.

This option treats the constituent of concern silver by isolating it from the environment in a stainless steel box that has been welded closed.

This option is preferred because:

- The containment building (canyon) has the needed equipment to remotely handle the waste, which is also contaminated with radioactive I^{129}.
- It satisfies LDR, provided a treatability variance is granted identifying the waste as "debris," and allowing encapsulation of the waste lead shielding as a whole which then allows macroencapsulation.
- No secondary waste is generated.

Options Rejected During IDOA

Note: IDOA scores for all of the five viable options were within four points. The model alone did not yield a clear preferred option.

Stabilization and Encapsulation by Vendors

Stabilization and encapsulation by vendors was rejected because:

- Process to encapsulate or stabilized is very difficult to do with remote handling.
- Highly radioactive materials must be removed from existing protective containers, which causes safety concerns.
- Waste volume more than doubles.
- Wasteform is not as long-lived as the preferred option.

Macroencapsulation in Stainless Steel Boxes in the HW/MW-TB

Macroencapsulation in stainless steel boxes in the HW/MW-TB was rejected because:

- Containment building option is technologically equal and more cost-effective.

Metathesis in a Containment Building

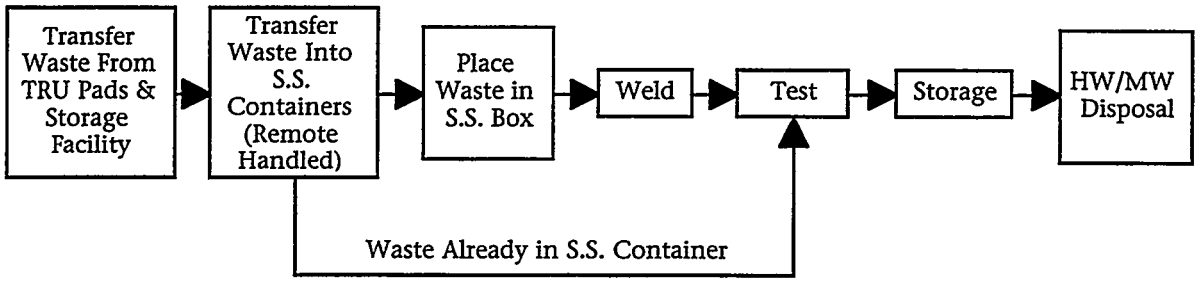
Metathesis in a containment building was rejected owing to a low Technology Success Factor (**TSF**). Nevertheless, at the request of SRTC personnel, an IDOA was performed.

Metathesis was rejected because:

- Process does not contain or treat I^{129}.
- Process exists only at the laboratory scale.
- Additional, time-consuming research may be required to scale the process up to full size.

Waste Stream Number & Name: SR-W009 Silver Coated Packing Material
Option Number: SR-W009-1
Facility: Containment Building
Treatment Technology: Macroencapsulation in a S. S. Box

Treatment Cycle Flow Diagram



Pros

- There is no secondary waste generation.
- All applicable LDR standards are met.
- This option can process a wide range of materials with no loss of efficiency due to off design input.
- S. S. containers will meet current DOT shipping requirements.
- Final waste form will meet RCRA Subtitle C Disposal WAC.
- All processes involved (including remote handling systems) are existing technology.
- Similar systems have demonstrated availability of >80%.
- Process failure does not produce altered waste form. A failed container does not create a waste that cannot be fixed with existing technology.
- Due to process simplicity, a schedule can be developed easily.
- Process does not create emissions related to the waste stream. Process simply involves container closure.

Cons

- A treatability variance is required since silver coated packing material does not meet definition of debris and SRS does not propose to macroencapsulate individual pieces of waste lead used as shielding.
- All waste will require disposal in HW/MW facilities.
- Not a budget item and will require line item funding.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	40	Subtract 10 points from the median score of 50 because volume of material increases slightly due to packaging in S. S. container.
• secondary waste generation	100	Add 20 points to the median score of 80 because there is no secondary waste generation.
• destruction removal and demobilization efficiency	80	All applicable LDR standards are met, assuming variance is granted.
• flexibility	80	This option can process a wide range of materials with no loss of efficiency due to off design input.
• ability to be shipped	80	S. S. containers will meet current DOT shipping requirements.
• final wasteform	80	Final wasteform will meet HW/MW Disposal WAC.

Waste Stream Number & Name: SR-W009 Silver Coated Packing Material
Option Number: SR-W009-1
Facility: Containment Building
Treatment Technology: Macroencapsulation in a S. S. Box

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Engineering Parameters		
• system implementability	90	Add 10 points to the median score of 80 because all processes involved (including remote handling systems) are existing technology.
• availability	80	Similar systems have demonstrated availability of greater than 80%
• scalability	50	Throughput is set by design and not easily expanded except by adding additional shifts of operation.
• remedial measures	90	Process failure does not produce altered waste form. Add 10 points to the median score of 80 because a failed container does not create a waste that cannot be fixed with existing technology.
• schedule for treatment of waste	80	Due to process simplicity, a schedule can be developed easily.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Process does not create emissions related to the waste stream. Process simply involves container closure.
• non operational worker potential exposure	50	Remote handled equipment would require decommissioning activities due to radioactive iodine.
• operational worker potential exposure	50	Exposure controlled by design. Number of workers is dependent upon throughput.
• transportation potential exposure	60	No additional characterization needed. Add 10 points to the median score of 50 because waste can be handled readily.
Regulatory Parameters		
• need for variance	20	A treatability variance is required since silver coated packing material does not meet definition of debris.
• ability to obtain a permit	40	Subtract 10 points from the median score of 50 because uncertainties surround attaining a permit related to the "containment building.
• waste disposal	20	All waste will require disposal in HW/MW facilities.
Public Acceptance		
• public acceptance	40	Public concern should be limited due to the simplicity of the process. Subtract 10 points from the median score of 50 because the waste form is not as permanent as vitrification.
Cost Considerations		
• life-cycle cost	89	
• funding availability	20	Not a budget item and will require line item funding.
Industry Involvement		
• market for technology	20	No market because this is a unique waste stream.
• private sector involvement	20	No vendor involvement

IDOA Score: **Technical** 53 **Total** 65

Waste Stream Number & Name: SR-W009 Silver Coated Packing Material
Option Number: SR-W009-1
Facility: Containment Building
Treatment Technology: Macroencapsulation in a S. S. Box

Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [ ] contact handled [√] remote handled

Module Location: SRS

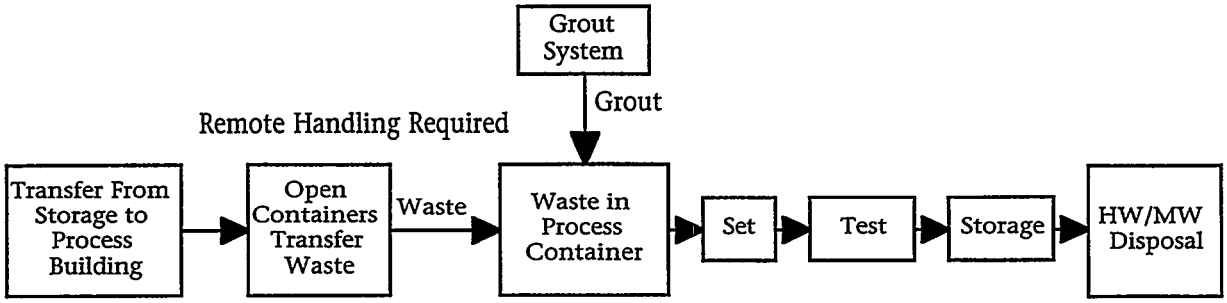
Module Status: [ ] Existing [√] New [ ] Small generator [√] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 53	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 212	
		1.3.2 Safety Assurance Documentation	$ 53	
		1.3.3 Permitting	$ 125	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 47	
		TOTAL PRE-OPERATIONS		$ 640
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 232	
	2.2	Inspection	$ 57	
	2.3	Project Management	$ 105	
	2.4	Building Construction (inc. indirect)	$ 500	
	2.5	Equipment (inc. indirect)	$ 555	
	2.6	Construction Management	$ 74	
	2.7	Contingency	$ 550	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 2,072
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 8	
	3.2	Annual Utilities	$ 0	
	3.3	Annual Materials	$ 5	
	3.4	Annual Maintenance	$ 3	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 15	
		X NUMBER OF YEARS OF OPERATION	1.00	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 15
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 844	
	4.2	Closure, Post-Closure, Monitoring	$ 8	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 852
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 150
		SUB COST FOR MACROENCAPSULATION MODULE		$ 3,729
		ESCALATION		1.267
		TOTAL COST		$ 4,725

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W009 Silver Coated Packing Material
Option Number: SR-W009-2
Facility: Vendor/Onsite
Treatment Technology: Stabilization

Treatment Cycle Flow Diagram



Pros

- No secondary waste will be generated.
- No additional treatment is required to meet LDR.
- This option can accommodate a wide range of similar wastes and radiation levels and is widely used in the commercial world.
- Waste form can be easily shipped as-is.
- The waste meets treatment standard and can be disposed of as non-hazardous radioactive waste.
- This is a proven process used both in DOE complex and the commercial world.
- Similar systems in the commercial nuclear industry experience availability of 80%.
- Mature technology. Vendor will bring onsite and set up with a minimum delay.
- Skid mounted, no D&D, vendor removes upon completion of work. Requires fewer non operational workers than comparably sized, skid mounted facilities. Experience in similar facilities indicates that little non-routine maintenance is needed.
- Well accepted wasteform. Similar processes result in wasteforms that meet stability requirements for radionuclides for class A stable waste.

Cons

- The waste volume will more than double.
- Waste cannot be contact-handled.
- Waste form is not as permanent as other forms of stabilization.
- Not a budgeted item and will require line item funding.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	10	Subtract 10 points from the median score of 20 because the waste volume will more than double.
• secondary waste generation	100	Add 20 points to the median score of 80 because no secondary waste will be generated.
• destruction removal and demobilization efficiency	80	No additional treatment is required to meet LDR.
• flexibility	80	This option can accommodate a wide range of similar wastes and radiation levels and is widely used in the commercial world.
• ability to be shipped	80	Wasteform can be easily shipped as-is.
• final wasteform	80	Final wasteform will meet HW/MW Disposal WAC.

Waste Stream Number & Name: SR-W009 Silver Coated Packing Material
Option Number: SR-W009-2
Facility: Vendor/Onsite **Treatment Technology: Stabilization**
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Engineering Parameters		
• system implementability	100	Add 20 points to the median score of 80 because this is a proven process used both in DOE complex and the commercial world.
• availability	80	Similar systems in the commercial nuclear industry experience availability of 80%.
• scalability	50	Throughput is set by design, and not easily expanded except by adding more shifts of operation.
• remedial measures	20	Failed wasteform can be ground up and reprocessed. Waste cannot be contact-handled.
• schedule for treatment of waste	80	Mature technology. Vendor will bring onsite and set up with a minimum delay.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Process can be installed in a building with adequate emission controls.
• non operational worker potential exposure	70	Requires the same number of non operational workers as comparable skid-mounted units. Most or all initial construction can be done in a vendor shop. Experience in similar facilities indicates that little non-routine maintenance is required. Subtract 10 points from median score of 80 because of uncertainties surrounding D&D efforts.
• operational worker potential exposure	40	Facility requires about the same number of operational workers as comparably sized skid mounted units. Subtract 10 points from median score of 50 because waste must be remote-handled.
• transportation potential exposure	60	No additional characterization needed. Add 10 points to the median score of 50 because waste can be handled readily.
Regulatory Parameters		
• need for variance	80	Well accepted wasteform. Similar processes result in wasteforms that meet stability requirements for radionuclides for class A stable waste.
• ability to obtain a permit	80	Must demonstrate that waste passes LDR treatment standards.
• waste disposal	20	Assumed disposal in HW/MW facility due to handling concerns associated with testing this material.
Public Acceptance		
• public acceptance	20	Mature and proven technology, however waste form is not as permanent as other forms of stabilization (i.e., vitrification).
Cost Considerations		
• life-cycle cost	67	
• funding availability	20	Not a budgeted item **and** will require line item funding.

Waste Stream Number & Name: SR-W009 Silver Coated Packing Material
Option Number: SR-W009-2
Facility: Vendor/Onsite
Treatment Technology: Stabilization

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Industry Involvement		
• market for technology	20	This is an existing vendor process.
• private sector involvement	50	Technology could be provided by an existing vendor process.

IDOA Score: **Technical** 56 **Total** 66

Waste Stream Number & Name: SR-W009 Silver Coated Packing Material
Option Number: SR-W009-2
Facility: Vendor/Onsite **Treatment Technology: Stabilization**
Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [ ] contact handled [√] remote handled

Module Location: SRS

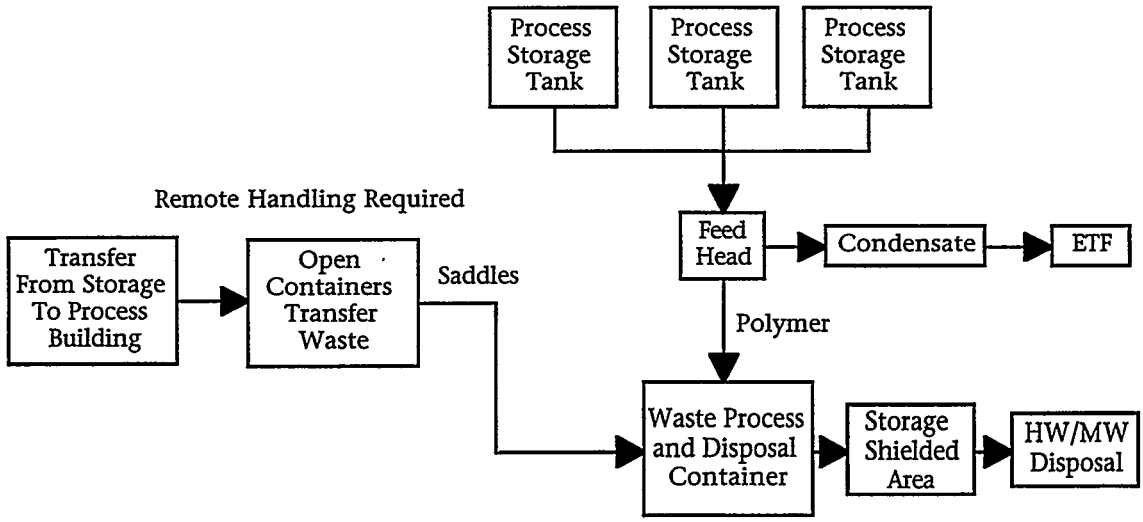
Module Status: [ ] Existing [√] New [ ] Small generator [√] Large generator
[√] Onsite [ ] Offsite [√] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
1.1	Studies and Bench Scale Tests		$ 168	
1.2	Demonstration Costs		$ N/A	
1.3	Operations Budget Funded Activities			
1.3.1		Conceptual Design	$ 672	
1.3.2		Safety Assurance Documentation	$ 168	
1.3.3		Permitting	$ 125	
1.3.4		Preparation for Operations	$ 150	
1.3.5		Project Management	$ 90	
		TOTAL PRE-OPERATIONS		$ 1,372
2.0	Facility Construction Cost			
2.1	Design (Title I and II)		$ 770	
2.2	Inspection		$ 140	
2.3	Project Management		$ 230	
2.4	Building Construction (inc. indirect)		$ 2,000	
2.5	Equipment (inc. indirect)		$ 0	
2.6	Construction Management		$ 245	
2.7	Contingency		$ 1,741	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 5,126
3.0	Operation and Maintenance			
3.1	Annual Operating Labor		$ 150	
3.2	Annual Utilities		$ 6	
3.3	Annual Materials		$ 90	
3.4	Annual Maintenance		$ 54	
3.5	Annual Contingency		$ 0	
		TOTAL ANNUAL O & M	$ 300	
		X NUMBER OF YEARS OF OPERATION	0.50	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 150
4.0	Decontamination & Decommissioning			
4.1	Facility D&D		$ 2,800	
4.2	Closure, Post-Closure, Monitoring		$ 25	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 2825
5.0	Contracted Services			
5.1	Commercial Treatment/Disposal		$ 1,500	
5.2	Mobile Treatment		$	
		TOTAL CONTRACTED SERVICES		$ 1,500
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 500
		SUB COST FOR STABILIZATION MODULE		$ 11,474
		ESCALATION		1.06
		TOTAL COST		$ 12,162

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W009 Silver Coated Packing Material
Option Number: SR-W009-3
Facility: Vendor/Onsite
Treatment Technology: Polymer Encapsulation

Treatment Cycle Flow Diagram



Pros

- No additional treatment is required to meet LDR standards.
- This option can accommodate a wide range of similar wastes and radiation levels. Widely used in the commercial world.
- Wasteform meets shipping requirements in the form it exits the treatment process.
- Final waste form meets treatment standards and can be disposed of as non-hazardous radioactive waste.
- This is a proven process, used both in DOE complex and the commercial world.
- Mature technology. Vendor will bring onsite and set up with a minimum delay.
- Skid mounted, no D&D, vendor removes upon completion of work. Facility requires more non operational workers than comparably sized, skid mounted facilities.
- No secondary waste is generated.

Cons

- The waste volume will more than double.
- Waste cannot be contact-handled.
- The facility requires more operational workers than comparably sized, skid mounted facilities.
- Wasteform is not as permanent as other forms of stabilization.
- Not a budgeted item and will require line item funding.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	10	Subtract 10 points from the median score of 20 because the waste volume will more than double.
• secondary waste generation	100	Add 20 points to the median score of 80 because no secondary waste generated.
• destruction removal and demobilization efficiency	80	No additional treatment is required to meet LDR standards.

Waste Stream Number & Name: SR-W009 Silver Coated Packing Material
Option Number: SR-W009-3
Facility: Vendor/Onsite
Treatment Technology: Polymer Encapsulation

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• flexibility	80	This option can accommodate a wide range of similar wastes and radiation levels. Widely used in the commercial world.
• ability to be shipped	80	Wasteform meets shipping requirements in the form it exits the treatment process.
• final waste form	80	Final wasteform will meet HW/MW Disposal WAC.
Engineering Parameters		
• system implementability	100	Add 20 points to the median score of 80 because this is a proven process, used both in DOE complex and the commercial world.
• availability	60	Add 10 points to the median score of 50 because system is normally available 50% of the time.
• scalability	50	Throughput is set by design, and not easily expanded except by adding more shifts of operation.
• remedial measures	20	Failed wasteform can be ground up and reprocessed. Waste cannot be contact-handled.
• schedule for treatment of waste	80	Mature technology. Vendor will bring onsite and set up with a minimum delay.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Process can be installed in a building with adequate emission controls.
• non operational worker potential exposure	80	Requires the same number of non operational workers as comparable skid-mounted units. Most or all initial construction can be done in a vendor shop. Experience in similar facilities indicates that little non-routine maintenance is required.
• operational worker potential exposure	20	The facility requires more operational workers than comparably sized, skid mounted facilities. Waste must be handled remotely.
• transportation potential exposure	60	No additional characterization is needed. Add 10 points to the median score of 50 because waste can be handled readily.
Regulatory Parameters		
• need for variance	80	Process will be in compliance without needing a variance.
• ability to obtain a permit	80	Must demonstrate that waste passes LDR treatment standards.
• waste disposal	20	Assumed HW/MW disposal due to handling concerns associated with testing this material.
Public Acceptance		
• public acceptance	20	Mature and proven technology, however wasteform is not as permanent as other forms of stabilization (i.e., vitrification).
Cost Considerations		
• life-cycle cost	70	
• funding availability	20	Not a budgeted item and will require line item funding.

Waste Stream Number & Name: SR-W009 Silver Coated Packing Material
Option Number: SR-W009-3
Facility: Vendor/Onsite
Treatment Technology: Polymer Encapsulation

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Industry Involvement		
• market for technology	20	This is an existing vendor process.
• private sector involvement	50	Technology could be provided by an existing vendor process.

IDOA Score: **Technical** 54 **Total** 64

Waste Stream Number & Name: SR-W009 Silver Coated Packing Material
Option Number: SR-W009-3
Facility: Vendor/Onsite
Treatment Technology: Polymer Encapsulation

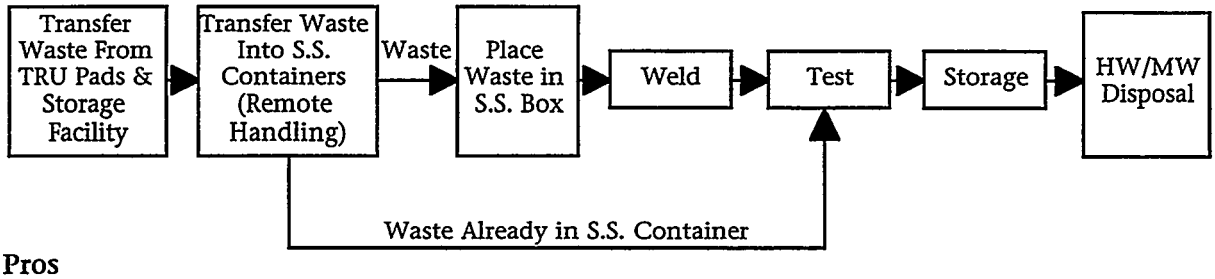
Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [ ] contact handled [√] remote handled
Module Location: SRS
Module Status: [ ] Existing [√] New [ ] Small generator [√] Large generator
[√] Onsite [ ] Offsite [√] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 146	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 585	
		1.3.2 Safety Assurance Documentation	$ 146	
		1.3.3 Permitting	$ 125	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 90	
		TOTAL PRE-OPERATIONS		$ 1,242
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 660	
	2.2	Inspection	$ 140	
	2.3	Project Management	$ 230	
	2.4	Building Construction (inc. indirect)	$ 2,000	
	2.5	Equipment (inc. indirect)	$ 0	
	2.6	Construction Management	$ 210	
	2.7	Contingency	$ 1,516	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 4756
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 150	
	3.2	Annual Utilities	$ 6	
	3.3	Annual Materials	$ 90	
	3.4	Annual Maintenance	$ 54	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 300	
		X NUMBER OF YEARS OF OPERATION	0.50	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 150
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 2,400	
	4.2	Closure, Post-Closure, Monitoring	$ 43	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 2,443
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$ 1,000	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$ 1,000
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 850
		SUB COST FOR POLYMER ENCAPSULATION MODULE		$ 10,440
		ESCALATION		1.06
		TOTAL COST		$ 11,066

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W009 **Silver Coated Packing Material**
Option Number: SR-W009-4
Facility: HW/MW-TB
Treatment Technology: Macroencapsulation in S. S. Box

Treatment Cycle Flow Diagram



Pros

- There is no secondary waste generation.
- No additional treatment is required to meet LDR standards.
- This option can accommodate a wide range of similar wastes and radiation levels. Widely used in the commercial world.
- S. S. containers will meet current DOT shipping requirements.
- Final waste form will meet RCRA Subtitle C Disposal WAC.
- This is a proven process, used both in DOE complex and the commercial world.
- Similar systems in the commercial nuclear industry experience availability of >80%.
- Process failure does not produce altered wasteform. A failed container does not create a waste that cannot be fixed with existing technology.
- Due to process simplicity, a schedule can be developed easily.
- Process does not create emissions related to the waste stream. Process simply involves container welding.

Cons

- A treatability variance is required since silver coated packing material does not meet definition of debris and the waste lead used as shielding cannot be individually encapsulated by piece.
- Requires HW/MW disposal.
- Not a budgeted item and will require line item funding.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	40	Subtract 10 points from the median score of 50 because volume of material increases slightly due to packaging in S. S. box.
• secondary waste generation	100	Add 20 points to the median score of 80 because there is no secondary waste generation, assuming variance is granted.
• destruction removal and demobilization efficiency	80	No additional treatment is required to meet LDR, assuming variance is granted.
• flexibility	80	This option can accommodate a wide range of similar wastes and radiation levels. Widely used in the commercial world.
• ability to be shipped	80	S.S. containers will meet current DOT shipping requirements.
• final wasteform	80	Final wasteform will meet RCRA Subtitle C Disposal WAC.

Waste Stream Number & Name: SR-W009 Silver Coated Packing Material
Option Number: SR-W009-4
Facility: HW/MW-TB
Treatment Technology: Macroencapsulation in S. S. Box

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Engineering Parameters		
• system implementability	90	Add 10 points to the median score of 80 because this is a proven process, used both in DOE complex and the commercial world.
• availability	80	Similar systems in the commercial nuclear industry experience availability of >80%.
• scalability	50	Throughput is set by design, and not easily expanded except by adding additional shifts of operation.
• remedial measures	90	Process failure does not produce altered wasteform. Add 10 points to the median score of 80 because a failed container does not create a waste that cannot be fixed with existing technology.
• schedule for treatment of waste	80	Due to process simplicity, a schedule can be developed easily.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Process does not create emissions related to the waste stream. Process simply involves container welding.
• non operational worker potential exposure	50	Remote handled equipment would require decommissioning activities due to radioactive iodine.
• operational worker potential exposure	40	Exposure is controlled by design and less than average number of workers. Subtract 10 points from the median score of 50 because of greater potential for exposure due to radiation levels.
• transportation potential exposure	60	No additional characterization needed. Add 10 points to the median score of 50 because waste can be handled readily after treatment.
Regulatory Parameters		
• need for variance	20	A treatability variance is required is macroencapsulate the silver coated packing material and the waste lead shielding.
• ability to obtain a permit	40	Subtract 10 points from the median score of 50 because uncertainties surround attaining a permit related to the "debris rule" and the containment building requirements.
• waste disposal	20	Requires HW/MW disposal.
Public Acceptance		
• public acceptance	40	Public concern should be limited due to simplicity of the process. Subtract 10 points from the median score of 50 because it does not eliminate the waste from the environment.

Waste Stream Number & Name: SR-W009 Silver Coated Packing Material
Option Number: SR-W009-4
Facility: HW/MW-TB
Treatment Technology: Macroencapsulation in S. S. Box

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Cost Considerations		
• life-cycle cost	66	
• funding availability	20	Not a budgeted item and will require line item funding.
Industry Involvement		
• market for technology	20	This is an existing technology.
• private sector involvement	20	SRS facility evaluated.

IDOA Score: **Technical** 52 **Total** 61

Waste Stream Number & Name: SR-W009 Silver Coated Packing Material
Option Number: SR-W009-4
Facility: HW/MW-TB
Treatment Technology: Macroencapsulation in S. S. Box

Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [ ] contact handled [√] remote handled

Module Location: SRS

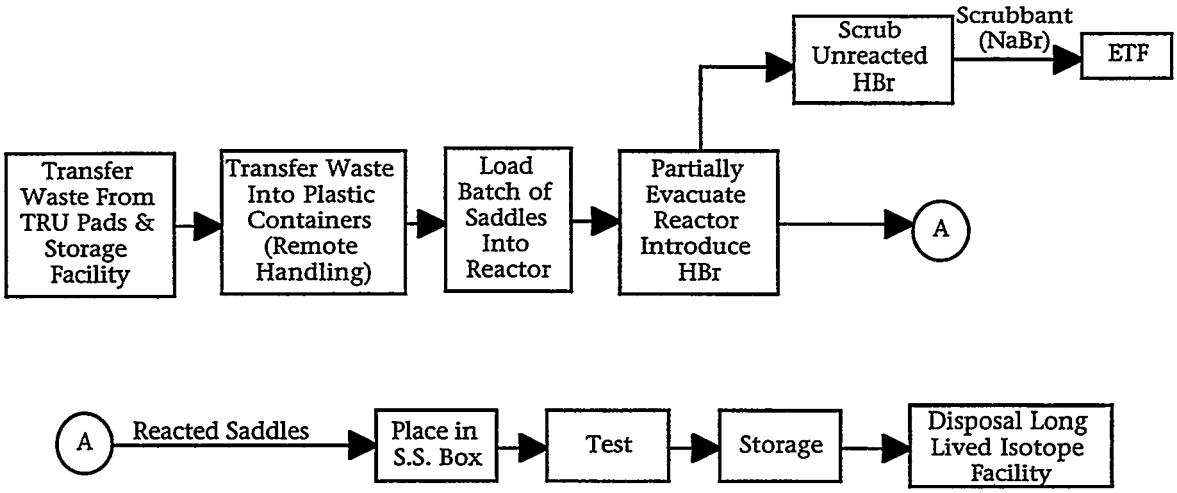
Module Status: [ ] Existing [√] New [ ] Small generator [√] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 181	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 725	
		1.3.2 Safety Assurance Documentation	$ 181	
		1.3.3 Permitting	$ 125	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 160	
		TOTAL PRE-OPERATIONS		$ 1522
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 782	
	2.2	Inspection	$ 232	
	2.3	Project Management	$ 392	
	2.4	Building Construction (inc. indirect)	$ 3,000	
	2.5	Equipment (inc. indirect)	$ 555	
	2.6	Construction Management	$ 249	
	2.7	Contingency	$ 1,880	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 7,090
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 8	
	3.2	Annual Utilities	$ 0	
	3.3	Annual Materials	$ 5	
	3.4	Annual Maintenance	$ 3	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 15	
		X NUMBER OF YEARS OF OPERATION	1.00	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 15
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 2,844	
	4.2	Closure, Post-Closure, Monitoring	$ 15	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 2,859
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 300
		SUB COST FOR MACROENCAPSULATION MODULE		$ 11,786
		ESCALATION		1.23
		TOTAL COST		$ 14,497

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W009 Silver Coated Packing Material
Option Number: SR-W009-5
Facility: Containment Building **Treatment Technology:** Metathesis

Treatment Cycle Flow Diagram



Pros

- LDR standards will be met.
- S. S. containers will meet current DOT shipping requirements.

Cons

- Process is specific to treatment of the waste stream.
- Technology is currently in the research and development (R&D) phase.
- Uncertainties related to the process make availability predictions difficult.
- Since treatment is in the research and development (R&D) phase, confidence in developing a schedule is low.
- Remote handled equipment would require decommissioning activities due to radioactive iodine.
- Treatability variance is required due to inability to analyze final wasteform.
- Disposal in long-lived isotope facility is required.
- Process is unfamiliar to the Stakeholders.
- Not a budgeted item and will require line item funding.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	40	Subtract 10 points from the median score of 50 because volume of material increases slightly due to packaging in S. S. container.
• secondary waste generation	50	Waste volume is increased since some unrelated hydrogen bromide (HBr) will result.
• destruction removal and demobilization efficiency	80	LDR standards will be met.
• flexibility	20	Process is specific to treatment of the waste stream.
• ability to be shipped	80	S. S. containers will meet current DOT shipping requirements.
• final wasteform	80	Final wasteform will meet RCRA Subtitle C Disposal WAC.

Waste Stream Number & Name: SR-W009 **Silver Coated Packing Material**
Option Number: SR-W009-5
Facility: Containment Building **Treatment Technology:** Metathesis
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Engineering Parameters		
• system implementability	10	Subtract 10 points from the median score of 20 because technology is currently in the R&D phase.
• availability	20	Uncertainties related to the process make availability predictions difficult.
• scalability	50	Throughput is set by design and not easily expanded.
• remedial measures	40	Subtract 10 points from the median score of 50 because resultant waste will be uncharacterized with high radiation.
• schedule for treatment of waste	20	Since treatment is in the R & D phase, confidence in developing a schedule is low.
Personnel Parameters		
• consequence of unmitigated accident scenarios	50	Extensive emission control system creates vulnerability to accidents.
• non operational worker potential exposure	50	Remote handled equipment would require decommissioning activities due to radioactive iodine.
• operational worker potential exposure	50	Exposure controlled by design. Number of workers is dependent upon throughput.
• transportation potential exposure	50	Waste is in S. S. container during shipping. Some additional characterization may be needed.
Regulatory Parameters		
• need for variance	20	Treatability variance is required due to inability to analyze final waste form.
• ability to obtain a permit	50	Uncertainties surround attaining a permit since process is new and in the R & D phase.
• waste disposal	20	Waste will require disposal waste facility that is compatible with I^{129}.
Public Acceptance		
• public acceptance	20	Process is unfamiliar to the Stakeholders.
Cost Considerations		
• life-cycle cost	84	
• funding availability	20	Not a budgeted item and will require line item funding.
Industry Involvement		
• market for technology	20	Unique SRS waste stream
• private sector involvement	20	No vendor involved in this evaluation.

IDOA Score: **Technical** 32 **Total** 44

Waste Stream Number & Name: SR-W009 Silver Coated Packing Material
Option Number: SR-W009-5
Facility: Containment Building **Treatment Technology: Metathesis**
Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [ ] contact handled [√] remote handled

Module Location: SRS

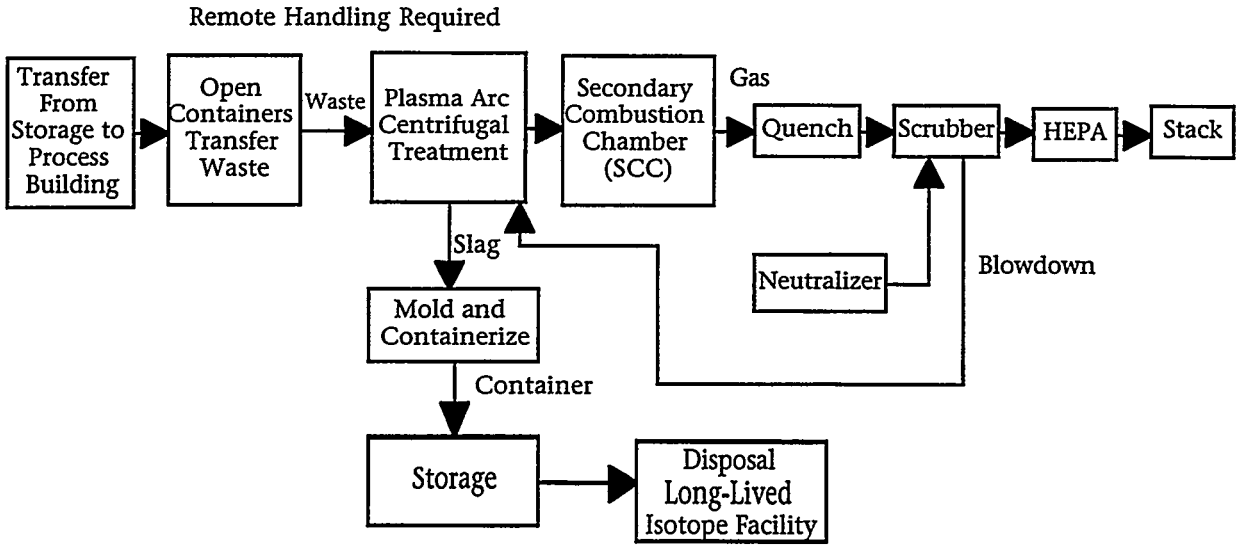
Module Status: [ ] Existing [√] New [ ] Small generator [√] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 83	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 330	
		1.3.2 Safety Assurance Documentation	$ 83	
		1.3.3 Permitting	$ 125	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 74	
		TOTAL PRE-OPERATIONS		$ 845
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 364	
	2.2	Inspection	$ 81	
	2.3	Project Management	$ 156	
	2.4	Building Construction (inc. indirect)	$ 500	
	2.5	Equipment (inc. indirect)	$ 1,155	
	2.6	Construction Management	$ 116	
	2.7	Contingency	$ 856	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 3,228
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 8	
	3.2	Annual Utilities	$ 0	
	3.3	Annual Materials	$ 5	
	3.4	Annual Maintenance	$ 3	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 15	
		X NUMBER OF YEARS OF OPERATION	.50	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 8
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 1,324	
	4.2	Closure, Post-Closure, Monitoring	$ 8	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 1,332
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 150
		SUB COST FOR METATHESIS MODULE		$ 5,562
		ESCALATION		1.267
		TOTAL COST		$ 7,047

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W009 **Silver Coated Packing Material**
Option Number: SR-W009-6
Facility: Vendor **Treatment Technology:** Plasma Arc

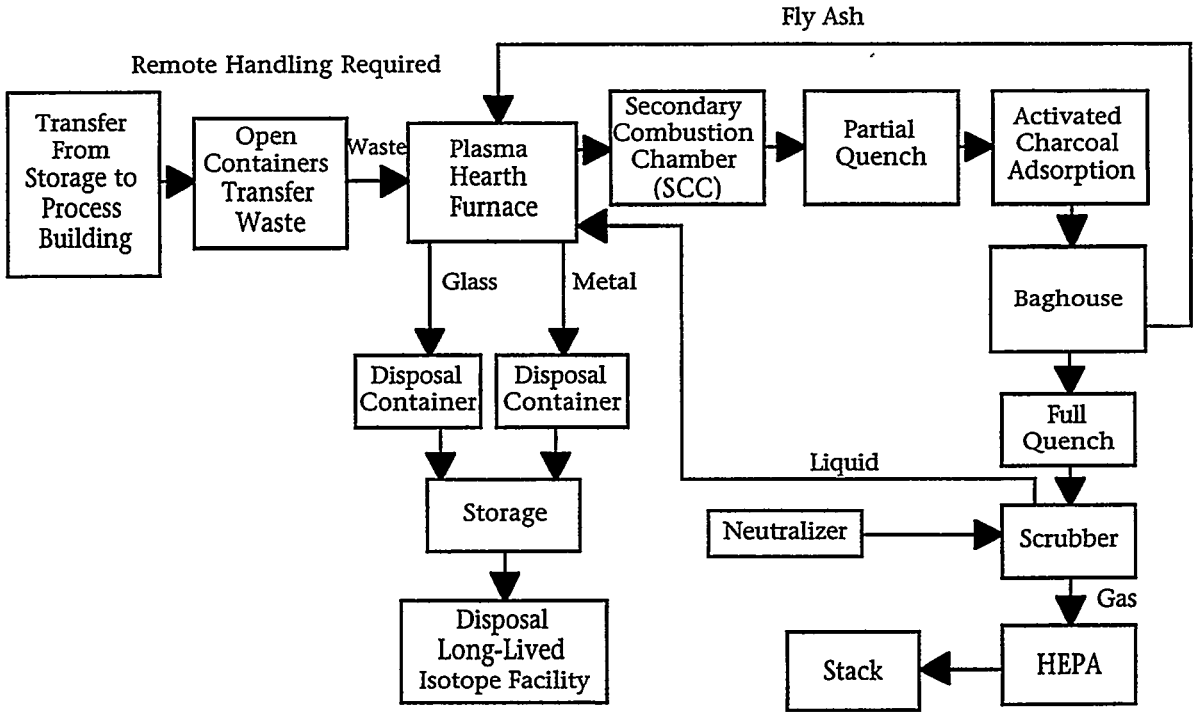
Treatment Cycle Flow Diagram



Option rejected during technical success factor evaluation. No further analysis performed.

Waste Stream Number & Name: SR-W009 Silver Coated Packing Material
Option Number: SR-W009-7
Facility: Vendor
Treatment Technology: Plasma Hearth

Treatment Cycle Flow Diagram



Option rejected during technical success factor evaluation. No further analysis performed.

Summary Page – THIS WASTE STREAM HAS BEEN CONSOLIDATED WITH WASTE STREAM SR-W001

Waste Stream Number & Name: SR-W010 Scintillation Solution

Background Information

This waste stream's data has been consolidated and reported under SR-W001, Rad-Contaminated Solvents. This decision to classify this waste as SR-W001 was made during the MWIR inventory update as of 9/30/94. The consolidation of solvent streams SR-W001, SR-W002, SR-W010, SR-W030, and SR-W059, in the mixed data reporting, grouped solvents with the same treatment.

This waste stream was formerly described as an organic solution used in bioassay analysis by analytical laboratories at the SRTC. Nonhazardous substitutes are now being used and this waste is no longer generated.

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Summary Page – Initial Screening

Waste Stream Number & Name: SR-W011 Cadmium-Coated HEPA Filters

Background Information

This waste stream is high efficiency particulate air (HEPA) filters used to filter ventilation air from the reactors. The filter frames are hazardous due to cadmium plating on the metal frames. Replacement units are stainless steel framed filters. Some filter material is glued onto the frames while other waste containers hold the metal frames only (filters removed). Waste is stored in 12 mil plastic within carbon steel B-25 boxes.

Volume

- Current volume through 09/30/94 is 100.2 m^3.
- No future waste generation is expected because HEPA filters with cadmium coated filter frames are no longer used at this site and all cadmium filters have been removed from service and collected.

Waste Stream Composition

- Cadmium containing metal debris

Waste Code

- D006A (TCLP Cd) nonwastewater

LDR Treatment Standard

- D006A = concentration based standard = 1.0 mg/l
- Alternate debris technology may be applied

Waste Characterization

- Sampling and analysis used to characterize the waste stream.
- Confidence level is high based on analytical results.
- A typical TCLP shows 154 mg/l Cd.

Radiological Characterization

- Tritium – contamination level 10^{-8} nCi/g
- Waste is contact handled.
- Mixed low-level waste

Initial Screening

The initial screening identified inappropriate treatment options. These options appear in the Initial Rejections table.

Initial Rejections

Treatment Facility	Treatment Technology	Reasons for Rejection
CIF	Incineration/ Stabilization	Incinerator would melt metal frames. It has no provision for handling molten metal.
ETF	Ion Exchange	ETF has no equipment to remove cadmium metal.
Lab.	Lab-scale process flowsheet	Volume of waste too great to handle with laboratory-scale equipment.
Z Area	Stabilization	Z Area can treat only those wastes that come by pipeline from Tank 50 and meet strict waste acceptance criteria. The Z Area process lacks flexibility to treat and dispose of a variety of waste streams.

Summary Page – Technology Success Factor (TSF) & In-Depth Options Analysis (IDOA)

Waste Stream Number & Name: SR-W011 Cadmium-Coated HEPA Filters

Feasible Options

Option No.	Treatment Facility	Treatment Technology	TSF Score	IDOA Scores Tech.	IDOA Scores Total	COST (x 1,000)	PO
SR-W011-1	M Area	Acid Leach/ Precipitation/ Vitrification	75	58	71	2,298	√
SR-W011-2	HW/MW-TB	Macro-encapsulation	94	58	60	31,396	
SR-W011-3	Vendor/Onsite	Stabilization	75	59	68	12,631	
SR-W011-4	Vendor/Onsite	Polymer Encapsulation	100	57	66	12,970	
SR-W011-5	Cont. Bldg.	Macro-encapsulation	88	58	69	8,589	
SR-W011-6	INEL/WEDF	Stabilization	*	52	65	1,279	
SR-W011-7	Vendor	Plasma Hearth	1				

* No TSF required for proposed or existing non-Savannah River Site-DOE waste processing facilities.

Options Rejected Due To Low Technology Success Factor (TSF)

Plasma Hearth Process Performed by Vendor

Plasma hearth process performed by vendor was rejected because:

- Plasma hearth incineration is currently still under development.
- Prototypes may exist, hence, Pm=0.9.
- Control of the process requires sophisticated computerized instrumentation, hence, Pc=0.9.
- It is not expected for this technology to reach a level of reliability suitable for industrial application for 5-10 years.

Engineering Assessment

Preferred Option Justification

The preferred treatment option for Cadmium-Coated HEPA Filters is Acid Leaching and Precipitation in the M-Area Dilute Effluent Treatment Facility (DETF) followed by Vitrification in the M-Area Vendor Treatment Process.

This option treats the constituent of concern cadmium by stabilizing it in a glass wasteform.

This option is preferred because:

- Volume of the constituent of concern will be reduced more than 5 to 1.
- All LDR standards will be met.
- It employs a vendor process for which a contract has already been let for other waste streams.
- Decontaminated frames can be disposed of as scrap.

Options Rejected During IDOA

Macroencapsulation by a Vendor in a Containment Building

Macroencapsulation by a vendor (in polymer, cement grout, and a stainless steel box) in a containment building was rejected because:

- Waste volume more than doubles.
- Wasteform is not as long-lived as the selected option.
- Large majority of waste will require HW/MW disposal.

Stabilization at INEL/WEDF

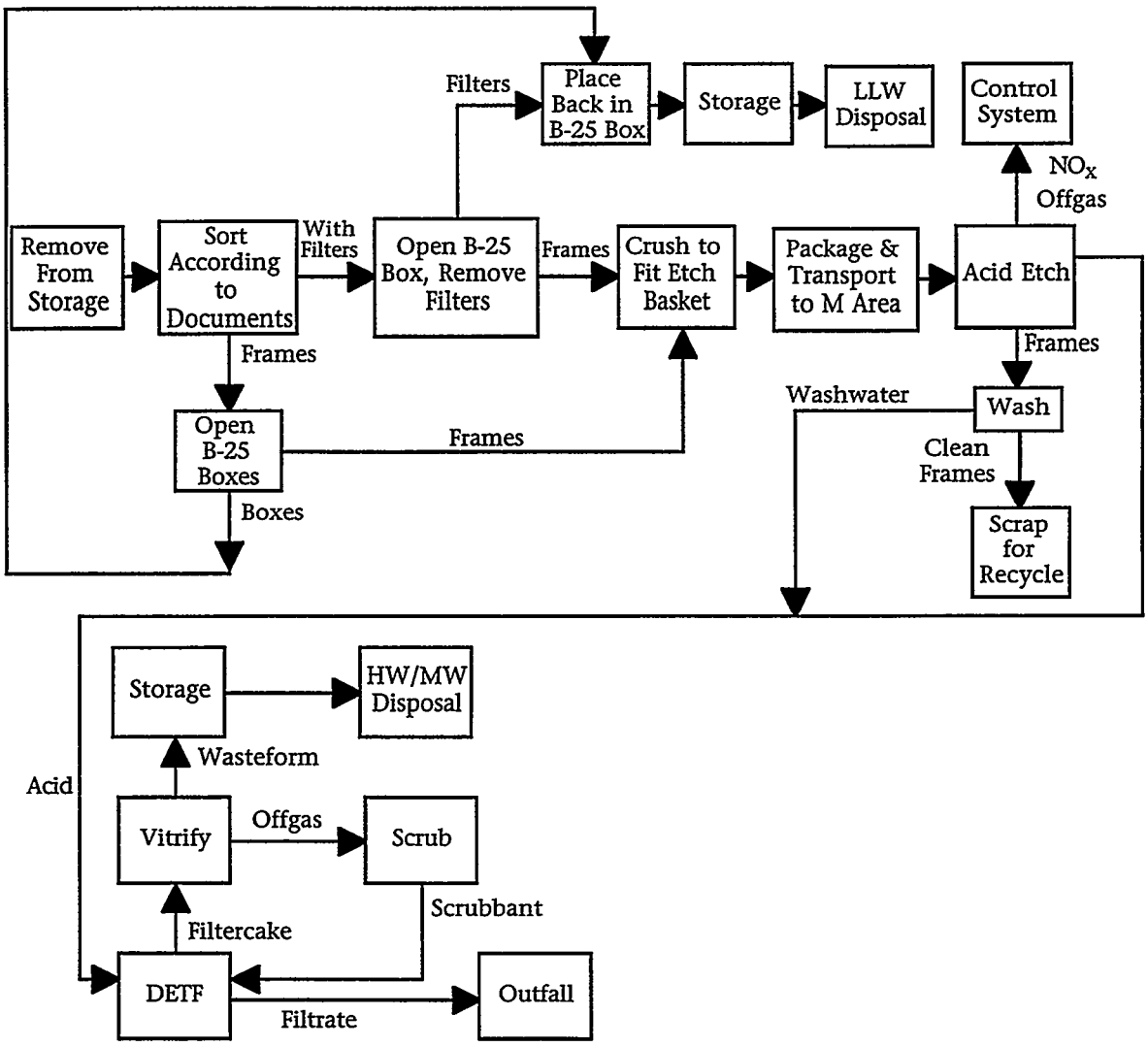
Stabilization at INEL/WEDF (encapsulating the waste with a grout matrix) was rejected because:

- Large volume waste streams are designated to be treated onsite.
- Throughput is limited by design. The facility is currently being designed.
- Waste volume more than doubles.
- Large majority of waste will require HW/MW disposal.

Waste Stream Number & Name: SR-W011 Cadmium-Coated HEPA Filters
Option Number: SR-W011-1
Facility: M Area

Treatment Technology: Acid Leach/ Precipitation/ Vitrification

Treatment Cycle Flow Diagram



Pros

- Volume of constituent of concern is reduced 5:1.
- Effluent will be in the form of filtercake. Little filtercake will be produced. HEPA filters are returned to original containers.
- All applicable LDR treatment standards are met and if the wasteform from M-Area Vendor Treatment Process is delisted, the final waste will be non-hazardous.
- Care must be taken not to include other wastes with frames.
- Final wasteform will meet disposal WAC.
- Normal maintenance requirements apply. This waste stream may require a "clean-out" earlier than anticipated based on curie load.

Waste Stream Number & Name: SR-W011 Cadmium-Coated HEPA Filters
Option Number: SR-W011-1
Facility: M Area
Treatment Technology: Acid Leach/ Precipitation/ Vitrification

Pros (contd)

- Extra tanks already available. Could run process with more shifts.
- Vitrified final wasteform can be recycled through the melter. Release of liquid to outfall done only after analysis.
- Few or no emissions even under accident conditions
- No increase in non operational worker crew size
- No increase in operational worker crew size
- Expect treatment to render a wasteform in compliance with LDR requirements.
- This employs existing vendor process.

Cons

- Not a budgeted item

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	80	Volume of constituent of concern is reduced 5:1.
• secondary waste generation	50	Effluent will be in the form of filtercake. Little filtercake will be produced. HEPA filters removed will require disposal.
• destruction removal and demobilization efficiency	80	All applicable LDR treatment standards are met and if waste is delisted (F006), the final waste will be non-hazardous.
• flexibility	50	Care must be taken not to include other wastes with frames.
• ability to be shipped	80	Care must be taken not to include other wastes with frames.
• final wasteform	80	Final wasteform will meet disposal WAC.
Engineering Parameters		
• system implementability	50	Individually demonstrated technology but not yet demonstrated as integrated.
• availability	80	Normal maintenance requirements apply. This waste stream may require a "clean-out" earlier than anticipated based on curie load.
• scalability	80	Extra tanks already available. Could run process with more shifts.
• remedial measures	80	Vitrified final wasteform can be recycled through the melter. Release of liquid to outfall done only after analysis.
• schedule for treatment of waste	50	Expect melter to be in place, but crusher/shredder not currently planned and building to house shredder is currently on schedule to be transferred to ER for D&D status.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Few or no emissions even under accident conditions.
• non operational worker potential exposure	80	No increase in non operational worker crew size.

Waste Stream Number & Name: SR-W011 Cadmium-Coated HEPA Filters
Option Number: SR-W011-1
Facility: M Area
Treatment Technology: Acid Leach/ Precipitation/ Vitrification

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• operational worker potential exposure	80	No increase in operational worker crew size.
• transportation potential exposure	60	Add 10 points to the median score of 50 because no additional characterization needed. Nothing unusual about wasteform. Expect low alpha and no liquids.
Regulatory Parameters		
• need for variance	80	Expect treatment to render a wasteform in compliance with LDR requirements.
• ability to obtain a permit	50	Will require modification to existing wastewater permit. DHEC and/or EPA could require a RCRA Part B permit with change in waste stream or for the acid leach step.
• waste disposal	50	Some final waste forms may require disposal as HW/MW.
Public Acceptance		
• public acceptance	80	Public approves of treatments that result in a glass wasteform.
Cost Considerations		
• life-cycle cost	93	
• funding availability	20	Not a budgeted item
Industry Involvement		
• market for technology	20	Not an SRS process to market.
• private sector involvement	80	Technology is available at an existing vendor process.

IDOA Score: **Technical** 58 **Total** 71

Waste Stream Number & Name: SR-W011 Cadmium-Coated HEPA Filters
Option Number: SR-W011-1
Facility: M Area
Treatment Technology: Acid Leach/ Precipitation/ Vitrification

Cost Estimate Sheet

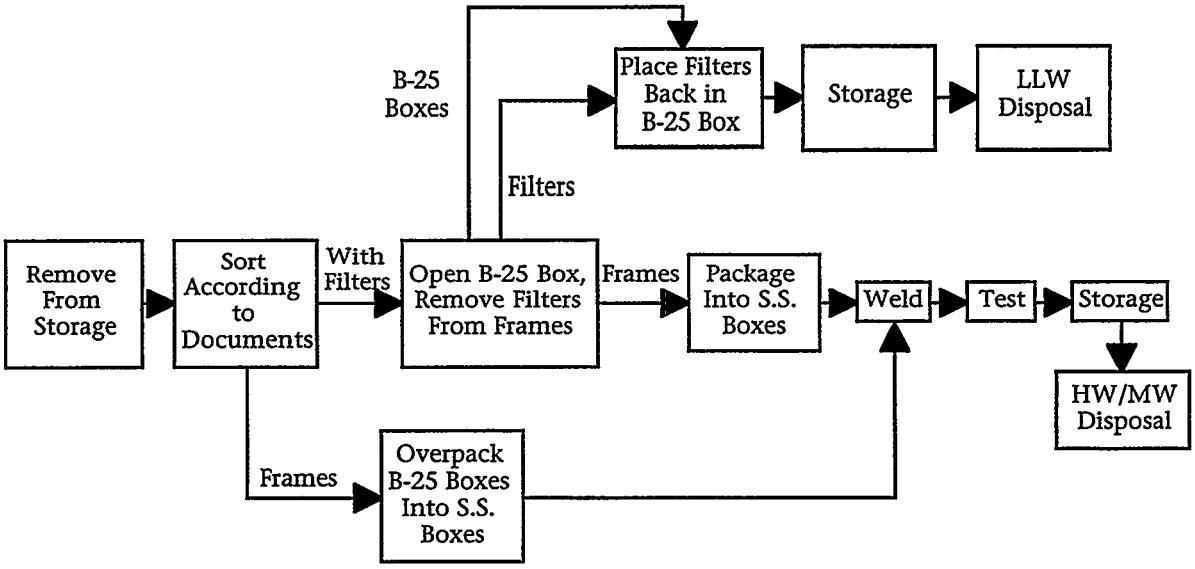
Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[ ] alpha [√] non-alpha [√] contact handled [ ] remote handled
Module Location: SRS
Module Status: [√] Existing [ ] New [ ] Small generator [√] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 12	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 47	
		1.3.2 Safety Assurance Documentation	$ 12	
		1.3.3 Permitting	$ 125	
		1.3.4 Preparation for Operations	$ 1,150	
		1.3.5 Project Management	$ 2	
		TOTAL PRE-OPERATIONS		$ 1,348
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 55	
	2.2	Inspection	$ 12	
	2.3	Project Management	$ 14	
	2.4	Building Construction (inc. indirect)	$ 50	
	2.5	Equipment (inc. indirect)	$ 200	
	2.6	Construction Management	$ 18	
	2.7	Contingency	$ 123	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 470
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 150	
	3.2	Annual Utilities	$ 6	
	3.3	Annual Materials	$ 90	
	3.4	Annual Maintenance	$ 54	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 300	
		X NUMBER OF YEARS OF OPERATION	1.00	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 300
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 0	
	4.2	Closure, Post-Closure, Monitoring	$ 0	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 50
	SUB COST FOR ACID LEACH/PRECIPITATION/VITRIFICATION MODULE			$ 2,168
		ESCALATION		1.06
		TOTAL COST		$ 2,298

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W011 Cadmium-Coated HEPA Filters
Option Number: SR-W011-2
Facility: HW/MW-TB
Treatment Technology: Macroencapsulation in a S. S. Box

Treatment Cycle Flow Diagram



Pros

- Process satisfies requirements of the "debris rule" and all applicable LDR standards are met.
- Can process a wide range of materials without loss of efficiency due to off design input.
- S. S. containers will meet current DOT shipping requirements.
- Final wasteform will meet RCRA Subtitle C Disposal WAC.
- All processes involved are existing technology.
- Similar systems have demonstrated availability of greater than 80%.
- Process failure does not produce altered wasteform. A failed container is easily fixed.
- Due to process simplicity, a schedule can be developed easily.
- Process does not create emissions related to the waste stream. Process simply involves container welding.
- Simple welding process requiring minimal maintenance. No additional requirements for decommissioning.
- Exposure controlled by design. Number of workers is dependent upon throughput.

Cons

- Not a budget item and will require line item funding.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	40	Subtract 10 points from the median score of 50 because volume of material increases slightly due to packaging in S. S. container.
• secondary waste generation	50	HEPA filters removed will require disposal by standard technology.
• destruction removal and demobilization efficiency	80	All applicable LDR standards are met.

Waste Stream Number & Name: SR-W011 Cadmium-Coated HEPA Filters
Option Number: SR-W011-2
Facility: HW/MW-TB
Treatment Technology: Macroencapsulation in a S. S. Box

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• flexibility	80	Can process a wide range of materials without loss of efficiency due to off design input.
• ability to be shipped	80	S. S. containers will meet current DOT shipping requirements.
• final wasteform	80	Final waste form will meet RCRA Subtitle C Disposal WAC.
Engineering Parameters		
• system implementability	90	Add 10 points to the median score of 80 because all processes involved are existing technology.
• availability	80	Similar systems have demonstrated availability of greater than 80%.
• scalability	50	Throughput is set by design and not easily expanded except by adding more shifts of operation.
• remedial measures	90	Add 10 points to the median score of 80 because process failure does not produce altered wasteform. A failed container is easily fixed.
• schedule for treatment of waste	80	Due to process simplicity, a schedule can be developed easily.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Process does not create emissions related to the waste stream. Process simply involves container welding.
• non operational worker potential exposure	80	Simple welding process requiring minimal maintenance. No additional requirements for decommissioning.
• operational worker potential exposure	80	Exposure controlled by design. Number of workers is dependent upon throughput.
• transportation potential exposure	60	Add 10 points to the median score of 50 because no additional characterization needed. Waste can be handled readily.
Regulatory Parameters		
• need for variance	80	Process satisfies requirements of the "debris rule."
• ability to obtain a permit	40	Subtract 10 points from the median score of 50 because uncertainties surround attaining a permit related to the "debris rule" and the "containment rule."
• waste disposal	60	Add 10 points to the median score of 50 because HEPA filters can go to LLW disposal. Filter frames require HW/MW disposal.
Public Acceptance		
• public acceptance	40	Public concern should be limited due to the simplicity of the process. Subtract 10 points from the median score of 50 because the wasteform is not unalterably stable.
Cost Considerations		
• life-cycle cost	10	
• funding availability	20	Not a budget item and will require line item funding.

Waste Stream Number & Name: SR-W011 Cadmium-Coated HEPA Filters
Option Number: SR-W011-2
Facility: HW/MW-TB
Treatment Technology: Macroencapsulation in a S. S. Box

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Industry Involvement		
• market for technology	20	SRS process, but not highly technical. Probably no marketable.
• private sector involvement	50	Technology would be provided by either SRS facility or vendor.

IDOA Score: **Technical** 58 **Total** 60

Waste Stream Number & Name: SR-W011 Cadmium-Coated HEPA Filters
Option Number: SR-W011-2
Facility: HW/MW-TB
Treatment Technology: Macroencapsulation in a S. S. Box

Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[ ] alpha [√] non-alpha [√] contact handled [ ] remote handled

Module Location: SRS

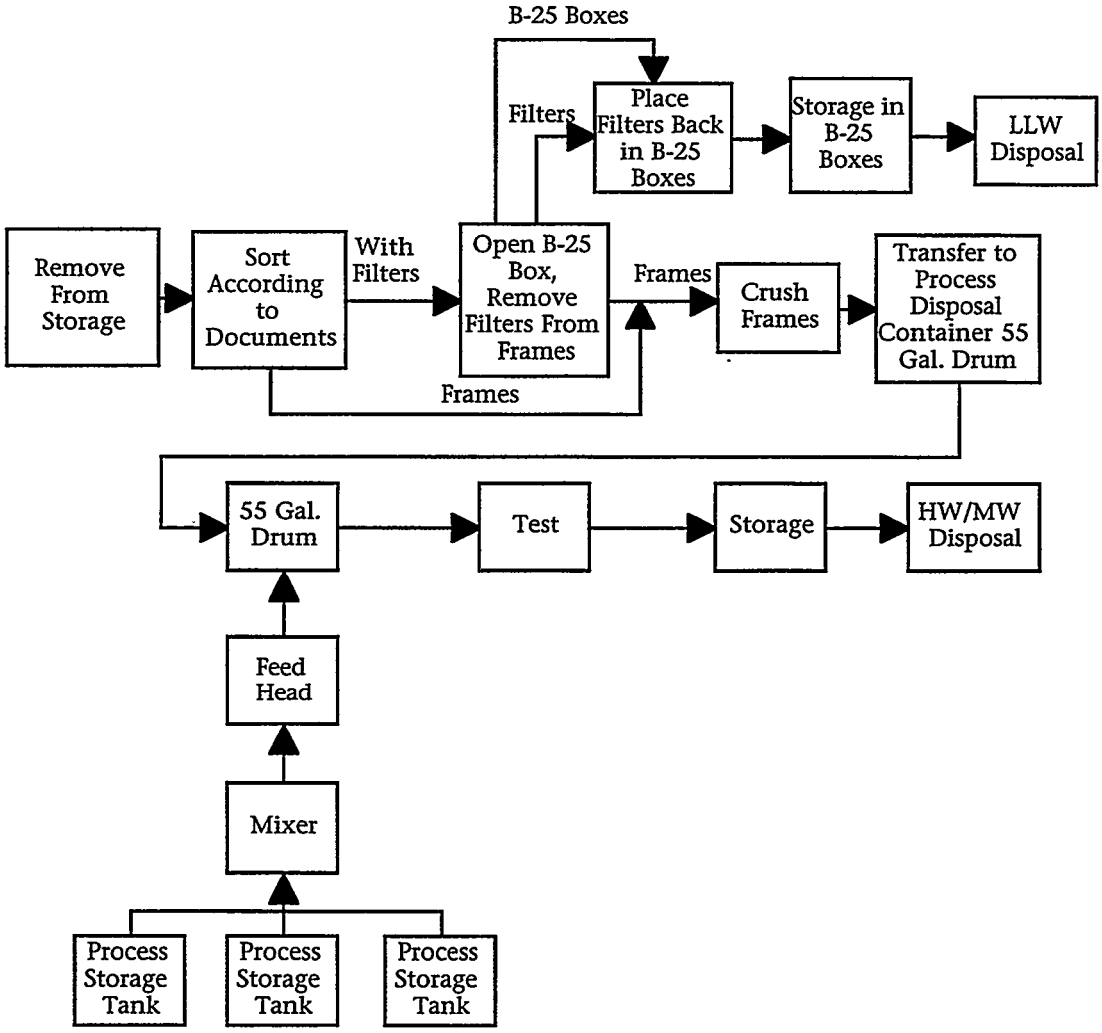
Module Status: [ ] Existing [√] New [ ] Small generator [√] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 366	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 1,464	
		1.3.2 Safety Assurance Documentation	$ 366	
		1.3.3 Permitting	$ 125	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 315	
		TOTAL PRE-OPERATIONS		$ 2,786
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 1,573	
	2.2	Inspection	$ 496	
	2.3	Project Management	$ 811	
	2.4	Building Construction (inc. indirect)	$ 7,000	
	2.5	Equipment (inc. indirect)	$ 150	
	2.6	Construction Management	$ 501	
	2.7	Contingency	$ 3,796	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 14,326
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 225	
	3.2	Annual Utilities	$ 9	
	3.3	Annual Materials	$ 135	
	3.4	Annual Maintenance	$ 81	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 450	
		X NUMBER OF YEARS OF OPERATION	4.00	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 1,800
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 5,720	
	4.2	Closure, Post-Closure, Monitoring	$ 43	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 5,763
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 850
		SUB COST FOR MACROENCAPSULATION MODULE		$ 25,525
		ESCALATION		1.23
		TOTAL COST		$ 31,396

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W011 Cadmium-Coated HEPA Filters
Option Number: SR-W011-3
Facility: Vendor/Onsite
Treatment Technology: Stabilization

Treatment Cycle Flow Diagram



Pros

- No additional treatment is required to meet LDR standards.
- Can accommodate a wide range of similar wastes and radiation levels. Widely used in the commercial world.
- Wasteform can be easily shipped as-is.
- The wasteform meets the expected WAC for disposal. No additional treatment is required. Wasteform is disposable in the form in which it exits the process.
- It is a proven process, used both in DOE complex and the commercial world.
- Similar systems in the commercial nuclear industry experience availability of 80%.
- Mature technology. Vendor will bring onsite and set up with a minimum delay.
- Process can be installed in a containment building with adequate emission controls.
- Skid mounted, no D&D, vendor removes upon completion of work. Requires fewer non operational workers than comparably sized, skid mounted facilities. Experience in similar facilities indicates that little non-routine maintenance is needed.
- Must demonstrate that waste passes Treatment Standards.
- Process will be in full compliance without requiring a variance.

Waste Stream Number & Name: SR-W011 Cadmium-Coated HEPA Filters
Option Number: SR-W011-3
Facility: Vendor/Onsite **Treatment Technology: Stabilization**

Cons

- The waste volume will more than double.
- Wasteform is not as permanent as other forms of stabilization.
- Not a budgeted item and will require line item funding.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	10	Subtract 10 points from the median score of 20 because the waste volume will more than double.
• secondary waste generation	50	Containers and HEPA filters removed will require disposal.
• destruction removal and demobilization efficiency	80	No additional treatment is required to meet LDR requirements.
• flexibility	80	Can accommodate a wide range of similar wastes and radiation levels. Widely used in the commercial world.
• ability to be shipped	80	Waste form can be easily shipped as-is.
• final wasteform	100	Waste form meets the expected WAC for disposal. Add 20 points to the median score of 80 because no additional treatment is required. Waste form is disposable in the form in which it exits the process.
Engineering Parameters		
• system implementability	100	Add 20 points to the median score of 80 because it is a proven process, used both in DOE complex and the commercial world.
• availability	80	Similar systems in the commercial nuclear industry experience availability of 80%.
• scalability	50	Throughput is set by design, and not easily expanded except by adding more shifts of operation.
• remedial measures	50	Failed wasteform can be overpacked or ground up and reprocessed.
• schedule for treatment of waste	80	Mature technology. Vendor will bring onsite and set up with a minimum delay.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Process can be installed in a building with adequate emission controls.
• non operational worker potential exposure	80	Skid mounted. Requires fewer non operational workers than comparably sized, skid mounted facilities. Experience in similar facilities indicates that little non-routine maintenance is needed.
• operational worker potential exposure	50	Facility requires about the same number of operational workers as comparably sized, skid mounted facilities.
• transportation potential exposure	60	No additional characterization needed. Add 10 points to the median score of 50 because waste can be handled readily.
Regulatory Parameters		
• need for variance	80	Process will be in full compliance without needing a variance.
• ability to obtain a permit	80	Must demonstrate that waste passes LDR Treatment Standards.

Waste Stream Number & Name: SR-W011 Cadmium-Coated HEPA Filters
Option Number: SR-W011-3
Facility: Vendor/Onsite **Treatment Technology: Stabilization**
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• waste disposal	80	All wastes disposed of as LLW.
Public Acceptance		
• public acceptance	20	Mature and proven technology, however waste form is not as permanent as other forms of stabilization (i.e., vitrification).
Cost Considerations		
• life-cycle cost	66	
• funding availability	20	Not a budgeted item and will require line item funding.
Industry Involvement		
• market for technology	20	This is an existing vendor process.
• private sector involvement	50	Technology could be provided by an existing vendor process.

IDOA Score: **Technical** 59 **Total** 68

Waste Stream Number & Name: SR-W011 Cadmium-Coated HEPA Filters
Option Number: SR-W011-3
Facility: Vendor/Onsite **Treatment Technology: Stabilization**
Cost Estimate Sheet

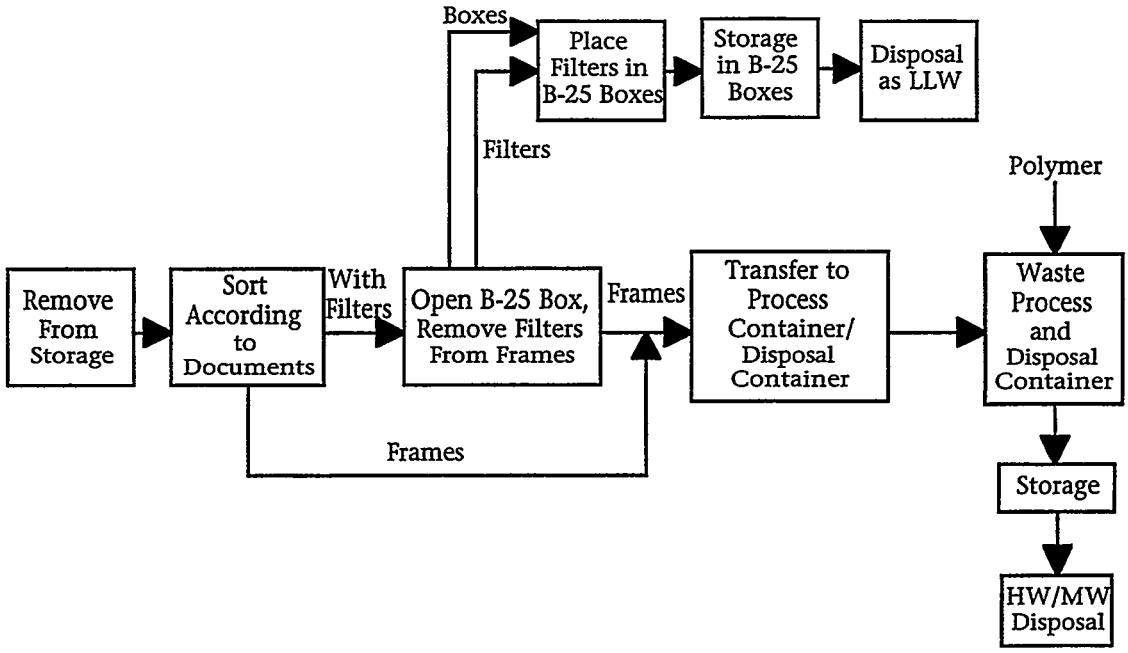
Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[ ] alpha [√] non-alpha [√] contact handled [ ] remote handled
Module Location: SRS
Module Status: [ ] Existing [√] New [ ] Small generator [√] Large generator
[√] Onsite [ ] Offsite [√] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 168	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 672	
		1.3.2 Safety Assurance Documentation	$ 168	
		1.3.3 Permitting	$ 125	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 90	
		TOTAL PRE-OPERATIONS		$ 1,372
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 770	
	2.2	Inspection	$ 140	
	2.3	Project Management	$ 230	
	2.4	Building Construction (inc. indirect)	$ 2,000	
	2.5	Equipment (inc. indirect)	$ 0	
	2.6	Construction Management	$ 245	
	2.7	Contingency	$ 1,741	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 5,126
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 28	
	3.2	Annual Utilities	$ 1	
	3.3	Annual Materials	$ 17	
	3.4	Annual Maintenance	$ 10	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 56	
		X NUMBER OF YEARS OF OPERATION	4.00	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 225
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 2,800	
	4.2	Closure, Post-Closure, Monitoring	$ 43	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 2,843
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$ 1,500	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$ 1,500
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 850
		SUB COST FOR CEMENT STABILIZATION MODULE		$ 11,916
		ESCALATION		1.06
		TOTAL COST		$ 12,631

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W011 Cadmium-Coated HEPA Filters
Option Number: SR-W011-4
Facility: Vendor/Onsite
Treatment Technology: Polymer Encapsulation

Treatment Cycle Flow Diagram



Pros

- No additional treatment is required to meet LDR requirements.
- Can accommodate a wide range of similar wastes and radiation levels. Widely used in the commercial world.
- Wasteform meets shipping requirements in the form it exits the treatment process.
- This meets the expected WAC for disposal. No additional treatment is required. Wasteform is disposable in the form in which it exits the process.
- This is a proven process, used both in DOE complex and the commercial world.
- Mature technology. Vendor will bring onsite and set up with a minimum delay.
- Process can be installed in a containment building with adequate emission controls.
- Skid mounted, no D&D, vendor removes upon completion of work. Facility requires more non operational workers than comparably sized, skid-mounted facilities.

Cons

- The waste volume will more than double.
- Waste form is not as permanent as other forms of stabilization.
- Not a budgeted item and will require line item funding.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	10	Subtract 10 points from the median score of 20 because the waste volume will more than double.
• secondary waste generation	50	HEPA filters removed will require treatment by standard technology.

Waste Stream Number & Name: SR-W011 Cadmium-Coated HEPA Filters
Option Number: SR-W011-4
Facility: Vendor/Onsite
Treatment Technology: Polymer Encapsulation

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• destruction removal and demobilization efficiency	80	No additional treatment is required to meet LDR requirements.
• flexibility	80	Can accommodate a wide range of similar wastes and radiation levels. Widely used in the commercial world.
• ability to be shipped	80	Wasteform meets shipping requirements in the form it exits the treatment process.
• final wasteform	100	This meets the expected WAC for disposal. Add 20 points to the median score of 80 because no additional treatment is required. Wasteform is disposable in the form in which it exits the process.
Engineering Parameters		
• system implementability	100	Add 20 points to the median score of 80 because this is a proven process, used both in DOE complex and the commercial world.
• availability	60	Although operator error can cause downtime, add 10 points to the median score of 50 because system is normally available 50% of the time.
• scalability	50	Throughput is set by design, and not easily expanded except by adding more shifts of operation.
• remedial measures	50	Failed wasteform can be ground up and reprocessed.
• schedule for treatment of waste	80	Mature technology. Vendor will bring onsite and set up with a minimum delay.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Process can be installed in a building with adequate emission controls.
• non operational worker potential exposure	80	Requires the same number of non operational workers as comparable skid-mounted units. Most or all initial construction can be done in a vendor shop. Experience in similar facilities indicates that little non-routine maintenance is required.
• operational worker potential exposure	40	Subtract 10 points from the median score of 50 because the facility requires more operational workers than comparably sized, skid-mounted facilities.
• transportation potential exposure	60	No additional characterization needed. Add 10 points to the median score of 50 because waste can be handled readily.
Regulatory Parameters		
• need for variance	80	Process will be in full compliance without needing a variance.
• ability to obtain a permit	80	Must demonstrate that waste meets treatment standard.
• waste disposal	60	Add 10 points to the median score of 50 because HEPA filters can go to LLW disposal. Filter frames must have HW/MW disposal.
Public Acceptance		
• public acceptance	20	Mature and proven technology, however wasteform is not as permanent as other forms of stabilization (i.e., vitrification).

Waste Stream Number & Name: SR-W011 Cadmium-Coated HEPA Filters
Option Number: SR-W011-4
Facility: Vendor/Onsite
Treatment Technology: Polymer Encapsulation

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Cost Considerations		
• life-cycle cost	65	
• funding availability	20	Not a budgeted item **and** will require line item funding.
Industry Involvement		
• market for technology	20	This is an existing vendor process.
• private sector involvement	50	Technology could be provided by an existing vendor process.

IDOA Score: **Technical** 57 **Total** 66

Waste Stream Number & Name: SR-W011 Cadmium-Coated HEPA Filters
Option Number: SR-W011-4
Facility: Vendor/Onsite
Treatment Technology: Polymer Encapsulation

Cost Estimate Sheet INCLUDES COST OF OPTION SR-W051-2

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[ ] alpha [√] non-alpha [√] contact handled [ ] remote handled

Module Location: SRS

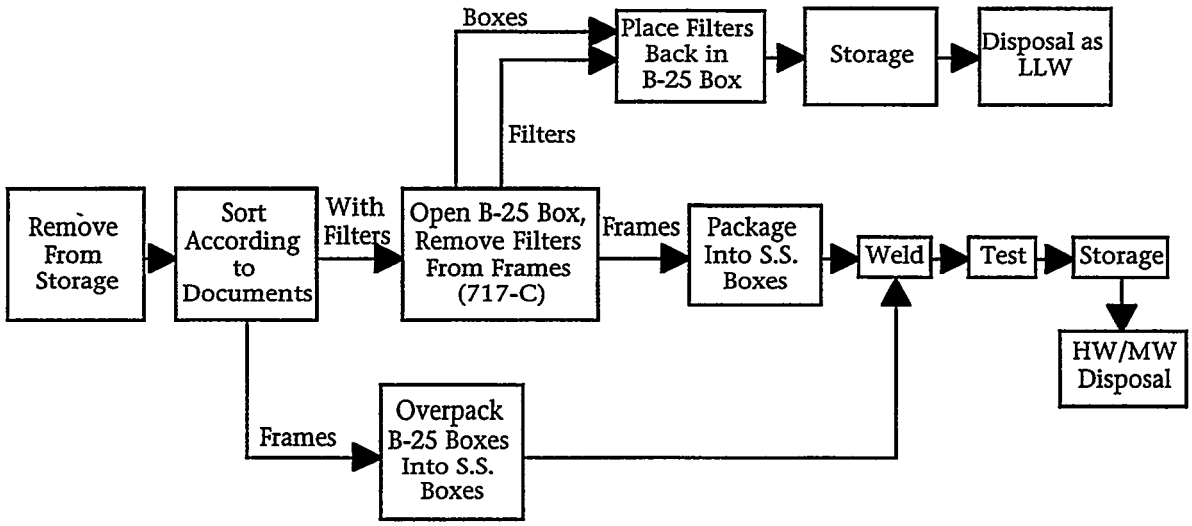
Module Status: [ ] Existing [√] New [ ] Small generator [√] Large generator
[√] Onsite [ ] Offsite [√] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 174	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 697	
		1.3.2 Safety Assurance Documentation	$ 174	
		1.3.3 Permitting	$ 125	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 0	
		TOTAL PRE-OPERATIONS		$ 1,320
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 880	
	2.2	Inspection	$ 0	
	2.3	Project Management	$ 0	
	2.4	Building Construction (inc. indirect)	$ 0	
	2.5	Equipment (inc. indirect)	$ 0	
	2.6	Construction Management	$ 280	
	2.7	Contingency	$ 1,806	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 2,966
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 28	
	3.2	Annual Utilities	$ 1	
	3.3	Annual Materials	$ 17	
	3.4	Annual Maintenance	$ 10	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 56	
		X NUMBER OF YEARS OF OPERATION	4.00	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 225
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 3,200	
	4.2	Closure, Post-Closure, Monitoring	$ 25	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 3,225
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$ 4,000	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$ 4,000
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 500
		SUB COST FOR POLYMER ENCAPSULATION MODULE		$ 12,236
		ESCALATION		1.06
		TOTAL COST		$ 12,970

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W011 Cadmium-Coated HEPA Filters
Option Number: SR-W011-5
Facility: Containment Building
Treatment Technology: Macroencapsulation in a S. S. Box

Treatment Cycle Flow Diagram



Pros

- Process satisfies requirements of the "debris rule" and all applicable LDR standards are met.
- Can process a wide range of materials without loss of efficiency.
- S. S. containers will meet current DOT shipping requirements.
- Final wasteform will meet RCRA Subtitle C Disposal WAC.
- All processes involved are existing technology.
- Similar systems have demonstrated availability of greater than 80%.
- Failure does not produce altered wasteform. A failed container is easily fixed.
- Due to process simplicity, a schedule can be developed easily.
- Process does not create emissions related to the waste stream. Process simply involves container welding.
- Simple welding process requiring minimal maintenance. No additional requirements for decommissioning.
- Exposure controlled by design, but uses fewer than average number of workers and potential for exposure is limited.

Cons

- Not a budget item and will require line item funding.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	40	Subtract 10 points from the median score of 50 because volume of material increases slightly due to packaging in S. S. container.
• secondary waste generation	50	HEPA filters removed will require disposal by standard technology.
• destruction removal and demobilization efficiency	80	All applicable LDR standards are met.

Waste Stream Number & Name: SR-W011 Cadmium-Coated HEPA Filters
Option Number: SR-W011-5
Facility: Containment Building
Treatment Technology: Macroencapsulation in a S. S. Box

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• flexibility	80	Can process a wide range of materials without loss of efficiency.
• ability to be shipped	80	S. S. containers will meet current DOT shipping requirements.
• final waste form	80	Final wasteform will meet RCRA Subtitle C Disposal WAC.
Engineering Parameters		
• system implementability	90	Add 10 points to the median score of 80 because all processes involved are existing technology.
• availability	80	Similar systems have demonstrated availability of greater than 80%.
• scalability	50	Throughput is set by design and not easily expanded except by adding additional shifts of operation.
• remedial measures	90	Failure does not produce altered wasteform. Add 10 points to the median score of 80 because a failed container is easily fixed.
• schedule for treatment of waste	80	Due to process simplicity, a schedule can be developed easily.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Process does not create emissions related to the waste stream. Process simply involves container welding.
• non operational worker potential exposure	80	Simple welding process requiring minimal maintenance. No additional requirements for decommissioning.
• operational worker potential exposure	80	Exposure controlled by design, but fewer than average number of workers and potential for exposure is limited.
• transportation potential exposure	60	No additional characterization needed. Add 10 points to the median score of 50 because waste can be handled readily.
Regulatory Parameters		
• need for variance	80	Process satisfies requirements of the "debris rule."
• ability to obtain a permit	40	Subtract 10 points from the median score of 50 because uncertainties surround attaining a permit related to the "debris rule" and the "containment rule."
• waste disposal	60	Add 10 points to the median score of 50 because HEPA filters can be disposed of as LLW. Filter frames require HW/MW disposal.
Public Acceptance		
• public acceptance	40	Public concern should be limited due to the simplicity of the process. Subtract 10 points from the median score of 50 because the wasteform is not as permanent as vitrification.
Cost Considerations		
• life-cycle cost	75	
• funding availability	20	Not a budgeted item and will require line item funding.

Waste Stream Number & Name: SR-W011 Cadmium-Coated HEPA Filters
Option Number: SR-W011-5
Facility: Containment Building
Treatment Technology: Macroencapsulation in a S. S. Box

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Industry Involvement		
• market for technology	20	This is an existing technology.
• private sector involvement	50	Technology could be provided by either DOE or vendor.

IDOA Score: **Technical** 58 **Total** 69

Waste Stream Number & Name: SR-W011 Cadmium-Coated HEPA Filters
Option Number: SR-W011-5
Facility: Containment Building
Treatment Technology: Macroencapsulation in a S. S. Box

Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[ ] alpha [√] non-alpha [√] contact handled [ ] remote handled

Module Location: SRS

Module Status: [ ] Existing [√] New [ ] Small generator [√] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 58	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 233	
		1.3.2 Safety Assurance Documentation	$ 58	
		1.3.3 Permitting	$ 125	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 45	
		TOTAL PRE-OPERATIONS		$ 669
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 253	
	2.2	Inspection	$ 76	
	2.3	Project Management	$ 121	
	2.4	Building Construction (inc. indirect)	$ 1,000	
	2.5	Equipment (inc. indirect)	$ 150	
	2.6	Construction Management	$ 81	
	2.7	Contingency	$ 604	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 2,284
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 225	
	3.2	Annual Utilities	$ 9	
	3.3	Annual Materials	$ 135	
	3.4	Annual Maintenance	$ 81	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 450	
		X NUMBER OF YEARS OF OPERATION	4.00	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 1,800
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 920	
	4.2	Closure, Post-Closure, Monitoring	$ 43	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 963
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 850
		SUB COST FOR MACROENCAPSULATION MODULE		$ 6,566
		ESCALATION		1.308
		TOTAL COST		$ 8,589

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W011 Cadmium-Coated HEPA Filters
Option Number: SR-W011-6
Facility: INEL/WEDF **Treatment Technology: Stabilization**

Treatment Technology

The Idaho National Engineering Laboratory (INEL) Waste Engineering Development Facility (WEDF) Stabilization process provides treatments for aqueous and organic liquids and debris. The process stabilizes waste in a grout matrix to reduce leachability.

Pros

- No secondary waste streams are generated.
- The facility will be able to treat waste streams similar in composition to those assumed in the design basis without modification.
- The stabilized waste could be shipped without additional treatment.
- Final wasteform is anticipated to meet the SRS disposal WAC.
- Stabilization has been demonstrated at the facility.
- The facility is anticipated to have minimal down time.
- Process failure is not anticipated to create a waste stream that cannot be treated.
- Few emissions for the facility are anticipated during normal operation and most accident scenarios.
- The facility could potentially be used to treat numerous waste streams throughout the DOE Complex.

Cons

- Stabilization will increase the overall waste volume by a factor of two or more after processing.
- Throughput will be limited by design. Facility currently is being designed.
- Waste characterization will be required for any waste streams returned to SRS for disposal.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	10	Subtract 10 points from the median score of 20 because stabilization will increase the overall waste volume by a factor of two or more after processing.
• secondary waste generation	80	No secondary waste streams are generated.
• destruction removal and demobilization efficiency	50	Additional treatment for some waste streams may be required prior to stabilization to ensure LDR standards are met.
• flexibility	80	The facility will be able to treat waste streams similar in composition to those assumed in the design basis without modification.
• ability to be shipped	80	The stabilized waste could be shipped without additional treatment.
• final wasteform	80	Final wasteform is anticipated to meet the SRS disposal WAC.
Engineering Parameters		
• system implementability	80	Stabilization has been demonstrated at the facility.
• availability	80	The facility is anticipated to have minimal down time.
• scalability	20	Throughput will be limited by design. Facility currently is being designed.
• remedial measures	80	Process failure is not anticipated to create a waste stream that cannot be treated.

Waste Stream Number & Name: SR-W011 Cadmium-Coated HEPA Filters
Option Number: SR-W011-6
Facility: INEL/WEDF **Treatment Technology: Stabilization**
In-Depth Options Analysis Score (IDOA) Sheet

Attribute	Score	Discussion/Notes
• schedule for treatment of waste	50	A schedule for waste treatment cannot be provided. Additionally, acceptance of SRS waste will be contingent upon state-approved permit modifications.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Few emissions for the facility are anticipated during normal operation and most accident scenarios
• non operational worker potential exposure	50	Processing this material will not increase the exposure to non operational personnel.
• operational worker potential exposure	50	Personnel exposure is average for operations of this type. Processing this material will not increase the exposure to operational personnel.
• transportation potential exposure	20	Waste characterization will be required for any waste streams returned to SRS for disposal.
Regulatory Parameters		
• need for variance	80	Process will be in full compliance without needing a variance.
• ability to obtain a permit	50	Permitting process is well defined, however, the state of Idaho acceptance of offsite waste treatment is unknown. Approval may be difficult.
• waste disposal	20	The treated waste will be classified as mixed waste which will require disposal in an HW/MW facility.
Public Acceptance		
• public acceptance	50	Public acceptance for stabilization is positive; however, the treatment of offsite waste is anticipated to reduce the overall public acceptance of this process.
Cost Considerations		
• life-cycle cost	99	
• funding availability	50	Not a budgeted item though line item funding may be required.
Industry Involvement		
• market for technology	80	The facility could potentially be used to treat numerous waste streams throughout the DOE Complex.
• private sector involvement	20	Technology is available at an existing DOE facility.

IDOA Score: Technical 52 **Total** 65

Waste Stream Number & Name: SR-W011 Cadmium-Coated HEPA Filters
Option Number: SR-W011-6
Facility: INEL/WEDF **Treatment Technology: Stabilization**
Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[ ] alpha [√] non-alpha [√] contact handled [ ] remote handled

Module Location: INEL

Module Status: [√] Existing [ ] New [ ] Small generator [√] Large generator
[ ] Onsite [√] Offsite [ ] Commercial [ ] Portable [ ] R&D

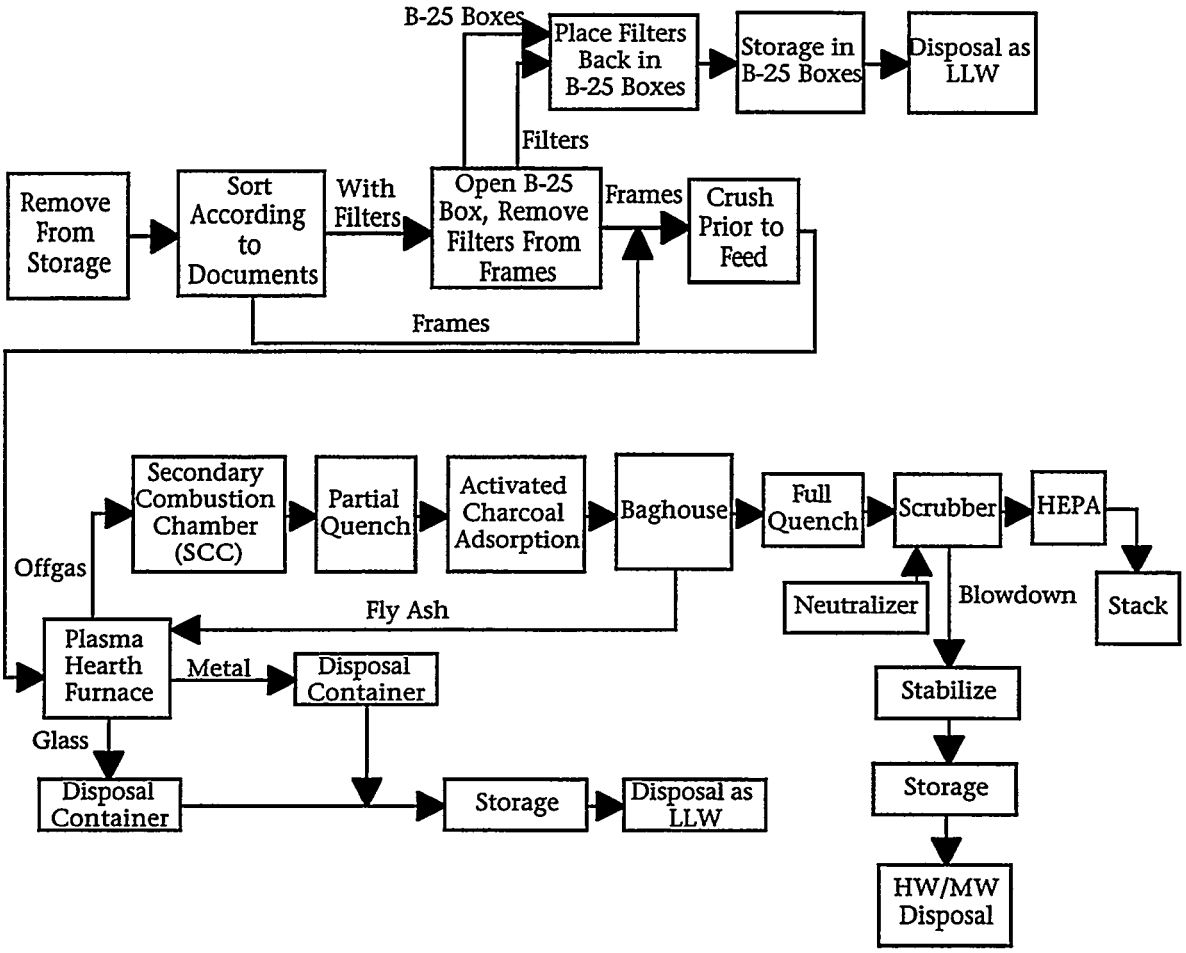
WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ N/A	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ N/A	
		1.3.2 Safety Assurance Documentation	$ N/A	
		1.3.3 Permitting	$ N/A	
		1.3.4 Preparation for Operations	$ N/A	
		1.3.5 Project Management	$ N/A	
		TOTAL PRE-OPERATIONS		$ N/A
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ N/A	
	2.2	Inspection	$ N/A	
	2.3	Project Management	$ N/A	
	2.4	Building Construction (inc. indirect)	$ N/A	
	2.5	Equipment (inc. indirect)	$ N/A	
	2.6	Construction Management	$ N/A	
	2.7	Contingency	$ N/A	
		TOTAL FACILITY CONSTRUCTION COSTS		$ N/A
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ N/A	
	3.2	Annual Utilities	$ N/A	
	3.3	Annual Materials	$ N/A	
	3.4	Annual Maintenance	$ N/A	
	3.5	Annual Contingency	$ N/A	
		TOTAL ANNUAL O & M	$ N/A	
		X NUMBER OF YEARS OF OPERATION		
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ N/A
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ N/A	
	4.2	Closure, Post-Closure, Monitoring	$ N/A	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ N/A
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$ N/A	
	5.2	Mobile Treatment	$ N/A	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$ 320
7.0	Transportation			$ 387
8.0	Disposal			$ 500
		SUB COST FOR STABILIZATION MODULE		$ 1,207
		ESCALATION		1.06
		TOTAL COST		$ 1,279

Note: Per DOE directions, this cost estimate is the incremental cost for treatment at on offsite DOE facility; therefore, it carries no overhead burden or capital costs.

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W011 Cadmium-Coated HEPA Filters
Option Number: SR-W011-7
Facility: Vendor
Treatment Technology: Plasma Hearth

Treatment Cycle Flow Diagram



Option rejected during technical success factor evaluation. No further analysis performed.

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Summary Page

Waste Stream Number & Name: SR-W012 Incinerable Toxic Characteristic (TC) Material

Background Information

This waste stream contains job control waste from In-Tank Precipitation (ITP) startup activities and various clean up materials such as rags, wipes, mopheads, gloves, etc., contaminated with toxic characteristic waste and radioactive materials. The waste stream is a collection of similar debris whose LDR treatment standards can be met by incineration followed by stabilization. The list of waste codes indicate the components which may be present in the waste. Waste from specific areas within SRS may not contain all the waste codes. Waste stream SR-W043 (Lab Waste w/Tetraphenyl Borate) listed in the Draft Site Treatment Plan has been consolidated into this stream.

Volume
- Current volume through 09/30/94 is 2.8 m^3.
- Expected 1995-1999 volume will be 1609.6 m^3. (Increase in generation due to inclusion of ITP job control waste into this waste stream description)

Waste Stream Composition
- Organic debris

Waste Code
- D004A (TCLP As)
- D005A (TCLP Ba)
- D006A (TCLP Cd)
- D007A (TCLP Cr)
- D008A (TCLP Pb)
- D009A (TCLP Hg)
- D009B (high organic Hg)
- D009C (high inorganic Hg)
- D010A (TCLP Se)
- D011A (TCLP Ag)
- D018 (benzene)

LDR Treatment Standard
- D004 = concentration based standard = 5 mg/l
- D005 = concentration based standard = 100 mg/l
- D006 = concentration based standard = 1 mg/l
- D007 = concentration based standard = 5 mg/l
- D008 = concentration based standard = 5 mg/l
- D009 = concentration based standard = 0.2 mg/l, or IMERC or RMERC for high organic Hg, or RMERC for high inorganic Hg
- D010 = concentration based standard = 5.7 mg/l
- D011 = concentration based standard = 5.0 mg/l
- D018* = concentration based standard = 10 mg/kg
- Alternate debris technology may be applied.

*D012-D043 nonwastewaters must be treated to meet the Universal Treatment Standards (UTS) for any underlying constituents that may be present.

Waste Characterization
- Some process knowledge used to characterize the waste stream.
- Confidence level is medium to low because no analytical data are available. Confidence level is based on knowing some information on the nature of the spill and concentration of the liquids cleaned up.

Radiological Characterization

- Alpha (U^{235}, Pu^{238}, Pu^{239}) emitters are present.
- Beta/gamma (Cs^{137}) emitter is present.
- Waste is contact handled.
- Mixed low-level waste

Preferred Option

The preferred treatment option for the Toxic Clean Up Material waste stream is Incineration followed by Stabilization in the Consolidated Incineration Facility. To implement the preferred option the waste must be prepared to meet CIF waste acceptance criteria.

Treatment Justification

In-depth options analysis (IDOA) was not performed for this waste stream.

During development of the Consolidated Incineration Facility (CIF) design basis, a determination was made of the types and volumes of hazardous, low-level radioactive, and mixed Savannah River Site (SRS) waste streams that would be generated in the future or were in storage for which treatment by incineration would be beneficial. The determination to initiate development of CIF was based on the facts that incineration was recommended or required by environmental regulations and a significant volume or toxicity reduction would be achieved. The wastes amenable to incineration were grouped by physical state, solid or liquid, and type of contamination, hazardous and/or radioactive. Some wastes such as Defense Waste Processing Facility (DWPF) benzene and low-level radioactive job control waste (JCW) were individually designated a waste group. The waste groups and current/future volume data were adopted as a design basis for the CIF Functional Performance Requirements (FPR) (OPS-WMP-90-4140). The FPR serves as the baseline design document for the initiation of project development at SRS.

Based on physical and chemical characteristics, the SRS mixed wastes already designated for treatment at CIF fall into one of the CIF design basis waste groups listed as follows:

FPR Waste Group	SRS Mixed Waste Streams
Beta/Gamma Boxed (Solid)	Solvent Contaminated Debris (LLW) (SR-W003) Incinerable Toxic Characteristic (TC) Material (SR-W012)
High BTU (Liquid)	Scintillation Solution (SR-W010) Mixed Waste Oil – Sitewide (SR-W035)
Chlorinated (Liquid)	Rad-Contaminated Solvents (SR-W001) Rad-Contaminated Chlorofluorocarbons (SR-W002)
DWPF Organic	DWPF Benzene (SR-W022)
Naval Fuel Organic	Spent Methanol Solution (SR-W030)

Some of the CIF design basis waste groups listed in the table are designated in the FPR as nonradioactive hazardous waste. The radioactive nature of the waste does not impact its combustion characteristics. The operation and efficiency of CIF combustion and air pollution control systems are not influenced by the presence of radioactivity. A mixed waste that meets the chemical and physical criteria of a design basis nonradioactive waste group can be treated in CIF as effectively as the nonradioactive waste.

The CIF Mission Need and Design Capacity Review (July 7, 1993) and the supporting Alternative Treatment Technologies for SRS Hazardous, Mixed and Job Control Wastes (JCW) (SWE-CIF-93020, July 29, 1993) reevaluated the treatment of certain existing and future SRS wastes in the CIF. The review was structured to generally reexamine the appropriateness of each FPR design basis waste group and additional mixed waste groups that are not listed in the FPR but are chemically and physically similar to an FPR nonradioactive waste group. The review compared

the incineration of each waste group to treatment by other candidate technologies using comparison criteria such as waste volume and toxicity reduction, treatment and disposal costs, and RCRA Land Disposal Restriction requirements. The review program concluded that the waste groups originally designated for CIF and the additional mixed waste groups are most effectively treated by incineration.

Alternative Technologies Investigated

Acid Digestion

An emerging technology for treatment of mixed JCW is Catalyzed Nitric Acid Oxidation which is being developed by the Savannah River Technology Center (SRTC). In this developmental process, the solids are processed in a nitric acid bath with a metal catalyst for oxidation of the organics and dissolution of the solids. Preliminary testing indicates that the process successfully dissolves cellulose and neoprene, but is unsuccessful in dissolving polyethylene and polyvinyl chloride (PVC). Polyethylene and PVC account for approximately 30 percent by weight of the JCW. The organic constituents are oxidized to carbon dioxide by the acid, and the metal contaminants are brought into solution. The resulting spent acid solution, with dissolved hazardous metals, would be treated in a chemical precipitation process to remove the metals and neutralize the solution prior to disposal through a permitted outfall. This technology is only in the development stage and has several safety and environmental issues requiring resolution.

Thermal Desorption

A possible treatment of this waste is by thermal desorption even through it is not demonstrated for this waste stream. Thermal desorption is typically used for volatilization of organics from soils at lower temperatures than provided by incineration. The desorption unit is equipped with an offgas system containing a carbon bed or organics condensation system to prevent environmental release of volatilized organics. Typical process operating temperatures (350°F - 600°F) are below the autoignition temperature of most JCW. The volatile organics would be volatilized and captured, while the treated solids could be compacted or incinerated before disposal. However, the plastics in the JCW begin to melt and volatilize at approximately 250°F (WSRC-TR-93-293). Therefore, this treatment is not practical for SRS JCW. Also, since these wastes contain hazardous metals, the solids would require further treatment prior to disposal.

Other Alternative Technologies

Several other possible alternative technologies are discussed in the CIF Mission Need and Design Capacity Review. These technologies are either in the developmental stage or have not demonstrated on organic and metal contaminated cellulose and plastic waste. Chemical oxidation processes will react with the cellulose and plastic and generate large volumes of partially oxidized organics. A demonstrated process to separate the hazardous constituents (organics and metals) from the cellulose and plastics has not been identified.

Selected Treatment Technology

Since no acceptable alternative treatment technology for JCW contaminated with organics and heavy metals was identified, the selected technology is incineration followed by stabilization of the residuals. Incineration destroys organic constituents, generated a residual which is easily stabilized, and significantly reduces the volume of waste requiring a disposal. Incineration is the treatment technology currently used by industry for treatment of this waste type.

Cost Estimate: THE COST FOR INCINERATION IS INCLUDED WITH THE COST FOR TREATING WASTE STREAM SR-W001. COST FOR PREPARING THE WASTE TO MEET THE CIF WASTE ACCEPTANCE CRITERIA APPEARS ON THIS COST ESTIMATE SHEET.

Waste Stream Number & Name: SR-W012 Incinerable Toxic Characteristic (TC) Material

Option Number: SR-W012

Facility:

Treatment Technology: Incineration

Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[ ] alpha [ ] non-alpha [√] contact handled [ ] remote handled

Module Location: INEL

Module Status: [√] Existing [ ] New [√] Small generator [ ] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 34	
	1.2	Demonstration Costs	$	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 138	
		1.3.2 Safety Assurance Documentation	$ 34	
		1.3.3 Permitting	$ 2,000	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 18	
		TOTAL PRE-OPERATIONS		$ 2,374
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 154	
	2.2	Inspection	$ 40	
	2.3	Project Management	$ 58	
	2.4	Building Construction (inc. indirect)	$ 400	
	2.5	Equipment (inc. indirect)	$ 300	
	2.6	Construction Management	$ 49	
	2.7	Contingency	$ 357	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 1,358
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 90	
	3.2	Annual Utilities	$ 4	
	3.3	Annual Materials	$ 54	
	3.4	Annual Maintenance	$ 32	
	3.5	Annual Contingency	$	
		TOTAL ANNUAL O & M	$ 180	
		X NUMBER OF YEARS OF OPERATION	5	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 900
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 560	
	4.2	Closure, Post-Closure, Monitoring	$ 22	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 582
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 430
9.0	Additional On-site Treatment (Incineration)			*
		SUB COST FOR INCINERATION MODULE		$ 5,643
		ESCALATION		1.23
		TOTAL COST		$ 6,942

If above numbers do not appear to add correctly, it is the result of computer rounding.

* **Included with baseline incineration costs.**

Summary Page – Initial Screening

Waste Stream Number & Name: **SR-W013** **Low-Level Waste (LLW) Lead – to be Decontaminated**

Background Information

This waste stream consists of elemental lead which can be decontaminated and reused. SR-W013 was identified as SR-W013A in the Draft Site Treatment Plan.

Volume
- Current volume through 09/30/94 is 82.2 m^3.
- Expected 1995-1999 generation volume will be 30 m^3.

Waste Stream Composition
- Elemental lead

Waste Code
- D008C – (elemental Pb)

LDR Treatment Standard
- D008 = specified technology = Macroencapsulation

Waste Characterization
- Process knowledge used to characterize the waste stream.
- Confidence level is high based on the fact that waste is easily identified as containing lead.

Radiological Characterization
- Beta/gamma emitters (Cs^{137} and Sr^{90}) are present.
- Alpha emitter (Pu^{238}, Pu^{239}, and U^{235}) are present.
- Waste is contact handled.
- Mixed low-level waste

Initial Screening

The initial screening identified inappropriate treatment options. These options appear in the Initial Rejections table.

Initial Rejections

Treatment Facility	Treatment Technology	Reasons for Rejection
CIF	Ashcrete Stabilization	Ashcrete encapsulation will not meet BDAT QC requirements.
CIF	Incineration	CIF has no provision for handling molten metal.
ETF	Ion Exchange	ETF has no equipment to treat elemental lead.
Lab.	Lab-scale process flowsheet	Volume of waste too great to handle with laboratory-scale equipment.
LETF	Ion Exchange	LEFT has no equipment to decontaminate elemental lead.
M Area	Vitrification	Lead must be recovered per LDR rules.
Z Area	Stabilization	Z Area can treat only those wastes that come by pipeline from Tank 50 and meet strict waste acceptance criteria. The Z-Area process lacks flexibility to treat and dispose of a variety of waste streams.

Summary Page – Technology Success Factor (TSF) & In-Depth Options Analysis (IDOA)

Waste Stream Number & Name: **SR-W013** **Low-Level Waste (LLW) Lead – to be Decontaminated**

Feasible Options

Option No.	Treatment Facility	Treatment Technology	TSF Score	IDOA Scores Tech.	IDOA Scores Total	COST (x 1,000)	PO
SR-W013-1	Vendor 1	Decontamination	88	69	82	627	√
SR-W013-2	Vendor 2	Decontamination	88	69	82	627	
SR-W013-3	Cont. Bldg.	Decontamination	51	47	49	32,019	
SR-W013-4	Vendor	Mineralization	26				

Options Rejected Due To Low Technology Success Factor (TSF)

Mineralization Treatment by Vendor

Mineralization treatment entails a carefully controlled chemical reaction to produce from the lead waste a compound with a particular mineral composition and crystal structure. Mineralization treatment was rejected because:

- It has not been demonstrated outside the laboratory, hence, Pm=0.9.
- Controls of the process and equipment needed are poorly specified, but can be assumed to be complex, hence Pc=0.5.

Engineering Assessment

Preferred Option Justification

The preferred treatment option for the LLW Lead – to be Decontaminated waste stream is Decontamination in an offsite vendor treatment facility.

This option is preferred because:

- The volume of the material going to disposal is reduced by more than a factor of 5.
- The volume of secondary waste is small.
- The vendor process is currently in operation.
- Vendor decontamination is cost-effective.

Options Rejected During IDOA

Decontamination in a Containment Building

Decontamination in a Containment Building was rejected because:

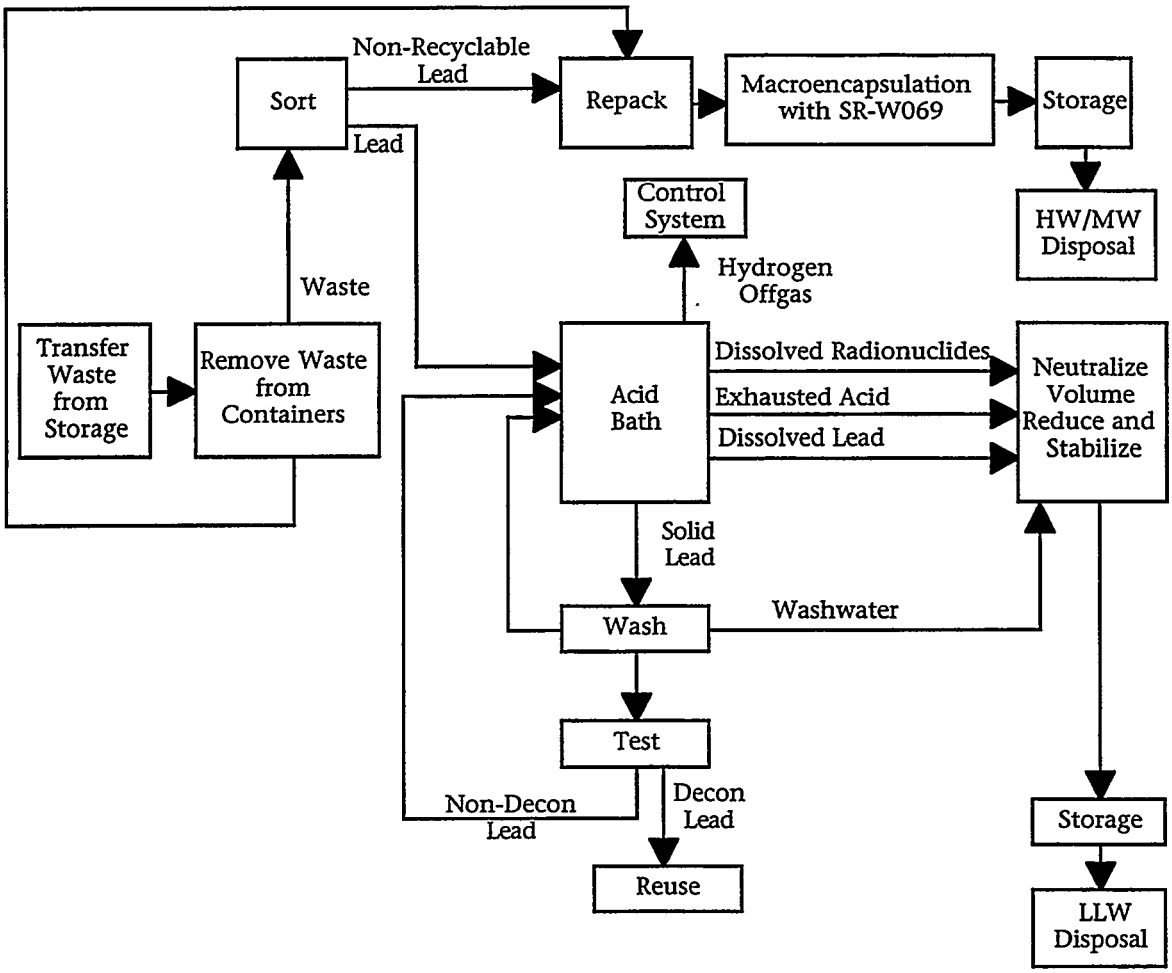
- It is less cost-effective than decontamination at a vendor's facility

Waste Stream Number & Name: SR-W013 Low-Level Waste (LLW) Lead – to be Decontaminated

Option Number: SR-W013-1
Facility: Vendor (Offsite)

Treatment Technology: Decontamination (Vendor 1)

Treatment Cycle Flow Diagram



Pros

- The volume reduction of the waste is much greater than five because the only waste returned is waste that cannot be decontaminated.
- A small quantity of secondary waste is generated by the process and is easily treated by existing technologies.
- The decontaminated lead is able to be shipped upon completion of the processes.
- Treatment results in decontaminated lead. Lead can be free-released and sold for reuse. Non decontaminated lead will meet the expected WAC after treatment at SRS.
- This is a proven process and is a vendor treatment that is being used by both the commercial world and some parts of the DOE Complex.
- System is simple to operate and generally available greater than 80% of the time.
- Process failure does not result in a waste that can not be treated by existing processes. Alternative treatments exist for the waste. Process is on the vendor's site.
- Treatment will take place in an existing, permitted, offsite vendor facility. Schedule can be developed with great confidence.
- The process is on the vendor's site and is permitted.

Waste Stream Number & Name: SR-W013 Low-Level Waste (LLW) Lead – to be Decontaminated

Option Number: SR-W013-1
Facility: Vendor (Offsite)

Treatment Technology: Decontamination (Vendor 1)

Cons (contd)

- Constituents of concern are not permanently isolated from the environment.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	80	The volume reduction of the waste is much greater than five times the original waste volume because the only waste returned is waste that cannot be decontaminated.
• secondary waste generation	80	A small quantity is generated by the process and is easily treated by existing technologies.
• destruction removal and demobilization efficiency	80	Total process produces wastes that meet LDR.
• flexibility	40	This process will only handle pure lead such as sheet lead. Subtract 10 points from the median score of 50 because process is not tolerant of residues such as glue from tape or certain types of marking pen ink.
• ability to be shipped	80	The decontaminated lead is able to be shipped upon completion of the processes.
• final waste form	80	Treatment results in decontaminated lead. Lead can be free-released and sold for reuse. Non decontaminated lead will meet the expected WAC after treatment at SRS.
Engineering Parameters		
• system implementability	100	This is a proven process. Add 20 points to the median score of 80 because a vendor treatment that is being used by both the commercial world and some parts of the DOE Complex.
• availability	80	Although operator error can cause downtime, system is simple to operate and generally available greater than 80% of the time.
• scalability	50	Throughput is set by design and not easily expandable except by adding more shifts.
• remedial measures	100	Process failure does not result in a waste that can not be treated by existing processes. Add 20 points to the median score of 80 because alternate treatments exist for the waste. Process is on the vendor's site. Remedial measures have no impact on SRS.
• schedule for treatment of waste	100	Treatment will take place in an existing, permitted, offsite vendor facility. Add 20 points to the median score of 80 because schedule can be developed with great confidence.
Personnel Parameters		
• consequence of unmitigated accident scenarios	100	The process is on vendor's site. Add 20 points to the median score of 80 because vendor's remedial measures have no impact on SRS.
• non operational worker potential exposure	80	Will require 5-6 loaders to load the waste containers on the truck for shipment.

Waste Stream Number & Name: SR-W013 Low-Level Waste (LLW) Lead – to be Decontaminated

Option Number: SR-W013-1
Facility: Vendor (Offsite)

Treatment Technology: Decontamination (Vendor 1)

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• operational worker potential exposure	100	Processing takes place in vendor's facility. Add 20 points to median score of 80 because process is currently in operation and vendor personnel are trained and experienced in its operation.
• transportation potential exposure	50	Drums must be transported 200 miles to the vendor's site. Non decontaminated lead must be returned to SRS.
Regulatory Parameters		
• need for variance	100	The process is at the vendor's site. Add 20 points to the median score of 80 because vendor handles permitting.
• ability to obtain a permit	100	Add 20 points to the median score of 80 because the process is on the vendor's site and is permitted.
• waste disposal	70	Subtract 10 points from the median score of 80 because non decontaminated lead must be returned to SRS for treatment and HW/MW disposal.
Public Acceptance		
• public acceptance	30	Constituents of concern are not permanently isolated from the environment. Add 10 points to the median score of 20 because much of the brick and sheet lead will be returned to use and not require disposal as waste.
Cost Considerations		
• life-cycle cost	98	
• funding availability	50	Expected to be funded by operational costs, but budget will have to be increased to cover expenditures.
Industry Involvement		
• market for technology	20	This is an existing vendor process.
• private sector involvement	80	This is an existing vendor process.

IDOA Score: Technical 69 Total 82

Waste Stream Number & Name: SR-W013 Low-Level Waste (LLW) Lead – to be Decontaminated

Option Number: SR-W013-1
Facility: Vendor (Offsite)

Treatment Technology: Decontamination (Vendor 1)

Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled

Module Location: Vendor facility

Module Status: [√] Existing [ ] New [ ] Small generator [√] Large generator
[ ] Onsite [√] Offsite [√] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 3	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 0	
		1.3.2 Safety Assurance Documentation	$ 3	
		1.3.3 Permitting	$ 0	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 0	
		TOTAL PRE-OPERATIONS		$ 157
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 0	
	2.2	Inspection	$ 0	
	2.3	Project Management	$ 0	
	2.4	Building Construction (inc. indirect)	$ 0	
	2.5	Equipment (inc. indirect)	$ 0	
	2.6	Construction Management	$ 0	
	2.7	Contingency	$ 35	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 35
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 19	
	3.2	Annual Utilities	$ 1	
	3.3	Annual Materials	$ 11	
	3.4	Annual Maintenance	$ 7	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 38	
		X NUMBER OF YEARS OF OPERATION	4.00	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 150
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 0	
	4.2	Closure, Post-Closure, Monitoring	$ 0	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 0
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$ 100	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$ 100
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 150
		SUB COST FOR DECONTAMINATION MODULE		$ 592
		ESCALATION		1.06
		TOTAL COST		$ 627

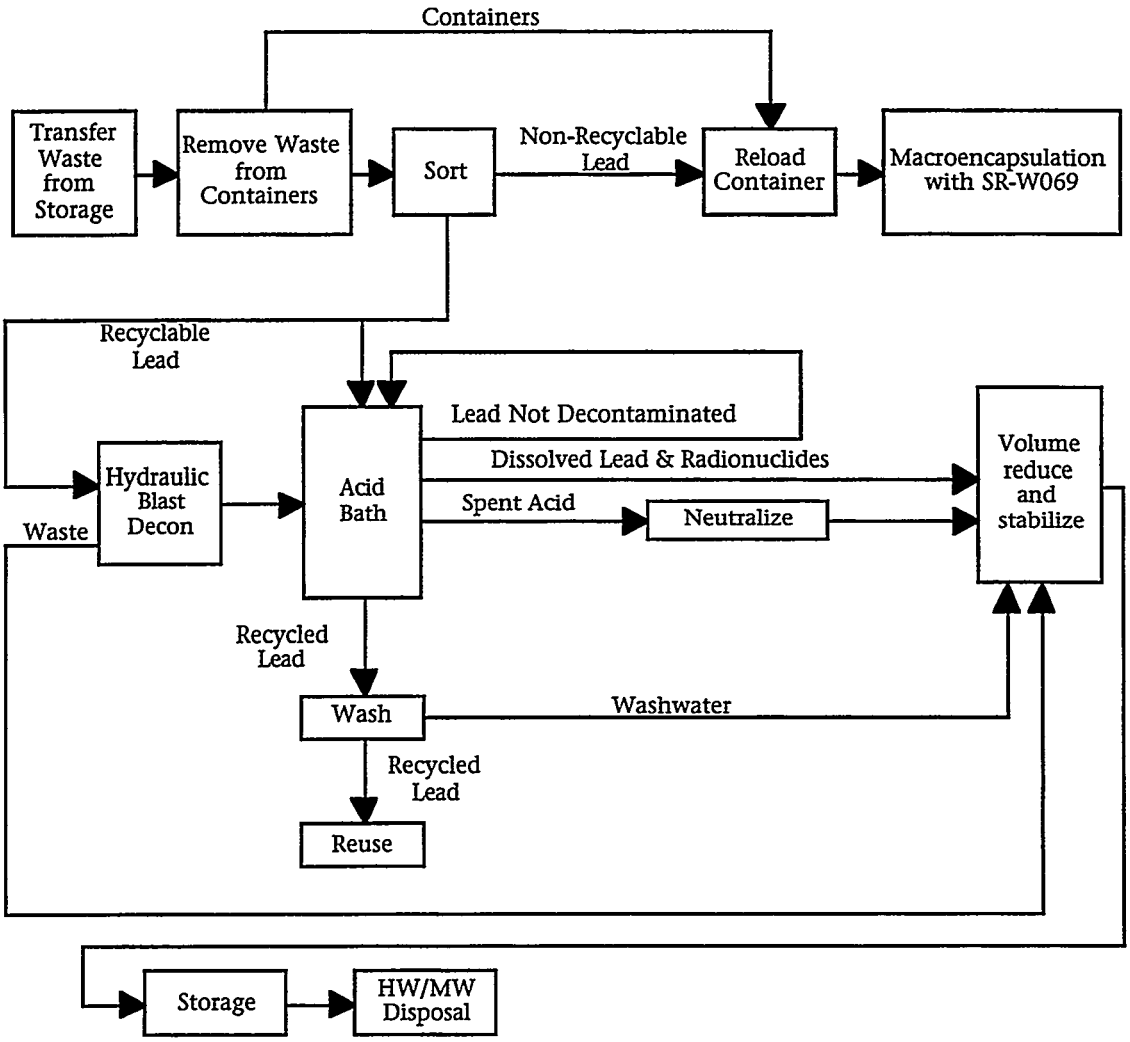
If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W013 **Low-Level Waste (LLW) Lead – to be Decontaminated**

Option Number: SR-W013-2
Facility: Vendor (Offsite)

Treatment Technology: Decontamination (Vendor 2)

Treatment Cycle Flow Diagram



Pros

- The volume reduction of the waste is much greater than 5 because the only waste returned is waste that cannot be decontaminated.
- Small quantity is generated by the process and easily treated by existing technologies.
- The decontaminated lead is able to be shipped upon completion of the processes.
- Treatment results in decontaminated lead. The lead can be free-released and sold for reuse. Non decontaminated lead will meet the expected WAC after treatment at SRS.
- This is a proven process. A vendor treatment that is being used by both the commercial world and some parts of the DOE Complex.
- Although operator error can cause downtime, system is simple to operate and generally available greater than 80% of the time.
- Process failure does not result in a waste that cannot be treated by existing processes and alternate treatments do exist for the waste. Process is on the vendor's site.

Waste Stream Number & Name: SR-W013 Low-Level Waste (LLW) Lead – to be Decontaminated

Option Number: SR-W013-2
Facility: Vendor (Offsite)

Treatment Technology: Decontamination (Vendor 2)

Pros (contd)

- This treatment will take place in an existing, permitted, offsite vendor facility. Schedule can be developed with great confidence.
- The process is on vendor's site. Vendor's remedial measures have no impact on SRS.
- The process is on the vendor's site and is permitted.
- Non-decontaminated lead must be returned to SRS for treatment and RCRA-permitted disposal.

Cons

- Constituents of concern are not permanently isolated from the environment.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	80	The volume reduction of the waste is much greater than five times the original waste volume because the only waste returned is waste that cannot be decontaminated.
• secondary waste generation	80	Small quantity is generated by the process and easily treated by existing technologies.
• destruction removal and demobilization efficiency	80	Total process produces wastes that meet LDR requirements.
• flexibility	40	The process will only handle pure lead such as sheet lead. Subtract 10 points from the median score of 50 because process is not tolerant of residues such as glue from tape or certain types of marking pen ink.
• ability to be shipped	80	The decontaminated lead is able to be shipped upon completion of the processes.
• final waste form	80	Treatment results in decontaminated lead. The lead can be free-released and sold for reuse. Non decontaminated lead will meet the expected WAC after treatment at SRS.
Engineering Parameters		
• system implementability	100	This is a proven process. Add 20 points to the median score of 80 because a vendor treatment that is being used by both the commercial world and some parts of the DOE Complex.
• availability	80	Although operator error can cause downtime, system is simple to operate and generally available greater than 80% of the time.
• scalability	50	Throughput is set by design and not easily expandable except by adding more shifts.
• remedial measures	100	Process failure does not result in a waste that cannot be treated by existing processes. Add 20 points to the median score of 80 because alternate treatments do exist for the waste. Process is on the vendor's site. Remedial measures have no impact on SRS.
• schedule for treatment of waste	100	This treatment will take place in an existing, permitted, offsite vendor facility. Add 20 points to the median score of 80 because schedule can be developed with great confidence.

Waste Stream Number & Name: SR-W013 Low-Level Waste (LLW) Lead – to be Decontaminated

Option Number: SR-W013-2
Facility: Vendor (Offsite)

Treatment Technology: Decontamination (Vendor 2)

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Personnel Parameters		
• consequence of unmitigated accident scenarios	100	The process is on vendor's site. Add 20 points to the median score of 80 because vendor's remedial measures have no impact on SRS.
• non operational worker potential exposure	80	Will require 5-6 loaders to load the waste containers on the truck for shipment.
• operational worker potential exposure	100	Processing takes place in vendor's facility. Add 20 points to median score of 80 because process is currently in operation and vendor personnel are trained and experienced in its operation.
• transportation potential exposure	50	Drums must be transported 200 miles to the vendor's site. Non decontaminated lead must be returned to SRS.
Regulatory Parameters		
• need for variance	100	The process is at the vendor's site. Add 20 points to the median score of 80 because vendor handles permitting.
• ability to obtain a permit	100	Add 20 points to the median score of 80 because the process is on the vendor's site and is permitted.
• waste disposal	70	Subtract 10 points from the median score of 80 because non-decontaminated lead must be returned to SRS for treatment and HW/MW disposal.
Public Acceptance		
• public acceptance	30	Constituents of concern are not permanently isolated from the environment. Add 10 points to the median score of 20 because much of the brick and sheet lead will be returned to use and not require disposal as waste.
Cost Considerations		
• life-cycle cost	98	
• funding availability	50	Expected to be funded by operational costs, but budget will have to be increased to cover expenditures.
Industry Involvement		
• market for technology	20	This is an existing vendor process.
• private sector involvement	50	This is an existing vendor process.

IDOA Score: **Technical** 69 **Total** 82

Waste Stream Number & Name: SR-W013 Low-Level Waste (LLW) Lead – to be Decontaminated

Option Number: SR-W013-2
Facility: Vendor (Offsite)

Treatment Technology: Decontamination (Vendor 2)

Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled

Module Location: Vendor facility

Module Status: [√] Existing [ ] New [ ] Small generator [√] Large generator
[ ] Onsite [√] Offsite [√] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 3	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 0	
		1.3.2 Safety Assurance Documentation	$ 3	
		1.3.3 Permitting	$ 0	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 0	
		TOTAL PRE-OPERATIONS		$ 157
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 0	
	2.2	Inspection	$ 0	
	2.3	Project Management	$ 0	
	2.4	Building Construction (inc. indirect)	$ 0	
	2.5	Equipment (inc. indirect)	$ 0	
	2.6	Construction Management	$ 0	
	2.7	Contingency	$ 35	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 35
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 19	
	3.2	Annual Utilities	$ 1	
	3.3	Annual Materials	$ 11	
	3.4	Annual Maintenance	$ 7	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 38	
		X NUMBER OF YEARS OF OPERATION	4.00	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 150
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 0	
	4.2	Closure, Post-Closure, Monitoring	$ 0	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 0
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$ 100	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$ 100
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 150
		SUB COST FOR DECONTAMINATION MODULE		$ 592
		ESCALATION		1.06
		TOTAL COST		$ 627

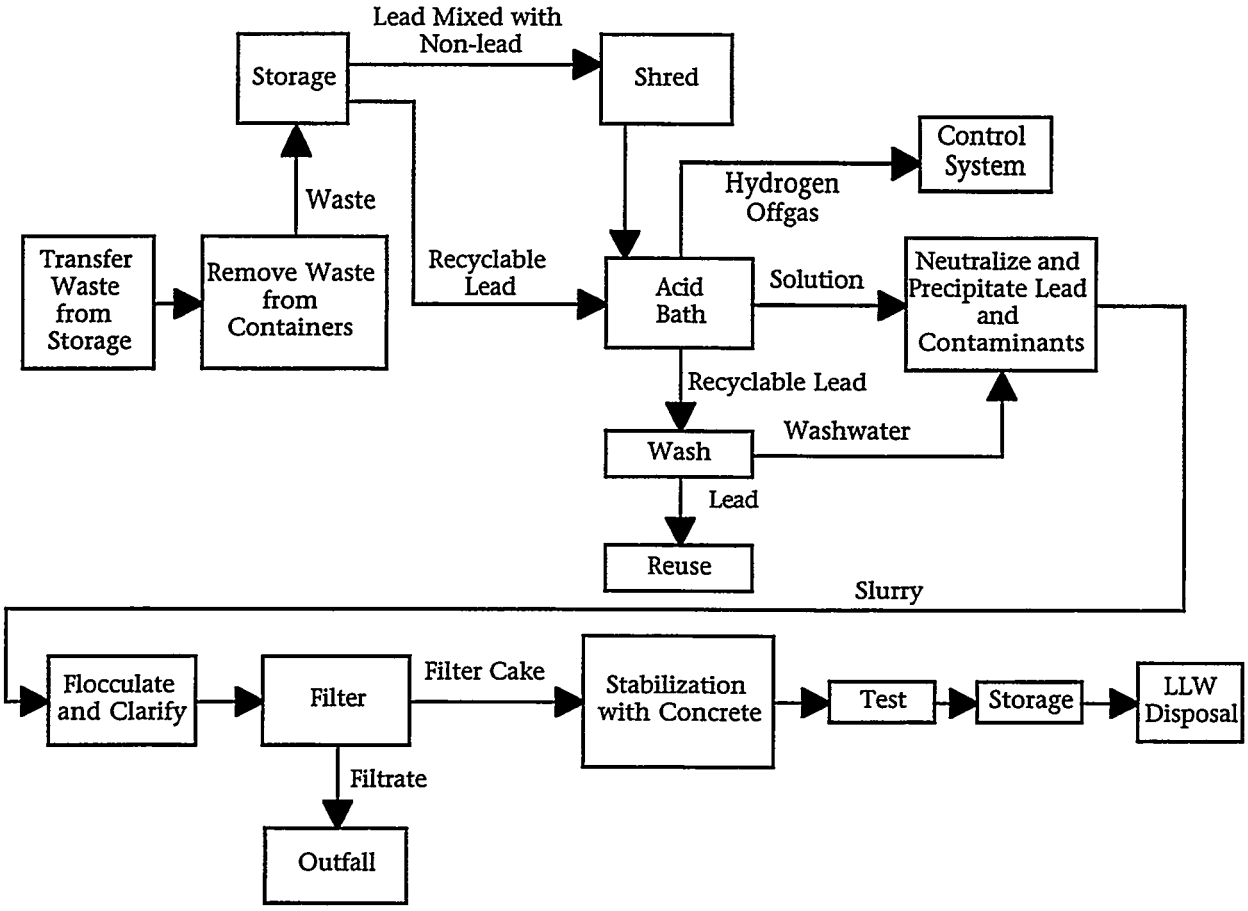
If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W013 Low-Level Waste (LLW) Lead – to be Decontaminated

Option Number: SR-W013-3
Facility: Containment Building

Treatment Technology: Decontamination/ Precipitation/ Stabilization

Treatment Cycle Flow Diagram



Pros

- Treatment is required to meet LDR requirements.
- Waste form meets shipping requirements in the form it exits the treatment process.
- The waste form meets the expected WAC for disposal. Waste form is disposable in the form in which it exits the process.
- Process will be in full compliance with LDR regulations without a variance.
- Small volume of secondary waste generated by removal of lead from the etching solution will require treatment by existing technologies.
- Waste meets LDR treatment standard and can be disposed of as LLW.

Cons

- Waste form is not as permanent as other forms of stabilization.
- Not a budgeted item and will require line item funding.

Waste Stream Number & Name: SR-W013 Low-Level Waste (LLW) Lead – to be Decontaminated

Option Number: SR-W013-3
Facility: Containment Building

Treatment Technology: Decontamination/ Precipitation/ Stabilization

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	60	Total waste volume for disposal will approximate original volume. Add 10 points to the median score of 50 because much of the decontaminated lead brick volume will be reusable.
• secondary waste generation	80	Small volume of secondary waste generated by removal of Pb from the etching solution will require treatment by existing technologies.
• destruction removal and demobilization efficiency	80	No additional treatment is required to meet LDR requirements.
• flexibility	50	System expected to be able to handle many wastes for which acid etching is a preferred treatment.
• ability to be shipped	80	Waste form meets shipping requirements in the form it exits the treatment process.
• final wasteform	80	The waste form meets the expected WAC for disposal.
Engineering Parameters		
• system implementability	60	The basic process is demonstrated. Add 10 points to the median score of 50 because shredding and acidizing Pb contaminated with plastic is unproved, may be difficult to install a process in a containment building.
• availability	50	System is normally available 50% of the time.
• scalability	50	Throughput is set by design, and not easily expanded except by adding more shifts of operation.
• remedial measures	40	Lead bricks and sheet lead that require additional decontamination can be recycled. Subtract 10 points from the median score of 50 because failure of lead salt removal by precipitation could lead to extensive retreatment.
• schedule for treatment of waste	40	This is a mature technology, but containment building process will have to be designed. Subtract 10 points from the median score of 50 because installation in a containment building will add uncertainties.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Process can be installed in a building with adequate emission controls.
• non operational worker potential exposure	40	Maintenance of encapsulating material mixing equipment will require an average crew. Subtract 10 points from the median score of 50 because personal protective equipment needed for work in a containment building, even though the mixing equipment contains no radiation.
• operational worker potential exposure	40	An average crew is required to operate the equipment. Subtract 10 points from the median score of 50 because manual labor required to unload boxes and stack Pb in the encapsulation containers.

Waste Stream Number & Name: SR-W013 Low-Level Waste (LLW) Lead – to be Decontaminated

Option Number: SR-W013-3
Facility: Containment Building

Treatment Technology: Decontamination/ Precipitation/ Stabilization

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• transportation potential exposure	60	No additional characterization needed. Add 10 points to the median score of 50 because waste can be handled readily.
Regulatory Parameters		
• need for variance	80	Process will be in full compliance with LDR regulations without a variance.
• ability to obtain a permit	50	Proven process that has been permitted elsewhere.
• waste disposal	20	Waste meets treatment standard and can be disposed of as LLW.
Public Acceptance		
• public acceptance	30	Mature and proven technology, however waste form is not as permanent as other forms of stabilization (i.e., vitrification). Add 10 points to the median score of 20 because much of the brick and sheet lead will be returned to use and not require disposal as waste.
Cost Considerations		
• life-cycle cost	9	
• funding availability	20	Not a budgeted item and will require line item funding.
Industry Involvement		
• market for technology	20	Similar processes are commercially available.
• private sector involvement	50	One qualified vendor has been identified who can provide this process.

IDOA Score: **Technical** 47 **Total** 49

Waste Stream Number & Name: SR-W013 Low-Level Waste (LLW) Lead – to be Decontaminated

Option Number: SR-W013-3

Facility: Containment Building

Treatment Technology: Decontamination/ Precipitation/ Stabilization

Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled

Module Location: SRS

Module Status: [ ] Existing [√] New [ ] Small generator [√] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 258	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 1,033	
		1.3.2 Safety Assurance Documentation	$ 258	
		1.3.3 Permitting	$ 125	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 180	
		TOTAL PRE-OPERATIONS		$ 2,005
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 1,133	
	2.2	Inspection	$ 326	
	2.3	Project Management	$ 506	
	2.4	Building Construction (inc. indirect)	$ 4,000	
	2.5	Equipment (inc. indirect)	$ 1,150	
	2.6	Construction Management	$ 361	
	2.7	Contingency	$ 2,679	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 10,155
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 422	
	3.2	Annual Utilities	$ 17	
	3.3	Annual Materials	$ 253	
	3.4	Annual Maintenance	$ 152	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 844	
		X NUMBER OF YEARS OF OPERATION	8.00	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 6,750
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 4,120	
	4.2	Closure, Post-Closure, Monitoring	$ 5	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 4,125
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 100
		SUB COST FOR DECONTAMINATION MODULE		$ 23,135
		ESCALATION		1.384
		TOTAL COST		$ 32,019

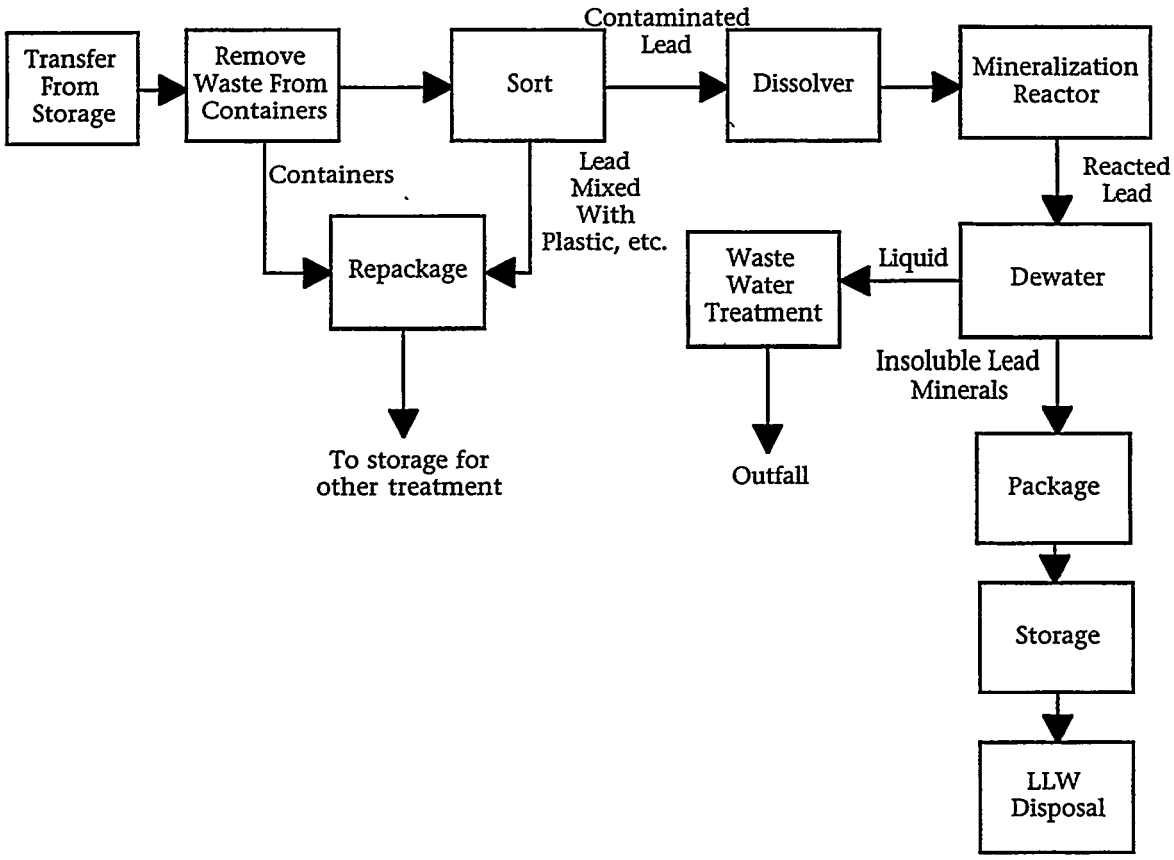
If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W013 **Low-Level Waste (LLW) Lead – to be Decontaminated**

Option Number: SR-W013-4
Facility: Vendor

Treatment Technology: Mineralization

Treatment Cycle Flow Diagram



Option rejected during technical success factor evaluation. No further analysis performed.

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Summary Page – Initial Screening

Waste Stream Number & Name: SR-W014 Tritium-Contaminated Mercury

Background Information

This waste stream is elemental mercury used as a pumping fluid in diffusion pumps for the transfer of tritium gas. The mercury waste is generated from pump maintenance or pump failure due to mercury oxide fouling. The waste contains floating slag or an oxidized layer from the erosion/leaching of stainless steel pump housings and pipes. Most of the tritium contamination is in the floating mercury oxide layer.

Volume
- Current volume through 09/30/94 is 0.3 m^3.
- Expected 1995-1999 generation volume will be 0.1 m^3.

Waste Stream Composition
- Elemental mercury

Waste Code
- D009D (Elemental mercury)

LDR Treatment Standard
- D009 = specified technology = Amalgamation

Waste Characterization
- Process knowledge used to characterize the waste stream.
- Confidence level is high based on the fact waste is elemental mercury with a small oxide layer.

Radiological Characterization
- Total activity is 350 nCi/g with tritium present.
- Waste is contact handled.
- Mixed low-level waste

Initial Screening

The initial screening identified inappropriate treatment options. These options appear in the Initial Rejections table.

Initial Rejections

Treatment Facility	Treatment Technology	Reasons for Rejection
CIF	Ashcrete Stabilization	Ashcrete will not micro encapsulate Hg so that it passes TCLP.
CIF	Incineration	CIF would volatize Hg without equipment to control it. Also, tritium content exceeds CIF WAC.
ETF	Ion Exchange	ETF has no equipment to treat elemental Hg.
Lab.	Lab-scale process flowsheet	Vitrification will not capture Hg in the glass.
LETF	Ion Exchange	LETF has no equipment to treat elemental Hg.
M Area	Vitrification	Vitrifier has no prevision to control volatized Hg.
Z Area	Stabilization	Z Area can treat only those wastes that come by pipeline from Tank 50 and meet strict waste acceptance criteria. The Z-Area process lacks flexibility to treat and dispose of a variety of waste streams.

Summary Page – Technology Success Factor (TSF) & In-Depth Options Analysis (IDOA)

Waste Stream Number & Name: SR-W014 Tritium-Contaminated Mercury

Feasible Options

Option No.	Treatment Facility	Treatment Technology	TSF Score	IDOA Scores Tech.	IDOA Scores Total	COST (x 1,000)	PO
SR-W014-1	INEL/WEDF	Amalgamation	*	51	64	228	√
SR-W014-2	Cont. Bldg.	Distill/Reuse	51	50	60	9,846	
SR-W014-3	Cont. Bldg.	Distill/Amalg	51	43	53	10,071	
SR-W014-4	HW/MW-TB	Distill/Amalg	51	43	50	18,630	

* No TSF required for proposed or existing non-Savannah River Site-DOE waste processing facilities.

Options Rejected Due To Low Technology Success Factor (TSF)

- No options were rejected.

Engineering Assessment

Preferred Option Justification

The preferred treatment option for the Tritiated Mercury waste stream is Amalgamation at an offsite DOE facility; the Idaho National Engineering Laboratory/Waste Engineering Development Facility (INEL/WEDF) – Amalgamation Unit.

This option treats the constituent of concern mercury by binding it with another metal into a non-leachable form (amalgam).

This option is preferred because:
- No secondary waste streams are generated.
- This waste stream is similar to the design basis waste for the facility.
- Treatment is BDAT.
- Offsite treatment is cost-effective.

Options Rejected During IDOA

Distillation (followed by either reuse or amalgamation) in either a Containment Building or HW/MW-TB

Distillation (followed by either reuse or amalgamation) in either a Containment Building or HW/MW-TB was rejected because:
- None of the rejected options were as cost-effective as the preferred option.
- Rejected options offered no technological advantage over the preferred option.

Waste Stream Number & Name: SR-W014 Tritium-Contaminated Mercury
Option Number: SR-W014-1
Facility: INEL/WEDF **Treatment Technology: Amalgamation**

Treatment Technology

This treatment process is amalgamation. It is a process applicable to radioactive wastes containing mercury and particularly to wastes containing radioactive mercury isotopes. Mercury compounds are converted into a solid alloy with mercury and the amalgamating material, which is more easily managed and less mobile than solutions containing radioactive mercury. Amalgamation provides a change in mobility from liquid.

Pros

- No secondary waste streams are generated.
- The facility will be able to treat waste streams similar in composition to those assumed in the design basis without modification.
- The stabilized waste could be shipped without additional treatment.
- Final waste form is anticipated to meet the SRS disposal WAC.
- Stabilization has been demonstrated.
- The facility is anticipated to have minimal down time.
- Process failure is not anticipated to create a waste stream that cannot be treated.
- Few emissions for the facility are anticipated during normal operation and most accident scenarios.
- The facility could potentially be used to treat numerous waste streams throughout the DOE Complex.

Cons

- Stabilization will increase the overall waste volume by a factor of two or more after processing.
- Throughput will be limited by design. The facility is currently being designed.
- Waste characterization will be required for any waste streams returned to SRS for disposal.
- The majority of the treated waste will be classified as mixed waste which will require disposal in a HW/MW facility.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	20	Stabilization will increase the overall waste volume by a factor of 2 or more after processing.
• secondary waste generation	80	No secondary waste streams are generated.
• destruction removal and demobilization efficiency	50	Additional treatment for some waste streams may be required prior to amalgamation to ensure LDR standards are met.
• flexibility	80	The facility can treat waste streams similar in composition to those assumed in the design basis without modification.
• ability to be shipped	80	The stabilized waste could be shipped without additional treatment.
• final waste form	80	Final waste form is anticipated to meet the SRS disposal WAC.
Engineering Parameters		
• system implementability	80	Stabilization has been demonstrated at the facility.
• availability	80	The facility is anticipated to have minimal down time.

Waste Stream Number & Name: SR-W014 **Tritium-Contaminated Mercury**
Option Number: SR-W014-1
Facility: INEL/WEDF **Treatment Technology: Amalgamation**
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• scalability	20	Throughput will be limited by design. The facility is currently being designed.
• remedial measures	80	Process failure is not anticipated to create a waste stream that cannot be treated.
• schedule for treatment of waste	50	A schedule for waste treatment cannot be provided. Additionally, acceptance of SRS waste will be contingent upon State of Idaho's approval of permit modifications.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Few emissions for the facility are anticipated during normal operation and most accident scenarios.
• non operational worker potential exposure	50	Processing this material will not increase the exposure to non operational personnel.
• operational worker potential exposure	50	Personnel exposure is average for operations of this type. Processing this material will not increase the exposure to operational personnel.
• transportation potential exposure	20	Waste characterization will be required for any waste streams returned to SRS for disposal.
Regulatory Parameters		
• need for variance	50	Acceptance of offsite waste will require submission of a permit modification. It is anticipated that the State of Idaho will call for a full Part B Permit Application prior to acceptance of offsite wastes.
• ability to obtain a permit	50	Permitting process is well defined, however, the State of Idaho's acceptance of offsite waste treatment is unknown. Approval may be difficult.
• waste disposal	20	The majority of the treated waste will be classified as mixed waste which will require disposal in a HW/MW facility.
Public Acceptance		
• public acceptance	50	Public acceptance for stabilization is positive; however, the treatment of offsite waste is anticipated to reduce the overall public acceptance of this process.
Cost Considerations		
• life-cycle cost	99	
• funding availability	20	Funding for treatment cost can be provided using the operating budget, however the additional costs may result in an increase in the budget in excess of 10%.
Industry Involvement		
• market for technology	80	The facility could potentially be used to treat numerous waste streams throughout the DOE Complex.
• private sector involvement	20	Technology is available at an existing DOE facility.

IDOA Score: **Technical** 51 **Total** 64

Waste Stream Number & Name: SR-W014 Tritium-Contaminated Mercury
Option Number: SR-W014-1
Facility: INEL/WEDF **Treatment Technology: Amalgamation**
Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[ ] alpha [√] non-alpha [√] contact handled [ ] remote handled

Module Location: INEL

Module Status: [ ] Existing [√] New [√] Small generator [ ] Large generator
[ ] Onsite [√] Offsite [ ] Commercial [ ] Portable [ ] R&D

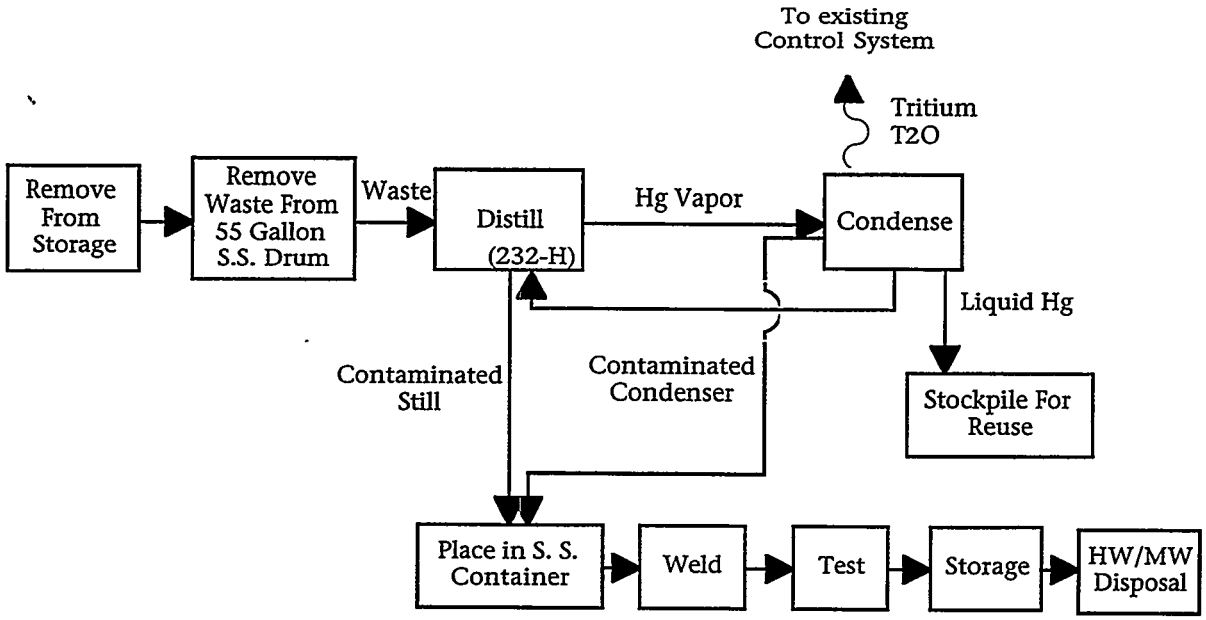
WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ N/A	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ N/A	
		1.3.2 Safety Assurance Documentation	$ N/A	
		1.3.3 Permitting	$ N/A	
		1.3.4 Preparation for Operations	$ N/A	
		1.3.5 Project Management	$ N/A	
		TOTAL PRE-OPERATIONS		$ N/A
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ N/A	
	2.2	Inspection	$ N/A	
	2.3	Project Management	$ N/A	
	2.4	Building Construction (inc. indirect)	$ N/A	
	2.5	Equipment (inc. indirect)	$ N/A	
	2.6	Construction Management	$ N/A	
	2.7	Contingency	$ N/A	
		TOTAL FACILITY CONSTRUCTION COSTS		$ N/A
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ N/A	
	3.2	Annual Utilities	$ N/A	
	3.3	Annual Materials	$ N/A	
	3.4	Annual Maintenance	$ N/A	
	3.5	Annual Contingency	$ N/A	
		TOTAL ANNUAL O & M	$ N/A	
		X NUMBER OF YEARS OF OPERATION		
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ N/A
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ N/A	
	4.2	Closure, Post-Closure, Monitoring	$ N/A	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ N/A
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$ N/A	
	5.2	Mobile Treatment	$ N/A	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$ 98
7.0	Transportation			$ 17
8.0	Disposal			$ 100
		SUB COST FOR AMALGAMATION MODULE		$ 215
		ESCALATION		1.06
		TOTAL COST		$ 228

Note: Per DOE directions this cost estimate is the incremental cost for treatment at an offsite DOE facility; therefore, it carries no overhead burden or capital costs.

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W014 **Tritium-Contaminated Mercury**
Option Number: SR-W014-2
Facility: Containment Building **Treatment Technology:** Distill/Reuse

Treatment Cycle Flow Diagram



Pros

- Significant reduction in waste volume as Hg is recovered for reuse.
- Final waste form will meet WAC.
- The process is commercially available.
- Small scale process. Availability will be of little concern.
- Potential for tritium release is small. Process will take place in a controlled area. Source is small.
- Process will comply with LDR regulations without requiring a variance.
- Process is well-defined, and has been permitted in other locations.

Cons

- Increased throughput possible only by adding operating shifts.
- All traps will require disposal in HW/MW.
- Public concern may be allayed because Hg is recycled for reuse. Public concern with tritium release could be an issue.
- Not a budgeted item **and** will require line item funding.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	80	Significant reduction in waste volume as Hg is recovered for reuse.
• secondary waste generation	60	Subtract 20 points from the median score of 80 because of the number of different small volume waste streams.
• destruction removal and demobilization efficiency	100	Add 20 points to the median score of 80 because materials will be reused.

Waste Stream Number & Name: SR-W014 Tritium-Contaminated Mercury
Option Number: SR-W014-2
Facility: Containment Building Treatment Technology: Distill/Reuse
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• flexibility	50	Process may require additional steps or equipment to handle off-design input streams.
• ability to be shipped	50	There are no treatment residuals because material will be for reuse. Contaminated processing equipment will require simple treatment prior to shipment.
• final waste form	80	Final waste form will meet WAC.
Engineering Parameters		
• system implementability	70	The process is commercially available. Subtract 10 points from the median score of 80 because there are uncertainties arising from operation in a tritium environment.
• availability	80	Small-scale process. Availability will be of little concern.
• scalability	20	Fixed by design. Increased throughput possible by adding operating shifts.
• remedial measures	50	Rupture or breakage of glass equipment will require a significant cleanup effort.
• schedule for treatment of waste	50	Some technology concerns about operating in a tritium environment.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Potential for tritium release is small. Process will take place in a controlled area. Source is small.
• non operational worker potential exposure	40	The process equipment is small. Subtract 10 points from the median score of 50 because decommissioning costs would be high for a waste stream of such small volume of waste.
• operational worker potential exposure	50	An average number of operational workers will be required to tend this process.
• transportation potential exposure	50	Waste will require some additional characterization before transportation to storage.
Regulatory Parameters		
• need for variance	80	Process will comply with LDR regulations without requiring a variance.
• ability to obtain a permit	70	Subtract 10 points from the median score of 80 even though process is well-defined, and has been permitted in other locations, because there is tritium contamination of the mercury waste.
• waste disposal	20	All traps will require disposal in HW/MW.
Public Acceptance		
• public acceptance	20	Public concern may be allayed because Hg is recycled for reuse. Public concern with tritium release could be an issue.
Cost Considerations		
• life-cycle cost	72	
• funding availability	20	Not a budgeted item and will require line item funding.

Waste Stream Number & Name: SR-W014 Tritium-Contaminated Mercury
Option Number: SR-W014-2
Facility: Containment Building **Treatment Technology:** Distill/Reuse
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Industry Involvement		
• market for technology	20	Adaptation of existing technology.
• private sector involvement	20	SRS facility evaluated.

IDOA Score: **Technical** 50 **Total** 60

Waste Stream Number & Name: SR-W014 Tritium-Contaminated Mercury
Option Number: SR-W014-2
Facility: Containment Building **Treatment Technology: Distill/Reuse**
Cost Estimate Sheet

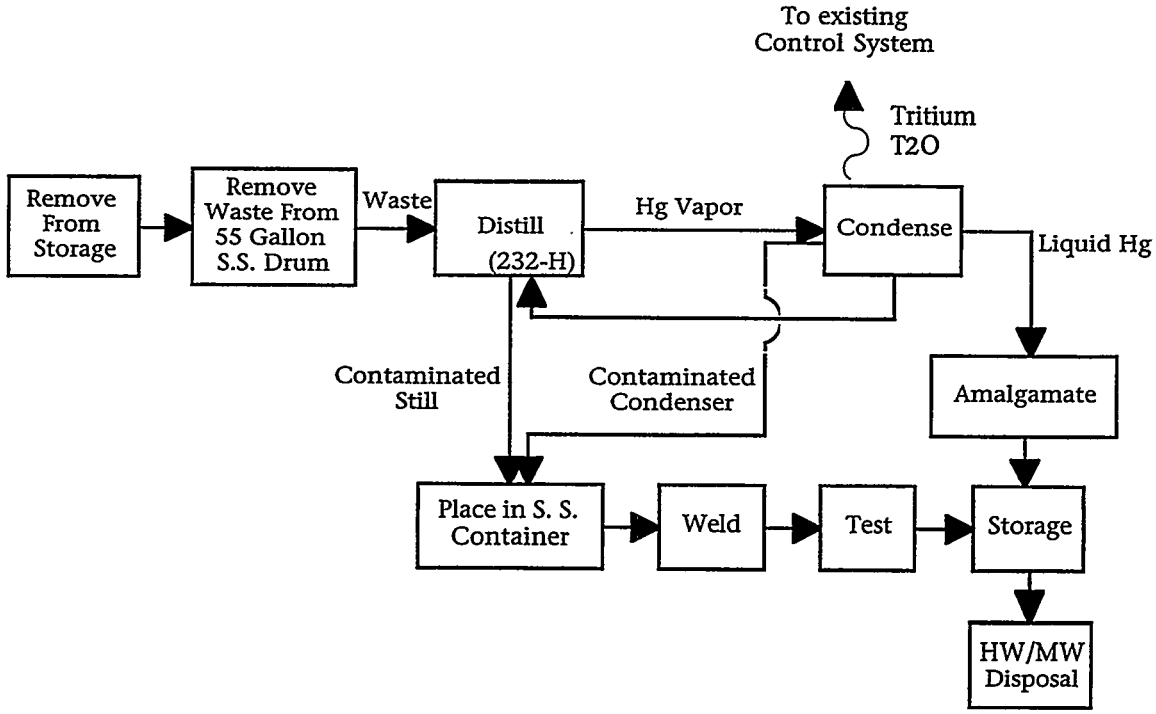
Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[ ] alpha [√] non-alpha [√] contact handled [ ] remote handled
Module Location: SRS
Module Status: [ ] Existing [√] New [√] Small generator [ ] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
1.1	Studies and Bench Scale Tests		$ 109	
1.2	Demonstration Costs		$ N/A	
1.3	Operations Budget Funded Activities			
1.3.1		Conceptual Design	$ 436	
1.3.2		Safety Assurance Documentation	$ 109	
1.3.3		Permitting	$ 0	
1.3.4		Preparation for Operations	$ 150	
1.3.5		Project Management	$ 45	
		TOTAL PRE-OPERATIONS		$ 850
2.0	Facility Construction Cost			
2.1	Design (Title I and II)		$ 495	
2.2	Inspection		$ 120	
2.3	Project Management		$ 165	
2.4	Building Construction (inc. indirect)		$ 1,020	
2.5	Equipment (inc. indirect)		$ 1,250	
2.6	Construction Management		$ 158	
2.7	Contingency		$ 1,131	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 4,319
3.0	Operation and Maintenance			
3.1	Annual Operating Labor		$ 188	
3.2	Annual Utilities		$ 8	
3.3	Annual Materials		$ 113	
3.4	Annual Maintenance		$ 68	
3.5	Annual Contingency		$ 0	
		TOTAL ANNUAL O & M	$ 375	
		X NUMBER OF YEARS OF OPERATION	2.00	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 750
4.0	Decontamination & Decommissioning			
4.1	Facility D&D		$ 1,800	
4.2	Closure, Post-Closure, Monitoring		$ 3	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 1,803
5.0	Contracted Services			
5.1	Commercial Treatment/Disposal		$	
5.2	Mobile Treatment		$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 50
		SUB COST FOR DISTILL AND REUSE MODULE		$ 7,771
		ESCALATION		1.267
		TOTAL COST		$ 9,846

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W014 **Tritium-Contaminated Mercury**
Option Number: SR-W014-3
Facility: Containment Building **Treatment Technology:** Distill/Amalg

Treatment Cycle Flow Diagram



Pros

- LDR will be met without further treatment.
- All treatment residuals will be able to be shipped without further treatment.
- Final waste form will meet waste disposal WAC.
- The process is commercially available.
- Small scale process. Availability will be of little concern.
- Potential for tritium release is small. Process will take place in a controlled area. Source is small.
- Process will comply with LDR regulations without requiring a variance.
- The process is well-defined and has been permitted in other locations.

Cons

- Waste volume increases by a factor of two because of the amalgam.
- Process may require additional steps or equipment because special precautions required with tritium.
- Fixed by design and does not accept a range of inputs.
- Owing to the small batch size, it is expected that this will be a labor intensive process.
- Amalgam will require disposal in HW/MW vault.
- Public will feel concern because this process does not produce as permanent a wasteform as vitrification, and tritium may be an issue.
- Not a budgeted item and will require line item funding.

Waste Stream Number & Name: SR-W014 Tritium-Contaminated Mercury
Option Number: SR-W014-3
Facility: Containment Building **Treatment Technology: Distill/Amalg**
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	10	Subtract 10 points from the median score of 20 because waste volume increases by a factor of two because of the amalgam.
• secondary waste generation	40	Subtract 10 points from the median score of 50 because contaminated process equipment created.
• destruction removal and demobilization efficiency	80	LDR will be met without further treatment.
• flexibility	20	Process may require additional steps or equipment because special precautions required with tritium.
• ability to be shipped	80	All treatment residuals will be able to be shipped without further treatment.
• final waste form	80	Final waste form will meet waste disposal WAC.
Engineering Parameters		
• system implementability	70	The process is commercially available. Subtract 10 points from the median score of 80 because there are uncertainties arising from operation in a tritium environment.
• availability	80	Small scale process. Availability will be of little concern.
• scalability	20	Fixed by design and does not accept a range of inputs.
• remedial measures	50	Failure to amalgamate can be addressed by reprocessing with more reagents.
• schedule for treatment of waste	50	Some technology concerns about operating in a tritium environment.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Potential for tritium release is small. Process will take place in a controlled area. Source is small.
• non operational worker potential exposure	40	The process equipment is small. Subtract 10 points from the median score of 50 because decommissioning costs will be high for a waste stream of such small volume.
• operational worker potential exposure	20	Owing to the small batch size, it is expected that this will be a labor-intensive process.
• transportation potential exposure	50	Waste will require some additional characterization before transportation to storage.
Regulatory Parameters		
• need for variance	80	Process will comply with regulations without requiring a variance.
• ability to obtain a permit	70	The process is well-defined. Subtract 10 points from the median score of 80 because has been permitted in other locations. Tritium is in the Hg.
• waste disposal	20	Amalgam will require disposal in HW/MW.
Public Acceptance		
• public acceptance	20	Public will feel concern because this process does not produce as permanent a waste form as vitrification and tritium may be an issue.

Waste Stream Number & Name: SR-W014 Tritium-Contaminated Mercury
Option Number: SR-W014-3
Facility: Containment Building Treatment Technology: Distill/Amalg
In-Depth Options Analysis Score (IDOA) Sheet

Attribute	Score	Discussion/Notes
Cost Considerations		
• life-cycle cost	71	
• funding availability	20	Not a budgeted item and will require line item funding.
Industry Involvement		
• market for technology	20	Adaptation of existing technology.
• private sector involvement	20	SRS facility evaluated.

IDOA Score: Technical 43 **Total** 53

Waste Stream Number & Name: SR-W014 Tritium-Contaminated Mercury
Option Number: SR-W014-3
Facility: Containment Building Treatment Technology: Distill/Amalg
Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[ ] alpha [√] non-alpha [√] contact handled [ ] remote handled

Module Location: SRS

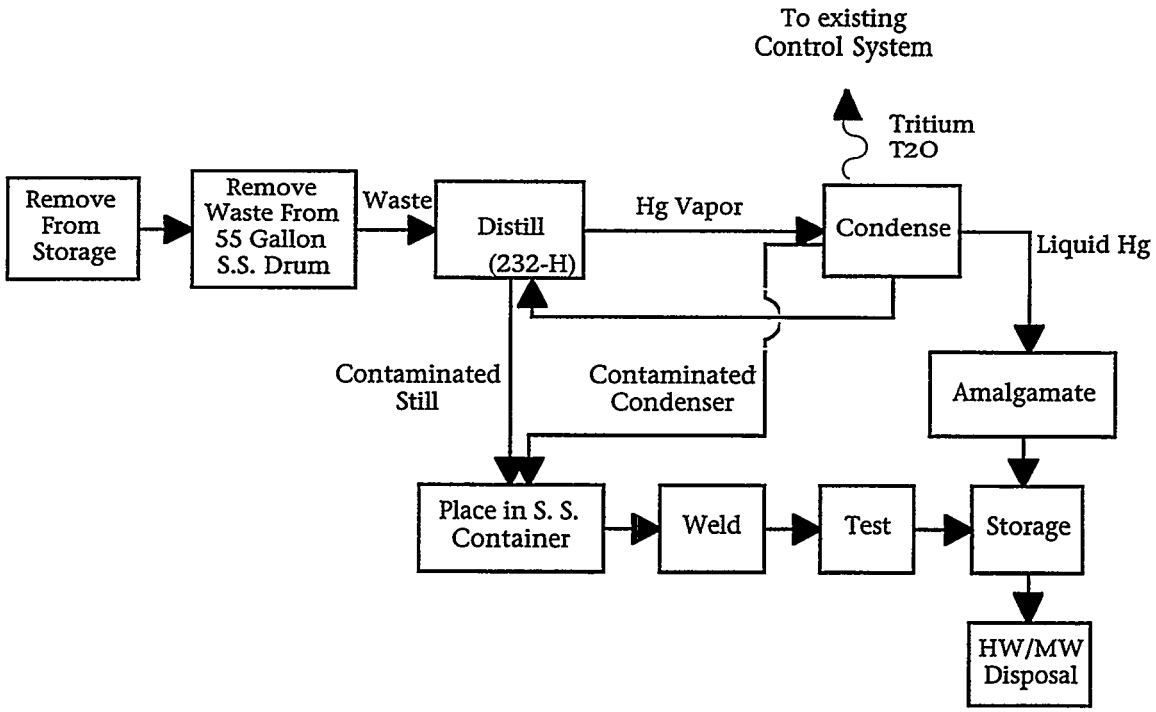
Module Status: [ ] Existing [√] New [√] Small generator [ ] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 109	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 436	
		1.3.2 Safety Assurance Documentation	$ 109	
		1.3.3 Permitting	$ 125	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 45	
		TOTAL PRE-OPERATIONS		$ 975
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 495	
	2.2	Inspection	$ 120	
	2.3	Project Management	$ 165	
	2.4	Building Construction (inc. indirect)	$ 1,000	
	2.5	Equipment (inc. indirect)	$ 1,250	
	2.6	Construction Management	$ 158	
	2.7	Contingency	$ 1,131	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 4,319
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 1,500	
	3.2	Annual Utilities	$ 60	
	3.3	Annual Materials	$ 900	
	3.4	Annual Maintenance	$ 540	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 3,000	
		X NUMBER OF YEARS OF OPERATION	0.25	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 750
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 1,800	
	4.2	Closure, Post-Closure, Monitoring	$ 5	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 1,805
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 100
		SUB COST FOR DISTILL/AMALGAMATION MODULE		$ 7,948
		ESCALATION		1.267
		TOTAL COST		$ 10,071

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W014 Tritium-Contaminated Mercury
Option Number: SR-W014-4
Facility: HW/MW-TB
Treatment Technology: Distill/Amalg

Treatment Cycle Flow Diagram



Pros

- Treatment residuals meet shipping requirements.
- Final waste form will meet RCRA Subtitle C Disposal WAC.
- The process is commercially available.
- Due to limited quantity of waste, availability should not be a great concern.
- Little or no release during normal operations, but release of tritium could occur in an accident.
- Process is specified BDAT and would be in full compliance with LDR standards without a variance.
- The process is well-defined.

Cons

- Volume is increased by a factor greater than two.
- Special precautions taken when tritium is involved.
- Fixed by design and does not accept a range of inputs.
- Work force would be large for such a small volume of waste.
- All waste will be disposed of in HW/MW facilities.
- Stakeholder concerns with tritium release could be an issue.
- Not a budgeted item and will require line item funding.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	10	Subtract 10 points from the median score of 20 because volume is increased by a factor greater than two.

Waste Stream Number & Name: SR-W014 Tritium-Contaminated Mercury
Option Number: SR-W014-4
Facility: HW/MW-TB Treatment Technology: Distill/Amalg
In-Depth Options Analysis Score (IDOA) Sheet

Attribute	Score	Discussion/Notes
• secondary waste generation	40	Subtract 10 points from the median score of 50 because contaminated process equipment created.
• destruction removal and demobilization efficiency	80	All LDR standards are met.
• flexibility	20	Special precautions taken when tritium is involved.
• ability to be shipped	80	Treatment residuals meet shipping requirements.
• final waste form	80	Final waste form will meet RCRA Subtitle C Disposal WAC.
Engineering Parameters		
• system implementability	70	The process is commercially available. Subtract 10 points from the median score of 80 because there are uncertainties arising from operation in a tritium environment.
• availability	80	Due to limited quantity of waste, availability should not be a great concern.
• scalability	20	Fixed by design and does not accept a range of inputs.
• remedial measures	50	Failure to amalgamate can be addressed by reprocessing with more reagents.
• schedule for treatment of waste	50	Due to technology uncertainties, confidence in a schedule would be low.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Little or no release during normal operations, but release of tritium could occur in an accident.
• non operational worker potential exposure	40	Subtract 10 points from the median score of 50 because the decommissioning costs would be high for a waste stream of such small volume.
• operational worker potential exposure	20	Work force would be large for such a small volume of waste.
• transportation potential exposure	50	Transportation would be limited due to small volume of waste but will require characterization of waste before transportation.
Regulatory Parameters		
• need for variance	80	Process is specified BDAT and would be in full compliance without a variance.
• ability to obtain a permit	70	Subtract 10 points from the median score of 80 because although the process is well defined, tritium in the mercury may cause concerns.
• waste disposal	20	All waste will be disposed of in HW/MW facilities.
Public Acceptance		
• public acceptance	20	Stakeholder concerns with tritium release could be an issue.
Cost Considerations		
• life-cycle cost	47	
• funding availability	20	Not a budgeted item and will require line item funding.

Waste Stream Number & Name: SR-W014 **Tritium-Contaminated Mercury**
Option Number: SR-W014-4
Facility: HW/MW-TB **Treatment Technology:** Distill/Amalg
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Industry Involvement		
• market for technology	20	Other DOE markets that have tritiated waste.
• private sector involvement	20	SRS facility evaluated.

IDOA Score: **Technical** 43 **Total** 50

Waste Stream Number & Name: SR-W014 Tritium-Contaminated Mercury
Option Number: SR-W014-4
Facility: HW/MW-TB **Treatment Technology: Distill/Amalg**
Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[ ] alpha [√] non-alpha [√] contact handled [ ] remote handled
Module Location: _____
Module Status: [ ] Existing [√] New [√] Small generator [ ] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 226	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 902	
		1.3.2 Safety Assurance Documentation	$ 226	
		1.3.3 Permitting	$ 125	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 135	
		TOTAL PRE-OPERATIONS		$ 1,763
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 1,001	
	2.2	Inspection	$ 272	
	2.3	Project Management	$ 407	
	2.4	Building Construction (inc. indirect)	$ 3,000	
	2.5	Equipment (inc. indirect)	$ 1,550	
	2.6	Construction Management	$ 319	
	2.7	Contingency	$ 2,339	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 8,888
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 1,500	
	3.2	Annual Utilities	$ 60	
	3.3	Annual Materials	$ 900	
	3.4	Annual Maintenance	$ 540	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 3,000	
		X NUMBER OF YEARS OF OPERATION	0.25	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 750
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 3,640	
	4.2	Closure, Post-Closure, Monitoring	$ 5	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 3,645
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 100
		SUB COST FOR DISTILL/AMALGAMATION MODULE		$ 15,146
		ESCALATION		1.23
		TOTAL COST		$ 18,630

If above numbers do not appear to add correctly, it is the result of computer rounding.

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Summary Page – Initial Screening

Waste Stream Number & Name: SR-W015 Mercury/Tritium Contaminated Equipment

Background Information

This waste stream consists of equipment used in the tritium process, the majority of which is failed or retired pumps used to pump tritium. Mercury was drained and poured from the pumps, but residual amounts still remain. Mercury is used as a pumping medium for the tritium gas. Lead may be present on some of the equipment as lead/tin solder from cooling coil construction or collars for shielding that are an integral part of the pump.

Volume
- Current volume through 09/30/94 is 9.9 m^3.
- Expected 1995-1999 volume will be 253.2 m^3.

Waste Stream Composition
- Inorganic debris

Waste Code
- D008A (TCLP Pb)
- D009A (TCLP Hg)

LDR Treatment Standard
- D008 = concentration based standard = 5.0 mg/l
- D009 = concentration based standard = 0.2 mg/l
- Alternative debris technology may be applied.

Waste Characterization
- Process knowledge used to characterize the waste stream.
- Confidence level is medium because no analytical data collected due to ALARA concerns.

Radiological Characterization
- Tritium – estimate 500 Ci/pump
- Waste is contact handled.
- Mixed low-level waste

Initial Screening

The initial screening identified inappropriate treatment options. These options appear in the Initial Rejections table.

Initial Rejections

Treatment Facility	Treatment Technology	Reasons for Rejection
CIF	Ashcrete Stabilization	Ashcrete will not microencapsulate mercury so that it passes TCLP.
CIF	Incineration/ Stabilization	Incineration volatilizes Hg. CIF has no equipment to control mercury vapors.
ETF	Ion Exchange	ETF has no equipment to treat elemental mercury contaminated equipment.
Lab.	Lab-scale process flowsheet	Vitrification has no provision to control volatize mercury.

Initial Rejections (contd)

Treatment Facility	Treatment Technology	Reasons for Rejection
LETF	Ion Exchange	LEFT has no equipment to treat elemental mercury .
M Area	Vitrification	Vitrifier has no prevision to control volatized mercury .
Z Area	Stabilization	Z Area can treat only those wastes that come by pipeline from Tank 50 and meet strict waste acceptance criteria. The Z-Area process lacks flexibility to treat and dispose of a variety of waste streams.

Summary Page – Technology Success Factor (TSF) & In-Depth Options Analysis (IDOA)

Waste Stream Number & Name: SR-W015 Mercury/Tritium Contaminated Equipment

Feasible Options

Option No.	Treatment Facility	Treatment Technology	TSF Score	IDOA Scores Tech.	IDOA Scores Total	COST (x 1,000)	PO
SR-W015-1	90-day generator	In situ macro-encapsulation in s.s. boxes	94	61	75	1,566	√
SR-W015-2	Cont. Bldg.	Macro-encapsulation	88	58	68	9,734	
SR-W015-3	Cont. Bldg.	Roast/Retort	51	45	51	20,211	
SR-W015-4	INEL ICPP	Decontamination	*	45	59	16,510	

* No TSF required for proposed or existing non-Savannah River Site-DOE waste processing facilities.

Options Rejected Due To Low Technology Success Factor (TSF)

- No options were rejected.

Engineering Assessment

Preferred Option Justification

The preferred treatment option for the Mercury and Tritium Contaminated Equipment waste stream is Macroencapsulation as debris in a stainless steel box as a 90-day generator. Existing inventory is in stainless steel boxes which meet the debris technology of macroencapsulation.

This option treats the constituent of concern, mercury, by isolating it from the environment in stainless steel boxes that have been welded shut.

This option is preferred because:
- It makes use of an existing facility that has the equipment installed to handle tritium gas.
- The waste satisfies the debris rule
- The process employs well-known techniques (e.g., welding stainless steel).
- LDR standards are met.

Options Rejected During IDOA

Macroencapsulation in Stainless Steel Boxes in a Containment Building

Macroencapsulation in stainless steel boxes in a containment building was rejected because:
- This option was not as cost-effective as the preferred option.
- This option offered no technological advantage over the preferred option.
- This option required a Part B RCRA permit.

Roasting and Retorting in a Containment Building

Roasting and retorting in a containment building was rejected because:
- The number of personnel needed to cut the contaminated equipment into pieces increased potential for personnel exposure to tritium and mercury.
- Option was not as cost-effective as the preferred option.

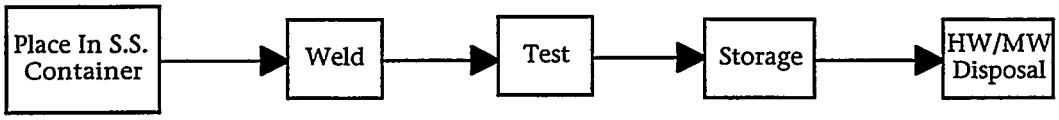
Decontamination at INEL ICPP

Decontamination at INEL ICPP was rejected because:

- An integrated facility has not been demonstrated.
- Uncertainties exist regarding the effectiveness of this treatment for removing liquid mercury contamination from internal crevices of equipment.
- This option is not cost-effective.

Waste Stream Number & Name: SR-W015 Mercury/Tritium Contaminated Equipment
Option Number: SR-W015-1
Facility: Containment Building
Treatment Technology: Macroencapsulation in a S. S. Box

Treatment Cycle Flow Diagram



Pros

- No permit required for 90-day generator.
- Can process a wide range of materials.
- S. S. containers will meet current DOT shipping requirements.
- Final waste form will meet RCRA Subtitle C Disposal WAC.
- All processes involved are existing technology.
- Similar systems have demonstrated availability of greater than 80%.
- The process failure does not produce altered waste form. A failed container is easily fixed.
- Due to process simplicity, a schedule can be developed easily.
- Process does not create emissions related to the waste stream. Process simply involves container welding.
- Simple welding process requiring minimal maintenance. No additional requirements for decommissioning.
- Exposure controlled by design. Number of workers is dependent upon throughput.
- Little secondary waste

Cons

- All waste will require disposal in HW/MW facilities.

Waste Stream Number & Name: SR-W015 Mercury/Tritium Contaminated Equipment
Option Number: SR-W015-1
Facility: In Situ as 90-day Generator
Treatment Technology: Macroencapsulation in a S. S. Box

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	40	Subtract 10 points from the median score of 50 because the volume of material increases slightly due to packaging in S. S. container.
• secondary waste generation	80	Little secondary waste.
• destruction removal and demobilization efficiency	80	All applicable LDR standards are met.
• flexibility	80	Can process a wide range of materials.
• ability to be shipped	80	S. S. containers will meet current DOT shipping requirements.
• final waste form	80	Final waste form will meet RCRA Subtitle C Disposal WAC.
Engineering Parameters		
• system implementability	90	Add 10 points to the median score of 80 because all processes involved are existing technology.
• availability	80	Similar systems have demonstrated availability of greater than 80%.
• scalability	50	Throughput is set by design and not easily expanded except by adding additional shifts of operation.
• remedial measures	90	The process failure does not produce altered waste form. Add 10 points to the median score of 80 because a failed container is easily fixed.
• schedule for treatment of waste	80	Due to process simplicity, a schedule can be developed easily.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Process does not create emissions related to the waste stream. Process simply involves container welding.
• non operational worker potential exposure	80	Simple welding process requiring minimal maintenance. No additional requirements for decommissioning.
• operational worker potential exposure	80	Exposure controlled by design. Number of workers is dependent upon throughput.
• transportation potential exposure	60	Add 10 points to the median score because no additional characterization needed. Waste can be handled readily.
Regulatory Parameters		
• need for variance	80	No permit required for 90-day generator.
• ability to obtain a permit	80	No permit required for 90-day generator.
• waste disposal	20	All waste will require disposal in HW/MW facilities.
Public Acceptance		
• public acceptance	40	Public concern should be limited due to the simplicity of the process. Subtract 10 points from the median score of 50 because the waste form is not as permanent as vitrification.

Waste Stream Number & Name: SR-W015 Mercury/Tritium Contaminated Equipment
Option Number: SR-W015-1
Facility: In Situ as 90-day Generator
Treatment Technology: Macroencapsulation in a S. S. Box

In-Depth Options Analysis Score (IDOA) Sheet

Attribute	Score	Discussion/Notes
Cost Considerations		
• life-cycle cost	96	
• funding availability	20	Not a budget item **and** will require line item funding.
Industry Involvement		
• market for technology	20	This is an existing technology.
• private sector involvement	50	Technology could be provided by either DOE or vendor.

IDOA Score: **Technical** 61 **Total** 75

Waste Stream Number & Name: SR-W015 Mercury/Tritium Contaminated Equipment
Option Number: SR-W015-1
Facility: In Situ as 90-day Generator
Treatment Technology: Macroencapsulation in a S. S. Box

Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[ ] alpha [√] non-alpha [√] contact handled [ ] remote handled

Module Location: SRS

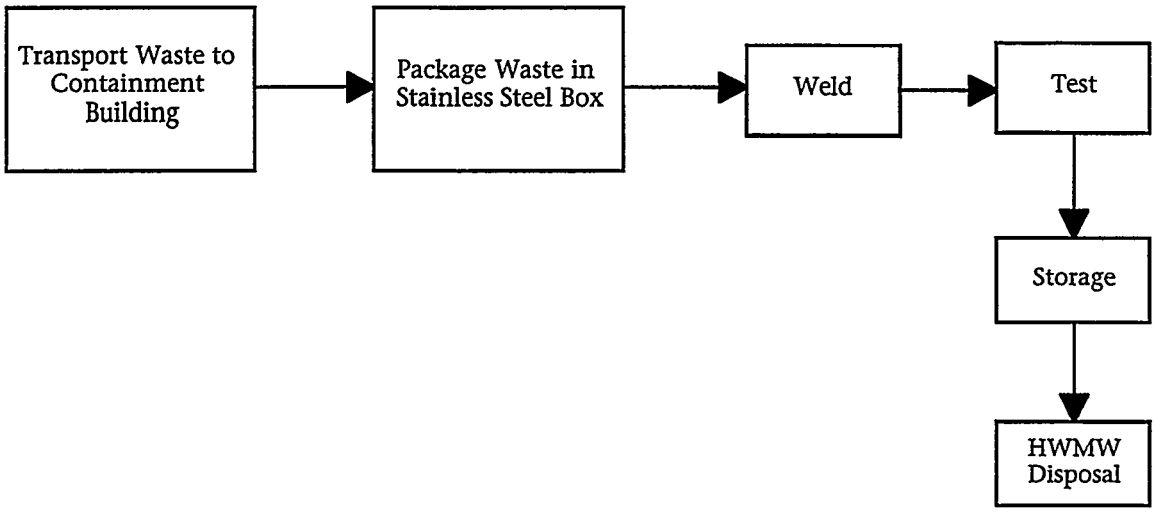
Module Status: [ ] Existing [√] New [ ] Small generator [√] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 56	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 23	
		1.3.2 Safety Assurance Documentation	$ 6	
		1.3.3 Permitting	$ 0	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 0	
		TOTAL PRE-OPERATIONS		$ 185
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 28	
	2.2	Inspection	$ 5	
	2.3	Project Management	$ 5	
	2.4	Building Construction (inc. indirect)	$ 0	
	2.5	Equipment (inc. indirect)	$ 125	
	2.6	Construction Management	$ 9	
	2.7	Contingency	$ 60	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 231
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 300	
	3.2	Annual Utilities	$ 12	
	3.3	Annual Materials	$ 180	
	3.4	Annual Maintenance	$ 108	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 600	
		X NUMBER OF YEARS OF OPERATION	1.00	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 600
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 100	
	4.2	Closure, Post-Closure, Monitoring	$ 8	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 108
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 150
		SUB COST FOR MACROENCAPSULATION MODULE		$ 1,273
		ESCALATION		1.23
		TOTAL COST		$ 1,566

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W015 Mercury/Tritium Contaminated Equipment
Option Number: SR-W015-2
Facility: Containment Building
Treatment Technology: Macroencapsulation in a S. S. Box

Treatment Cycle Flow Diagram



Pros

- Process satisfies requirements of the "debris rule" and all applicable LDR standards are met.
- Can process a wide range of materials.
- S. S. containers will meet current DOT shipping requirements.
- Final waste form will meet RCRA Subtitle C Disposal WAC.
- All processes involved are existing technology.
- Similar systems have demonstrated availability of greater than 80%.
- Process failure does not produce altered waste form. A failed container is easily fixed.
- Due to process simplicity, a schedule can be developed easily.
- Process does not create emissions related to the waste stream. Process simply involves container welding.
- Simple welding process requiring minimal maintenance. No additional requirements for decommissioning.
- Exposure controlled by design and less than average number of workers. Low potential for exposure.
- Little secondary waste

Cons

- All waste will require disposal in HW/MW facilities.
- Public concern should be limited due to the simplicity of the process, but the wasteform is not permanent as some.
- Not a budget item and will require line item funding.

Waste Stream Number & Name: SR-W015 Mercury/Tritium Contaminated Equipment
Option Number: SR-W015-2
Facility: Containment Building
Treatment Technology: Macroencapsulation in a S. S. Box

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	40	Subtract 10 points from the median score of 50 because volume of material increases slightly due to packaging in S. S. container.
• secondary waste generation	80	Little secondary waste.
• destruction removal and demobilization efficiency	80	All applicable LDR standards are met.
• flexibility	80	Can process a wide range of materials.
• ability to be shipped	80	S. S. containers will meet current DOT shipping requirements.
• final waste form	80	Final waste form will meet RCRA Subtitle C Disposal WAC.
Engineering Parameters		
• system implementability	90	Add 10 points to the median score of 80 because all processes involved are existing technology.
• availability	80	Similar systems have demonstrated availability of greater than 80%.
• scalability	50	Throughput is set by design and not easily expanded except by adding additional shifts of operation.
• remedial measures	90	Process failure does not produce altered waste form. Add 10 points to the median score of 80 because a failed container is easily fixed.
• schedule for treatment of waste	80	Due to process simplicity, a schedule can be developed easily.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Process does not create emissions related to the waste stream. Process simply involves container welding.
• non operational worker potential exposure	80	Simple welding process requiring minimal maintenance. No additional requirements for decommissioning.
• operational worker potential exposure	80	Exposure controlled by design and less than average number of workers. Low potential for exposure.
• transportation potential exposure	60	No additional characterization needed. Add 10 points to the median score of 50 because waste can be handled readily.
Regulatory Parameters		
• need for variance	80	Process satisfies requirements of the "debris rule."
• ability to obtain a permit	40	Subtract 10 points from the median score of 50 because uncertainties surround attaining a permit related to the "debris rule" and the "containment rule."
• waste disposal	20	All waste will require disposal in HW/MW facilities.
Public Acceptance		
• public acceptance	40	Public concern should be limited due to the simplicity of the process. Subtract 10 points from the median score of 50 because the waste form is not as permanent as vitrification.

Waste Stream Number & Name: SR-W015 Mercury/Tritium Contaminated Equipment
Option Number: SR-W015-2
Facility: Containment Building
Treatment Technology: Macroencapsulation in a S. S. Box

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Cost Considerations		
• life-cycle cost	72	
• funding availability	20	Not a budget item and will require line item funding.
Industry Involvement		
• market for technology	20	This is an existing technology.
• private sector involvement	50	Technology could be provided by a vendor or DOE.

IDOA Score: **Technical** 58 **Total** 68

Waste Stream Number & Name: SR-W015 Mercury/Tritium Contaminated Equipment
Option Number: SR-W015-2
Facility: Containment Building
Treatment Technology: Macroencapsulation in a S. S. Box

Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[ ] alpha [√] non-alpha [√] contact handled [ ] remote handled

Module Location: SRS

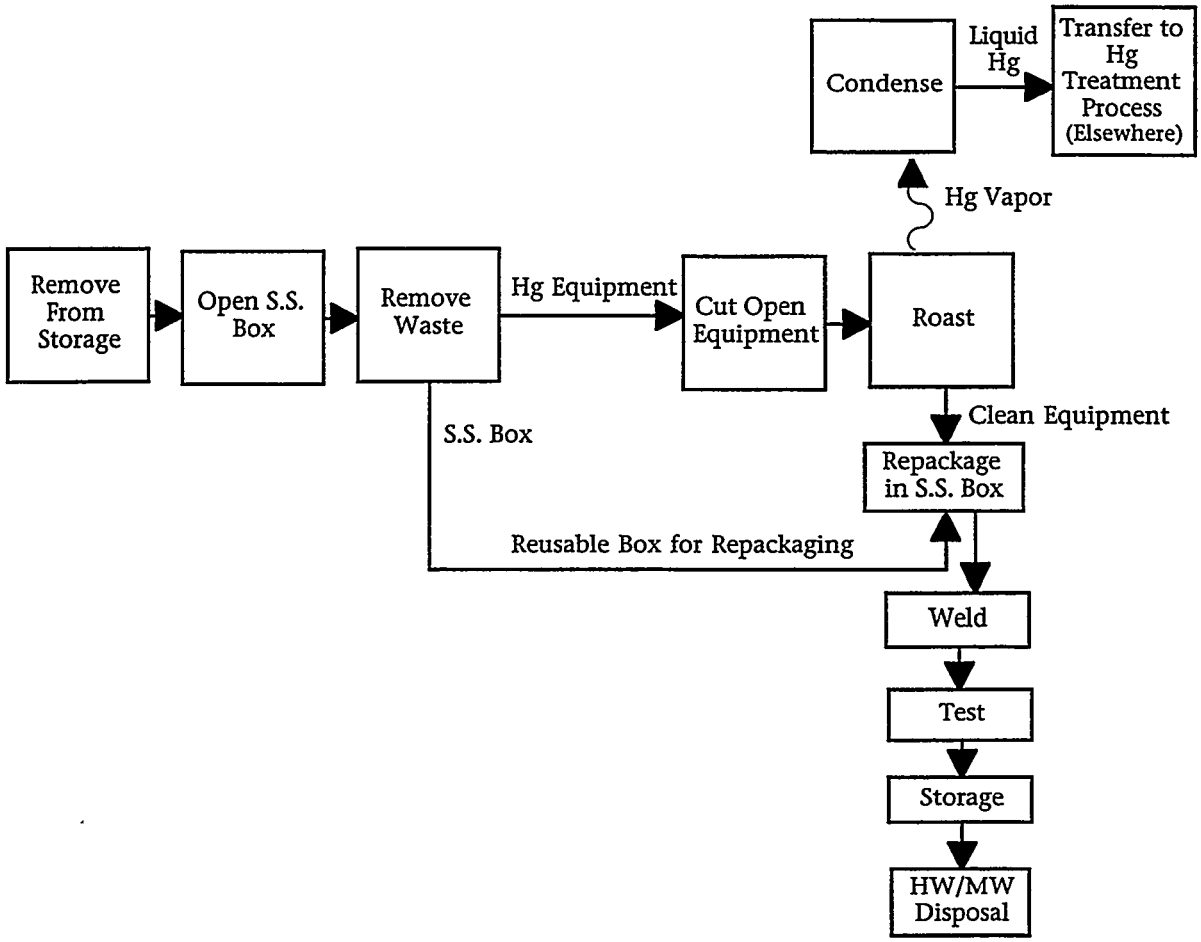
Module Status: [ ] Existing [√] New [ ] Small generator [√] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 57	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 288	
		1.3.2 Safety Assurance Documentation	$ 57	
		1.3.3 Permitting	$ 2,000	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 45	
		TOTAL PRE-OPERATIONS		$ 2,537
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 248	
	2.2	Inspection	$ 75	
	2.3	Project Management	$ 120	
	2.4	Building Construction (inc. indirect)	$ 1,000	
	2.5	Equipment (inc. indirect)	$ 125	
	2.6	Construction Management	$ 79	
	2.7	Contingency	$ 592	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 2,238
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 600	
	3.2	Annual Utilities	$ 24	
	3.3	Annual Materials	$ 360	
	3.4	Annual Maintenance	$ 216	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 1,200	
		X NUMBER OF YEARS OF OPERATION	1.00	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 1,200
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 900	
	4.2	Closure, Post-Closure, Monitoring	$ 8	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 908
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 150
		SUB COST FOR MACROENCAPSULATION MODULE		$ 7,023
		ESCALATION		1.384
		TOTAL COST		$ 9,734

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W015 Mercury/Tritium Contaminated Equipment
Option Number: SR-W015-3
Facility: Containment Building **Treatment Technology:** Roast/Retort

Treatment Cycle Flow Diagram



Pros

- Roast and retort is the specified technology for mercury recovery. The process will meet LDR standards.
- Straightforward processing can handle a wide variety of equipment contaminated with mercury.
- Process will treat all residuals so that they can be shipped without further treatment.
- Final waste form will meet the waste disposal WAC without additional treatment.
- Few moving parts indicate that the process will have an availability of 80%.
- Equipment that contain mercury after treatment can be rerun.
- Part of process for S. S. boxes satisfies requirements for "debris rules."
- As roast and retort is the specified technology, little difficulty obtaining a permit is expected.

Cons

- The step to cut up the pump will limit the throughput.
- The number of operational workers will be greater than other comparable tritium processes, owing to the need to cut the equipment up manually.
- Not a budgeted item and will require line item funding.

Waste Stream Number & Name: SR-W015 Mercury/Tritium Contaminated Equipment
Option Number: SR-W015-3
Facility: Containment Building Treatment Technology: Roast/Retort
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	40	Subtract 10 points from the median score of 50 because waste volume about the same after processing, secondary waste volume.
• secondary waste generation	50	Secondary waste liquid Hg must be treated.
• destruction removal and demobilization efficiency	80	Roast and retort is the specified technology for Hg recovery. The process will meet LDR standards.
• flexibility	80	Straightforward processing can handle a wide variety of equipment contaminated with Hg.
• ability to be shipped	80	Process will treat all residuals so that they can be shipped without further treatment.
• final waste form	80	Roast and retort is the specified technology for recovery of Hg equipment. Final waste form will meet waste disposal WAC without additional treatment.
Engineering Parameters		
• system implementability	50	Some parts of the roast and retort process have not been proven at plant scale.
• availability	80	Few moving parts indicate that the process will have an availability of 80%.
• scalability	20	Fixed by design. The step to cut up the pump will limit the throughput.
• remedial measures	80	Equipment that contain Hg after treatment can be rerun.
• schedule for treatment of waste	50	Technology and design issues result in some uncertainties about the schedule.
Personnel Parameters		
• consequence of unmitigated accident scenarios	50	Unpacking and cutting the equipment apart has the potential for a significant release under some accident scenarios.
• non operational worker potential exposure	50	The number of non operational workers will be approximately the same as other comparable tritium processes.
• operational worker potential exposure	20	The number of operational workers will be greater than other comparable tritium processes, owing to the need to cut the equipment up manually.
• transportation potential exposure	50	Limited transportation of waste form after treatment. Little or no additional characterization required.
Regulatory Parameters		
• need for variance	80	Part of process for S. S. boxes satisfies requirements for "debris rule."
• ability to obtain a permit	80	As roast and retort is the specified technology, little difficulty obtaining a permit is expected.
• waste disposal	20	Most wastes will require disposal in HW/MW facilities.

Waste Stream Number & Name: SR-W015 Mercury/Tritium Contaminated Equipment
Option Number: SR-W015-3
Facility: Containment Building Treatment Technology: Roast/Retort
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Public Acceptance		
• public acceptance	30	Public will be concerned because roast and retort may be the specified technology. Subtract 20 points from the median score of 50 because the largest volume of waste will not be as permanent a waste form as some.
Cost Considerations		
• life-cycle cost	45	
• funding availability	20	Not a budgeted item and will require line item funding.
Industry Involvement		
• market for technology	50	Other DOE sites have similar waste streams.
• private sector involvement	20	SRS facility evaluated.

IDOA Score: Technical 45 **Total** 51

Waste Stream Number & Name: SR-W015 Mercury/Tritium Contaminated Equipment
Option Number: SR-W015-3
Facility: Containment Building Treatment Technology: Roast/Retort
Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[ ] alpha [√] non-alpha [√] contact handled [ ] remote handled

Module Location: _____

Module Status: [ ] Existing [√] New [ ] Small generator [√] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 152	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 609	
		1.3.2 Safety Assurance Documentation	$ 152	
		1.3.3 Permitting	$ 2,000	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 90	
		TOTAL PRE-OPERATIONS		$ 3,154
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 677	
	2.2	Inspection	$ 183	
	2.3	Project Management	$ 273	
	2.4	Building Construction (inc. indirect)	$ 2,000	
	2.5	Equipment (inc. indirect)	$ 1,075	
	2.6	Construction Management	$ 215	
	2.7	Contingency	$ 1,579	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 6,002
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 300	
	3.2	Annual Utilities	$ 12	
	3.3	Annual Materials	$ 180	
	3.4	Annual Maintenance	$ 108	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 600	
		X NUMBER OF YEARS OF OPERATION	4.00	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 2,400
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 2,460	
	4.2	Closure, Post-Closure, Monitoring	$ 8	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 2,468
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 150
		SUB COST FOR ROAST AND RETORT MODULE		$ 14,174
		ESCALATION		1.426
		TOTAL COST		$ 20,211

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W015 Mercury/Tritium Contaminated Equipment
Option Number: SR-W015-4
Facility: INEL/ICPP **Treatment Technology: Decontamination**

Treatment Technology

Idaho National Engineering Laboratory (INEL) Idaho Chemical Processing Plant (ICPP) will employ mechanical decontamination methods (e.g., carbon dioxide pellet blasting) that are useful in removing surface contamination.

Pros

- The facility can treat waste streams similar in composition to those assumed in the design basis without modification.
- Decontaminated waste and treated secondary waste streams could be shipped without additional treatment.
- Final waste form is anticipated to meet the SRS disposal WAC.
- The facility is anticipated to have less than 20% down time.
- Process failures are not anticipated to create a waste stream that cannot be treated.
- Few emissions for the facility are anticipated during normal operation and most accident scenarios.

Cons

- The facility is currently being designed. Although individual treatment methods have been proven, an integrated facility has not been demonstrated.
- Uncertainties exist regarding the effectiveness of this treatment on equipment contaminated in internal crevices with liquid mercury.
- A schedule for waste treatment can be provided; however, acceptance of SRS waste will be contingent upon state-approved permit modifications. In addition, since this is a proposed facility, the operating schedule is contingent upon receipt of DOE funding. The early stage of design also adds uncertainties.
- Waste characterization will be required for any waste streams returned to SRS for disposal.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	50	Decontamination will cause the total waste volume to remain unchanged.
• secondary waste generation	50	Additional waste (i.e., liquid mercury) will need treatment by amalgamation.
• destruction removal and demobilization efficiency	50	Additional treatment for some waste streams may be required to ensure LDR standards are met.
• flexibility	80	The facility can treat waste streams similar in composition to those assumed in the design basis without modification.
• ability to be shipped	80	Decontaminated waste and treated secondary waste streams waste could be shipped without additional treatment.
• final waste form	80	Final waste form is anticipated to meet the SRS disposal WAC.

Waste Stream Number & Name: SR-W015 Mercury/Tritium Contaminated Equipment
Option Number: SR-W015-4
Facility: INEL/ICPP Treatment Technology: Decontamination
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Engineering Parameters		
• system implementability	30	The facility is currently being designed. Although individual treatment methods have been proven, an integrated facility has not been demonstrated. Subtract 20 points from median of 50 because uncertainties exist regarding the effectiveness of this treatment on mercury contamination.
• availability	80	The facility is anticipated to have less than 20% down time.
• scalability	50	The process is currently in the early design phase so additional modification could be incorporated.
• remedial measures	80	Process failures are not anticipated to create a waste stream that cannot be treated.
• schedule for treatment of waste	20	A schedule for waste treatment cannot be provided;. Additionally, acceptance of SRS waste will be contingent upon state-approved permit modifications. In addition, since this is a proposed facility, the operating schedule is contingent upon receipt of DOE funding. The early stage of design also adds uncertainties.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Few emissions for the facility anticipated during normal operation and most accident scenarios.
• non operational worker potential exposure	50	Average number of non operational workers is anticipated.
• operational worker potential exposure	50	Personnel exposure is expected to be average for operations of this type.
• transportation potential exposure	20	Waste characterization will be required for any waste streams returned to SRS for disposal.
Regulatory Parameters		
• need for variance	50	Process will be permitted under RCRA Part B permit. Acceptance of offsite waste will require submission of a permit modification.
• ability to obtain a permit	50	Permitting process is well defined; however, the state's acceptance of offsite waste treatment is unknown. Approval may be difficult.
• waste disposal	50	The 50% of the treated waste will be classified as mixed waste which will require disposal in a RCRA-permitted facility.
Public Acceptance		
• public acceptance	40	Public acceptance for decontamination is reasonably positive; however, the treatment of offsite waste is anticipated to reduce the overall public acceptance of this process at INEL's location. Subtract 10 points from the median of 50 because the constituent of concern is not eliminated permanently with amalgamation of mercury.

Waste Stream Number & Name: SR-W015 Mercury/Tritium Contaminated Equipment
Option Number: SR-W015-4
Facility: INEL/ICPP **Treatment Technology:** Decontamination
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Cost Considerations		
• life-cycle cost	53	
• funding availability	50	Funding for treatment cost can be provided using the operating budget; however, the additional costs may result in an increase in the budget in excess of 10%.
Industry Involvement		
• market for technology	80	The facility could potentially be used to treat numerous waste streams throughout the DOE complex.
• private sector involvement	20	No private sector involvement.

IDOA Score: **Technical** 45 **Total** 50

Waste Stream Number & Name: SR-W015 Mercury Contaminated Equipment

Option Number: SR-W015-4
Facility: INEL/ICPP **Treatment Technology: Decontamination**
Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[ ] alpha [ ] non-alpha [√] contact handled [ ] remote handled

Module Location: _____

Module Status: [ ] Existing [√] New [ ] Small generator [√] Large generator
[ ] Onsite [√] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ N/A	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ N/A	
		1.3.2 Safety Assurance Documentation	$ N/A	
		1.3.3 Permitting	$ N/A	
		1.3.4 Preparation for Operations	$ N/A	
		1.3.5 Project Management	$ N/A	
		TOTAL PRE-OPERATIONS		$ N/A
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ N/A	
	2.2	Inspection	$ N/A	
	2.3	Project Management	$ N/A	
	2.4	Building Construction (inc. indirect)	$ N/A	
	2.5	Equipment (inc. indirect)	$ N/A	
	2.6	Construction Management	$ N/A	
	2.7	Contingency	$ N/A	
		TOTAL FACILITY CONSTRUCTION COSTS		$ N/A
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ N/A	
	3.2	Annual Utilities	$ N/A	
	3.3	Annual Materials	$ N/A	
	3.4	Annual Maintenance	$ N/A	
	3.5	Annual Contingency	$ N/A	
		TOTAL ANNUAL O & M	$ N/A	
		X NUMBER OF YEARS OF OPERATION		
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ N/A
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ N/A	
	4.2	Closure, Post-Closure, Monitoring	$ N/A	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ N/A
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$ N/A	
	5.2	Mobile Treatment	$ N/A	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$ 16,500
7.0	Transportation			$ 10
8.0	Disposal			$ 108
		SUB COST FOR DECONTAMINATION MODULE		$ 16,618
		ESCALATION		1.305
		TOTAL COST		$ 21,686

Note: Per DOE directions this cost estimate is the incremental cost for treatment of an offsite DOE facility; therefore, it carries no overhead burden or capital costs.
If above numbers do not appear to add correctly, it is the result of computer rounding.

Summary Page

Waste Stream Number & Name: SR-W016 221-F Canyon High-Level Liquid Waste

Background Information

This waste is an aqueous liquid containing fission products generated from the 221-F Canyon facility in support of the PUREX Process. F-Canyon waste materials are generated from the extraction of plutonium from reactor targets assemblies and dissolution of spent fuel rods.

Volume
- Current volume through 09/30/94 is 53,800 m^3.
- Expected 1995-1999 volume will be 5464 m^3.

Waste Stream Composition
- Aqueous liquid

Waste Code
- D002C (corrosive high-level waste)
- D005B (high-level waste Ba)
- D007B (high-level waste Cr)
- D008D (high-level waste Pb)
- D009F (high-level waste Hg)
- D011B (high-level waste Ag)
- Nonwastewater slurry

LDR Treatment Standard
- All waste codes = specified technology = Vitrification of high-level mixed radioactive wastes

Waste Characterization
- Sampling and analysis used to characterize the waste stream.
- Confidence level is high based on availability of analysis.

Radiological Characterization
- Total activity for radiological characterization is 6.81 Ci/gal.
- Alpha emitters (U^{235}, U^{238} , Pu^{239}, Pu^{240}, Pu^{241}, Am^{241}, and Cm^{241}) are present.
- Beta/gamma emitters (Sr^{90}, Ru^{106}, Zr^{95}, Nb^{95}, Rh^{106}, Cs^{137}, Ce^{144}, Pr^{144}, Pm^{147}, and H^3) are present.
- Waste is remote handled.
- High-level waste

Preferred Option

The preferred treatment option for 221-F Canyon High Level Liquid Waste is removal of the low-level component of the waste stream by evaporation with treatment at the F-Area and H-Area Effluent Treatment Facility, or at the In-Tank Precipitation Unit with Stabilization at the Z-Area Saltstone Facility followed by High-Level Waste Vitrification in the Defense Waste Processing Facility (DWPF).

Treatment Justification

In-depth options analysis (IDOA) is not required for this waste stream since a Preferred Option has been identified utilizing an existing facility with existing treatment technology.

The principal objective in the treatment of the high-level waste sludge, the high-level waste precipitate, and the low-level waste salt solution was to effectively isolate the waste in a suitable matrix. If the toxic characteristics of the low-level and high-level waste streams do not leach out of the treatment matrix above the regulatory limit, then the wastes are considered nonhazardous and meet the Land Disposal Restrictions (LDR) treatment standard. After the examination of

numerous wasteforms from treatment, the Savannah River Technology Center (SRTC) determined that borosilicate glass would be the best matrix for the high-level waste sludge and precipitate because it was capable of meeting the treatment standard while creating the most stable and long-lived wasteform. WSRC document, WSRC-IM-91-116-13, Rev. C, provides details on TCLP test results performed on vitrified simulated high-level wastes. Similar studies resulted in a determination that saltstone, a cementatious grout, should be chosen for the low-level waste salt solution treatment alternative because it too created a stable, long-lived wasteform that met the regulatory treatment standard for the waste stream.

For a more detailed account of the technical justification for the technology chosen for high-level waste treatment, please refer to Section 2 and 3 of the Final Environmental Impact Statement (February 1982, DOE/EIS-0082, UC-70) for the Defense Waste Processing Facility (DWPF).

Waste Stream Number & Name: SR-W016(1) 221-F Canyon High-Level Liquid Waste
Facility: DWPF
Cost Estimate Sheet **Treatment Technology: Vitrification**

Waste Type: ☐ MLLW ☑ HLW ☐ M-TRU
☑ alpha ☐ non-alpha ☐ contact handled ☑ remote handled

Module Location: SRS

Module Status: ☑ Existing ☐ New ☐ Small generator ☑ Large generator
☑ Onsite ☐ Offsite ☐ Commercial ☐ Portable ☐ R&D

WBS Element		($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations		
1.1	Studies and Bench Scale Tests	$ TBD	
1.2	Demonstration Costs	$ TBD	
1.3	Operations Budget Funded Activities	$ TBD	
	TOTAL PRE-OPERATIONS		$ 258,435
2.0	Facility Construction Cost		
2.1	Design (Title I and II)	$ TBD	
2.2	Inspection	$ TBD	
2.3	Project Management	$ TBD	
2.4	Building Construction (inc. indirect)	$ TBD	
2.5	Equipment (inc. indirect)	$ TBD	
2.6	Construction Management	$ TBD	
2.7	Contingency	$ TBD	
	TOTAL FACILITY CONSTRUCTION COSTS		$ 488,900
3.0	Operation and Maintenance		
3.1	Annual Operating Labor	$ TBD	
3.2	Annual Utilities	$ TBD	
3.3	Annual Materials	$ TBD	
3.4	Annual Maintenance	$ TBD	
3.5	Annual Contingency	$ TBD	
	TOTAL ANNUAL O & M	$ 137,705	
	X NUMBER OF YEARS OF OPERATION	x 27	
	TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 3,718,035
4.0	Decontamination & Decommissioning		
4.1	Facility D&D	$ TBD	
4.2	Closure, Post-Closure, Monitoring	$ TBD	
	TOTAL DECONTAMINATION & DECOMMISSIONING		$ TBD
5.0	Contracted Services		
5.1	Commercial Treatment/Disposal	$ N/A	
5.2	Mobile Treatment	$ N/A	
	TOTAL CONTRACTED SERVICES		$ N/A
6.0	Offsite Treatment (DOE)		$ N/A
7.0	Transportation		$ N/A
8.0	Disposal		$ 1,375,000
9.0	Additional Anticipated Costs		$ 5,959,630 (4)
	SUB COST FOR VITRIFICATION MODULE		$ 11,800,000 (3)
	ESCALATION		5,500,000
	TOTAL COST		$ 17,300,000 (1)(2)(3)

1 – General Note: These estimates of costs include both applicable waste streams (SR-W016 and SR-W017).
2 – These estimates are provided for cost comparisons only and do not represent any agreements on budgets for the DWPF or Saltstone facilities. DWPF budgets are currently under revision.
3 – D&D costs for facilities scheduled to be in service through the year 2021 have not been identified.
4 – HLW System Plan, Revision 4, Addendum (Pro Forma Funding and System Attainment Analysis) provides cost estimates that were developed in accordance with the programmatic assumptions stated in the HLW System Plan. These costs are not fully subdivided into the WBS methodology. This cost estimate reflects Case 3 of the HLW System Plan as described in Volume II of the Site Treatment Plan.

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Summary Page

Waste Stream Number & Name: SR-W017 221-H Canyon High-Level Liquid Waste

Background Information

This waste stream is an aqueous liquid containing mixed fission products from the H-Canyon facility in support of the modified PUREX process. The stream also contains decontamination solution from maintenance activities in the H-Area High-Level Waste Tank Farm. H-Canyon waste materials are generated from the recovery of enriched uranium from fuel tubes.

Volume
- Current volume through 09/30/94 is 73,240 m^3.
- Expected 1995-1999 volume will be 9,970 m^3.

Waste Stream Composition
- Aqueous liquid

Waste Code
- D002C (corrosive high-level waste), D005B (high-level waste Ba), D007B (high-level waste Cr), D008D (high-level waste Pb), D009F (high-level waste Hg), D011B (high-level waste Ag)
- nonwastewater slurry

LDR Treatment Standard
- All waste codes = specified technology = Vitrification of high-level mixed radioactive wastes

Waste Characterization
- Sampling and analysis used to characterize the waste stream.
- Confidence level is high based on availability of analysis, with the exceptions of TCLP.

Radiological Characterization
- Total activity for radiological characterization is 37.8 Ci/gal.
- Alpha emitters (U^{235}, U^{238}, Pu^{239}, Pu^{240}, Pu^{241}, Am^{241}, and Cm^{241}) are present.
- Beta/gamma emitters (Sr^{90}, Ru^{106}, Zr^{95}, Nb^{95}, Rh^{106}, Cs^{137}, Ce^{144}, Pr^{144}, Pm^{147}, and H^3) are present.
- Waste is remote handled.
- High-level waste

Preferred Option

The preferred treatment option for 221-H Canyon High-Level Liquid Waste is removal of the low-level component of the waste stream by evaporation with treatment at the F-Area and H-Area Effluent Treatment Facility or at the In-Tank Precipitation Unit with Stabilization at the Z-Area Saltstone Facility followed by High-Level Vitrification in the Defense Waste Processing Facility (DWPF).

Treatment Justification

In-depth options analysis (IDOA) is not required for this waste stream since a Preferred Option has been identified utilizing an existing facility with existing treatment technology.

The principal objective in the treatment of the high-level waste sludge, the high-level waste precipitate, and the low-level waste salt solution was to effectively isolate the waste in a suitable matrix. If the toxic characteristics of the low-level and high-level waste streams do not leach out of the treatment matrix above the regulatory limit, then the wastes are considered nonhazardous and meet the Land Disposal Restrictions (LDR) treatment standard. After the examination of numerous wasteforms from treatment, the Savannah River Technology Center (SRTC) determined that borosilicate glass would be the best matrix for the high-level waste sludge and

precipitate because it was capable of meeting the treatment standard while creating the most stable and long-lived wasteform. Similar studies resulted in a determination that saltstone, a cementatious grout, should be chosen for the low-level waste salt solution treatment alternative because it, too, created a stable, long-lived wasteform that met the regulatory treatment standard for the waste stream.

For a more detailed account of the technical justification for the technology chosen for high-level waste treatment, please refer to Section 2 and 3 of the Final Environmental Impact Statement (February 1982, DOE/EIS-0082, UC-70) for the Defense Waste Processing Facility (DWPF).

Cost Estimate: INCLUDED WITH COST INFORMATION FOR TREATING WASTE STREAM SR-W016. SEE COST ESTIMATE SHEET FOR SR-W016.

Summary Page – Initial Screening

Waste Stream Number & Name: SR-W018 Filter Paper Take Up Rolls (FPTUR)

Background Information

This waste consists of "tyvek" filter paper contaminated with residual filtercake and filter media from the filtering of M-Area metal plating sludges (F006 waste). The rolls are six feet long and two feet in diameter.

Volume
- Current volume through 09/30/94 is 260 m^3.
- There is no expected future generation. Operations which generated this waste closed on December 31, 1994.

Waste Stream Composition
- Organic debris

Waste Code
- F006 (metal plating line waste, without cyanide)

LDR Treatment Standard
- F006 = concentration based standards = 0.19-5.0 mg/l

Waste Characterization
- Process knowledge and sampling and analysis used to characterize the waste.
- Confidence level high due to availability of sample results and knowledge the process generates listed waste.
- Primary contaminant is Ni. Others included are Cd, Cr, Pb, and Ag, but these are below RCRA LDR concentration standards.

Radiological Characterization
- Total activity 0.0173 Ci/kg.
- Alpha emitters are U^{234}, U^{235}, and U^{238}.
- Waste is contact handled.
- Mixed low-level waste

Initial Screening

The initial screening identified inappropriate treatment options. These options appear in the Initial Rejections table.

Initial Rejections

Treatment Facility	Treatment Technology	Reasons for Rejection
ETF	Ion Exchange	ETF has no equipment to treat this waste.
Lab.	Lab-scale process flowsheet	Volume of waste too great to handle with laboratory-scale equipment.
LETF	Ion Exchange	LETF has no equipment to treat this waste.
Z Area	Stabilization	Z Area can treat only those wastes that come by pipeline from Tank 50 and meet strict waste acceptance criteria. The Z-Area process lacks flexibility to treat and dispose of a variety of waste streams.

Summary Page – Technology Success Factor (TSF) & In-Depth Options Analysis (IDOA)

Waste Stream Number & Name: SR-W018 Filter Paper Take Up Rolls (FPTUR)

Feasible Options

Option No.	Treatment Facility	Treatment Technology	TSF Score	IDOA Scores Tech.	IDOA Scores Total	COST (x 1,000)	PO
SR-W018-1	CIF	Incineration/ Stabilization	94	56	67	6,624	√
SR-W018-2	M-Area	Vitrification	75	56	68	3,862	
SR-W018-3	Cont. Bldg.	Macro-encapsulation	100	58	66	16,017	
SR-W018-4	HW/MW-TB	Macro-encapsulation	100	58	65	18,570	
SR-W018-5	CIF	Ashcrete Stabilization	88	54	62	15,522	
SR-W018-6	INEL/WEDF	Stabilization	*	45	59	4,211	
SR-W018-7	Vendor	Plasma Hearth	1				

* No TSF required for proposed or existing non-Savannah River Site-DOE waste processing facilities.

Options Rejected Due To Low Technology Success Factor (TSF)

Plasma Hearth Process by Vendor

Plasma hearth process by vendor was rejected because:

- Plasma hearth incineration is currently still in the laboratory. While prototypes may exist, they have no record of continuous reliable operation in industrial settings, hence, Pm=0.9.
- Control of the process requires sophisticated computerized instrumentation, hence, Pc=0.9.
- It is not expected for this technology to reach a level of reliability suitable for industrial application for 5-10 years.

Engineering Assessment

Preferred Option Justification

The preferred treatment option for the Filter Paper Take Up Rolls waste stream is Incineration followed by stabilization in the Consolidated Incineration Facility (CIF).

This option treats the constituent of concern, plating line waste, by converting the combustible fraction of the filter paper rolls to carbon dioxide and water and stabilizing the metal-containing ash with cement.

This option is preferred because:

- Waste volume will be reduced by a factor of at least 2.
- Final wasteform will meet LDR standards.
- Incineration and ash stabilization are demonstrated technologies.
- CIF is currently under construction.
- Residual solids are stabilized with cement.
- It is a cost-effective option.

Treatability Study Requirements

The impact of incinerating filter paper rolls on the ashcrete and blowcrete systems must be assessed. The ashcrete impact study will be conducted on a laboratory scale and consist of:

- Incinerating a sample of the filter paper to obtain a sample of ash
- Measuring the volume of the ash
- Mixing the ash with cement and other additives as needed to form ashcrete
- Monitoring the set up of the ashcrete
- Testing the sample to determine that it met LDR standards

Impact on the stabilized blowdown liquid (blowcrete) will be determined by studying the existing analysis of the filter paper waste to identify any unique constituents that might partition to the blowdown. If any such constituents are identified, the impact on the blowcrete will be tested by:

- Formulating a simulant blowdown liquid
- Mixing the simulant with cement and other additives as needed to form blowcrete
- Monitoring the set up of the blowcrete
- Testing the sample to determine that it met LDR standards

Options Rejected During IDOA

Ashcrete Stabilization at CIF

Ashcrete stabilization at CIF was rejected because:
- Waste volume more than doubles.
- Final wasteform requires disposal in HW/MW facility.

Vitrification by M-Area Vendor Treatment Process

Vitrification by M-Area Vendor Treatment Process was rejected because:
- Extensive treatability studies will be required to confirm viability of treatment method.
- Uncertainties exist about vitrifier's capability of handling large chunks of material added directly to the melt pool.

Macroencapsulation in Stainless Steel Boxes (either in a Containment Building or in HW/MW-TB)

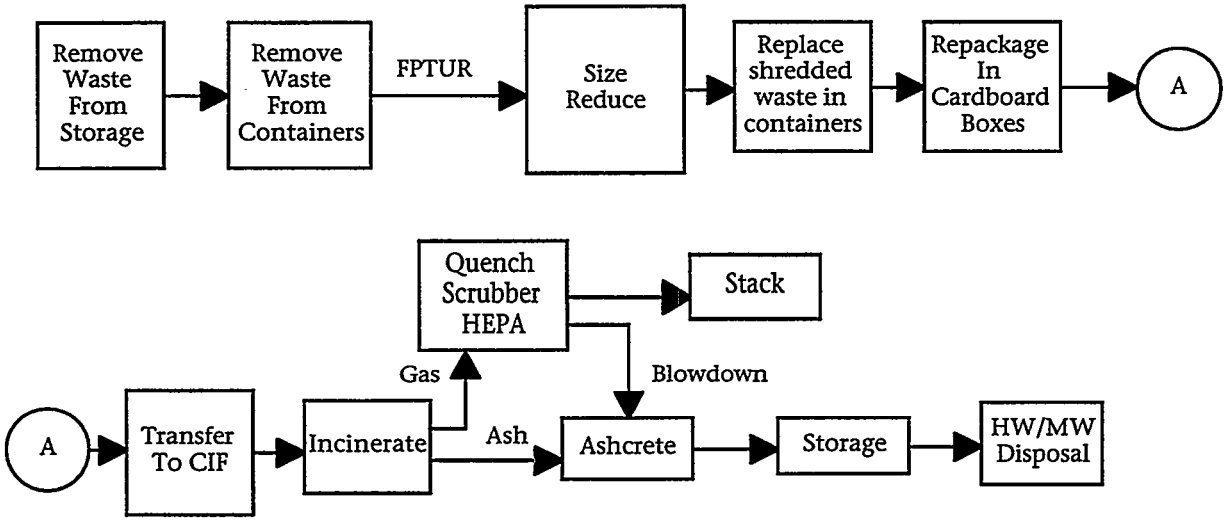
Macroencapsulation in stainless steel boxes (either in a containment building or in HW/MW-TB) was rejected because:
- Waste volume more than doubles.
- Final wasteform requires disposal in HW/MW facility.
- Throughput will be limited by design, the facility is currently being designed.

Stabilization at INEL/WEDF

Stabilization at INEL/WEDF (encapsulating the waste with a grout matrix) was rejected because:
- Waste volume more than doubles.
- Final wasteform requires disposal in HW/MW facility.

Waste Stream Number & Name: SR-W018 Filter Paper Take Up Rolls (FPTUR)
Option Number: SR-W018-1
Facility: CIF
Treatment Technology: Incineration/ Stabilization

Treatment Cycle Flow Diagram



Pros

- Expect at least 2:1 volume reduction.
- The waste stream is expected to meet all applicable LDR standards after treatment by this facility.
- Incinerator designed for a wide range of wastes with some operational limitations.
- Waste required no additional treatment to meet shipping requirements.
- Incineration is a current demonstrated technology, and all elements and processes have been previously demonstrated.
- The presence of metals in the secondary wastes might require rework, but process failure should not create a waste that cannot be treated by existing technologies.
- Reasonably easy to schedule this waste stream assuming current startup schedule.
- Most of the additional metals in this waste stream will be captured in the ashcrete resulting in little or no emissions even in most accidents.
- No increase in non operational workers is required to treat this waste, but increase in non-routine maintenance will be required.
- No impact due to this waste stream. No impact because there is no increase in exposure potential and no additional workers are required.
- Processes are in full compliance with all applicable regulations and no variance needed.
- This waste is part of the basis for permitting, meeting LDR treatment standards is required for the final wasteform.
- Line item is funded.
- This is purchased technology.

Cons

- 100% of the final wasteform will go to the HW/MW vaults.
- The public has limited acceptance of treatment involving incineration.

Waste Stream Number & Name: SR-W018 Filter Paper Take Up Rolls (FPTUR)
Option Number: SR-W018-1
Facility: CIF
Treatment Technology: Incineration/ Stabilization

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	70	Subtract 10 points from the median score of 80 because expect at least 2:1 volume reduction.
• secondary waste generation	50	Significant volume of secondary waste due to non-combustible sludge and it can be handled by an existing technology.
• destruction removal and demobilization efficiency	80	All applicable LDR standards after treatment by this facility.
• flexibility	80	Incinerator designed for a wide range of wastes with some operational limitations.
• ability to be shipped	80	Waste required no additional treatment to meet shipping requirements.
• final wasteform	80	Final wasteform meets the expected waste disposal WAC upon exit from the process.
Engineering Parameters		
• system implementability	100	Incineration is a current demonstrated technology. Add 20 points to the median score of 80 because all elements and processes have been previously demonstrated.
• availability	50	Incinerator availability for solids is 50%. Normal maintenance requirements apply.
• scalability	50	Process can accept a range of input but capacity is set by design. Excess capacity does exist at this point.
• remedial measures	70	Subtract 10 points from the median score of 80 because the presence of metals in the secondary wastes might require rework. Process failure should not create a waste that cannot be treated by existing technologies.
• schedule for treatment of waste	80	Reasonably easy to schedule this waste steam assuming current startup schedule.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Most of the additional metals in this waste stream will be captured in the ashcrete, resulting in little or no emissions even in most accidents.
• non operational worker potential exposure	50	Processing this material will not increase exposure to non operational personnel.
• operational worker potential exposure	50	Personnel exposure is average for operations of this type. Processing this material will not increase the exposure to operational personnel.
• transportation potential exposure	50	Requires transportation, but limited additional characterization required to support transportation.
Regulatory Parameters		
• need for variance	80	Processes are in full compliance with all applicable regulations and no variance needed.
• ability to obtain a permit	80	This waste is part of the basis for permitting if SCDHEC says preparation for treatment requires treatment permit there maybe a problem.

Waste Stream Number & Name: SR-W018 Filter Paper Take Up Rolls (FPTUR)
Option Number: SR-W018-1
Facility: CIF
Treatment Technology: Incineration/ Stabilization

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Regulatory Parameters (contd)		
• waste disposal	20	100% of the final wasteform will go to the HW/MW vaults.
Public Acceptance		
• public acceptance	20	The public has limited acceptance of treatment involving incineration.
Cost Considerations		
• life-cycle cost	81	
• funding availability	80	Line item is funded.
Industry Involvement		
• market for technology	20	Technology is being purchased.
• private sector involvement	20	Technology is available at an existing DOE facility.

IDOA Score: **Technical** 56 **Total** 67

Waste Stream Number & Name: SR-W018 Filter Paper Take Up Rolls (FPTUR)
Option Number: SR-W018-1
Facility: CIF
Treatment Technology: Incineration/ Stabilization

Cost Estimate Sheet INCLUDES COST OF OPTION SR-W028-1

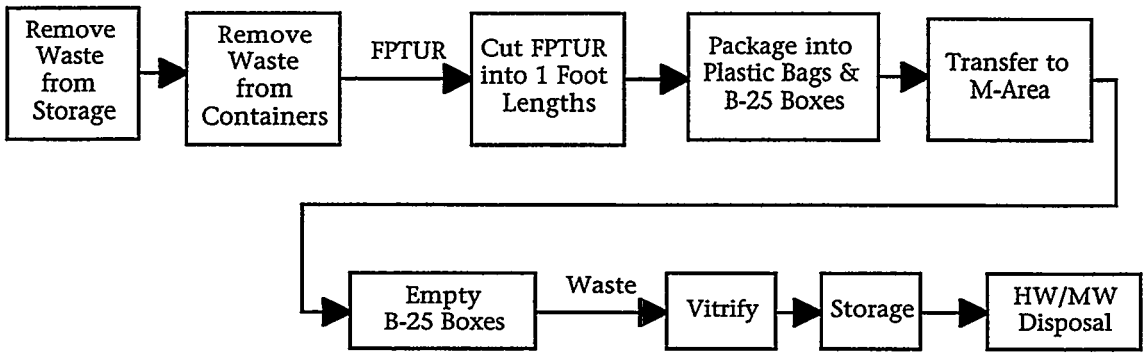
Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled
Module Location: SRS
Module Status: [√] Existing [ ] New [ ] Small generator [√] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 65	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 261	
		1.3.2 Safety Assurance Documentation	$ 65	
		1.3.3 Permitting	$ 0	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 45	
		TOTAL PRE-OPERATIONS		$ 586
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 286	
	2.2	Inspection	$ 82	
	2.3	Project Management	$ 127	
	2.4	Building Construction (inc. indirect)	$ 1,000	
	2.5	Equipment (inc. indirect)	$ 300	
	2.6	Construction Management	$ 91	
	2.7	Contingency	$ 676	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 2,562
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 141	
	3.2	Annual Utilities	$ 6	
	3.3	Annual Materials	$ 84	
	3.4	Annual Maintenance	$ 51	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 281	
		X NUMBER OF YEARS OF OPERATION	4.00	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 1,125
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 0	
	4.2	Closure, Post-Closure, Monitoring	$ 5	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 5
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 100
		SUB COST FOR INCINERATOR MODULE		$ 4,378
		ESCALATION		1.513
		TOTAL COST		$ 6,624

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W018 Filter Paper Take Up Rolls (FPTUR)
Option Number: SR-W018-2
Facility: M Area
Treatment Technology: Vitrification

Treatment Cycle Flow Diagram



Pros

- Volume reduction greater than 5:1.
- All applicable LDR treatment standards are met and if waste is delisted (F006), final waste will be non-hazardous.
- Will meet all shipping requirements.
- Final vitrified wasteform will meet disposal requirements. No additional treatment required.
- An alternative study shows equipment is available for cutting rolls. A pilot scale demonstration has been successful.
- Failed wasteforms can be recycled easily.
- Schedule easily developed.
- This is not different from waste currently scheduled for treatment here. Emissions are few and controlled even in accident scenarios.
- Process will be in full compliance with regulations. Waste is similar to existing permitted waste.

Cons

- Throughput fixed by design
- Not budgeted

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	90	Add 10 points to the median score of 80 because volume reduction greater than 5:1.
• secondary waste generation	50	Some secondary waste in the form of a sludge will require further treatment by existing technology.
• destruction removal and demobilization efficiency	80	All applicable LDR treatment standards are met and if waste is delisted (F006), final waste will be non-hazardous.
• flexibility	80	Vitrification technology can handle a wide variety of wastes without extensive adjustments in operating parameters.
• ability to be shipped	80	Will meet all shipping requirements.
• final wasteform	100	Final vitrified wasteform will meet disposal requirements. Add 20 points to the median score of 80 because no additional treatment required.

Waste Stream Number & Name: SR-W018 Filter Paper Take Up Rolls (FPTUR)
Option Number: SR-W018-2
Facility: M Area **Treatment Technology: Vitrification**
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Engineering Parameters		
• system implementability	80	An alternative study shows equipment is available for cutting rolls. A pilot-scale demonstration has been successful.
• availability	50	Normal maintenance requirements apply. This waste stream may require a "clean-out" earlier than anticipated based on curie load.
• scalability	50	Throughput fixed by design
• remedial measures	80	Recoverable. Recycle through melter.
• schedule for treatment of waste	80	Schedule easily developed
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	This is not different from waste currently scheduled for treatment here. Emissions are few and controlled even in accident scenarios.
• non operational worker potential exposure	50	Additional non-routine maintenance required.
• operational worker potential exposure	40	Size reduction and repackaging of waste will require extensive handling. Subtract 10 points from median score of 50 because of concerns about manual size reduction.
• transportation potential exposure	50	Nothing unusual about wasteform. Expect low alpha and no liquids.
Regulatory Parameters		
• need for variance	80	Process will be in full compliance with regulations. Waste is similar to existing permitted waste.
• ability to obtain a permit	30	Wastewater permit would exist though some modifications might be required. SCDHEC and/or EPA could require a RCRA Part B permit application for M Area with a change in waste stream. Subtract 20 points from median score of 50 because SCDHEC has expressed concern about permitting additional wastes.
• waste disposal	50	Treated wasteform may require disposal in a HW/MW facility unless delisted.
Public Acceptance		
• public acceptance	50	Public has supported treatment that results in a glass wasteform.
Cost Considerations		
• life-cycle cost	89	
• funding availability	20	Not budgeted
Industry Involvement		
• market for technology	20	This is an existing vendor process.
• private sector involvement	80	Technology is available at an existing vendor process.

IDOA Score: Technical 56 **Total** 68

Waste Stream Number & Name: SR-W018 Filter Paper Take Up Rolls (FPTUR)
Option Number: SR-W018-2
Facility: M Area **Treatment Technology: Vitrification**
Cost Estimate Sheet INCLUDES COST OF OPTIONS SR-W028-2

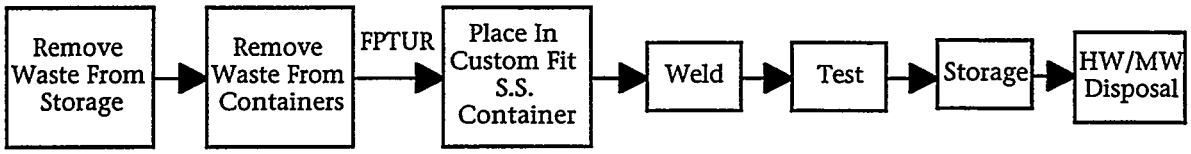
Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled
Module Location: SRS
Module Status: [√] Existing [ ] New [ ] Small generator [√] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 44	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 174	
		1.3.2 Safety Assurance Documentation	$ 44	
		1.3.3 Permitting	$ 125	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 5	
		TOTAL PRE-OPERATIONS		$ 541
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 205	
	2.2	Inspection	$ 40	
	2.3	Project Management	$ 45	
	2.4	Building Construction (inc. indirect)	$ 100	
	2.5	Equipment (inc. indirect)	$ 800	
	2.6	Construction Management	$ 65	
	2.7	Contingency	$ 451	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 1,706
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 9	
	3.2	Annual Utilities	$ 0	
	3.3	Annual Materials	$ 6	
	3.4	Annual Maintenance	$ 3	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 19	
		X NUMBER OF YEARS OF OPERATION	8.00	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 150
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 0	
	4.2	Closure, Post-Closure, Monitoring	$ 3	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 3
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$ 30	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 50
		SUB COST FOR VITRIFICATION MODULE		$ 2,479
		ESCALATION		1.556
		TOTAL COST		$ 3,862

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W018 Filter Paper Take Up Rolls (FPTUR)
Option Number: SR-W018-3
Facility: Containment Building
Treatment Technology: Macroencapsulation in a S. S. Box

Treatment Cycle Flow Diagram



Pros

- Process satisfies requirements of the "debris rule" and all applicable LDR standards are met.
- Can process a wide range of materials.
- S. S. containers will meet current DOT shipping requirements.
- Final wasteform will meet RCRA Subtitle C Disposal WAC.
- All processes involved are existing technology.
- Similar systems have demonstrated availability of greater than 80%.
- Process failure does not produce altered wasteform. A failed container is easily fixed.
- Due to process simplicity, a schedule can be developed easily.
- Process does not create emissions related to the waste stream. Process simply involves container welding.
- Simple welding process requiring minimal maintenance. No additional requirements for decommissioning.
- Exposure controlled by design. Number of workers is dependent upon throughput.
- Little secondary waste.

Cons

- All waste will require disposal in HW/MW facilities.
- Not a budget item and will require line item funding.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	40	Subtract 10 points from the median score of 50 because volume of material increases slightly due to packaging in S. S. container.
• secondary waste generation	80	Little secondary waste.
• destruction removal and demobilization efficiency	80	All applicable LDR standards are met.
• flexibility	80	Can process a wide range of materials.
• ability to be shipped	80	S. S. containers will meet current DOT shipping requirements.
• final wasteform	80	Final wasteform will meet RCRA Subtitle C Disposal WAC.
Engineering Parameters		
• system implementability	90	Add 10 points to the median score of 80 because all processes involved are existing technology.
• availability	80	Similar systems have demonstrated availability of greater than 80%.
• scalability	50	Throughput is set by design and not easily expanded except by adding additional shifts of operation.

Waste Stream Number & Name: SR-W018 Filter Paper Take Up Rolls (FPTUR)
Option Number: SR-W018-3
Facility: Containment Building
Treatment Technology: Macroencapsulation in a S. S. Box

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• remedial measures	90	Process failure does not produce altered wasteform. Add 10 points to the median score of 80 because a failed container is easily fixed.
• schedule for treatment of waste	80	Due to process simplicity, a schedule can be developed easily.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Process does not create emissions related to the waste stream. Process simply involves container welding.
• non operational worker potential exposure	80	Simple welding process requiring minimal maintenance. No additional requirements for decommissioning.
• operational worker potential exposure	80	Exposure controlled by design. Number of workers is dependent upon throughput.
• transportation potential exposure	60	No additional characterization needed. Add 10 points to the median score of 50 because waste can be handled readily.
Regulatory Parameters		
• need for variance	80	Process satisfies requirements of the "debris rule."
• ability to obtain a permit	40	Subtract 10 points from the median score of 50 because uncertainties surround attaining a permit related to the "debris rule" and the "containment rule."
• waste disposal	20	All waste will require disposal in HW/MW facilities.
Public Acceptance		
• public acceptance	40	Public concern should be limited due to the simplicity of the process. Subtract 10 points from the median score of 50 because the wasteform is not unalterably inert.
Cost Considerations		
• life-cycle cost	54	
• funding availability	20	Not a budget item and will require line item funding.
Industry Involvement		
• market for technology	20	This is an existing technology.
• private sector involvement	50	Technology could be provided by either DOE or vendor.

IDOA Score: **Technical** 58 **Total** 66

Waste Stream Number & Name: SR-W018 Filter Paper Take Up Rolls (FPTUR)
Option Number: SR-W018-3
Facility: Containment Building
Treatment Technology: Macroencapsulation in a S. S. Box

Cost Estimate Sheet

INCLUDES COST OF OPTIONS SR-W028-4 AND SR-W051-4

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled

Module Location: SRS

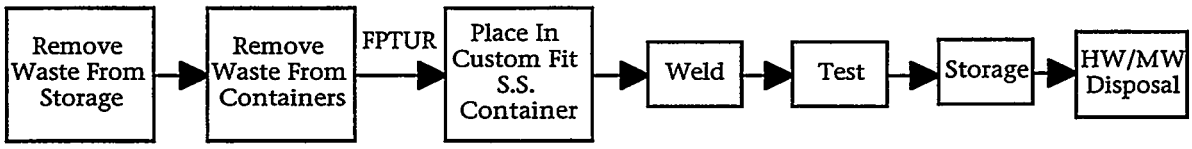
Module Status: [ ] Existing [√] New [ ] Small generator [√] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 58	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 233	
		1.3.2 Safety Assurance Documentation	$ 58	
		1.3.3 Permitting	$ 125	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 45	
		TOTAL PRE-OPERATIONS		$ 669
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 253	
	2.2	Inspection	$ 76	
	2.3	Project Management	$ 121	
	2.4	Building Construction (inc. indirect)	$ 1,000	
	2.5	Equipment (inc. indirect)	$ 150	
	2.6	Construction Management	$ 81	
	2.7	Contingency	$ 604	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 2,284
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 788	
	3.2	Annual Utilities	$ 32	
	3.3	Annual Materials	$ 473	
	3.4	Annual Maintenance	$ 284	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 1,575	
		X NUMBER OF YEARS OF OPERATION	4.00	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 6,300
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 920	
	4.2	Closure, Post-Closure, Monitoring	$ 100	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 1,020
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 2,000
		SUB COST FOR MACROENCAPSULATION MODULE		$ 12,274
		ESCALATION		1.305
		TOTAL COST		$ 16,017

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W018 Filter Paper Take Up Rolls (FPTUR)
Option Number: SR-W018-4
Facility: Containment Building
Treatment Technology: Macroencapsulation in a S. S. Box

Treatment Cycle Flow Diagram



Pros

- All applicable LDR standards are met.
- Can process a wide range of materials.
- S. S. containers will meet current DOT shipping requirements.
- Final wasteform will meet RCRA Subtitle C Disposal WAC.
- All processes involved are existing technology.
- Similar systems have demonstrated availability of greater than 80%.
- The process failure does not produce altered wasteform. A failed container is easily fixed.
- Due to process simplicity, a schedule can be developed easily.
- Process does not create emissions related to the waste stream. Process simply involves container welding.
- Simple welding process requiring minimal maintenance. No additional requirements for decommissioning.
- Exposure controlled by design. Number of workers is dependent upon throughput.
- Process satisfies requirements of the "debris rule."

Cons

- All waste will require disposal in HW/MW facilities.
- Not a budgeted item and will require line item funding.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	40	Subtract 10 points from the median score of 50 because volume of material increases slightly due to packaging in S. S. container.
• secondary waste generation	80	Little secondary waste.
• destruction removal and demobilization efficiency	80	All applicable LDR standards are met.
• flexibility	80	Can process a wide range of materials
• ability to be shipped	80	S. S. containers will meet current DOT shipping requirements.
• final wasteform	80	Final wasteform will meet RCRA Subtitle C Disposal WAC.
Engineering Parameters		
• system implementability	90	Add 10 points to the median score of 80 because all processes involved are existing technology.
• availability	80	Similar systems have demonstrated availability of greater than 80%.
• scalability	50	Throughput is set by design and not easily expanded except by adding additional shifts of operation.

Waste Stream Number & Name: SR-W018 . Filter Paper Take Up Rolls (FPTUR)
Option Number: SR-W018-4
Facility: Containment Building
Treatment Technology: Macroencapsulation in a S. S. Box

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• remedial measures	90	The process failure does not produce altered wasteform. Add 10 points to the median score of 80 because a failed container is easily fixed.
• schedule for treatment of waste	80	Due to process simplicity, a schedule can be developed easily.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Process does not create emissions related to the waste stream. Process simply involves container welding.
• non operational worker potential exposure	80	Simple welding process requiring minimal maintenance. No additional requirements for decommissioning.
• operational worker potential exposure	80	Exposure controlled by design. Number of workers is dependent upon throughput.
• transportation potential exposure	60	No additional characterization needed. Add 10 points to the median score of 50 because waste can be handled readily.
Regulatory Parameters		
• need for variance	80	Process satisfies requirements of the "debris rule."
• ability to obtain a permit	40	Subtract 10 points from the median score of 50 because uncertainties surround attaining a permit related to the "debris rule" and the "containment rule."
• waste disposal	20	All waste will require disposal in HW/MW facilities.
Public Acceptance		
• public acceptance	40	Public concern should be limited due to the simplicity of the process. Subtract 10 points from the median score of 50 because the wasteform is not unalterably inert.
Cost Considerations		
• life-cycle cost	47	
• funding availability	20	Not a budgeted item and will require line item funding.
Industry Involvement		
• market for technology	20	This is an existing technology.
• private sector involvement	50	Technology could be provided either DOE or by vendor.

IDOA Score: **Technical** 58 **Total** 65

Waste Stream Number & Name: SR-W018 Filter Paper Take Up Rolls (FPTUR)
Option Number: SR-W018-4
Facility: Containment Building
Treatment Technology: Macroencapsulation in a S. S. Box

Cost Estimate Sheet

INCLUDES COST OF OPTIONS SR-W028-5 AND SR-W051-3

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled

Module Location: SRS

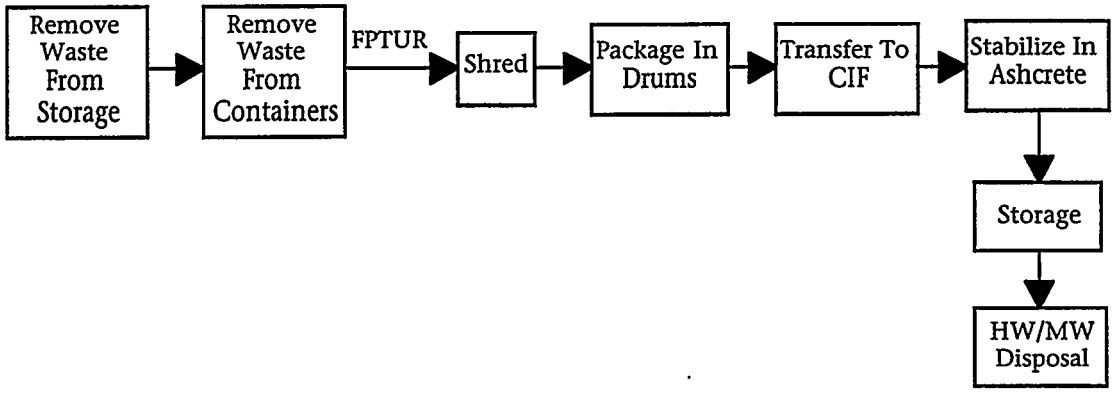
Module Status: [ ] Existing [√] New [ ] Small generator [√] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 58	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 233	
		1.3.2 Safety Assurance Documentation	$ 58	
		1.3.3 Permitting	$ 125	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 45	
		TOTAL PRE-OPERATIONS		$ 669
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 253	
	2.2	Inspection	$ 76	
	2.3	Project Management	$ 121	
	2.4	Building Construction (inc. indirect)	$ 1,000	
	2.5	Equipment (inc. indirect)	$ 150	
	2.6	Construction Management	$ 81	
	2.7	Contingency	$ 604	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 2,284
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 788	
	3.2	Annual Utilities	$ 32	
	3.3	Annual Materials	$ 473	
	3.4	Annual Maintenance	$ 284	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 1,575	
		X NUMBER OF YEARS OF OPERATION	4.00	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 6,300
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 920	
	4.2	Closure, Post-Closure, Monitoring	$ 100	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 1,020
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 2,000
		SUB COST FOR MACROENCAPSULATION MODULE		$ 12,274
		ESCALATION		1.513
		TOTAL COST		$ 18,570

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W018 Filter Paper Take Up Rolls (FPTUR)
Option Number: SR-W018-5
Facility: CIF
Treatment Technology: Ashcrete Stabilization

Treatment Cycle Flow Diagram



Pros

- No secondary waste produced by ashcrete process.
- The waste stream is expected to meet all applicable LDR standards after this treatment.
- The wasteform meets the expected waste disposal WAC. Wasteform suitable for disposal in the form it exits the process.
- Ashcrete process is a current demonstrated technology and a proven technology.
- Process failure should not create a wasteform that can not be treated by existing technologies.
- Reasonably easy to schedule this waste steam assuming current startup schedule.
- The metals in this waste stream will be captured in the ashcrete. Little or no emissions even during accidents.
- Well accepted wasteform. No variance needed.
- Line item is funded.

Cons

- Expected to increase volume by factor of three.
- 100% of the final wasteform will go to the HW/MW vaults.
- Wasteform is not as permanent as other forms of stabilization.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	10	Subtract 10 points from the median score of 20 because expected to increase volume by factor of three.
• secondary waste generation	100	Add 20 points to the median score of 80 because no secondary waste produced by ashcrete process.
• destruction removal and demobilization efficiency	80	The waste stream is expected to meet all applicable LDR standards after this treatment.
• flexibility	50	Waste handling of waste streams directly in ashcrete is an off-normal process which lowers efficiency.
• ability to be shipped	50	Wasteform may require additional characterization to determine that it satisfies shipping requirements.
• final wasteform	80	The wasteform meets the expected waste disposal WAC.

Waste Stream Number & Name: SR-W018 Filter Paper Take Up Rolls (FPTUR)
Option Number: SR-W018-5
Facility: CIF
Treatment Technology: Ashcrete Stabilization

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Engineering Parameters		
• system implementability	100	Add 20 points to the median score of 80 because ashcrete is a current demonstrated technology and a proven technology.
• availability	50	Normal maintenance requirements apply. This waste stream may require a "clean out" earlier than anticipated based on curie load.
• scalability	50	Limited excess capacity exists because it is set by design.
• remedial measures	70	The presence of metals in the final wasteform might require rework. Subtract 10 points from the median score of 80 because a process failure would create a wasteform that cannot be treated by existing technologies.
• schedule for treatment of waste	80	Reasonably easy to schedule this waste steam assuming current startup schedule.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	The metals in this waste stream will be captured in the ashcrete. Little or no emissions even during accidents.
• non operational worker potential exposure	70	Subtract 10 points from the median score of 80 because additional non-routine maintenance required.
• operational worker potential exposure	50	Increased operator handling due to this waste stream so the potential for exposure is increased.
• transportation potential exposure	50	Does not require additional characterization to support transportation and limited number of waste transports required.
Regulatory Parameters		
• need for variance	80	Well accepted wasteform. No variance needed.
• ability to obtain a permit	50	Modification required to facilities existing permit, but final waste must meet LDR treatment standards.
• waste disposal	20	100% of the final wasteform will go to the HW/MW disposal.
Public Acceptance		
• public acceptance	20	Mature and proven technology, however wasteform is not as permanent as other forms of stabilization.
Cost Considerations		
• life-cycle cost	56	
• funding availability	80	Line item is funded.
Industry Involvement		
• market for technology	20	Incinerator purchased from a vendor. Incineration is common technology. DOE has nothing new to market.
• private sector involvement	20	SRS facility technology.

IDOA Score: **Technical** 54 **Total** 62

Waste Stream Number & Name: SR-W018 Filter Paper Take Up Rolls (FPTUR)
Option Number: SR-W018-5
Facility: CIF
Treatment Technology: Ashcrete Stabilization

Cost Estimate Sheet INCLUDES COST OF OPTION SR-W028-3

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled

Module Location: SRS

Module Status: [√] Existing [ ] New [ ] Small generator [√] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
1.1	Studies and Bench Scale Tests		$ 65	
1.2	Demonstration Costs		$ N/A	
1.3	Operations Budget Funded Activities			
1.3.1		Conceptual Design	$ 261	
1.3.2		Safety Assurance Documentation	$ 65	
1.3.3		Permitting	$ 1,500	
1.3.4		Preparation for Operations	$ 150	
1.3.5		Project Management	$ 45	
		TOTAL PRE-OPERATIONS		$ 2,086
2.0	Facility Construction Cost			
2.1	Design (Title I and II)		$ 286	
2.2	Inspection		$ 82	
2.3	Project Management		$ 127	
2.4	Building Construction (inc. indirect)		$ 1,000	
2.5	Equipment (inc. indirect)		$ 300	
2.6	Construction Management		$ 91	
2.7	Contingency		$ 676	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 2,562
3.0	Operation and Maintenance			
3.1	Annual Operating Labor		$ 63	
3.2	Annual Utilities		$ 3	
3.3	Annual Materials		$ 38	
3.4	Annual Maintenance		$ 23	
3.5	Annual Contingency		$ 0	
		TOTAL ANNUAL O & M	$ 125	
		X NUMBER OF YEARS OF OPERATION	9.00	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 1,125
4.0	Decontamination & Decommissioning			
4.1	Facility D&D		$ 1,040	
4.2	Closure, Post-Closure, Monitoring		$ 150	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 1,190
5.0	Contracted Services			
5.1	Commercial Treatment/Disposal		$	
5.2	Mobile Treatment		$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 3,000
		SUB COST FOR ASHCRETE STABILIZATION MODULE		$ 9,963
		ESCALATION		1.558
		TOTAL COST		$ 15,522

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W018 Filter Paper Take Up Rolls (FPTUR)
Option Number: SR-W018-6
Facility: INEL/WEDF **Treatment Technology: Stabilization**

Treatment Technology

The Idaho National Engineering Laboratory (INEL) Waste Engineering Development Facility (WEDF) Stabilization process provides treatments for aqueous and organic liquids and debris. The process stabilizes waste in a grout matrix to reduce leachability.

Pros

- No secondary waste streams are generated.
- The facility can treat waste streams similar in composition to those assumed in the design basis without modification.
- The stabilized waste could be shipped without additional treatment.
- Final wasteform is anticipated to meet the SRS disposal WAC.
- Stabilization has been demonstrated at the facility.
- The facility is anticipated to have minimal down time.
- Process failure is not anticipated to create a waste stream that cannot be treated.
- Few emissions for the facility are anticipated during normal operation and most accident scenarios.
- The facility could potentially be used to treat numerous waste streams throughout the DOE Complex.

Cons

- Stabilization will increase the overall waste volume by a factor of two or more after processing.
- Throughput is limited by design. The facility is currently being designed.
- Waste characterization will be required for any waste streams returned to SRS for disposal.
- The majority of the treated waste will be classified as mixed waste which will require disposal in a HW/MW facility.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	10	Subtract 10 points from the median score of 20 because stabilization will increase the overall waste volume by a factor of 2 or more after processing.
• secondary waste generation	80	No secondary waste streams are generated.
• destruction removal and demobilization efficiency	50	Additional treatment for some waste streams may be required prior to stabilization to ensure LDR standards are met.
• flexibility	80	The facility can treat waste streams similar in composition to those assumed in the design basis without modification.
• ability to be shipped	80	The stabilized waste could be shipped without additional treatment.
• final wasteform	80	Final wasteform is anticipated to meet the SRS disposal WAC.
Engineering Parameters		
• system implementability	80	Stabilization has been demonstrated at the facility.
• availability	80	The facility is anticipated to have minimal down time.
• scalability	20	Throughput is limited by design. The facility is currently being designed.

Waste Stream Number & Name: SR-W018 Filter Paper Take Up Rolls (FPTUR)
Option Number: SR-W018-6
Facility: INEL/WEDF **Treatment Technology:** Stabilization
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• remedial measures	80	Process failure is not anticipated to create a waste stream that cannot be treated.
• schedule for treatment of waste	50	A schedule for waste treatment cannot be provided. Additionally, acceptance of SRS waste will be contingent upon state-approved permit modifications.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Few emissions for the facility are anticipated during normal operation and most accident scenarios.
• non operational worker potential exposure	50	Processing this material will not increase the exposure to non operational personnel.
• operational worker potential exposure	50	Personnel exposure is average for operations of this type. Processing this material will not increase the exposure to operational personnel.
• transportation potential exposure	20	Waste characterization will be required for any waste streams returned to SRS for disposal.
Regulatory Parameters		
• need for variance	80	Process will be in full compliance with LDR requirements without needing a variance.
• ability to obtain a permit	50	Permitting process is well defined, however, the states acceptance of offsite waste treatment is unknown. Approval may be difficult.
• waste disposal	20	The majority of the treated waste will be classified as mixed waste which will require disposal in a HW/MW facility.
Public Acceptance		
• public acceptance	50	Public acceptance for stabilization is positive; however, the treatment of offsite waste is anticipated to reduce the overall public acceptance of this process.
Cost Considerations		
• life-cycle cost	88	
• funding availability	50	Not a budgeted item though line item funding may be required.
Industry Involvement		
• market for technology	80	The facility could potentially be used to treat numerous waste streams throughout the DOE Complex.
• private sector involvement	20	Technology is available at an existing facility.

IDOA Score: **Technical** 45 **Total** 59

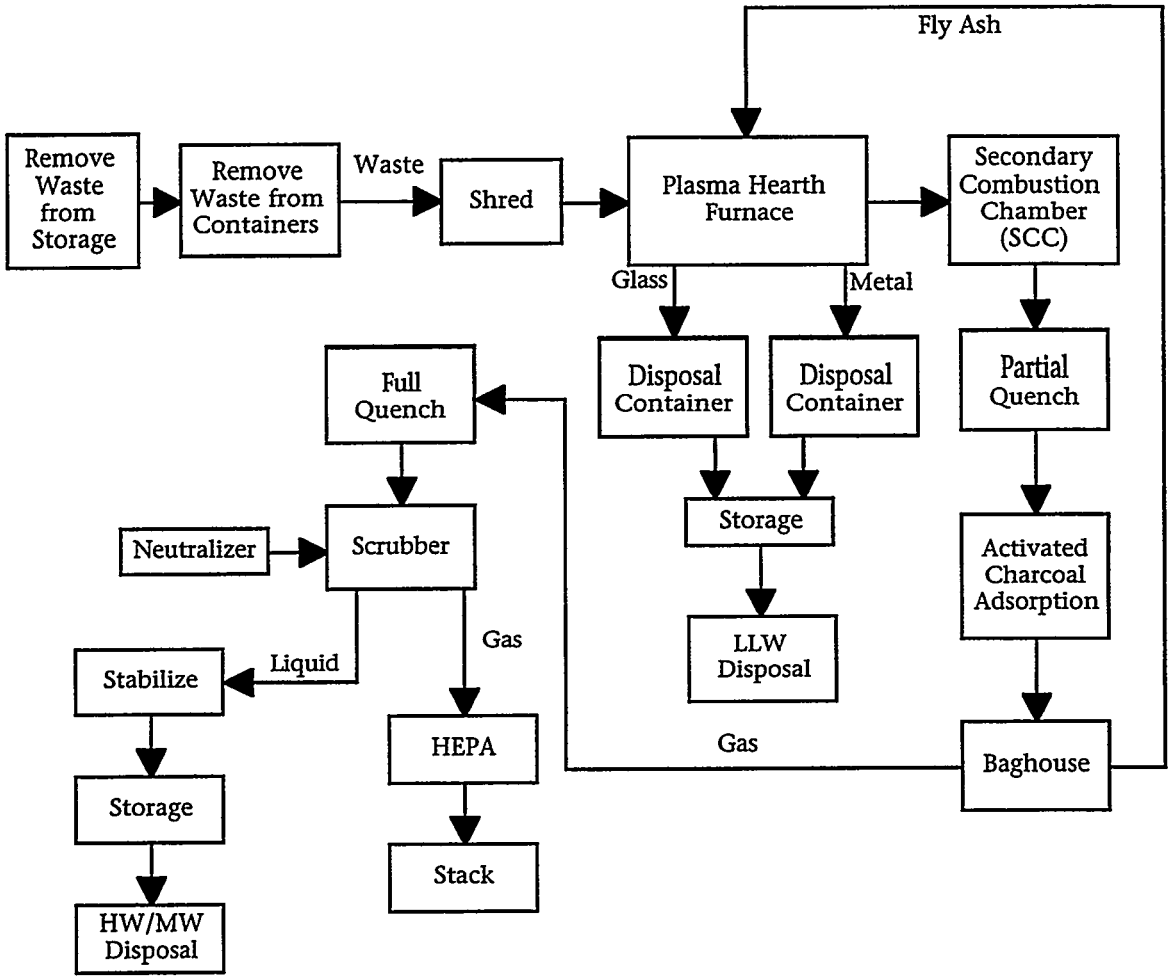
Waste Stream Number & Name: SR-W018 Filter Paper Take Up Rolls (FPTUR)
Option Number: SR-W018-6
Facility: INEL/WEDF **Treatment Technology: Stabilization**
Cost Estimate Sheet INCLUDES COST OF OPTION SR-W028-6

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled
Module Location: INEL
Module Status: [√] Existing [ ] New [ ] Small generator [√] Large generator
[ ] Onsite [√] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ N/A	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ N/A	
		1.3.2 Safety Assurance Documentation	$ N/A	
		1.3.3 Permitting	$ N/A	
		1.3.4 Preparation for Operations	$ N/A	
		1.3.5 Project Management	$ N/A	
		TOTAL PRE-OPERATIONS		$ N/A
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ N/A	
	2.2	Inspection	$ N/A	
	2.3	Project Management	$ N/A	
	2.4	Building Construction (inc. indirect)	$ N/A	
	2.5	Equipment (inc. indirect)	$ N/A	
	2.6	Construction Management	$ N/A	
	2.7	Contingency	$ N/A	
		TOTAL FACILITY CONSTRUCTION COSTS		$ N/A
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ N/A	
	3.2	Annual Utilities	$ N/A	
	3.3	Annual Materials	$ N/A	
	3.4	Annual Maintenance	$ N/A	
	3.5	Annual Contingency	$ N/A	
		TOTAL ANNUAL O & M	$ N/A	
		X NUMBER OF YEARS OF OPERATION		
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ N/A
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ N/A	
	4.2	Closure, Post-Closure, Monitoring	$ N/A	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ N/A
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$ N/A	
	5.2	Mobile Treatment	$ N/A	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$ 876
7.0	Transportation			$ 97
8.0	Disposal			$ 3,000
		SUB COST FOR STABILIZATION MODULE		$ 3,973
		ESCALATION		1.06
		TOTAL COST		$ 4,211

Note: Per DOE directions this cost estimate is the incremental cost for treatment at an offsite DOE facility; therefore, it carries no overhead burden or capital costs.
If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W018 Filter Paper Take Up Rolls (FPTUR)
Option Number: SR-W018-7
Facility: Vendor
Treatment Technology: Plasma Hearth



Option rejected during technical success factor evaluation. No further analysis performed.

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Summary Page

Waste Stream Number & Name: SR-W019 244-H RBOF High Activity Liquid Waste

Background Information

Processes have been changed to remove the hazardous characteristic from this waste stream. The previously generated, existing waste in storage is indistinguishable from the 221-H Canyon waste stream as both have been combined and are stored in the H-Area HLW Tank Farm.

Changes have now been made in the processing of this waste stream prior to its discharge to the H-Area Tank Farm. It is no longer necessary to maintain such a high pH to prevent corrosion in the tanks during storage. This adjustment reduced the pH to below regulatory limits for alkaline characteristic so that it is no longer classified as a mixed waste because it no longer carries the corrosive characteristic. Former waste generated by the receiving basin for offsite fuels waste is indistinguishable from other wastes stored in the H-Area tank farm. As a result, this waste stream has been deleted from the Mixed Waste Inventory Report (MWIR) and the volume of waste previously generated is reported in the volume listed under 221-H Canyon High-Level Liquid Waste (SR-W017).

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Summary Page

Waste Stream Number & Name: SR-W020 In-Tank Precipitation (ITP) and Late Wash (LW) Filters

Background Information

A future debris waste stream generated from the In-Tank Precipitation (ITP) process which treats and separates radioactive salt solution in preparation for processing in the Defense Waste Processing Facility (DWPF) and Saltstone Facility. The salt solution is treated with tetraphenyl borate to precipitate radioactive cesium and sodium titanate to absorb strontium, and plutonium. This precipitate is filtered by the ITP filters and is expected to eventually foul the filters, requiring their removal, treatment, and disposal. The filter consists of 144 sintered metal tubes. Each tube is 10 feet long and sits in an assembly measuring 14 feet long by 1.5 feet in diameter. The Late Wash process uses the exact filter but operates in a later step of the High-Level Waste process.

Volume
- Expected 1995-1999 volume generation is 32.6 m^3.

Waste Stream Composition
- Inorganic debris

Waste Code
- D009A (TCLP Hg)
- D018 (benzene)
- D036 (nitrobenzene)

LDR Treatment Standard
- D009 = concentration based standard = 0.2 mg/l
- D018* = concentration based standard = 10 mg/kg
- D036* = concentration based standard = 14 mg/kg
- Alternate debris technology may be applied

*D012-D043 nonwastewaters must be treated to meet the Universal Treatment Standards (UTS) for any underlying constituents may be present.

Waste Characterization
- Process knowledge used to characterize the waste stream.
- Confidence level is medium since this waste stream has not yet been generated.
- Typical expected concentration is 286 g Hg, and 5000 g benzene per filter. This is estimated by calculation.

Radiological Characterization
- Total activity is estimated to be 3400 Ci/filter.
- Beta/gamma emitters are Cs^{137}, Cs^{134}, Sr^{90}, Tc^{99}, Ru^{106}, Sb^{125}, and I^{129}.
- Waste is remote handled.
- Mixed low-level waste

Preferred Option

The preferred treatment option for In-Tank Precipitation (ITP) and Late Wash (LW) Filters is in situ treatment using an Acid Wash technology followed by placement in an engineered stainless steel boxes under a treatability variance.

Treatment Justification

In-depth options analysis is not required for this waste stream since the waste stream meets the treatment standards without addition treatment.

Waste stream is treated by oxalic acid wash followed by placement into an engineered box under authority of a treatability variance approved by the Environmental Protection Agency, Region IV (EPA-IV).

A determination has been made that in the process of filtering salt solution from the tank farm to remove highly radioactive cesium and other contaminants, the filters could become clogged to the point that they could not effectively operate and they could not be satisfactorily cleaned to resume operation. At that time, the filters would have to be declared a waste. The material to be filtered is characteristically hazardous from mercury and benzene. Because of the nature of the precipitated material and its high level of radioactivity, it will not be possible to remove it from the filters sufficiently to reduce the potential concentration of mercury below the treatment standard. Also, benzene generation within the material will continue over time as a result of the radiological activity degrading the tetraphenyl borate. Therefore, the filters will be a mixed waste. Because of the make up of the filter and the high radioactivity level, it is not considered practical to treat the filters in a manner to satisfy the treatment standard for mercury or effectively treat the benzene. Therefore, the SRS proposed an alternative treatment of oxalic acid wash followed by placement in an engineered box and requested a treatability variance from the treatment standards for this waste stream. The variance was submitted to the U.S. Environmental Protection Agency in January 1992. Final approval for the variance was granted by the EPA in October 1, 1993.

Since the treatability variance was granted in October 1993, new information, based on simulant testing, has shown the waste to fail TCLP for nitrobenzene (D036). The data also suggests that mercury, while present in total constituent analysis, will not fail the TCLP. However, SRS will continue to indicate that mercury could be present (i.e., carry the D009 code). In late 1994 a request to amend the variance approval to include nitrobenzene was submitted to EPA Region IV. If approval is granted to amend the variance to include nitrobenzene, a general revision of the variance will be made, incorporating both the nitrobenzene and the LW filter and updating the regulatory citations and interpretations.

Waste Stream Number & Name: SR-W020 In-Tank Precipitation (ITP) and Late Wash (LW) Filters

Facility: ITP In-Situ
Treatment Technology: Encapsulation
Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[ ] alpha [√] non-alpha [ ] contact handled [√] remote handled

Module Location: SRS

Module Status: [√] Existing [ ] New [ ] Small generator [√] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ N/A	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ N/A	
		1.3.2 Safety Assurance Documentation	$ N/A	
		1.3.3 Permitting	$ N/A	
		1.3.4 Preparation for Operations	$ N/A	
		1.3.5 Project Management	$ N/A	
		TOTAL PRE-OPERATIONS		$ 0
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ N/A	
	2.2	Inspection	$ N/A	
	2.3	Project Management	$ N/A	
	2.4	Building Construction (inc. indirect)	$ N/A	
	2.5	Equipment (inc. indirect)	$ N/A	
	2.6	Construction Management	$ N/A	
	2.7	Contingency	$ N/A	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 0
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 40	
	3.2	Annual Utilities	$	
	3.3	Annual Materials	$ 600	
	3.4	Annual Maintenance	$	
	3.5	Annual Contingency	$ 85	
		TOTAL ANNUAL O & M	$ 725	
		X NUMBER OF YEARS OF OPERATION	16	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 11,600
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ N/A	
	4.2	Closure, Post-Closure, Monitoring	$ N/A	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 0
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$ N/A	
	5.2	Mobile Treatment	$ N/A	
		TOTAL CONTRACTED SERVICES		$ 0
6.0	Offsite Treatment (DOE)			$ 0
7.0	Transportation			$ 0
8.0	Disposal			$ 2,767
		SUB COST FOR ENCAPSULATION MODULE		$ 14,367
		ESCALATION		1.36
		TOTAL COST		$ 19,580

If above numbers do not appear to add correctly, it is the result of computer rounding.

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Summary Page

Waste Stream Number & Name: SR-W021 Poisoned Catalyst Material

Background Information

A proposed future waste stream which was to have been generated by the treatment and destruction of benzene vapors generated in the In-Tank Precipitation (ITP) process. The waste is no longer expected to be generated. This waste stream will be deleted from the Mixed Waste Inventory Report (MWIR) and the Site Treatment Plan (STP).

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Summary Page

Waste Stream Number & Name: SR-W022 DWPF Benzene

Background Information

A future waste stream generated from DWPF operations to vitrify high-level waste. Prior to introduction into the vitrification process, feed chemicals containing tetraphenyl borate react with the waste precipitate slurry to remove unwanted radiological constituents. The reaction between the precipitate slurry and the process feed chemicals within the precipitate reactor will liberate benzene from the slurry. The tetraphenyl borate compounds will decompose in the presence of formic acid and copper catalyst to form boric acid, formate salts, and organics (primarily benzene). This offgas will be condensed and transferred to the Organic Waste Storage Tank (OWST). The OWST is solely a storage and transfer facility; no treatment of the benzene occurs in the tank.

This waste stream consists of essentially 100% organic substances, with only incidental carry-over of aqueous material. The organic stream, which is primarily benzene (80%-95%), also is composed of biphenyl, diphenylamine, phenol, and diphenylmercury (~5%-20% combined total). The benzene is contaminated with radioactive cesium and mercury. The primary radiological contaminant is cesium since cesium is a fairly volatile metal.

Volume
- Expected 1995-1999 volume is 1512 m^3.

Waste Stream Composition
- Organic liquid

Waste Code
- D001A (ignitable high TOC)
- D009A (TCLP Hg)
- D018 (benzene)

LDR Treatment Standard
- D001* = specified technology = Recovery of Organics or Combustion
- D009 = concentration based standard = 0.2 mg/l
- D018* = concentration based standard = 10 mg/kg

  *D012-D043 nonwastewaters must be treated to meet the Universal Treatment Standards (UTS) for any underlying constituents that may be present.

Waste Characterization
- Sampling and analysis used to characterize the waste stream.
- Confidence level is high based on the availability of analysis on pilot feed stream.
- Typical contaminant levels are 15-120 mg/l Hg, benzene ≈ 80%-95% of organic waste stream

Radiological Characterization
- Beta/gamma emitters (primarily Cs^{137}) are present.
- Waste is contact handled.
- Mixed low-level waste

Preferred Option

The preferred treatment option for the Defense Waste Processing Facility Benzene waste stream is Incineration followed by Stabilization in the Consolidated Incineration Facility (CIF).

Treatment Justification

In-depth options analysis was not performed for this waste stream.

During development of the Consolidated Incineration Facility (CIF) design basis, a determination was made of the types and volumes of hazardous, low-level radioactive, and mixed Savannah River Site (SRS) waste streams that would be generated in the future or were in storage for which treatment by incineration would be beneficial. The determination to initiate development of CIF was based on the facts that incineration was recommended or required by environmental regulations and a significant volume or toxicity reduction would be achieved. The wastes amenable to incineration were grouped by physical state, solid or liquid, and type of contamination, hazardous and/or radioactive. Some wastes such as Defense Waste Processing Facility benzene and low-level radioactive job control waste were individually designated a waste group. The waste groups and current/future volume data were adopted as a design basis for the CIF Functional Performance Requirements (FPR) (OPS-WMP-90-4140). The FPR serves as the baseline design document for the initiation of project development at SRS.

Based on physical and chemical characteristics, SRS mixed wastes already designated for treatment at the CIF fall into one of the CIF design basis waste groups listed as follows:

FPR Waste Group	SRS Mixed Waste Streams
Beta/Gamma Boxed (Solid)	Solvent Contaminated Debris (LLW) (SR-W003) Incinerable Toxic Characteristic (TC) Material (SR-W012)
High BTU (Liquid)	Scintillation Solution (SR-W010) Mixed Waste Oil – Sitewide (SR-W035)
Chlorinated (Liquid)	Rad-Contaminated Solvents (SR-W001) Rad-Contaminated Chlorofluorocarbons (SR-W002)
DWPF Organic	DWPF Benzene (SR-W022)
Naval Fuel Organic	Spent Methanol Solution (SR-W030)

Some of the CIF design basis waste groups listed in the table are designated in the FPR as nonradioactive hazardous waste. The radioactive nature of the waste does not impact its combustion characteristics. The operation and efficiency of the CIF combustion and air pollution control systems are not influenced by the presence of radioactivity. A mixed waste that meets the chemical and physical criteria of a design basis nonradioactive waste group can be treated in the CIF as effectively as the nonradioactive waste.

The CIF Mission Need and Design Capacity Review (July 7, 1993) and the supporting Alternative Treatment Technologies for SRS Hazardous, Mixed and Job Control Wastes (SWE-CIF-93020, July 29, 1993) reevaluated the treatment of certain existing and future SRS wastes in the CIF. The review was structured to generally reexamine the appropriateness of each FPR design basis waste group and additional mixed waste groups that are not listed in the FPR but are chemically and physically similar to an FPR nonradioactive waste group. The review compared the incineration of each waste group to treatment by other candidate technologies using comparison criteria such as waste volume and toxicity reduction, treatment and disposal costs, and RCRA Land Disposal Restriction (LDR) requirements.

Alternative Technologies Investigated

Chemical Oxidation

Chemical oxidation involves the addition of a chemical oxidizing agent such as ozone to the waste stream. The organic material in the waste is oxidized to carbon dioxide and water vapor. The offgas would be passed through carbon filters to remove any volatile organic vapors generated. This process was developed for dilute organic streams, not for concentrated organic wastes. Formation of incomplete oxidation byproducts would be difficult to prevent. The time required for complete oxidation of the waste could be unacceptably long. Also, this treatment has not been demonstrated or developed for this waste stream. Until such technology development work is completed, this technology is not considered a viable treatment alternative.

Steam Gasification

Steam gasification uses superheated steam to oxidize complex organic compounds to carbon monoxide, carbon dioxide, water, hydrogen, and methane. The destruction of organics is completed at high temperature using an electrically heated reactor. Heavy metals and halogens are removed by adsorption beds. This technology was tested at SRS for treatment of this waste stream. Although destruction efficiencies of 99.99% were obtained, excessive carbon formation resulted in catastrophic failure of the reactor after a few days of operation. Thus, this technology was rejected as a possible treatment alternative.

The Government Accounting Office (GAO) estimates that steam gasification could reach "full-rate operations" around 2007 to 2011.

Selected Treatment Technology

The review program concluded that the waste groups originally designated for CIF and the additional mixed waste groups are most effectively treated by incineration. Since no acceptable alternative treatment technology for this waste was identified, the selected technology is incineration followed by stabilization of the residuals. Incineration destroys organic constituents, generates a residual which is easily stabilized, and significantly reduces the waste volume requiring disposal. Incineration is the technology typically used for treatment of this waste type.

Nevertheless, should administrative or technical reasons prevent CIF's operation, other alternatives for benzene treatment must be considered. These alternatives are "options" only in the loosest sense. Many technologies have just begun to be developed and hold but a remote possibility of maturing into viable methods. Others offer no technological advantage over CIF.

Consideration of the shortcomings of all available alternatives leads to the conclusion that incineration is the only currently acceptable treatment for DWPF benzene. If CIF cannot commence operations, the services of a vendor's incinerator would have to be obtained.

Onsite Incineration by Mobile Incinerator

A mobile incinerator offers no technological advantage over CIF. Many objections raised to CIF incineration also apply to a mobile unit. To prepare a vendor solicitation package, evaluate proposals, and select a vendor may take 12 to 18 months from authorization to proceed.

Offsite Incineration

Offsite incineration (or "thermal destruction," or "pyrolysis") offers no technological advantage over onsite incineration. Moreover, transportation of the benzene waste stream to the incinerator's location incurs additional safety and environmental risk. To prepare a vendor solicitation package, evaluate proposals, and select a vendor may take 12 to 18 months from authorization to proceed.

Molten Metal

Molten metal processing is primarily a method for recovering metals from scrap. One vendor alleges that the process could be adapted to destroy benzene. The benzene stream would be injected into a pool of molten metal in an anaerobic atmosphere. The "closed-loop, recycle" design is supposed to result in zero air emissions. From the literature available, it is difficult to deduce the fate of the carbon and hydrogen liberated by the reduction of the benzene ring.

This technology is currently bench scale. One vendor estimates that the process is three to five years away from commercial application, with obtaining environmental permits as the critical path. The General Accounting Office (GAO) estimates that molten metal technology could reach "full-rate operations" around 2007 to 2008.

Aerobic Digestion

Communities of microorganisms in the presence of oxygen can metabolize organic compounds into carbon dioxide (CO_2) and biomass. High-rate aerobic processes ("activated sludge plants") require large volumes of air to be pumped through the bioreactors. For benzene to be accessible to the micro organisms, it would have to be dissolved in water. As benzene is only "slightly soluble" in water, the amount needed to dissolve 150 gallons per day of benzene is significant. It is also to be expected that benzene would be released into the atmosphere from an activated sludge process. Large quantities of benzene in an aerobic environment could also pose a fire hazard.

Anaerobic Digestion

Communities of microorganisms in the absence of oxygen can metabolize organic compounds into carbon dioxide (CO_2) and methane (CH_4). High-rate anaerobic digesters remain relatively small and inexpensive facilities. Nevertheless, they can prove difficult to startup. Destruction efficiency of anaerobic digesters usually does not exceed 90% of input biological oxygen demand (BOD). Trace amounts of certain chemicals can seriously reduce a digester's destruction efficiency and prolong startup. For benzene to be accessible to the microorganisms, it would have to be dissolved in water. As benzene is only "slightly soluble" in water, the amount needed to dissolve 150 gallons of benzene per day is significant.

Cost Estimate: INCLUDED WITH COST INFORMATION FOR TREATING WASTE STREAM SR-W001. SEE COST ESTIMATE SHEET FOR SR-W001.

Summary Page

Waste Stream Number & Name: SR-W023 Cadmium Safety/Control Rods

Background Information

Cadmium rods encapsulated in stainless steel are used to control neutron flux in the reactors. Most rods are one inch in diameter and 22 feet long. There also are some smaller rods that were used in a test reactor. Cadmium is used as a neutron poison in the nuclear fission process.

Volume
- Current volume through 09/30/94 is 0.3 m^3.
- Expected 1995-1999 volume will be 3.2 m^3.

Waste Stream Composition
- Inorganic debris
- Cadmium containing metal debris

Waste Code
- D006A (TCLP Cd)

LDR Treatment Standard
- D006 = concentration based standard = 1.0 mg/l
- Alternate debris technology may be applied

Waste Characterization
- Process knowledge and sampling and analysis used to characterize the waste.
- Contaminant level = 1473 mg/l Cd
- Confidence level is high based on knowledge of materials of construction and TCLP analysis.
- TCLP analysis results were on a non-radiated rod

Radiological Characterization
- Calculated radiation rates reported as 10-56 R/hr.
- Activation products and beta/gamma emitters (Co^{60} and Ni^{59}) are present.
- Waste must be remotely handled.
- Mixed low-level waste

Preferred Option

The preferred treatment option for Cadmium Safety/Control Rods is Macroencapsulation in a cask as a 90-day generator.

Treatment Justification

In-depth options analysis is not required for this waste stream.

The final rule, Land Disposal Restrictions for Newly Identified Waste and Debris, 57 FR 37194, dated August 18, 1992, described the conditions for treatment of debris that would meet regulatory standards.

To facilitate treatment, storage, and disposal of the cadmium containing safety/control rods, it will be necessary to seal the rods in a cask. This action meets the definition of macroencapsulation as stated in the "debris rule." SRS had a cask already in existence which would serve this purpose; however, the cask was too short and necessitated that the rods be cut in order to fit the cask. SCDHEC agreed that the cutting of the rods and placing them in the existing cask did not require a treatment permit. This decision is documented in correspondence between SRS and SCDHEC regarding the Cadmium Control and Safety Rod Management Plan (Roberts to Wilson, September 8, 1993, and Thompson to Roberts, November 9, 1993).

Waste Stream Number & Name: SR-W023 Cadmium Safety/Control Rods
Facility: Waste stream is in a condition that already meets the Land Disposal Restrictions (LDR) Treatment Standard.

Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[ ] alpha [√] non-alpha [ ] contact handled [√] remote handled

Module Location: SRS

Module Status: [√] Existing [ ] New [ ] Small generator [√] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ N/A	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ N/A	
		1.3.2 Safety Assurance Documentation	$ N/A	
		1.3.3 Permitting	$ N/A	
		1.3.4 Preparation for Operations	$ N/A	
		1.3.5 Project Management	$ N/A	
		TOTAL PRE-OPERATIONS		$ 0
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ N/A	
	2.2	Inspection	$ N/A	
	2.3	Project Management	$ N/A	
	2.4	Building Construction (inc. indirect)	$ N/A	
	2.5	Equipment (inc. indirect)	$ N/A	
	2.6	Construction Management	$ N/A	
	2.7	Contingency	$ N/A	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 0
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor $75,000/cask for placement	$ 550	
	3.2	Annual Utilities	$ N/A	
	3.3	Annual Materials	$ 200	
	3.4	Annual Maintenance	$ N/A	
	3.5	Annual Contingency	$ 43	
		TOTAL ANNUAL O & M	$ 793	
		X NUMBER OF YEARS OF OPERATION	1	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 793
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ N/A	
	4.2	Closure, Post-Closure, Monitoring	$ N/A	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 0
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$ N/A	
	5.2	Mobile Treatment	$ N/A	
		TOTAL CONTRACTED SERVICES		$ 0
6.0	Offsite Treatment (DOE)			$ 0
7.0	Transportation			$ 60
8.0	Disposal			$ 120
		SUB COST FOR MACROENCAPSULATION MODULE		$ 973
		ESCALATION		1.029
		TOTAL COST		$ 1,001

*Note: Cost of cask is a sunk cost.

If above numbers do not appear to add correctly, it is the result of computer rounding.

Westinghouse
Savannah River Company

P.O. Box 616
Aiken, SC 29802

ESH-ENV-93-0322

September 8, 1993

Mr. D. E. Wilson, P.E., Director
Division of Hazardous and Infectious
Waste Management
Bureau Of Solid and Hazardous
Waste Management
South Carolina Department of Health
and Environment Control
2600 Bull Street
Columbia, SC 29201

Dear Mr. Wilson:

CADMIUM CONTROL AND SAFETY ROD MANAGEMENT PLAN (U)

As previously discussed with you and your staff at a meeting in the Sims/Aycock Building on June 8, 1993, the Savannah River Site (SRS) wishes to begin a program of removal and management of reactor cadmium control/safety rods in the very near future. In order to ensure that the regulatory issues are identified and addressed early in the process, we are providing you with a conceptual outline of our plan. It is our intent to begin and complete this process as quickly as possible while the budget, staffing resources, and equipment are available.

A Cadmium Rod Task Team was formed to develop a plan to determine the most time and cost efficient solution ensuring consolidation and management of all Savannah River Site cadmium rods determined to be no longer required for reactor operations.

The plan developed by the Task Team is presented in summary below:

- Inventory all cadmium rods on site and determine which rods will be kept in reserve for possible future K Reactor operation based on contamination/radiation levels of the rods.

- Determine methods of discharging rods from the test reactor. Discharge rods from reactor and dry store rods in K Area as spares for K Reactor. An analysis has been performed indicating these rods are at or below natural background radiation levels. Rods not required for K Reactor will be sent to Waste Management for disposal. Non-irradiated rods will be shipped to the SRS surplus facility and irradiated rods will be managed as waste in an appropriate onsite RCRA facility. Surface contamination will be removed prior to packaging for disposal.

- Evaluate and perform corrective maintenance on charge and/or discharge machines in P, L, K, and C Reactors.

- Obtain existing stainless steel cask for irradiated cadmium rods with adequate lead shielding to comply with radiation level storage requirements.

- Discharge rods to disassembly basins from the reactors as the reactor discharge equipment becomes available. The process of discharging the reactors is expected to begin in September 1993, and is expected to take about 14 months because of upgrades required to bring the idle discharge machines back to operating condition. In addition, equipment installed for the C Reactor tank repair in 1986 must be removed prior to discharging the cadmium rods from that reactor.

- Process rods through disassembly basin to prepare for storage at appropriate facility. This process will remove the aluminum extension from the rods so that the cadmium portion of the rods will fit in the cask. This process involves cutting the aluminum extension off of the rods so that the rods can be placed in the existing cask. The cadmium core will not be cut. The disassembly basins contain equipment routinely used to process/prepare all assemblies discharged from the reactor. All reactor assemblies removed from the reactor are disassembled or cut to accommodate shipping containers to further process the components at other facilities on the Site.

- Load cask with rods from each reactor area as the rods are processed through disassembly. The rods are expected to be removed, processed, and containerized within two to four weeks of being discharged from each reactor. The cask will be closed and then be moved to the next reactor scheduled to be discharged.

- Once all the applicable SRS rods have been loaded into the cask, the cask will be dried (different methods are currently being evaluated to determine the best means of ensuring no free liquids exist in the cask).

- Sealing of the cask will be examined (different alternatives are currently being evaluated to determine the best technology for sealing the cask lid onto the cask such as welding or high tech sealant materials) to meet the RCRA macro-encapsulation treatment standard. The cask may require sealing because the inherent macro-encapsulation of the stainless steel sheathing of the rods may be voided when the rods are cut in order to fit in the cask.

- After removal activities are completed, the cask will be transported and managed at an appropriate onsite RCRA facility.

Mr. D. E. Wilson
ESH-ENV-93-0322
Page 3
September 8, 1993

Due to the accelerated schedule for this project, SRS asks for your review and concurrence with this plan as quickly as possible. The SRS is willing to meet with you at your convenience concerning this project. Please contact Marshall F. Perks (725-1564) of my staff if you have any questions or need additional information.

Sincerely,

JS Roberts

JJ S. Roberts
Manager, Environmental Protection Department
Westinghouse Savannah River Company

MFP:pr

CC: M. F. Perks, 742-4A
A. B. Gould, 703-47A
M. C. Reece, SCDHEC-Aiken
A. Linton, EPA Region IV

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orig - Joe Odom
cc: Brent Rankin
Gloria Barnes

South Carolina
DHEC
Department of Health and Environmental Control
2600 Bull Street, Columbia, SC 29201

Commissioner: Douglas E. Bryant

Board: Richard E. Jabbour, DDS, Chairman
Robert J. Stripling, Jr., Vice Chairman
Sandra J. Molander, Secretary

Promoting Health, Protecting the Environment

William E. Applegate, III,
John H. Burriss
Tony Graham, Jr., MD
John B. Pate, MD

November 9, 1993

NOV 29 1993

Mr. J.S. Roberts, Manager
Environmental Protection Department
Westinghouse Savannah River Company
Post Office Box 616
Aiken, SC 29802

Re: Cadmium Control and Safety Rod Management Plan
United States Department of Energy (DOE)
Savannah River Site (SRS)

Dear Mr. Roberts:

The South Carolina Department of Health and Environmental Control (SCDHEC) received a letter dated September 8, 1993 from Westinghouse Savannah River Company which outlined a plan for management of cadmium control and safety rods after removal from the reactors. On November 4, 1994 a conference call was held between DOE representatives and SCDHEC representatives to discuss regulatory aspects of the management plan. After review of the letter and conversation with DOE representatives, SCDHEC has identified one (1) regulatory concern in relation to the plan. This concern is presented below.

The plan proposes to utilize one (1) cask for containerization of cadmium rods from all of the reactors. SRS would be allowed to accumulate the cadmium rods in the cask for a temporary period without coverage of a Resource Conservation and Recovery Act (RCRA) permit or interim status provided that the requirements of South Carolina Hazardous Waste Management Regulation (SCHWMR) R.61-79.262.34 were met. The temporary period is specified in the SCHWMR as ninety (90) days and may be extended to one-hundred twenty (120) days if approval for the extension is granted by the SCDHEC Environmental Quality Control District Office. If SRS complies with the requirements of R.61-79.262.34(c), then the temporary period may begin when fifty-five (55) gallons of waste have been placed in the cask. At the end of the accumulation period, the accumulated hazardous waste must be managed in an area which is covered by a RCRA permit or interim status or transported offsite to a facility which has a RCRA permit or interim status. Once the accumulation period begins, SRS must complete loading of cadmium rods into the cask within the allowable time period.

Letter to Mr. Roberts
November 9, 1993
Page 2

If you have any questions, please contact Shelly Sherritt at (803) 734-5203.

Sincerely,

G. Randall Thompson

G. Randall Thompson, P.E., Manager
Hazardous Waste Permitting Section
Bureau of Solid & Hazardous Waste Management

GRT/SS/rrb

cc: Myra Reece, Lower Savannah EQC

JSR 5-4A-W (Rev 1-89)

WESTINGHOUSE SAVANNAH RIVER COMPANY

INTER-OFFICE MEMORANDUM

ESH-ENV-93-0403

December 8, 1993

TO: I. B. NEW, 704-C

FROM: J. S. ROBERTS, 742-A
5-1728

CADMIUM ROD REMOVAL, SCDHEC'S RESPONSE AND CONCURRENCE (U)

Ref: Letter, D. E. Wilson from J. S. Roberts, 9/8/93

The purpose of this memorandum is to provide you with South Carolina Department of Health and Environmental Control (SCDHEC) response to our proposal to remove the cadmium control and safety rods as described in the referenced letter.

Attached to this memorandum is SCDHEC's letter of response. The letter stipulates only one provision which deviates from our original proposal. SCDHEC requires that once a quantity of cadmium rods is placed in the cask exceeding a volume of 55 gallons, the cask must be transported to an area which has a RCRA permit or interim status within 90 days (or 120 days if a 30 day extension is requested and granted). The time storage prohibition stipulated is the only requirement expressly defined by SCDHEC.

Should you have any questions please contact R. C. Foust of my staff at 5-1564. Mr. Foust will continue to provide EPD program support and coordination for this effort.

RCF:pr
Attachment

CC: J. F. Jordan, 703-A
F. R. McCoy, DOE, 703-41A
J. V. Odum, 742-A
D. B. Rankin, 704-C
R. A. Adams, 717-K
A. B. Gould, DOE, 703-47A
EPD Files, 742-A

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Summary Page

Waste Stream Number & Name: SR-W024 Mercury/Tritium Gold Traps

Background Information

This waste stream contains gold foil which traps elemental mercury entrained in process gases in the tritium facility. A typical trap consists of a stainless steel cylindrical housing that is 38 inches high and 2 inches in diameter that contains gold foil on 16 evenly spaced trays.

Volume
- Current volume through 09/30/94 is 2.3 m^3.
- Expected 1995-1999 volume will be 0.2 m^3.

Waste Stream Composition
- Elemental mercury

Waste Code
- D009D (Elemental mercury contaminated with radioactive materials)

LDR Treatment Standard
- D009 = specified technology = Amalgamation

Waste Characterization
- Process knowledge used to characterize the waste stream.
- Confidence level is high based on knowledge of the process that generates the waste.
- No direct analysis made because of ALARA concerns for tritium.

Radiological Characterization
- Total activity is estimated to be 1.6 Ci/g.
- Tritium is present.
- Waste is contact handled.
- Mixed low-level waste

Preferred Option

The preferred treatment option for Mercury/Tritium Gold Traps is amalgamation. The waste stream already meets the treatment standard.

Treatment Justification

In-depth options analysis is not required for this waste stream since the waste stream meets the treatment standards without addition treatment.

Waste stream is in a condition that already meets the Land Disposal Restriction treatment standard.

The Land Disposal Restrictions require a specified technology for the treatment of elemental mercury contaminated with radioactive materials. The specified technology is amalgamation. Amalgamation is a process of utilizing inorganic reagents such as copper, zinc, nickel, gold, and sulfur to create a nonliquid, semi-solid amalgam which reduces the potential emissions of elemental mercury into the air.

The Savannah River Site submitted correspondence to the U. S. Environmental Protection Agency, Region IV, dated September 28, 1992, describing the amalgamation process for the liquid mercury released from the Tritium Facility and including a regulatory analysis demonstrating that the gold trap amalgam meets the elemental mercury contaminated with radioactive materials treatment standard. Concurrence was given by EPA Region IV via telephone on October 2, 1992, that the gold traps did represent specified technology treatment

for the mercury waste stream emission from the Tritium Facility, that the Land Disposal Restrictions (LDR) requirement was thus met, and no further treatment was necessary.

Waste Stream Number & Name: SR-W024 Mercury/Tritium Gold Traps
Facility: Waste stream is in a condition that already meets the Land Disposal Restrictions (LDR) Treatment Standard.

Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[ ] alpha [√] non-alpha [√] contact handled [ ] remote handled

Module Location: SRS

Module Status: [√] Existing [ ] New [ ] Small generator [√] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ N/A	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ N/A	
		1.3.2 Safety Assurance Documentation	$ N/A	
		1.3.3 Permitting	$ N/A	
		1.3.4 Preparation for Operations	$ N/A	
		1.3.5 Project Management	$ N/A	
		TOTAL PRE-OPERATIONS		$ 0
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ N/A	
	2.2	Inspection	$ N/A	
	2.3	Project Management	$ N/A	
	2.4	Building Construction (inc. indirect)	$ N/A	
	2.5	Equipment (inc. indirect)	$ N/A	
	2.6	Construction Management	$ N/A	
	2.7	Contingency	$ N/A	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 0
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor 1.0 casks/yr x 1500/2 casks	$ .750	
	3.2	Annual Utilities	$ N/A	
	3.3	Annual Materials	$	
	3.4	Annual Maintenance	$ N/A	
	3.5	Annual Contingency	$ N/A	
		TOTAL ANNUAL O & M	$ .750	
		X NUMBER OF YEARS OF OPERATION	5.0	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 3.75
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ N/A	
	4.2	Closure, Post-Closure, Monitoring	$ N/A	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 0
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$ N/A	
	5.2	Mobile Treatment	$ N/A	
		TOTAL CONTRACTED SERVICES		$ 0
6.0	Offsite Treatment (DOE)			$ 0
7.0	Transportation			$ 0
8.0	Disposal for 5 year window plus inventory (9 drums)			$ 14.2
		SUB COST FOR DISPOSAL MODULE		$ 18
		ESCALATION		1.092
		TOTAL COST		$ 20

If above numbers do not appear to add correctly, it is the result of computer rounding.

Westinghouse
Savannah River Company

P O Box 616
Aiken, SC 29802

ESH-FSS-920721

September 28, 1992

Dr. Judy Sophianopoulos
RCRA Section
4WD - RCRA
U. S. Environmental Protection Agency-Region IV
345 Courtland Street
Atlanta, GA 30365

Dear Dr. Sophianopoulos:

GOLD TRAPS REGULATORY ANALYSIS (U)

The Westinghouse Savannah River Company is providing a regulatory analysis for gold traps (hazardous waste code D009-elemental mercury contaminated with radioactive materials), a mixed waste stream that is generated and stored at the Savannah River Site in South Carolina. The gold traps are ". . .wastes that are generated in such a way as to naturally meet the standard can be land disposed without treatment" (53 CFR 31146 dated August 17, 1988). Therefore, the analysis summarizes that treatment in addition to the amalgamation onto the gold traps is not necessary before the mercury's final disposal in the RCRA permitted Hazardous Waste/Mixed Waste Disposal Facility.

Although Appendix 5 of the FFCA First Amendment indicated that a treatability variance would be sought, it has now been determined that based on the information contained in this letter, the treatment standards can be met without the need for a variance. Therefore, WSRC will not perform additional treatment to this waste prior to disposal in the RCRA disposal facility.

If WSRC has not heard a negative response within sixty days of your receiving this letter, we will assume our course of action is appropriate. Please contact Laura Curtis of my staff at FTS (803) 725-7370 for assistance should questions arise. Thank you for your consideration of this important matter.

Sincerely,

J. V. Odum, Manager
Facility Support Section
Environmental Protection Department

LBC:sam
Attachment

CC: P. Prater, 703-41A (concur)
S. Ross, 703-A (concur)
D. Zweifel, 703-41A (concur)
D. Wilson, SCDHEC
M. C. Reece, SCDHEC-Aiken

SR 25-82-W14-891

GH5600srd 1/31/95

RCRA Regulatory Analysis of Gold Trap Amalgamation

Introduction

Per a current Land Disposal Restrictions (LDR) analysis on the tritium gas operation, the Savannah River Site has made the regulatory interpretation that amalgamation of mercury in the tritium processing operations meets the specified treatment for waste elemental mercury (D009-elemental mercury contaminated with radioactive materials). The following analysis of the tritium process clearly identifies the elemental mercury as an impurity that must be removed from the tritium gas to meet the stringent purity standards set for the final product.

Background

Tritium, a radioactive isotope of hydrogen, is processed in the Savannah River Tritium Facility and has high purity standards set forth by the Department of Energy (DOE). Mercury pumps are used to move the tritium through the process since diaphragm pumps present personnel and environmental hazards due to diaphragm failures. Mercury is the working fluid for the pumps and comes in physical contact with the tritium gas for the purpose of pumping and compressing the gas. For some mercury pumps, mercury is circulated by vaporization in one part of the pump and by condensation in another part of the pump. The vaporized mercury is distributed through venturi nozzles to educe the process gas from the pump inlet to the pump outlet. The condensed mercury flows by gravity to the pump's reservoir where it is re-vaporized for the next pumping cycle, while the gas continues to the next process step.

During the pumping operation, some mercury vapor escapes the pump and becomes a contaminant in the product gas stream. As a purification step, the gas passes through mercury traps (also referred to as gold traps) where the mercury amalgamates to the gold foil and is separated from the product gas.

The gold trap consists of the gold foil rolls placed on tiered trays and a stainless steel shell that defines the trap boundary and directs the gas flow through the trap. With a radiation level of about 200 Curies per trap, separating the amalgamated gold waste from the steel shell is not performed as it would compromise protection of personnel due to radiological and environmental hazards associated with tritium. Radiological practices to protect the worker from unreasonable exposure requires the entire assembly (steel shell, gold foil) to be discarded. The entire gold trap is removed from the process to maintain tritium product purity and is replaced at a frequency determined by process experience (usually between 2-4 years) and trap location within the process. Data on mercury characteristics indicate mercury is very insoluble to stainless steel and would not be present on the stainless steel shell, if there existed a method to separate the shell from the gold foil without precipitating unnecessary radiation exposure.

When a gold trap is taken out of service, it is placed in a stainless steel container and welded shut to prevent the release of tritium (estimated to be 200 Curies per gold trap per STA-229, Tritium-Contaminated Gold Amalgam Disposal, 7/30/85). Final disposal will be in the vault expansion project of the Hazardous Waste/ Mixed Waste disposal facility at the Savannah River Site. This project is in the conceptual phase and is expected to be authorized as a 1994 Line Item. In the interim, the overpacks are being stored in the Mixed Waste Storage Building (Building 643-29E).

Regulatory Analysis

Part 261.4(c) of the RCRA regulations states, 'A hazardous waste which is generated . . . in a manufacturing process unit or an associated non-waste-treatment-manufacturing unit, is not subject to regulation under Parts 262 through. . . [RCRA regulations, including LDR] or to the notification requirements of section 3010 of RCRA until it exits the unit in which it was generated. . . '. When the mercury exits the unit described above (tritium gas process), it is in the form of an amalgam and enters the waste universe with a D009 classification. In the Third Third proposed rule to the Land Disposal Restrictions (LDRs), the Environmental Protection Agency (EPA) identified amalgamation as the treatment standard for elemental mercury contaminated with radioactive materials (hazardous waste codes D009 and U151), using zinc as the amalgam reagent. The DOE commented to EPA the amalgam standard be expanded to employ gold as a reagent for mercury amalgamation. In the final rule, EPA specifies this method may employ gold as an acceptable inorganic reagent, in addition to copper, zinc, nickel, and sulfur (55 FR 22628, dated June 1, 1990). Therefore, mixed wastes carrying these waste codes and meeting the description must undergo this specified method of treatment before disposal. In addition, the resultant amalgam must be non-liquid or semi-solid. The Agency established this method as the treatment standard because it believes that amalgamation not only reduces the leaching potential of mercury by leaving a paste-like residue but also significantly reduces the potential for airborne mercury (atmospheric) emissions.

The tritium manufacturing process amalgamates the elemental mercury in order to meet its stringent product criteria. The specific LDR treatment for elemental mercury contaminated with radioactive materials is amalgamation. To liberate the mercury from the gold trap through high temperature recovery, only to re-amalgamate it in order to meet the waste treatment standard for land disposal, does not improve the treatment of the mercury waste, is very costly, and may generate additional D009 waste because of additional processing. The amalgamation occurring in the production of tritium is not a waste-treatment and is product driven. However, amalgamation is the treatment for elemental mercury so the gold traps would not require further treatment prior to final hazardous waste disposal. Since the gold traps already meet the waste-specific treatment, any unnecessary handling would go against the ALARA policy (As Low As Reasonably Achievable) by exposing personnel to high radiation levels associated with the gold traps in addition to assimilation potentials with the off-gassing of tritium during treatment.

Summary

The radioactive elemental mercury that exits the pump and becomes entrained in the tritium gas must be removed to meet DOE's stringent purity standards. These gold traps remove the radioactive elemental mercury from the product gas via amalgamation which is also the prescribed treatment technology for this waste stream when it exits the unit in which it was generated. To protect personnel and reduce radiation exposure, the entire gold trap is taken out of service and replaced at a frequency to insure product consistency. Therefore, the radioactive elemental mercury is treated per the required technology and can be disposed in a RCRA Subtitle C disposal facility, in accordance with the amalgamation treatment for mercury in the Third Third Final Rule.

WSRC-EPD Telecon Record

Subject Title : Gold Trap Regulatory Analysis Agreement ***Date:*** 10/2/92 ***Time:*** 4:00 PM

Purpose: EPA-Region IV concurrence of regulatory analysis

Call Made By: Dr. Judy Sophianopoulos 404-347-7603

Person(s) Contacted: Laura Curtis, WSRC (803)725-7370

Discussion Notes:

Caller

Dr. Sophianopoulos informed me she had received the gold trap regulatory analysis (Letter, J. Sophianopoulos from J.V. Odum ESH-FSS-920721, dated September 28, 1992) and agreed with the analysis. She asked if we wanted a letter of concurrence.

Respondent

I responded that we did not need a letter, as I was going to document EPA-Region IV's concurrence in this telecon. The letter referenced was worded such that we would proceed with our course of action (no additional treatment prior to disposal) unless a negative response was received.

Additional Actions Needed:
Transmit a site letter to inform involved organizations of EPA's favorable response to the analysis.

Distribution:
cc: J.V. Odum, 742-A
S.J. Carroll, 742-A
M.P. Prater, 703-41A
J. Sophianopoulos, EPA-IV

Summary Page – Initial Screening

Waste Stream Number & Name: SR-W025 Solvent/TRU Job Control Waste <100 nCi/g

Background Information

The waste stream is composed primarily of solids such as disposable personnel protective equipment (PPE), floor sweepings, rags, labware, and other job control waste generated through separation activities for plutonium production. The waste stream includes small amounts of transuranic waste from onsite laboratories. This waste differs from SR-W033 because solvent rags are suspected of being in the waste. A conservative interpretation of the mixture rule causes all contents in a container to be characterized with listed solvent waste codes due to the presence of solvent rags.

Volume

- Current volume through 09/30/94 is 2744.8 m^3.
- No future waste generation is expected because of a program implemented to segregate F-listed solvent rags from other job control waste. This waste stream ceased to be generated when the program began. (Thirds/TRU Job Control Waste <100 nCi/g is the current waste stream which evolved from SR-W025 under current F-listed solvent waste segregation.)

Waste Stream Composition

- Organic debris

Waste Code

- D001C (Ignitable)
- D003D
- D004A
- D006A
- D007A
- D008A
- D009A
- D011A (TCLP metals)
- D018-D019
- D022-D026 (characteristic organics)
- F001-F003
- F005A (halogenated and nonhalogenated spent solvents)
- P012
- P015
- P048
- P113
- P120 (acutely toxic commercial chemical wastes)
- U002
- U032
- U052
- U080
- U133
- U134
- U144
- U151
- U154
- U161
- U209
- U211
- U220
- U226
- U239 (commercial chemical wastes)

LDR Treatment Standard

- D001 = specified technology = Recovery of Organics or Combustion
- D003 = specified technology = DEACT
- D004 = concentration based standard = 5 mg/l
- D006 = concentration based standard = 1 mg/l
- D007 = concentration based standard = 5 mg/l
- D008 = concentration based standard = 5 mg/l
- D009 = concentration based standard = 0.2 mg/l
- D011 = concentration based standard = 5 mg/l
- D018* = concentration based standard = 10 mg/kg
- D019* = concentration based standard = 6 mg/kg
- D022* = concentration based standard = 6 mg/kg
- D023* = concentration based standard = 5.6 mg/kg
- D024* = concentration based standard = 5.6 mg/kg
- D025* = concentration based standard = 5.6 mg/kg
- D026* = concentration based standard = 11.2 mg/kg
- F001 = concentration based standard = 6-30 mg/kg
- F002 = concentration based standard = 6-30 mg/kg
- F003 = concentration based standard 0.75 mg/l TCLF - 160 mg/kg
- F005 = concentration based standard = 10-170 mg/kg, except 2-Ethoxyethanol, 2-Nitropropane = Incineration
- P012 = concentration based standard = 5 mg/l
- P015 = specified technology = RMETL or RTHRM
- P048 = concentration based standard = 160 mg/kg
- P113 = specified technology = RTHRM or STABL
- P120 = specified technology = STABL
- U002 = concentration based standard = 160 mg/kg
- U032 = concentration based standard = 0.86 mg/l
- U052 = concentration based standard = 5.6-11.2 mg/kg
- U080 = concentration based standard = 30 mg/kg
- U133 = specified technology = CHOXD, CHRED, or CMBST
- U134 = specified technology = ADGAS fb NEUTR or NEUTR
- U144 = concentration based standard = 0.37 mg/l
- U151 = concentration based standard = 0.025 mg/l
- U154 = concentration based standard = 0.75 mg/l, or CMBST
- U161 = concentration based standard = 33 mg/kg
- U209 = concentration based standard = 6.0 mg/kg
- U211 = concentration based standard = 6.0 mg/kg
- U220 = concentration based standard = 10 mg/kg
- U226 = concentration based standard = 6.0 mg/kg
- U239 = concentration based standard = 30 mg/kg
- Alternate debris technology

*D012-D043 nonwastewaters must be treated to meet the Universal Treatment Standards for any underlying constituents that may be present.

Waste Characterization

- Process knowledge used to characterize the waste stream.
- Confidence level is medium based on the varying composition of the job control waste and the exact contents of specific waste containers.

Radiological Characterization

- Total activity is 10-100 nCi/g
- Alpha emitters (Pu^{238}, Pu^{239}, Pu^{240}, Pu^{241}, Pu^{242}, Am^{241}, U^{233}) are present.
- Beta/gamma emitters (H^3, Co^{60}, Cs^{137}) are present.
- Waste is contact handled.

- Mixed low-level waste

Initial Screening

The initial screening revealed that this waste stream potentially fits into one or more waste classifications (orphan waste) and will require further characterization to determine the portion that is mixed TRU waste. This determination is based on the lack of adequate assay technology to properly classify this waste at the time of generation. Further screening revealed that this waste may contain metal debris or large pieces of metal. Therefore, option analyses were prepared on the supposition that the expected waste characterization results will show that the waste consists of both metal debris (or bulk metal) and combustible organic materials.

Initial screening identified several inappropriate treatment options. These options appear in the Initial Rejections Table.

Initial Rejections

Treatment Facility	Treatment Technology	Reasons for Rejection
ETF	Ion Exchange	ETF has no process to treat this waste.
Lab	Lab-scale process flowsheet	Volume of waste too great to handle with laboratory-scale equipment.
LETF	Ion Exchange	LETF has no process to treat this waste.
M Area	Vitrification	This waste has too large a volume for M-Area to handle effectively. Waste contains plastics which create vapors during vitrification that the offgas system cannot handle. Moreover, TRU waste characterization is scheduled after the M-Area vitrification mission is complete.
Tritium	Macroencapsulation	Bringing fission products into the tritium production area is prohibited.
Z Area	Stabilization	Z Area can treat only those wastes that come by pipeline from Tank 50 and meet strict waste acceptance criteria. The Z-Area process lacks flexibility to treat and dispose of a variety of waste streams.
INEL/WERF	Incineration/ Stabilization	WERF will not accept alpha waste.
INEL/WEDF	Stabilization	WEDF is in preconceptual design. It is too early to determine if technology is applicable.

Summary Page – Technology Success Factor (TSF) & In-Depth Options Analysis (IDOA)

Waste Stream Number & Name: SR-W025 Solvent/TRU Job Control Waste <100 nCi/g

Feasible Options

Option No.	Treatment Facility	Treatment Technology	TSF Score	IDOA Scores Tech.	IDOA Scores Total	COST (x 1,000)	PO
SR-W025-1	TWCCF/AVF	Characterization/ Vitrification	*	53	53	127,186	√
SR-W025-2	TWCCF/ Cont. Bldg.	Characterization/ Macroencapsulation	100	56	65	20,890	√
SR-W025-3	CIF	Incineration/ Stabilization	94	56	67	9,941	
SR-W025-4	INEL/IWPF	Incineration/ Stabilization	*	36	50	1,685	

* No TSF required for proposed or existing non-Savannah River Site-DOE waste processing facilities.

Options Rejected Due To Low Technology Success Factor (TSF)

- No options were rejected.

Engineering Assessment

Preferred Option Justification

The preferred option for Solvent/TRU Job Control Waste <100 nCi/g is to assay, sort, and characterize the waste stream in the TRU Waste Certification/Characterization Facility (TWCCF). Then, the waste will be either macroencapsulated or vitrified.

This option is preferred because it identifies the mixed TRU portion of this waste stream. Two waste treatment options have been identified to ensure the remaining MLLW portion of this waste stream meets LDR Treatment Standards for onsite disposal: Macroencapsulation in a stainless-steel box and Stabilization by Vitrification.

Macroencapsulation is preferred for treating the metal debris because:

- Final wasteform will meet RCRA, Subtitle C Disposal WAC.
- Process satisfies requirements of the "debris rule" and meets applicable LDR requirements.
- The technology exists, and the process employs well-known techniques (e.g., welding stainless steel).
- Similar systems have demonstrated availability of greater than 80 percent.

This option treats the constituents of concern by isolating them from the environment in stainless-steel boxes that have been welded closed.

Stabilization by vitrification is preferred for treating the combustible organic component because:

- Waste volume will be reduced by a factor of 15 to one.
- Final wasteform will meet LDR Treatment Standards.
- Cost sharing with equal to or greater than 100 nanocuries per gram mixed and non-mixed TRU waste streams.

This option treats the constituents of concern and listed organics by stabilizing them in a non-leaching class matrix. The vitrification process could concentrate the TRU fraction equal to or above 100 nanocuries per gram, requiring WIPP disposal of the final wasteform.

Options Rejected During IDOA

Incineration and Stabilization at CIF

Incineration and Stabilization at CIF was rejected because:

- Public has significant concerns about incineration and publicly expressed concerns about the incinerator safety.
- 100 percent of final solid wasteform will go to HW/MW Facilities for disposal.

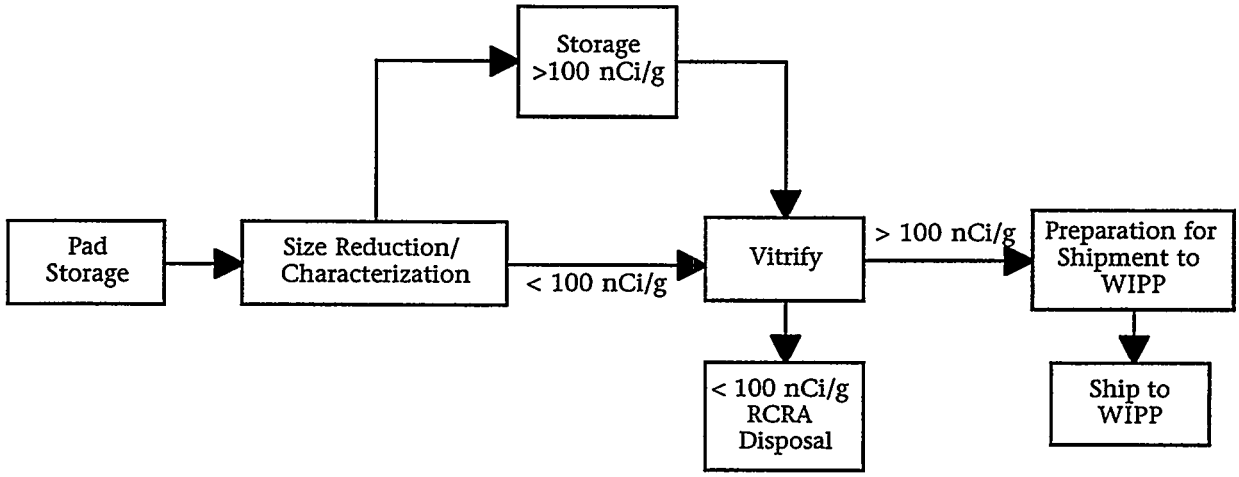
Incineration at INEL/IWPF

Incineration at INEL/IWPF was rejected because:

- INEL/IWPF is planned, but not approved.
- Large volume streams will be treated onsite (SR-W025 and SR-W033).

Waste Stream Number & Name: SR-W025 Solvent/TRU Job Control Waste <100 nCi/g
Option Number: SR-W025-1
Facility: Alpha Vitrification Facility (AVF) **Treatment Technology:** Stabilization by Vitrification

Treatment Cycle Flow Diagram



Pros

- Volume reduction of 15 to one.
- All applicable LDR treatment standards are met, and if waste delisted (F-listed waste), final waste will be nonhazardous.
- Treatment destroys organics and stabilizes metals to meet LDR requirements.
- Final vitrified wasteform will meet disposal requirement. No additional treatment required.

Cons

- Cost of technology is in the higher third for treatment technologies.
- Treatment facilities are in the conceptual design phase.
- The scope of the TWCCF will require line-item funding which is not planned at this time.
- Process generates secondary wastes and offgas residuals requiring treatment.
- Technology has not been fully proven for waste stream.
- No full scale operating facility exists for this application.
- Waste stream requires further characterization before a final volume determination can be made.
- Waste stream must be treated first in the TWCCF to avoid higher activity wastes.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	100	Add 20 points to the median score of 80 because volume reduction is 15 to one.
• secondary waste generation	50	Some secondary waste in the form of a sludge will require further treatment by existing technology.
• destruction removal and demobilization efficiency	100	Add 20 points to the median score of 80 because all applicable LDR treatment standards are met and if waste is delisted, final waste will be non-hazardous.

Waste Stream Number & Name: SR-W025 Solvent/TRU Job Control Waste <100 nCi/g
Option Number: SR-W025-1
Facility: Alpha Vitrification Facility (AVF) Treatment Technology: Stabilization by Vitrification

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• flexibility	80	Vitrification technology can handle a wide variety of wastes without extensive adjustments in operating parameters.
• ability to be shipped	80	Will meet all DOT shipping requirements.
• final wasteform	100	Final vitrified wasteform will meet disposal requirements. Add 20 points to the median score of 80 because no additional treatment required.
Engineering Parameters		
• system implementability	50	Technology has not been fully proven for waste stream.
• availability	20	No full scale operating facility exists.
• scalability	50	Throughput fixed by design.
• remedial measures	80	Recoverable. Recycle through melter.
• schedule for treatment of waste	20	AVF is pre-conceptual.
Personnel Parameters		
• consequence of unmitigated accident scenarios	90	This is not different from waste currently scheduled for treatment here. Add 10 points to the median score of 80 because emissions are few and controlled even in accident scenarios.
• non operational worker potential exposure	50	Additional non-routine maintenance required. Assumed less than 25% downtime required.
• operational worker potential exposure	50	Size reduction and repackaging of waste will require extensive handling.
• transportation potential exposure	50	Nothing unusual about wasteform. Expect low alpha and no liquids. Onsite transport required.
Regulatory Parameters		
• need for variance	80	Process will be in full compliance.
• ability to obtain a permit	50	Both an RCRA Part A and Part B permits may be required by SCDHEC. The time needed to obtain these permits may be lengthy.
• waste disposal	50	Treated wasteform may require disposal in a HW/MW facility unless delisted.
Public Acceptance		
• public acceptance	50	Public has supported treatment that results in a glass wasteform.
Cost Considerations		
• life-cycle cost	0	
• funding availability	20	Not budgeted; pre-conceptual
Industry Involvement		
• market for technology	20	Technology exists, but not fully proven.
• private sector involvement	80	No private sector involvement is anticipated.

IDOA Score: Technical 53 **Total** 53

Waste Stream Number & Name: SR-W025 Solvent/TRU Job Control Waste <100 nCi/g
Option Number: SR-W025-1
Facility: Alpha Vitrification Facility (AVF) Treatment Technology: Stabilization by Vitrification

Cost Estimate Sheet **INCLUDES COST OF SR-W033-1**

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled

Module Location: INEL

Module Status: [ ] Existing [√] New [ ] Small generator [√] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

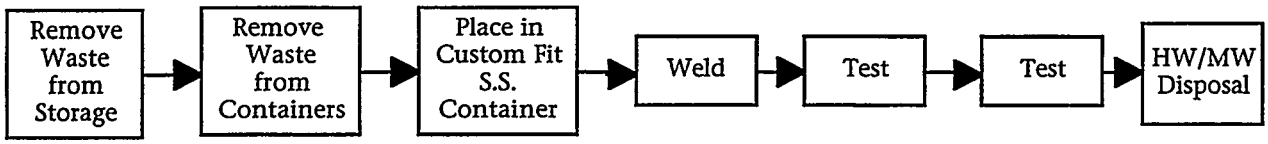
WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$	
	1.2	Demonstration Costs	$	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$	
		1.3.2 Safety Assurance Documentation	$	
		1.3.3 Permitting	$	
		1.3.4 Preparation for Operations	$	
		1.3.5 Project Management	$	
		TOTAL PRE-OPERATIONS		$
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$	
	2.2	Inspection	$	
	2.3	Project Management	$	
	2.4	Building Construction (inc. indirect)	$	
	2.5	Equipment (inc. indirect)	$	
	2.6	Construction Management	$	
	2.7	Contingency	$	
		TOTAL FACILITY CONSTRUCTION COSTS		$
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 27	
	3.2	Annual Utilities	$ 1	
	3.3	Annual Materials	$ 16	
	3.4	Annual Maintenance	$ 10	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 15,672	
		X NUMBER OF YEARS OF OPERATION	4.4	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 68,957
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$	
	4.2	Closure, Post-Closure, Monitoring	$	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$
5.0	Contracted Services			
	5.1	Commercial Treatment/WIPP	$ 3,555	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$
	SUB COST FOR STABILIZATION BY VITRIFICATION MODULE			$ 72,512
		ESCALATION		1.754
		TOTAL COST		$ 127,186

If above numbers do not appear to add correctly, it is the result of computer rounding.

Estimates derived from WMEIS expected case B for vitrification of transuranic waste. It is assumed that the TRU waste drives the program and thus bears the burden of all capital cost.

Waste Stream Number & Name: SR-W025 Solvent/TRU Job Control Waste <100 nCi/g
Option Number: SR-W025-2
Facility: Containment Building
Treatment Technology: Macroencapsulation in a S. S. Box

Treatment Cycle Flow Diagram



Pros

- Process satisfies requirements of the "debris rule" and all applicable LDR requirements are met.
- Can process a wide range of materials.
- S.S. containers will meet current DOT shipping requirements.
- Final wasteform will meet RCRA Subtitle C Disposal WAC.
- All processes involved are existing technology.
- Similar systems have demonstrated availability of greater than 80%.
- Process failure does not produce altered wasteform. A failed container is easily fixed.
- Due to process simplicity, a schedule can be developed easily.
- Process does not create emissions related to the waste stream. Process simply involves container welding.
- Simple welding process requiring minimal maintenance. No additional requirements for decommissioning.
- Exposure controlled by design. Number of workers is dependent upon throughput.
- Little secondary waste.

Cons

- All waste will require disposal in HW/MW facilities.
- Not a budget item and will require line item funding.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	40	Subtract 10 points from the median score of 50 because volume of material increases slightly due to packaging in S.S. container.
• secondary waste generation	80	Little secondary waste.
• destruction removal and demobilization efficiency	80	All applicable LDR requirements are met.
• flexibility	80	Can process a wide range of materials.
• ability to be shipped	80	S.S. containers will meet current DOT shipping requirements.
• final wasteform	80	Final wasteform will meet RCRA Subtitle C Disposal WAC.
Engineering Parameters		
• system implementability	90	Add 10 points to the median score of 80 because all processes involved are existing technology.
• availability	80	Similar systems have demonstrated availability of greater than 80%.
• scalability	50	Throughput is set by design and not easily expanded except by adding additional shifts of operation.

Waste Stream Number & Name: SR-W025 Solvent/TRU Job Control Waste <100 nCi/g
Option Number: SR-W025-2
Facility: Containment Building
Treatment Technology: Macroencapsulation in a S. S. Box

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• remedial measures	90	Process failure does not produce altered wasteform. Add 10 points to the median score of 80 because a failed container is easily fixed.
• schedule for treatment of waste	80	Due to process simplicity, a schedule can be developed easily.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Process does not create emissions related to the waste stream. Process simply involves container welding.
• non operational worker potential exposure	80	Simple welding process requiring minimal maintenance. No additional requirements for decommissioning.
• operational worker potential exposure	80	Exposure controlled by design. Number of workers is depending upon throughput.
• transportation potential exposure	60	No additional characterization needed. Add 10 points to the median score of 50 because waste can be handled readily.
Regulatory Parameters		
• need for variance	80	Process satisfies requirements of the "debris rule."
• ability to obtain a permit	40	Subtract 10 points from the median score of 50 because uncertainties surround attaining a permit related to the "debris rule" and the "containment rule."
• waste disposal	20	All waste will require disposal in HW/MW facilities.
Public Acceptance		
• public acceptance	20	Public may express concern that the wasteform is not unalterably inert.
Cost Considerations		
• life-cycle cost	66	
• funding availability	20	Not a budget item and will require line item funding.
Industry Involvement		
• market for technology	20	This is an existing technology.
• private sector involvement	20	SRS facility evaluated.

IDOA Score: **Technical** 56 **Total** 65

Waste Stream Number & Name: SR-W025 Solvent/TRU Job Control Waste <100 nCi/g
Option Number: SR-W025-2
Facility: Containment Building
Treatment Technology: Macroencapsulation in a S. S. Box

Cost Estimate Sheet INCLUDES COST OF SR-W033-2

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled

Module Location: SRS

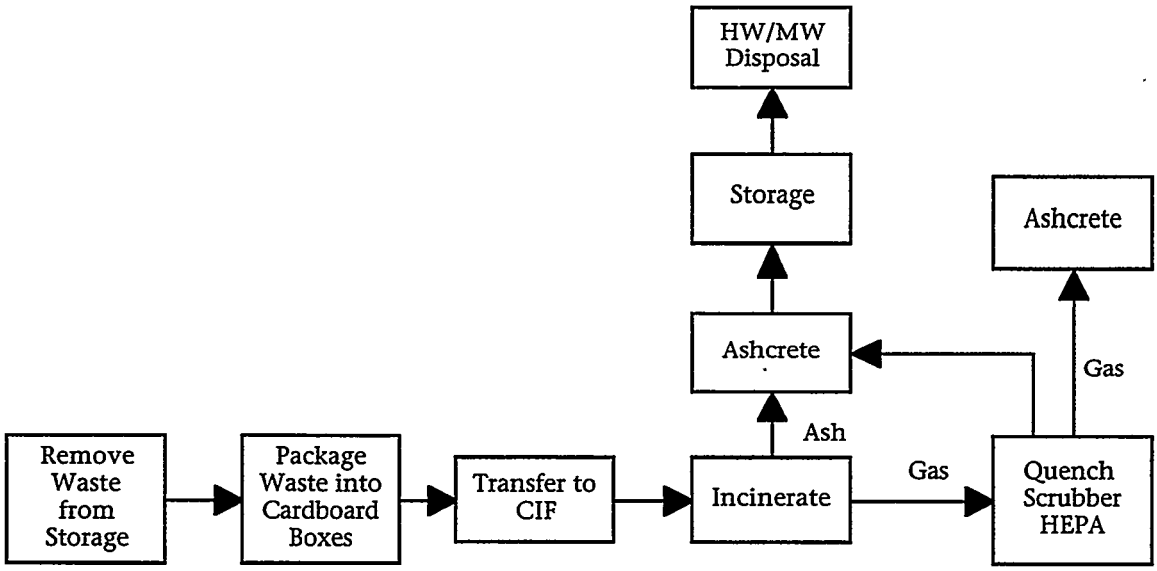
Module Status: [ ] Existing [√] New [ ] Small generator [√] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$	
	1.2	Demonstration Costs	$ -	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$	
		1.3.2 Safety Assurance Documentation	$	
		1.3.3 Permitting	$ 125	
		1.3.4 Preparation for Operations	$	
		1.3.5 Project Management	$	
		TOTAL PRE-OPERATIONS		$ 125
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$	
	2.2	Inspection	$	
	2.3	Project Management	$	
	2.4	Building Construction (inc. indirect)	$	
	2.5	Equipment (inc. indirect)	$	
	2.6	Construction Management	$	
	2.7	Contingency	$	
		TOTAL FACILITY CONSTRUCTION COSTS		$
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 30	
	3.2	Annual Utilities	$ 1	
	3.3	Annual Materials	$ 418	
	3.4	Annual Maintenance	$ 11	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 4,525	
		X NUMBER OF YEARS OF OPERATION	2	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 9,050
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$	
	4.2	Closure, Post-Closure, Monitoring	$	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 2,735
		SUB COST FOR MACROENCAPSULATION MODULE		$ 11,910
		ESCALATION		1.754
		TOTAL COST		$ 20,890

Estimates derived from WMEIS expected case B for macroencapsulation of Transuranic debris waste. It is assumed that the TRU Waste drives the program and thus bears the burden of all capital costs.

Waste Stream Number & Name: SR-W025 Solvent/TRU Job Control Waste <100 nCi/g
Option Number: SR-W025-3
Facility: CIF
Treatment Technology: Incineration/ Stabilization

Treatment Cycle Flow Diagram:



Pros

- Expect at least two to one volume reduction.
- The waste stream is expected to meet all applicable LDR requirements.
- Incinerator designed for a wide range of wastes with some operation limitations.
- Waste does not require additional treatment to meet shipping requirements.
- The wasteforms expected to meet the disposal WAC in the form it exits the facility.
- Incineration is a current demonstrated technology.
- Process failures will not result in a wasteform that cannot be treated by existing technologies.
- Reasonably easy to schedule this waste steam assuming current startup schedule.
- No additional non operational workers are required.
- No additional operational workers will be required.
- All processes are in full compliance with existing regulations and no variances are required.
- Line item is funded.

Cons

- 100% of the final solid wasteform will go to HW/MW disposal facilities.
- The public has significant concerns about incineration and publicly expressed concerns about the safety of incinerators.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	70	Subtract 10 points from the median score of 80 because we expect at least two to one reduction but not as much as five to one.

Waste Stream Number & Name: SR-W025 Solvent/TRU Job Control Waste <100 nCi/g
Option Number: SR-W025-3
Facility: CIF
Treatment Technology: Incineration/ Stabilization

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• secondary waste generation	40	Subtract 10 points from the median score of 50 because significant volume of secondary waste due to ash and blowdown solidification.
• destruction removal and demobilization efficiency	80	The waste stream is expected to meet all applicable LDR standards.
• flexibility	80	Incinerator designed for a wide range of wastes with some operational limitations.
• ability to be shipped	80	Waste does not require additional treatment to meet shipping requirements.
• final wasteform	100	Add 20 points to the median score of 80 because the wasteform is expected to meet the disposal WAC in the form it exits the facility.
Engineering Parameters		
• system implementability	100	Add 20 points to the median score of 80 because incineration is a current demonstrated technology.
• availability	50	Incinerator availability for solids is 50%. Normal maintenance requirements apply.
• scalability	50	Capacity is set by design, but the facility can accept a wide range of inputs.
• remedial measures	70	Subtract 10 points from the median score of 80 because process failures will result in a wasteform that requires special treatment.
• schedule for treatment of waste	80	Reasonably easy to schedule this waste steam assuming current startup schedule.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Metals in this waste stream will be immobilized in the ashcrete resulting in little or no emissions from the facility even during most accident scenarios.
• non operational worker potential exposure	70	No additional non operational workers are required. Subtract 10 points from the median score of 80 because additional non routine maintenance will be required.
• operational worker potential exposure	40	Subtract 10 points from medium median score of 50 because of the labor required to repackage the waste in cardboard boxes.
• transportation potential exposure	60	Some transportation will be required. Add 10 points to the median score of 50 because no additional characterization will be required.
Regulatory Parameters		
• need for variance	80	All processes are in full compliance with existing regulations and no variances are required.
• ability to obtain a permit	50	Permitting incineration of alpha-contaminated waste may be difficult.
• waste disposal	20	100% of the final wasteform will go to HW/MW facilities for disposal.

Waste Stream Number & Name: SR-W025 Solvent/TRU Job Control Waste <100 nCi/g
Option Number: SR-W025-3
Facility: CIF
Treatment Technology: Incineration/ Stabilization

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Public Acceptance		
• public acceptance	20	Incineration has limited acceptance. Public has expressed concerns about the safety of incinerators.
Cost Considerations		
• life-cycle cost	78	
• funding availability	20	Unbudgeted item will require line item funding.
Industry Involvement		
• market for technology	20	This is an existing technology.
• private sector involvement	20	SRS facility evaluated

IDOA Score: **Technical** 56 **Total** 67

Waste Stream Number & Name: SR-W025 Solvent/TRU Job Control Waste <100 nCi/g
Option Number: SR-W025-3
Facility: CIF
Treatment Technology: Incineration/ Stabilization

Cost Estimate Sheet INCLUDES COST OF SR-W033-1

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled

Module Location: SRS

Module Status: [√] Existing [ ] New [ ] Small generator [√] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 64	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 255	
		1.3.2 Safety Assurance Documentation	$ 64	
		1.3.3 Permitting	$ 125	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 7	
		TOTAL PRE-OPERATIONS		$ 665
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 300	
	2.2	Inspection	$ 59	
	2.3	Project Management	$ 66	
	2.4	Building Construction (inc. indirect)	$ 160	
	2.5	Equipment (inc. indirect)	$ 1,202	
	2.6	Construction Management	$ 95	
	2.7	Contingency	$ 661	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 2,544
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 185	
	3.2	Annual Utilities	$ 7	
	3.3	Annual Materials	$ 111	
	3.4	Annual Maintenance	$ 67	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 370	
		X NUMBER OF YEARS OF OPERATION	5.00	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 1,8520
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 1,090	
	4.2	Closure, Post-Closure, Monitoring	$ 2	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 1,092
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 43
		SUB COST FOR INCINERATION/STABILIZATION MODULE		$ 6,194
		ESCALATION		1.605
		TOTAL COST		$ 9,941

If above numbers do not appear to add correctly, it is the result of computer rounding.
Note: Per DOE directions, this cost estimate is the incremental cost for treatment at an offsite DOE facility; therefore, it carries r overhead burden or capital costs.

Waste Stream Number & Name: **SR-W025 Solvent/TRU Job Control Waste <100 nCi/g**

Option Number: **SR-W025-4**
Facility: **INEL/IWPF**

Treatment Technology: **Incineration/ Stabilization**

Treatment Technology

Idaho National Engineering Laboratory (INEL) Idaho Waste Processing Facility (IWPF) incinerator is in the preliminary design phase. The type of kiln and offgas system have not yet been determined.

Pros

- Incineration will reduce the waste volume by more than 100 to one.
- The facility will treat waste streams similar in composition to those assumed in the design basis without modification.
- Any ash waste generated, after stabilization, is anticipated to meet the SRS disposal WAC.
- Process failure is not anticipated to result in the creation of a waste that cannot be treated.

Cons

- The facility is in preliminary design phase, uncertain of facility design and secondary waste streams. An ash waste stream and some blowdown type wastes are anticipated.
- The process is currently in the preliminary design phase, final incinerator type has not been selected.
- Uncertainties surrounding the design prevent an accurate estimation of availability.
- A schedule for waste treatment can be provided; however, acceptance of SRS waste will be contingent upon state-approved permit modifications. In addition, facility operation is contingent upon the receipt of DOE funding.
- Waste characterization will be required for any waste streams returned to SRS for disposal.
- The process will require RCRA Part B Permit Application approval from the state. State approval for treatment of offsite waste may be difficult.
- The majority of the treated waste will be classified as mixed waste which will require disposal in a HW/MW facility.
- Currently stakeholder acceptance of incineration is perceived as low. Public approval of incineration is anticipated to drop will the additional treatment of offsite wastes.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	100	Add 20 points to the median score of 80 because incineration will reduce the waste volume by more than 100 to one.
• secondary waste generation	20	The facility is in preliminary design phase, uncertain of facility design and secondary waste streams. An ash waste stream and some blowdown type wastes are anticipated.
• destruction removal and demobilization efficiency	50	Additional LDR treatment may be required for waste streams contaminated with non-organic materials.
• flexibility	80	The facility will treat waste streams similar in composition to those assumed in the design basis without modification.
• ability to be shipped	50	The ash waste, when generated, must be stabilized in a grout matrix prior to shipment.
• final wasteform	80	Any ash waste generated, after stabilization, is anticipated to meet the SRS disposal WAC.

Waste Stream Number & Name: SR-W025 Solvent/TRU Job Control Waste <100 nCi/g
Option Number: SR-W025-4
Facility: INEL/IWPF
Treatment Technology: Incineration/ Stabilization

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Engineering Parameters		
• system implementability	20	The process is currently in the preliminary design phase and final incinerator type has not been selected.
• availability	20	Uncertainties surrounding the design prevent an accurate estimation of availability.
• scalability	50	The facility is currently in the preliminary design phase. Any modification required for unique waste streams could be incorporated in to the facility design.
• remedial measures	80	Process failure is not anticipated to result in the creation of a waste that cannot be treated.
• schedule for treatment of waste	20	A schedule for waste treatment cannot be provided. Additionally, acceptance of SRS waste will be contingent upon State of Idaho-approved permit modifications. Also facility operation is contingent upon the receipt of DOE funding.
Personnel Parameters		
• consequence of unmitigated accident scenarios	50	Emissions form the planned facility could result during potential accident scenarios.
• non operational worker potential exposure	50	Personnel exposure is expected to be average for operations of this type.
• operational worker potential exposure	50	Personnel exposure is anticipated to be average for operations of this type.
• transportation potential exposure	20	Waste characterization will be required for any waste streams returned to SRS for disposal.
Regulatory Parameters		
• need for variance	20	The process will require RCRA Part B Permit Application approval from the state. State of Idaho approval for treatment of offsite waste may be difficult.
• ability to obtain a permit	50	Permitting process is well defined, however, the state's acceptance of offsite waste treatment is unknown. Approval may be difficult.
• waste disposal	20	The majority of the treated waste will be classified as mixed waste which will require disposal in a HW/MW facility.
Public Acceptance		
• public acceptance	20	Currently stakeholder acceptance of incineration is perceived as low. Public approval of incineration is anticipated to drop will the additional treatment of offsite wastes.
Cost Considerations		
• life-cycle cost	17	
• funding availability	50	Funding for treatment cost can be provide using the operating budget, however the additional costs may result in an increase in the budget in excess of 10%. (Line item funding is being pursued by the facility contractor).

Waste Stream Number & Name: SR-W025 Solvent/TRU Job Control Waste <100 nCi/g
Option Number: SR-W025-4
Facility: INEL/IWPF
Treatment Technology: Incineration/ Stabilization

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Industry Involvement-		
• market for technology	20	This is an existing commercial technology.
• private sector involvement	20	Technology is being developed at an existing DOE facility.

IDOA Score: **Technical** 36 **Total** 50

Waste Stream Number & Name: SR-W025 Solvent/TRU Job Control Waste <100 nCi/g
Option Number: SR-W025-4
Facility: INEL/IWPF
Treatment Technology: Incineration/ Stabilization

Cost Estimate Sheet INCLUDES COST OF SR-W033-4

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled

Module Location: INEL

Module Status: [ ] Existing [√] New [ ] Small generator [√] Large generator
[ ] Onsite [√] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ N/A	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ N/A	
		1.3.2 Safety Assurance Documentation	$ N/A	
		1.3.3 Permitting	$ N/A	
		1.3.4 Preparation for Operations	$ N/A	
		1.3.5 Project Management	$ N/A	
		TOTAL PRE-OPERATIONS		$ N/A
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ N/A	
	2.2	Inspection	$ N/A	
	2.3	Project Management	$ N/A	
	2.4	Building Construction (inc. indirect)	$ N/A	
	2.5	Equipment (inc. indirect)	$ N/A	
	2.6	Construction Management	$ N/A	
	2.7	Contingency	$ N/A	
		TOTAL FACILITY CONSTRUCTION COSTS		$ N/A
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ N/A	
	3.2	Annual Utilities	$ N/A	
	3.3	Annual Materials	$ N/A	
	3.4	Annual Maintenance	$ N/A	
	3.5	Annual Contingency	$ N/A	
		TOTAL ANNUAL O & M	$ N/A	
		X NUMBER OF YEARS OF OPERATION		
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ N/A
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ N/A	
	4.2	Closure, Post-Closure, Monitoring	$ N/A	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ N/A
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$ N/A	
	5.2	Mobile Treatment	$ N/A	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$ 154
7.0	Transportation			$ 1,000
8.0	Disposal			$ 100
		SUB COST FOR INCINERATION/STABILIZATION MODULE		$ 1,254
		ESCALATION		1.344
		TOTAL COST		$ 1,685

Note: Per DOE directions, this cost estimate is the incremental cost for treatment at an offsite DOE facility; therefore, it carries no overhead burden or capital costs.

If above numbers do not appear to add correctly, it is the result of computer rounding.

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Summary Page

Waste Stream Number & Name: SR-W026 Thirds/TRU Job Control Waste

Background Information

This waste stream is a defense-related TRU waste and is composed primarily of *organic* solids such as booties, lab coats, floor sweepings, rags, labware, and other job control waste generated primarily through separation activities for plutonium production.

Volume
- Current volume through 09/30/94 is 67 m^3.
- Expected 1995-1999 volume will be 241 m^3.

Waste Stream Composition
- Organic debris

Waste Code
- D001C (Ignitable)
- D003D
- D004A (TCLP Ag)
- D006A
- D007A-D009A
- D011A
- D018-D019 (characteristic organics)
- D022-D026
- P012 (acutely toxic commercial chemical wastes)
- P015
- P048
- P113
- P120
- U002 (commercial chemical products)
- U032
- U052
- U080
- U133
- U134
- U144
- U151
- U154
- U161
- U209
- U211
- U220
- U226
- U239

LDR Treatment Standard
- Manage at the Waste Isolation Pilot Plant (WIPP) through a No-Migration Determination

Waste Characterization
- Sampling and analysis used to characterize the waste stream.
- Confidence level is medium based on the varying composition of the job waste as it is generated.

Radiological Characterization

- Total activity is >100 nCi/g
- Contains Pu^{238}, Pu^{239}, Pu^{240}, Pu^{241}, Pu^{242}, Am^{241}, U^{233}, H^3, Co^{60}, Cs^{137}, and other isotopes (transuranics and alpha emitters)
- Waste is contact handled.
- Mixed transuranic waste (MTRU)

Preferred Option

The preferred option for this waste stream is to assay, sort, size reduce, and characterize the waste stream at the TRU Waste Certification/Characterization Facility (TWCCF), followed by preparation, shipment to, and disposal at, WIPP.

Treatment Justification

In-depth options analysis is not required for this waste stream. For further information on this waste stream, see the "TRU Waste Management Section," Chapter 4, of Volume II.

Summary Page

Waste Stream Number & Name: SR-W027 Solvent TRU Job Control Waste

Background Information

This waste stream is a defense-related TRU waste and is composed primarily of solids such as booties, lab coats, floor sweepings, rags, labware, and other job control waste generated primarily through separation activities for plutonium production. This waste differs from SR-W026 because solvent rags are suspected of being in the waste. A conservative interpretation of the mixture rule causes contents of containers to be characterized with listed solvent waste codes due to the presence of solvent rags.

Volume

- Current volume through 09/30/94 is 4873.2 m^3.
- No future waste generation is expected because of a current program that segregates F-listed solvent rags from other job control waste. This waste stream ceased to be generated when the solvent rag program was implemented. Thirds TRU is the current waste stream which evolved from SR-W027 under current F-listed solvent waste segregation.

Waste Stream Composition

- Organic debris

Waste Codes

- D001C (Ignitable)
- D003D
- D004A (TCLP metals)
- D006A
- D007A-D009A
- D011A
- D018-D019 (characteristic organics)
- D022-D026
- F001-F003 (halogenated and nonhalogenated spent solvents)
- F005A
- P012 (acutely toxic commercial chemical wastes)
- P015
- P048
- P113
- P120
- U002 (commercial chemical wastes)
- U032
- U052
- U080
- U133
- U134
- U144
- U151
- U154
- U161
- U209
- U211
- U220
- U226
- U239

LDR Treatment Standard

- Manage at the WIPP through a No-Migration Determination.

Waste Characterization

- Sampling and analysis used to characterize the waste stream.
- Confidence level is medium based on the varying composition of the job waste and the exact contents of specific waste containers.

Radiological Characterization

- Total activity is >100 nCi/g.
- Contains Pu^{238}, Pu^{239}, Pu^{240}, Pu^{241}, Pu^{242}, Am^{241}, U^{233}, H^3, Co^{60}, Cs^{137}, and other isotopes.
- Waste is contact handled.
- Mixed transuranic waste (MTRU)

Preferred Option

The preferred option for this waste stream is to assay, sort, size reduce, and characterize the stream in the TRU Waste Certification/Characterization Facility (TWCCF), followup by preparation, shipment to, disposal at, WIPP.

Treatment Justification

In-depth options analysis is not required for this waste stream.. For further information on this waste stream, see the "TRU Waste Management Section," Chapter 4 of Volume II.

Summary Page – Initial Screening

Waste Stream Number & Name: SR-W028 Mark 15 Filter Paper

Background Information

The filter paper is from a plate and frame filter press used in M Area to filter etching solution from nickel plating solutions. The filter paper is contaminated with residual filtercake.

Volume
- Current volume through 09/30/94 is 1.0 m^3.
- No future waste generation expected because the manufacturing process which generated this waste is no longer operational.

Waste Stream Composition
- Organic debris

Waste Code
- F006 (metal plating line waste, without cyanide)

LDR Treatment Standard
- F006 = concentration based standard = 0.19-5.0 mg/l

Waste Characterization
- Process knowledge used to characterize the waste stream.
- Confidence level is high based upon analysis on a similar material and knowledge that the process generates a listed hazardous waste.
- Primary contaminant is Ni. Others included are Cd, Cr, Pb, and Ag, but these are below RCRA LDR concentration standards.

Radiological Characterization
- Total activity is 10-100 nCi/g.
- Alpha emitters are U^{234}, U^{235}, U^{236}, and U^{238}.
- Waste is contact handled.
- Mixed low-level waste

Initial Screening

The initial screening identified inappropriate treatment options. These options appear in the Initial Rejections table.

Initial Rejections

Treatment Facility	Treatment Technology	Reasons for Rejection
ETF	Ion Exchange	ETF has no process to treat this waste.
Lab.	Lab-scale process flowsheet	Volume of waste too great to handle with laboratory-scale equipment.
LETF	Ion Exchange	Wastewater treatment is not designed to treat this stream.
Z Area	Stabilization	Z Area can treat only those wastes that come by pipeline from Tank 50 and meet strict waste acceptance criteria. The Z-Area process lacks flexibility to treat and dispose of a variety of waste streams.

Summary Page – Technology Success Factor (TSF) & In-Depth Options Analysis (IDOA)

Waste Stream Number & Name: SR-W028 Mark 15 Filter Paper

Feasible Options

Option No.	Treatment Facility	Treatment Technology	TSF Score	IDOA Scores Tech.	IDOA Scores Total	COST (x 1,000)	PO
SR-W028-1	CIF	Incineration/ Stabilization	94	56	70	416	√
SR-W028-2	M Area	Vitrification	75	57	71	416	
SR-W028-3	CIF	Ashcrete Stabilization	88	53	65	4,561	
SR-W028-4	Cont. Bldg.	Macro-encapsulation	100	58	70	4,838	
SR-W028-5	HW/MW-TB	Macro-encapsulation	100	58	71	2,009	
SR-W028-6	INEL/WEDF	Stabilization	*	52	66	138	
SR-W028-7	Vendor	Plasma Hearth	1				
SR-W028-8	Vendor	Plasma Arc	1				

* No TSF required for proposed or existing non-Savannah River Site-DOE waste processing facilities.

Options Rejected Due To Low Technology Success Factor (TSF)

Plasma Arc Centrifugal Treatment by Vendor

Plasma arc centrifugal treatment by vendor was rejected because:

- Plasma arc centrifugal incineration is currently still in the laboratory with no units in the field, hence, Pm=0.9.
- Control of the process requires sophisticated computerized instrumentation, hence, Pc=0.9.
- It is not expected for this technology to reach a level of reliability suitable for industrial application for 5-10 years.

Plasma Hearth Process by Vendor

Plasma hearth process by vendor was rejected because:

- Plasma hearth incineration is currently still in the laboratory. While prototypes may exist, they have no record of continuous reliable operation in industrial settings, hence, Pm=0.9.
- Control of the process requires sophisticated computerized instrumentation, hence, Pc=0.9.
- It is not expected for this technology to reach a level of reliability suitable for industrial application for 5-10 years.

Engineering Assessment

Preferred Option Justification

The preferred treatment option for the Mark 15 Filter Paper waste stream is Incineration followed by Stabilization in the Consolidated Incineration Facility (CIF).

This option treats the constituent of concern and the plating line waste by incinerating the combustible fraction of the filter paper by conversion to carbon dioxide and water and stabilizing the metal-containing ash.

This option is preferred because:

- Waste volume will be reduced by a factor of at least two.
- Final wasteform will meet LDR standards.
- Incineration and ash stabilization are demonstrated technologies.
- CIF is currently under construction.
- Residual solids are stabilized with cement.
- It is a cost-effective option.

Options Rejected During IDOA

Ashcrete Stabilization at CIF

Ashcrete Stabilization at CIF was rejected because:

- Waste volume more than doubles.
- Final wasteform requires disposal in HW/MW facility.

Vitrification by M-Area Vendor Treatment Process

Vitrification by M-Area Vendor Treatment Process was rejected because:

- Extensive treatability studies will be required to confirm viability of treatment method.
- Uncertainties exist about vitrifier's capability of handling waste material added directly to the melt pool.
- Without treatment of waste stream SR-W018 to also help bear the burden of overhead costs, this option is not cost-effective.

Macroencapsulation in Stainless Steel Boxes (either in a Containment Building or in HW/MW-TB)

Macroencapsulation in stainless steel boxes (either in a containment building or in HW/MW-TB) was rejected because:

- Waste volume more than doubles.
- Final wasteform requires disposal in HW/MW facility.
- This process is not cost-effective unless it is also selected for waste stream SR-W018.

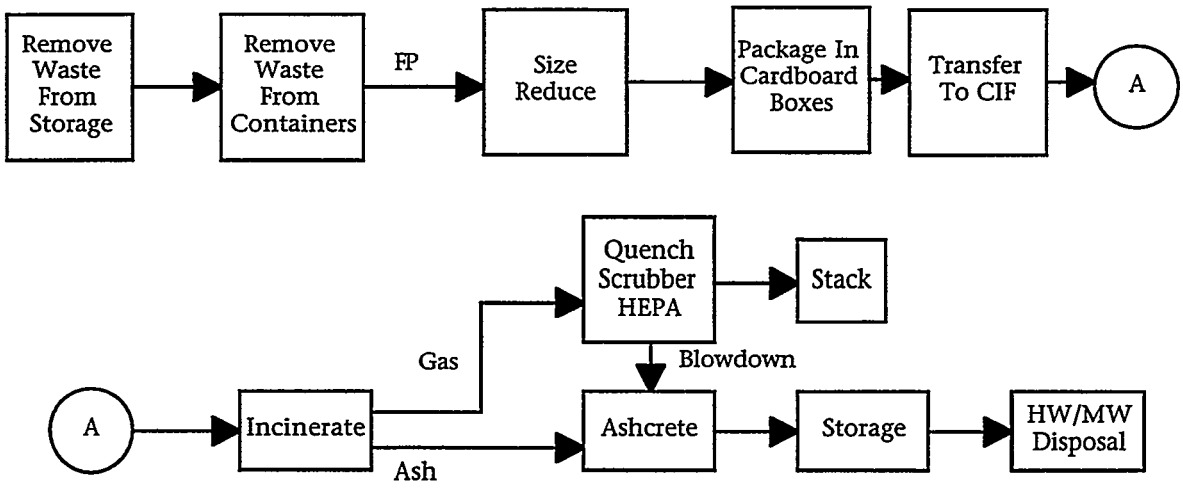
Stabilization at INEL/WEDF

Stabilization at INEL/WEDF (encapsulating the waste with a grout matrix) was rejected because:

- Waste volume more than doubles.
- Final wasteform requires disposal in HW/MW facility.
- Throughput will be limited by design. Facility currently being designed.

Waste Stream Number & Name: SR-W028 Mark 15 Filter Paper
Option Number: SR-W028-1
Facility: CIF
Treatment Technology: Incineration/ Stabilization

Treatment Cycle Flow Diagram



Pros

- Expect at least 2:1 volume reduction.
- The waste stream is expected to meet all applicable LDR standards after treatment by this facility.
- Incinerator designed for a wide range of wastes with some operational limitations.
- Waste required no additional treatment to meet shipping requirements.
- Final wasteform meets the expected WAC upon exit from the process.
- Incineration is a current demonstrated technology, and all elements and processes have been previously demonstrated.
- Process failure should not create a waste that cannot be treated by existing technologies.
- Reasonably easy to schedule this waste steam assuming current startup schedule.
- Most of the additional metals in this waste stream will be captured in the ashcrete. Resulting in little or no emissions even in most accidents.
- No increase in non operational workers is required to treat this waste, but increase in non-routine maintenance will be required.
- No impact due to this waste stream. No impact because there is no increase in exposure potential and no additional workers are required.
- Processes are in full compliance with all applicable regulations and no process modifications are needed.
- This waste is part of the basis for permitting. Final wasteform must meet the LDR treatment standards.
- Line item is funded.

Cons

- 100% of the final wasteform will go to the HW/MW vaults.
- The public has limited acceptance of treatment involving incineration.

Waste Stream Number & Name: SR-W028 Mark 15 Filter Paper
Option Number: SR-W028-1
Facility: CIF
Treatment Technology: Incineration/ Stabilization

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	70	Subtract 10 points from the median score of 80 because of at least 2:1 volume reduction.
• secondary waste generation	50	Significant volume of secondary waste due to non-combustible sludge and it can be handled by an existing technology.
• destruction removal and demobilization efficiency	80	All applicable LDR standards after treatment by this facility.
• flexibility	80	Incinerator designed for a wide range of wastes with some operational limitations.
• ability to be shipped	80	Waste required no additional treatment to meet shipping requirements.
• final wasteform	80	Final wasteform meets the expected waste disposal WAC upon exit from the process.
Engineering Parameters		
• system implementability	100	Incineration is a current demonstrated technology. Add 20 points to the median score of 80 because all elements and processes have been previously demonstrated.
• availability	50	Incinerator availability for solids is 50. Normal maintenance requirements apply. This waste stream may require a "clean-out" earlier than anticipated based on curie load.
• scalability	50	Process can accept a range of input but capacity is set by design. Excess capacity does exist at this point.
• remedial measures	70	Subtract 10 points from the median score of 80 because the presence of metals in the secondary wastes might require rework. Process failure should not create a waste that cannot be treated by existing technologies.
• schedule for treatment of waste	80	Reasonably easy to schedule this waste steam assuming current startup schedule.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Most of the additional metals in this waste stream will be captured in the ashcrete, resulting in little or no emissions even in most accidents.
• non operational worker potential exposure	50	Processing this material will not increase the exposure to non operational personnel.
• operational worker potential exposure	50	Personnel exposure is average for operations of this type. Processing this material will not increase the exposure to operational personnel.
• transportation potential exposure	50	Requires transportation, but limited additional characterization required to support transportation.
Regulatory Parameters		
• need for variance	80	Processes are in full compliance with all applicable regulations and no variances are needed.

Waste Stream Number & Name: SR-W028 Mark 15 Filter Paper
Option Number: SR-W028-1
Facility: CIF
Treatment Technology: Incineration/ Stabilization

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• ability to obtain a permit	100	Add 20 points to the median score of 80 because this waste is part of the basis for permitting.
• waste disposal	20	100% of the final wasteform will go to the HW/MW vaults.
Public Acceptance		
• public acceptance	20	The public has limited acceptance of treatment involving incineration.
Cost Considerations		
• life-cycle cost	99	
• funding availability	80	Line item is funded.
Industry Involvement		
• market for technology	20	Technology has applicability to all DOE complex sites. Technology is being purchased. Nothing new to market.
• private sector involvement	20	Technology is available at an existing DOE facility.

IDOA Score: **Technical** 56 **Total** 70

Waste Stream Number & Name: SR-W028 Mark 15 Filter Paper
Option Number: SR-W028-1
Facility: CIF
Treatment Technology: Incineration/ Stabilization

Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[ ] alpha [ ] non-alpha [√] contact handled [ ] remote handled

Module Location: INEL

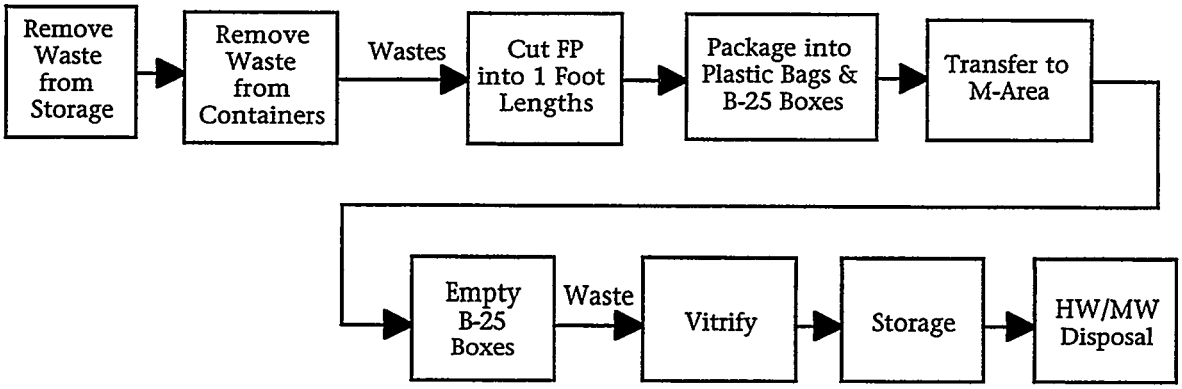
Module Status: [ ] Existing [√] New [√] Small generator [ ] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$	
	1.2	Demonstration Costs	$	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 2	
		1.3.2 Safety Assurance Documentation	$	
		1.3.3 Permitting	$ 125	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$	
		TOTAL PRE-OPERATIONS		$ 178
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 2	
	2.2	Inspection	$	
	2.3	Project Management	$	
	2.4	Building Construction (inc. indirect)	$	
	2.5	Equipment (inc. indirect)	$ 10	
	2.6	Construction Management	$ 1	
	2.7	Contingency	$ 5	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 18
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 12	
	3.2	Annual Utilities	$	
	3.3	Annual Materials	$ 7	
	3.4	Annual Maintenance	$ 4	
	3.5	Annual Contingency	$ 24	
		TOTAL ANNUAL O & M	$ 1	
		X NUMBER OF YEARS OF OPERATION		
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 24
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 8	
	4.2	Closure, Post-Closure, Monitoring	$ 0	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 8
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ NIL
		SUB COST FOR INCINERATION/STABILIZATION MODULE		$ 328
		ESCALATION		1.267
		TOTAL COST		$ 416

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W028 Mark 15 Filter Paper
Option Number: SR-W028-2
Facility: M Area
Treatment Technology: Vitrification

Treatment Cycle Flow Diagram



Pros

- Volume reduction greater than 5:1.
- All applicable LDR treatment standards are met and if waste is delisted (F006), final waste will be non-hazardous.
- Fixed quantity of known waste.
- Will meet all shipping requirements.
- Final vitrified wasteform will meet disposal WAC. No additional treatment required.
- An alternative study shows equipment is available for cutting rolls. A pilot-scale demonstration has been successful.
- Recoverable. Recycle through melter.
- Schedule easily developed.
- It is not different from waste currently scheduled for treatment here.
- Additional non-routine maintenance required.
- Treatment will render wasteform to compliance with LDR. No variance required.

Cons

- Not budgeted. Will require increase in operating budget.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	90	Add 10 points to the median score of 80 because volume reduction >5:1.
• secondary waste generation	50	Some secondary waste in the form of a sludge will require further treatment by existing technology.
• destruction removal and demobilization efficiency	80	All applicable LDR treatment standards are met.
• flexibility	80	Vitrification technology can handle a wide variety of wastes without extensive adjustments in operating parameters.
• ability to be shipped	80	Will meet all shipping requirements.
• final wasteform	100	Final vitrified wasteform will meet disposal WAC. Add 20 points to the median score of 80 because no additional treatment required.

Waste Stream Number & Name: SR-W028 Mark 15 Filter Paper
Option Number: SR-W028-2
Facility: M Area **Treatment Technology: Vitrification**
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Engineering Parameters		
• system implementability	80	An alternative study shows equipment is available for cutting rolls. A pilot scale demonstration has been successful.
• availability	50	Normal maintenance requirements apply. This waste stream may require a "clean-out" earlier than anticipated based on curie load.
• scalability	50	Throughput is set by design and not easily expanded except by adding additional shifts of operation.
• remedial measures	80	Recoverable. Recycle through melter.
• schedule for treatment of waste	80	Schedule easily developed.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Consequence of accidents is not different from waste currently scheduled for treatment here.
• non operational worker potential exposure	50	Additional non routine maintenance required.
• operational worker potential exposure	40	Size reduction and repackaging of waste will require extensive handling. Subtract 10 points from median score of 50 because of potential exposure during manual size reduction.
• transportation potential exposure	50	Nothing unusual about wasteform. Expect low alpha and no liquids.
Regulatory Parameters		
• need for variance	80	Expect treatment to render wasteform to compliance with LDR. No variance required.
• ability to obtain a permit	30	Wastewater permit would exist though it may require some modification. SCDHEC and/or EPA could require a RCRA Part B Permit Application for M Area with a change in waste stream. Subtract 20 points from median score of 50 because SCDHEC has expressed concerns about permitting additional wastes.
• waste disposal	50	Treated wasteform may require disposal in a HW/MW facility unless delisted.
Public Acceptance		
• public acceptance	50	Stakeholder acceptance of a glass wasteform is high, but lack of understanding technology and permitting may engender concerns.
Cost Considerations		
• life-cycle cost	99	
• funding availability	20	Not budgeted, will require increase in operating budget.

Waste Stream Number & Name: SR-W028 Mark 15 Filter Paper
Option Number: SR-W028-2
Facility: M Area **Treatment Technology:** Vitrification
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Industry Involvement		
• market for technology	20	This is an existing vendor process.
• private sector involvement	20	Technology is available as an existing vendor process.

IDOA Score: **Technical** 57 **Total** 71

Waste Stream Number & Name: SR-W028 Mark 15 Filter Paper
Option Number: SR-W028-2
Facility: M Area
Treatment Technology: Vitrification
Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[ ] alpha [ ] non-alpha [√] contact handled [ ] remote handled

Module Location: INEL

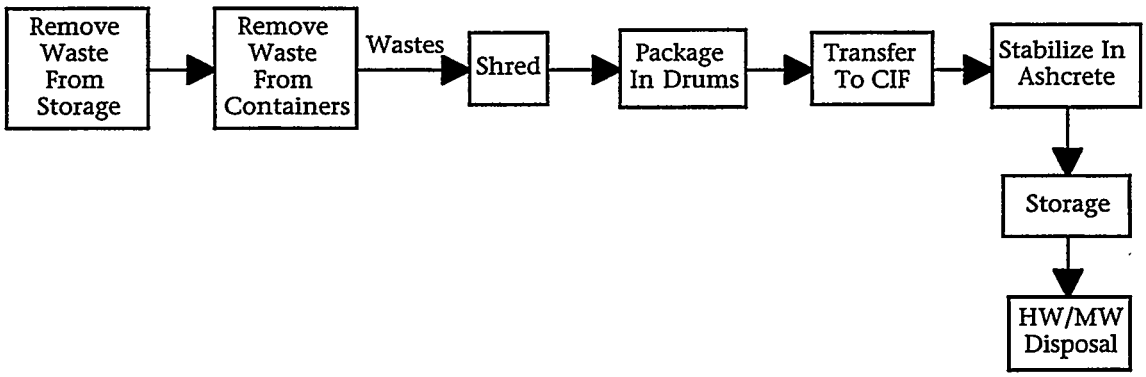
Module Status: [ ] Existing [√] New [√] Small generator [ ] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$	
	1.2	Demonstration Costs	$	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 2	
		1.3.2 Safety Assurance Documentation	$	
		1.3.3 Permitting	$ 125	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$	
		TOTAL PRE-OPERATIONS		$ 178
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 2	
	2.2	Inspection	$	
	2.3	Project Management	$	
	2.4	Building Construction (inc. indirect)	$	
	2.5	Equipment (inc. indirect)	$ 10	
	2.6	Construction Management	$ 1	
	2.7	Contingency	$ 5	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 18
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 12	
	3.2	Annual Utilities	$	
	3.3	Annual Materials	$ 7	
	3.4	Annual Maintenance	$ 4	
	3.5	Annual Contingency	$ 24	
		TOTAL ANNUAL O & M	$ 1	
		X NUMBER OF YEARS OF OPERATION		
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 24
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 8	
	4.2	Closure, Post-Closure, Monitoring	$ 0	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 8
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ NIL
		SUB COST FOR VITRIFICATION MODULE		$ 328
		ESCALATION		1.267
		TOTAL COST		$ 416

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W028 Mark 15 Filter Paper
Option Number: SR-W028-3
Facility: CIF
Treatment Technology: Ashcrete Stabilization

Treatment Cycle Flow Diagram



Pros

- No secondary waste is produced by the ashcrete process.
- The waste stream is expected to meet all applicable LDR standards after this treatment.
- The wasteform meets the expected WAC. Wasteform is suitable for disposal in the form it exits the process.
- Ashcrete is a current demonstrated technology and a proven technology.
- Process failure should not create a wasteform that cannot be treated by existing technologies.
- Reasonably easy to schedule this waste steam assuming current startup schedule.
- The metals in this waste stream will be captured in the ashcrete. Little or no emissions even during accidents.
- Additional nonroutine maintenance required.
- Well accepted wasteform. No variance is required.
- Modification required to facilities existing permit, but final waste must meet LDR treatment standards.
- Line item is funded.

Cons

- It is expected to increase volume by factor of three.
- 100% of the final wasteform will go to the HW/MW vaults.
- Wasteform is not as permanent as other forms of stabilization.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	10	Subtract 10 points from the median score of 20 because it is expected to increase volume by factor of 3.
• secondary waste generation	100	Add 20 points to the median score of 80 because no secondary waste produced by the ashcrete process.
• destruction removal and demobilization efficiency	80	The waste stream is expected to meet all applicable LDR standards after this treatment.
• flexibility	50	Waste handling of waste streams directly in ashcrete is an off-normal process, which lowers efficiency.

Waste Stream Number & Name: SR-W028 Mark 15 Filter Paper
Option Number: SR-W028-3
Facility: CIF
Treatment Technology: Ashcrete Stabilization

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• ability to be shipped	50	Wasteform may require additional characterization to determine that it satisfies shipping requirements.
• final wasteform	80	The wasteform meets the expected waste disposal WAC.
Engineering Parameters		
• system implementability	100	Add 20 points to this median score of 80 because ashcrete is a current demonstrated technology and a proven technology.
• availability	50	Normal maintenance requirements apply. This waste stream may require a "clean-out" earlier than anticipated based on curie load.
• scalability	50	Limited excess capacity exists because it is set by design.
• remedial measures	70	The presence of metals in the final wasteform might require rework. Subtract 10 points from the median score of 80 because a process failure could create a wasteform that can not be treated by existing technologies.
• schedule for treatment of waste	80	Reasonably easy to schedule this waste steam assuming current startup schedule.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	The metals in this waste stream will be captured in the ashcrete. Little or no emissions even during accidents.
• non operational worker potential exposure	70	Subtract 10 points from the median score of 80 because additional nonroutine maintenance required.
• operational worker potential exposure	50	Increased operator handling due to this waste stream so the potential for exposure is increased.
• transportation potential exposure	50	Does not require additional characterization to support transportation and limited number of waste transports required.
Regulatory Parameters		
• need for variance	80	Well accepted wasteform. No variance is required.
• ability to obtain a permit	50	Modification required to facilities existing permit, but final wasteform must meet LDR treatment standards.
• waste disposal	20	100% of the final wasteform will go to the HW/MW vaults.
Public Acceptance		
• public acceptance	20	Mature and proven technology, however wasteform is not as permanent as other forms of stabilization.
Cost Considerations		
• life-cycle cost	87	
• funding availability	80	Line item is funded.

Waste Stream Number & Name: SR-W028 Mark 15 Filter Paper
Option Number: SR-W028-3
Facility: CIF
Treatment Technology: Ashcrete Stabilization

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Industry Involvement		
• market for technology	20	Unique use of ashcrete system evaluated.
• private sector involvement	20	Technology is available at an existing DOE facility.

IDOA Score: Technical 53 Total 65

Waste Stream Number & Name: SR-W028 Mark 15 Filter Paper
Option Number: SR-W028-3
Facility: CIF
Treatment Technology: Ashcrete Stabilization

Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[ ] alpha [ ] non-alpha [√] contact handled [ ] remote handled

Module Location: INEL

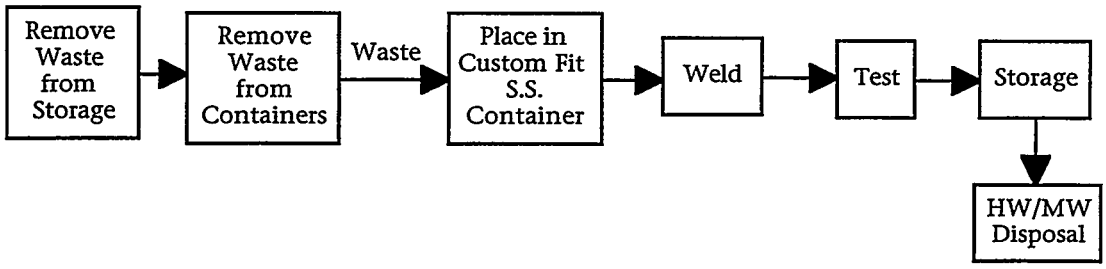
Module Status: [ ] Existing [√] New [√] Small generator [ ] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 23	
	1.2	Demonstration Costs	$	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 91	
		1.3.2 Safety Assurance Documentation	$ 23	
		1.3.3 Permitting	$ 2,000	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 18	
		TOTAL PRE-OPERATIONS		$ 2,305
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 99	
	2.2	Inspection	$ 30	
	2.3	Project Management	$ 48	
	2.4	Building Construction (inc. indirect)	$ 400	
	2.5	Equipment (inc. indirect)	$ 50	
	2.6	Construction Management	$ 32	
	2.7	Contingency	$ 237	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 895
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 12	
	3.2	Annual Utilities	$	
	3.3	Annual Materials	$ 7	
	3.4	Annual Maintenance	$ 4	
	3.5	Annual Contingency	$ 24	
		TOTAL ANNUAL O & M	$ 1	
		X NUMBER OF YEARS OF OPERATION		
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 24
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 360	
	4.2	Closure, Post-Closure, Monitoring	$ 1	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 361
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 15
		SUB COST FOR ASHCRETE STABILIZATION MODULE		$ 3,600
		ESCALATION		1.267
		TOTAL COST		$ 4,561

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W028 Mark 15 Filter Paper
Option Number: SR-W028-4
Facility: Containment Building
Treatment Technology: Macroencapsulation in a S. S. Box

Treatment Cycle Flow Diagram



Pros

- Process satisfies requirements of the "debris rule" and all applicable LDR standards are met.
- Can process a wide range of materials.
- Stainless steel containers will meet current DOT shipping requirements.
- Final wasteform will meet RCRA Subtitle C Disposal WAC.
- All processes involved are existing technology.
- Similar systems have demonstrated availability of greater than 80.
- Process failure does not produce altered wasteform. A failed container is easily fixed.
- Due to process simplicity, a schedule can be developed easily.
- Process does not create emissions related to the waste stream. Process simply involves container welding.
- Simple welding process requiring minimal maintenance. No additional requirements for decommissioning.
- Exposure controlled by design and less than average number of workers. Low potential for exposure.
- Little secondary waste.

Cons

- All waste will require disposal in HW/MW facilities.
- Not a budget item and will require line item funding.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	40	Subtract 10 points from the median score of 50 because volume of material increases slightly due to packaging in stainless steel container.
• secondary waste generation	80	Little secondary waste.
• destruction removal and demobilization efficiency	80	All applicable LDR standards are met.
• flexibility	80	Can process a wide range of materials.
• ability to be shipped	80	S. S. containers will meet current DOT shipping requirements.
• final wasteform	80	Final wasteform will meet RCRA Subtitle C Disposal WAC.

Waste Stream Number & Name: SR-W028 Mark 15 Filter Paper
Option Number: SR-W028-4
Facility: Containment Building
Treatment Technology: Macroencapsulation in a S. S. Box

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Engineering Parameters		
• system implementability	90	Add 10 points to the median score of 80 because all processes involved are existing technology.
• availability	80	Similar systems have demonstrated availability of greater than 80%.
• scalability	50	Throughput is set by design and not easily expanded except by adding additional shifts of operation.
• remedial measures	90	Process failure does not produce altered wasteform. Add 10 points to the median score of 80 because a failed container is easily fixed.
• schedule for treatment of waste	80	Due to process simplicity, a schedule can be developed easily.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Process does not create emissions related to the waste stream. Process simply involves container welding.
• non operational worker potential exposure	80	Simple welding process requiring minimal maintenance. No additional requirements for decommissioning.
• operational worker potential exposure	80	Exposure controlled by design and less than average number of workers. Low potential for exposure.
• transportation potential exposure	60	No additional characterization needed. Add 10 points to the median score of 50 because waste can be handled readily.
Regulatory Parameters		
• need for variance	80	Process satisfies requirements of the "debris rule."
• ability to obtain a permit	40	Subtract 10 points from the median score of 50 because uncertainties surround attaining a permit related to the "debris rule" and the "containment rule."
• waste disposal	20	All waste will require disposal in HW/MW facilities.
Public Acceptance		
• public acceptance	40	Public concern should be limited due to the simplicity of the process. Subtract 10 points from the median score of 50 because the wasteform is not as permanent as vitrification.
Cost Considerations		
• life-cycle cost	100	
• funding availability	20	Not a budget item and will require line item funding.
Industry Involvement		
• market for technology	20	This is an existing technology.
• private sector involvement	50	Technology could be provided by either DOE or vendor.

IDOA Score: **Technical** 58 **Total** 70

Waste Stream Number & Name: SR-W028 Mark 15 Filter Paper
Option Number: SR-W028-4
Facility: Containment Building
Treatment Technology: Macroencapsulation in a S. S. Box

Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[ ] alpha [ ] non-alpha [√] contact handled [ ] remote handled

Module Location: INEL

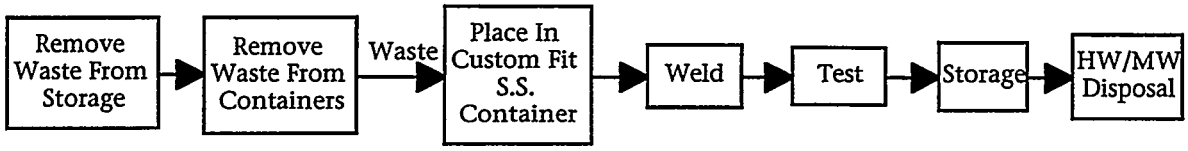
Module Status: [ ] Existing [√] New [√] Small generator [ ] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 23	
	1.2	Demonstration Costs	$	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 91	
		1.3.2 Safety Assurance Documentation	$ 23	
		1.3.3 Permitting	$ 2,000	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 18	
		TOTAL PRE-OPERATIONS		$ 2,305
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 99	
	2.2	Inspection	$ 30	
	2.3	Project Management	$ 48	
	2.4	Building Construction (inc. indirect)	$ 400	
	2.5	Equipment (inc. indirect)	$ 50	
	2.6	Construction Management	$ 32	
	2.7	Contingency	$ 237	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 895
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 12	
	3.2	Annual Utilities	$	
	3.3	Annual Materials	$ 7	
	3.4	Annual Maintenance	$ 4	
	3.5	Annual Contingency	$ 24	
		TOTAL ANNUAL O & M	$ 1	
		X NUMBER OF YEARS OF OPERATION		
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 24
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 360	
	4.2	Closure, Post-Closure, Monitoring	$ 1	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 361
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 15
		SUB COST FOR MACROENCAPSULATION MODULE		$ 3,600
		ESCALATION		1.344
		TOTAL COST		$ 4,838

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W028 Mark 15 Filter Paper
Option Number: SR-W028-5
Facility: HW/MW-TB
Treatment Technology: Macroencapsulation in a S. S. Box

Treatment Cycle Flow Diagram



Pros

- Process satisfies requirements of the "debris rule" and all applicable LDR standards are met.
- Can process a wide range of materials.
- S. S. containers will meet current DOT shipping requirements.
- Final wasteform will meet RCRA Subtitle C Disposal WAC.
- All processes involved are existing technology.
- Similar systems have demonstrated availability of greater than 80%.
- The process failure does not produce altered wasteform. A failed container is easily fixed.
- Due to process simplicity, a schedule can be developed easily.
- Process does not create emissions related to the waste stream. Process simply involves container welding.
- Simple welding process requiring minimal maintenance. No additional requirements for decommissioning.
- Exposure controlled by design. Number of workers is dependent upon throughput.
- Little secondary waste.

Cons

- All waste will require disposal in HW/MW facilities.
- Not a budgeted item and will require line item funding.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	40	Subtract 10 points from the median score of 50 because volume of material increases slightly due to packaging in S. S. container.
• secondary waste generation	50	Initial container will require disposal.
• destruction removal and demobilization efficiency	80	All applicable LDR standards are met.
• flexibility	80	Can process a wide range of materials.
• ability to be shipped	80	S. S. containers will meet current DOT shipping requirements.
• final wasteform	80	Final wasteform will meet RCRA Subtitle C Disposal WAC.
Engineering Parameters		
• system implementability	90	Add 10 points to the median score of 80 because all processes involved are existing technology.
• availability	80	Similar systems have demonstrated availability of greater than 80%.
• scalability	50	Throughput is set by design and not easily expanded except by adding additional shifts of operation.

Waste Stream Number & Name: SR-W028 Mark 15 Filter Paper
Option Number: SR-W028-5
Facility: HW/MW-TB
Treatment Technology: Macroencapsulation in a S. S. Box

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• remedial measures	90	The process failure does not produce altered wasteform. Add 10 points to the median score of 80 because a failed container is easily fixed.
• schedule for treatment of waste	80	Due to process simplicity, a schedule can be developed easily.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Process does not create emissions related to the waste stream. Process simply involves container welding.
• non operational worker potential exposure	80	Simple welding process requiring minimal maintenance. No additional requirements for decommissioning.
• operational worker potential exposure	80	Exposure controlled by design. Number of workers is dependent upon throughput.
• transportation potential exposure	60	No additional characterization needed. Add 10 points to the median score of 50 because waste can be handled readily.
Regulatory Parameters		
• need for variance	80	Process satisfies requirements of the "debris rule."
• ability to obtain a permit	40	Subtract 10 points from the median score of 50 because uncertainties surround attaining a permit related to the "debris rule" and the "containment rule."
• waste disposal	20	All waste will require disposal in HW/MW facilities.
Public Acceptance		
• public acceptance	40	Public concern should be limited due to the simplicity of the process. Subtract 10 points from the median score of 50 because the wasteform is not as permanent as vitrification.
Cost Considerations		
• life-cycle cost	100	
• funding availability	20	Not a budgeted item and will require line item funding.
Industry Involvement		
• market for technology	20	This is an existing technology.
• private sector involvement	20	SRS facility evaluated.

IDOA Score: **Technical** 58 **Total** 71

Waste Stream Number & Name: SR-W028 Mark 15 Filter Paper
Option Number: SR-W028-5
Facility: HW/MW-TB
Treatment Technology: Macroencapsulation in a S. S. Box

Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[ ] alpha [ ] non-alpha [√] contact handled [ ] remote handled
Module Location: INEL
Module Status: [ ] Existing [√] New [√] Small generator [ ] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 18	
	1.2	Demonstration Costs	$	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 71	
		1.3.2 Safety Assurance Documentation	$ 18	
		1.3.3 Permitting	$ 125	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 14	
		TOTAL PRE-OPERATIONS		$ 395
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 77	
	2.2	Inspection	$ 23	
	2.3	Project Management	$ 37	
	2.4	Building Construction (inc. indirect)	$ 300	
	2.5	Equipment (inc. indirect)	$ 50	
	2.6	Construction Management	$ 25	
	2.7	Contingency	$ 184	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 695
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 12	
	3.2	Annual Utilities	$	
	3.3	Annual Materials	$ 7	
	3.4	Annual Maintenance	$ 4	
	3.5	Annual Contingency	$ 24	
		TOTAL ANNUAL O & M	$ 1	
		X NUMBER OF YEARS OF OPERATION		
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 24
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 280	
	4.2	Closure, Post-Closure, Monitoring	$ 1	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 281
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 15
		SUB COST FOR MACROENCAPSULATION MODULE		$ 1,409
		ESCALATION		1.426
		TOTAL COST		$ 2,009

Note: Per DOE directions this cost estimate is the incremental cost for treatment at an offsite DOE facility; therefore, it carries no overhead burden for capital costs.
If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W028 Mark 15 Filter Paper
Option Number: SR-W028-6
Facility: INEL/WEDF **Treatment Technology: Stabilization**

Treatment Technology

The Idaho National Engineering Laboratory (INEL) Waste Engineering Development Facility (WEDF) Stabilization process provides treatments for aqueous and organic liquids and debris. The process stabilizes waste in a grout matrix to reduce leachability.

Pros

- Little secondary waste.
- The facility can treat waste streams similar in composition to those assumed in the design basis without modification.
- The stabilized waste could be shipped without additional treatment.
- Final wasteform is anticipated to meet the SRS disposal WAC.
- Stabilization has been demonstrated at the facility.
- The facility is anticipated to have minimal down time.
- Process failure is not anticipated to create a waste stream that cannot be treated.
- Few emissions for the facility are anticipated during normal operation and most accident scenarios.
- The facility could potentially be used to treat numerous waste streams throughout the DOE Complex.

Cons

- Stabilization will increase the overall waste volume by a factor of two or more after processing.
- Throughput is fixed by design. The facility is currently being designed.
- Waste characterization will be required for any waste streams returned to SRS for disposal.
- The majority of the treated waste will be classified as mixed waste which will require disposal in a RCRA facility.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	20	Stabilization will increase the overall waste volume by a factor of 2 or more after processing.
• secondary waste generation	80	Little secondary waste.
• destruction removal and demobilization efficiency	50	Additional treatment for some waste streams may be required prior to stabilization to ensure LDR standards are met.
• flexibility	80	The facility can treat waste streams similar in composition to those assumed in the design basis without modification.
• ability to be shipped	80	The stabilized waste could be shipped without additional treatment.
• final wasteform	80	Final wasteform is anticipated to meet the SRS disposal WAC.
Engineering Parameters		
• system implementability	80	Stabilization has been demonstrated at the facility.
• availability	80	The facility is anticipated to have minimal down time.
• scalability	20	Throughput is fixed by design. The facility is currently being designed
• remedial measures	80	Process failure is not anticipated to create a waste stream that cannot be treated.

Waste Stream Number & Name: SR-W028 Mark 15 Filter Paper
Option Number: SR-W028-6
Facility: INEL/WEDF **Treatment Technology:** Stabilization
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• schedule for treatment of waste	50	A schedule for waste treatment cannot be provided. Additionally, acceptance of SRS waste will be contingent upon state-approved permit modifications.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Few emissions for the facility are anticipated during normal operation and most accident scenarios.
• non operational worker potential exposure	50	Processing this material will not increase the exposure to non operational personnel.
• operational worker potential exposure	50	Personnel exposure is average for operations of this type. Processing this material will not increase the exposure to operational personnel.
• transportation potential exposure	20	Waste characterization will be required for any waste streams returned to SRS for disposal.
Regulatory Parameters		
• need for variance	80	Well accepted wasteform. No variance required.
• ability to obtain a permit	50	Permitting process is well defined, however, the state's acceptance of offsite waste treatment is unknown. Approval may be difficult.
• waste disposal	20	The treated waste will be classified as mixed waste which will require disposal in a HW/MW facility.
Public Acceptance		
• public acceptance	50	Public acceptance for stabilization is positive; however, the treatment of offsite waste is anticipated to reduce the overall public acceptance of this process.
Cost Considerations		
• life-cycle cost	99	
• funding availability	50	Funding for treatment cost can be provided using the operating budget, however the additional costs may result in an increase in the budget in excess of 10%.
Industry Involvement		
• market for technology	80	The facility could potentially be used to treat numerous waste streams throughout the DOE Complex.
• private sector involvement	20	Technology is available at an existing DOE facility.

IDOA Score: **Technical** 52 **Total** 66

Waste Stream Number & Name: SR-W028 Mark 15 Filter Paper
Option Number: SR-W028-6
Facility: INEL/WEDF **Treatment Technology: Stabilization**
Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[ ] alpha [ ] non-alpha [√] contact handled [ ] remote handled

Module Location: INEL

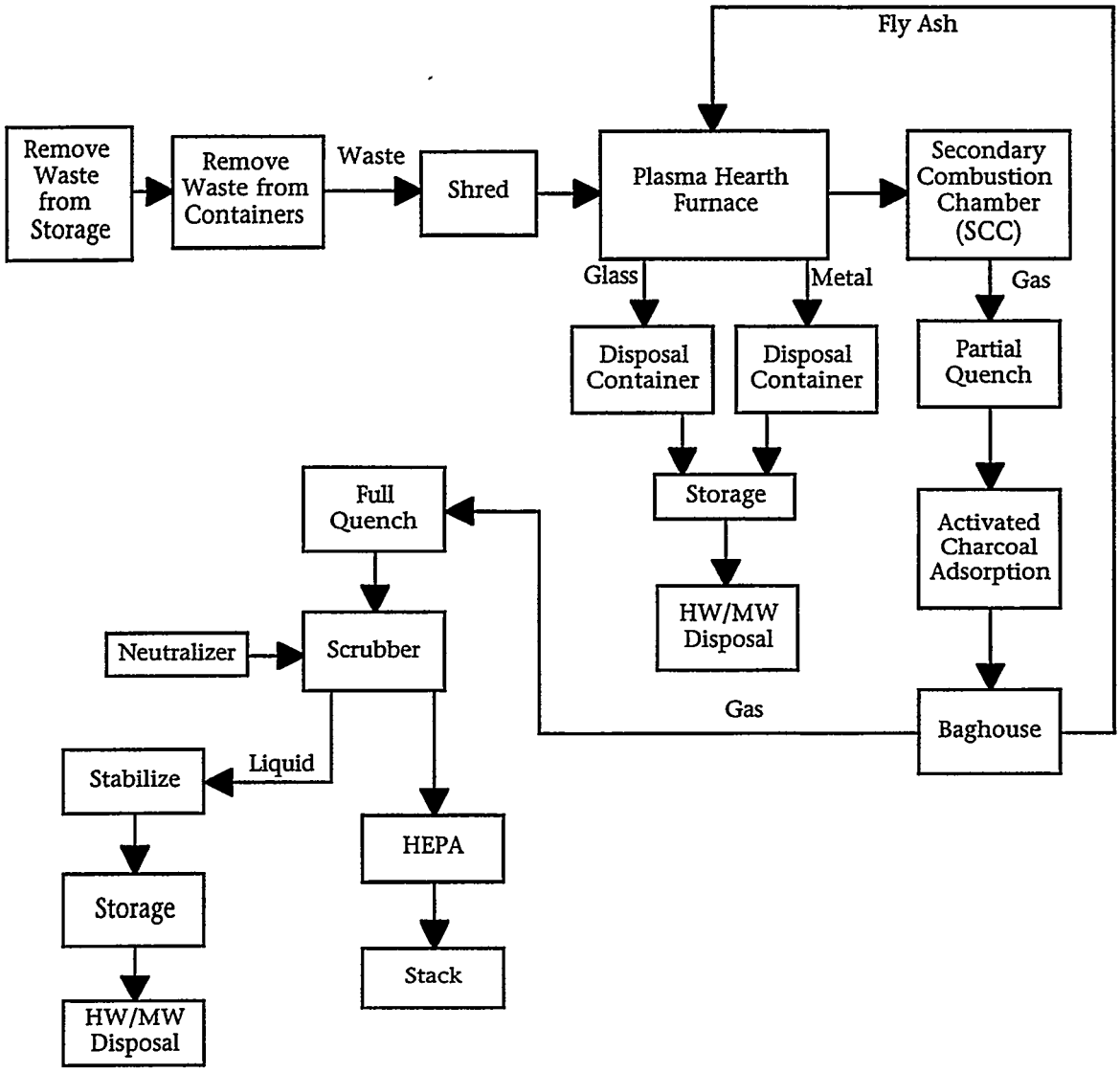
Module Status: [ ] Existing [√] New [√] Small generator [ ] Large generator
[ ] Onsite [√] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$	
	1.2	Demonstration Costs	$	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$	
		1.3.2 Safety Assurance Documentation	$	
		1.3.3 Permitting	$	
		1.3.4 Preparation for Operations	$	
		1.3.5 Project Management	$	
		TOTAL PRE-OPERATIONS		$
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$	
	2.2	Inspection	$	
	2.3	Project Management	$	
	2.4	Building Construction (inc. indirect)	$	
	2.5	Equipment (inc. indirect)	$	
	2.6	Construction Management	$	
	2.7	Contingency	$	
		TOTAL FACILITY CONSTRUCTION COSTS		$
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$	
	3.2	Annual Utilities	$	
	3.3	Annual Materials	$	
	3.4	Annual Maintenance	$	
	3.5	Annual Contingency	$	
		TOTAL ANNUAL O & M	$	
		X NUMBER OF YEARS OF OPERATION		
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$	
	4.2	Closure, Post-Closure, Monitoring	$	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$ 70
7.0	Transportation			$ 18
8.0	Disposal			$ 15
		SUB COST FOR STABILIZATION MODULE		$ 103
		ESCALATION		1.344
		TOTAL COST		$ 138

Note: Per DOE directions this cost estimate is the incremental cost for treatment at an offsite DOE facility; therefore, it carries no overhead burden or capital costs.
If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W028 Mark 15 Filter Paper
Option Number: SR-W028-7
Facility: Vendor
Treatment Technology: Plasma Hearth

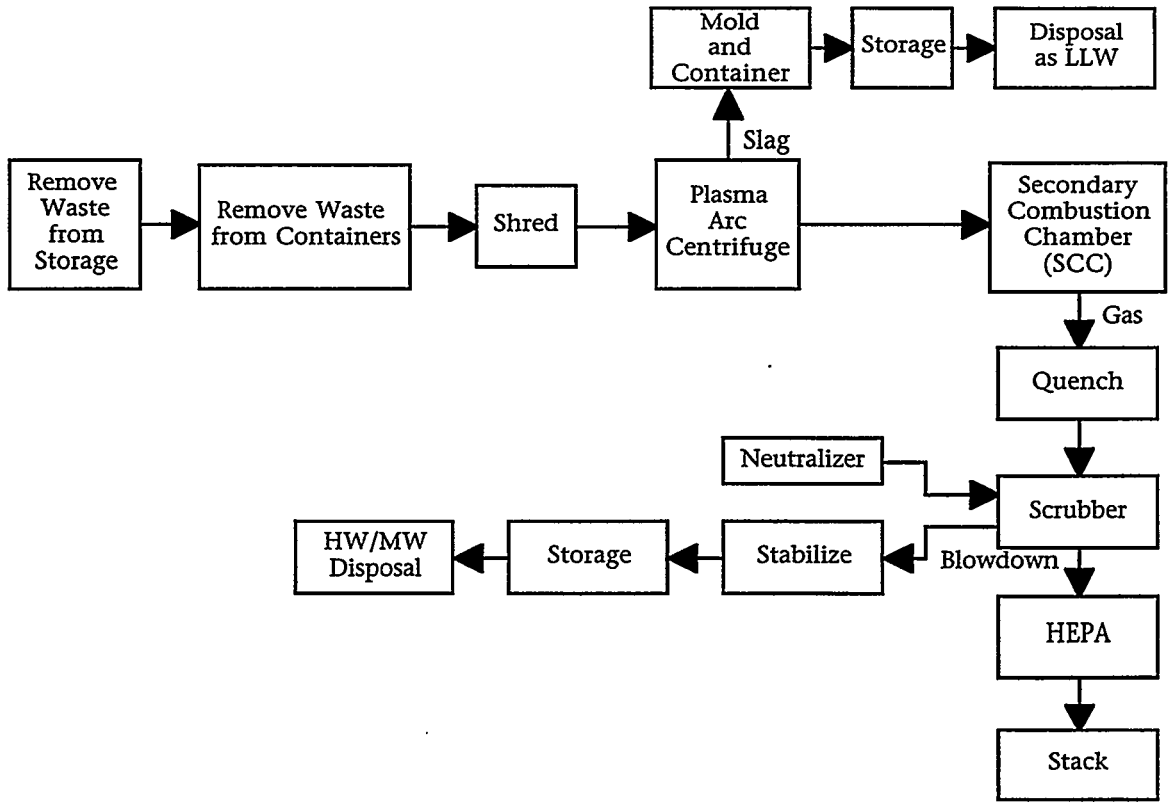
Treatment Cycle Flow Diagram



Option rejected during technical success factor evaluation. No further analysis performed.

Waste Stream Number & Name: SR-W028 Mark 15 Filter Paper
Option Number: SR-W028-8
Facility: Vendor
Treatment Technology: Plasma Arc

Treatment Cycle Flow Diagram



Option rejected during technical success factor evaluation. No further analysis performed.

Summary Page

Waste Stream Number & Name: SR-W029 M-Area Sludge Treatability Samples

Background Information

This waste stream consists of stabilized sludge samples from the Process Waste Interim Treatment/Storage Facility of M Area that has been stabilized with cement, cement/fly ash/blast furnace slag, or by vitrification. Samples are generated during waste treatability studies to determine the formulation of the stabilized wasteform.

Volume
- Current volume through 09/30/94 is 1.0 m^3.
- Expected 1995-1999 volume will be 0.4 m^3. DSTP reported no future waste generation. Additional testing because of the STP process has been identified.

Waste Stream Composition
- Cemented solids/vitrified solids

Waste Code
- F006 (metal plating waste, without cyanide)

LDR Treatment Standard
- F006 = concentration based standards = 0.19-5 mg/l

Waste Characterization
- Sampling and analysis used to characterize the waste stream.
- Confidence level is high based on total constituent analysis performed on the sludge and knowledge that the process generates a listed waste.
- The primary contaminant is Ni with Pb and Cr.

Radiological Characterization
- Total activity is 0.0176 Ci.
- Alpha emitters are U^{234}, U^{235} , and U^{238}.
- Waste is contact handled.
- Mixed low-level waste

Preferred Option

The preferred treatment option for M-Area Sludge Treatability Samples is Stabilization by Vitrification in the M-Area Vendor Treatment Process.

Treatment Justification

In-depth options analysis (IDOA) is not required for this waste stream since a Preferred Option has been identified utilizing an existing facility with existing treatment technology.

The proposed action is to stabilize the M-Area mixed wastes utilizing a thermal vitrification process. The process facility would be constructed and operated by a subcontractor to the Westinghouse Savannah River Company (WSRC). The vitrification process would result in the lowest volume of stabilized waste for final disposal, provide the most durable final wasteform, and could be completed for the lowest cost (including final disposal costs) of all treatment alternatives for wastes needing to be treated in M Area.

The proposed action was evaluated with respect to the technical ability to meet the Land Disposal Restrictions (LDR) criteria for the final stabilized wasteform, and for the overall cost of the treatment activities. The ability to meet the durability requirements, that is, Toxicity Characteristic Leaching Procedure (TCLP) testing requirements, for constituents of concern in the final wasteform was a critical consideration. The total life-cycle cost, including the cost of

treating the waste itself, the cost to treat any effluents generated by the vendor, and the cost to dispose of the final wasteform were also considered. In addition, the environmental impacts, onsite and offsite health effects, and occupational health and safety concerns for this treatment method were evaluated.

When blending and treatment of the Process Waste Intermediate Treatment/Storage Facility (PWIT/SF) sludge is begun, it is projected that approximately 700,000 gallons of F006 listed mixed waste will be in storage in the tanks. This includes an estimated 50,000 gallons of supernate which cannot be separated from the sludge. Waste streams stored in the tanks include SR-W004, M-Area Plating Line Sludges from Supernate Treatment and SR-W037, M-Area High Nickel Plating Line Sludge. One waste stream (SR-W054 – Enriched Uranium Contaminated with Lead, total volume 35 gallons) has been combined with waste stream SR-W037. SR-W054 is now indistinguishable from SR-W037 and will be treated identically.

Other M-Area mixed wastes to be treated are stored in 55-gallon drums in the Mixed Waste Storage Shed in M Area. These wastes include:

- A Watts Plating bath, California list waste solution, SR-W039, Nickel Plating Line Solution
- Mark 15 sludge filtercake, waste stream SR-W005, Mark 15 Filtercake
- Solid treatability sample residues, waste stream SR-W029, M-Area Sludge Treatability Samples

Two drums of Plating Line Sump Material (SR-W038) are stored in the 645-2N storage facility.

Equipment required for treatment of the M-Area waste would continue to belong to the vendor and, if the equipment could meet Department of Transportation (DOT) shipping criteria for radioactivity, would be removed from SRS. If equipment could not be successfully decontaminated, it would be disposed onsite. The cost of disposal was a part of the total contract cost.

The M-Area Vendor Treatment Process is capable of effectively treating all of these waste streams to meet regulatory requirements. As a result, upon completion of treatment, all listed and characteristically hazardous waste sludges and liquids from M-Area operations will be eliminated.

Cost Estimate: INCLUDED WITH COST INFORMATION FOR TREATING WASTE STREAM SR-W004. SEE COST ESTIMATE SHEET FOR SR-W004.

Summary Page – THIS WASTE STREAM HAS BEEN CONSOLIDATED WITH WASTE STREAM SR-W001

Waste Stream Number & Name: SR-W030 Spent Methanol Solution

Background Information

This waste stream's data has been consolidated and reported under SR-W001, Rad-Contaminated Solvents. This decision to classify this waste as SR-W001 was made during the MWIR inventory update as of 9/30/94. The consolidation of solvent streams SR-W001, SR-W002, SR-W010, SR-030, and SR-W059, in the mixed waste data reporting, grouped solvents with the same treatment.

This waste stream was formerly described as a waste generated in a classified operation at the now closed Naval Fuels (NF) Facility.

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Summary Page – Initial Screening

Waste Stream Number & Name: SR-W031 Uranium/Chromium Solution

Background Information

This waste stream is a combination of two one-time waste generation. A portion of the waste stream was generated by the Naval Fuels laboratory to assay uranium content by scintillation/Davis Gray procedure. It is a 2% solids solution in a glass container overpacked in a 55 gallon drum. Another portion of the waste stream is sludge which accumulated in stainless steel air ducts in the Naval Fuels Facility where uranium in the sludge caused a reaction with the stainless steel, liberating leachable chromium. This waste sludge is in two lined 55-gallon drums.

Volume
- Current volume through 09/30/94 is 0.6 m^3.
- No future waste generation expected because the manufacturing process (Naval Fuels) which generated this waste, is no longer operational.

Waste Stream Composition
- Aqueous liquid
- Inorganic sludge/particulate

Waste Code
- D007A (TCLP Cr)

LDR Treatment Standard
- D007 = concentration based standard = 5.0 mg/l

Waste Characterization
- Process knowledge and sampling and analysis used to characterize the waste.
- Process knowledge was used to characterize laboratory waste stream via mass balance calculation.
- Confidence level is high because analysis was performed on the duct cleaning waste from Naval Fuels.

Radiological Characterization
- Total activity is 0.4 nCi/g.
- Alpha emitter is U^{235}.
- Waste is contact handled.
- Mixed low-level waste

Initial Screening

The initial screening identified inappropriate treatment options. These options appear in the Initial Rejections table.

Initial Rejections

Treatment Facility	Treatment Technology	Reasons for Rejection
CIF	Incineration	The constituents of concern would end up in the ash. Ashcrete will not immobilize them to pass TCLP.
ETF	Ion Exchange	ETF cannot accept this level of uranium in the facility.
Lab.	Lab-scale process flowsheet	Volume of waste too is great to handle with laboratory-scale equipment.
LETF	Ion Exchange	LETF cannot handle this quantity of uranium.

Summary Page – Technology Success Factor (TSF) & In-Depth Options Analysis (IDOA)

Waste Stream Number & Name: SR-W031 Uranium/Chromium Solution

Feasible Options

Option No.	Treatment Facility	Treatment Technology	TSF Score	IDOA Scores Tech.	IDOA Scores Total	COST (x 1,000)	PO
SR-W031-1	M Area	Vitrification	100	57	71	673	√
SR-W031-2	Vendor/Onsite	Polymer Emulsification	88	52	65	563	
SR-W031-3	CIF	Ashcrete Stabilization	88	56	69	2,048	
SR-W031-4	Vendor/Onsite	Stabilization	75	56	70	563	
SR-W031-5	Cont. Bldg.	In-Drum Stab.	51	51	65	1,249	
SR-W031-6	INEL/WEDF	Stabilization	*	52	65	586	

* No TSF required for proposed or existing non-Savannah River Site-DOE waste processing facilities.

Options Rejected Due To Low Technology Success Factor (TSF)

- No options were rejected.

Engineering Assessment

Preferred Option Justification

The preferred treatment option for the Uranium/Chromium Solution waste stream is Stabilization by Vitrification in the M-Area Vendor Treatment Process.

This option treats the constituent of concern, chromium, by stabilizing it in non-leaching glass matrix.

This option is preferred because:
- Volume reduction will be greater than a factor of 5.
- Treatment meets LDR.
- This small volume waste stream can be easily processed along with the wastes for which the vendor vitrification unit was originally contracted.
- The final wasteform is very stable and long-lived.
- This option is cost-effective.

Options Rejected During IDOA

Encapsulation (at CIF in ashcrete, in a Containment Building, by a Vendor)

Encapsulation (at CIF in ashcrete, in a containment building, by a vendor) was rejected because:
- Final wasteform not as long-lived as the preferred option.
- Waste volume will more than double.
- Majority of the final waste will require disposal in HW/MW facility.

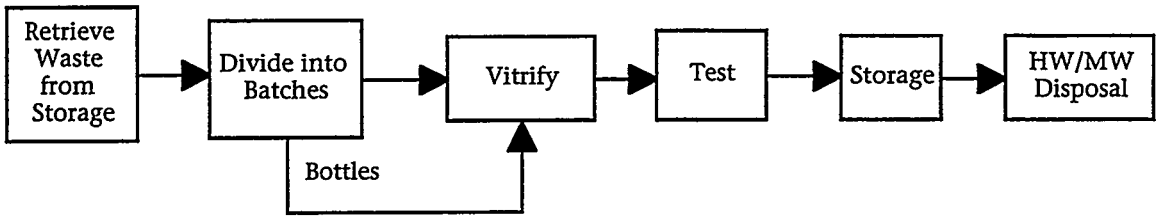
Stabilization at INEL/WEDF

Stabilization at INEL/WEDF (encapsulating the waste with a grout matrix) was rejected because:
- Large volume waste streams are designated to be treated onsite.
- It is less cost-effective than the preferred option.
- Waste volume will more than double.
- Throughput is fixed by design. The facility is currently being designed.

Waste Stream Number & Name: SR-W031 Uranium/Chromium Solution

Option Number: SR-W031-1
Facility: M-Area
Treatment Technology: Vitrification

Treatment Cycle Flow Diagram



Pros

- Volume reduction greater than 5:1.
- Rinse water can be treated in DETF and released to outfall.
- All applicable LDR treatment standards are met and if waste is delisted (F006), final waste will be non-hazardous.
- Fixed quantity of waste, expect system to easily handle.
- Containerization required. Will meet all shipping requirements.
- Final vitrified wasteform will meet disposal WAC. No additional treatment required.
- Small amount of waste which can be processed easily with other vitrifier feeds.
- Failed wasteform can be recycled through the melter.
- Scheduled with other wastes for vitrification.
- Not different from waste currently scoped for treatment. Emissions are few and controlled even in accident scenarios.
- Expect treatment to render a wasteform to compliance with LDR. No variance required.
- Treated wasteform disposable as LLW.

Cons

- Unbudgeted

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	90	Add 10 points to the median score of 80 because of volume reduction greater than 5:1.
• secondary waste generation	80	Rinse water can be treated in DETF and released to outfall.
• destruction removal and demobilization efficiency	80	All applicable LDR treatment standards are met.
• flexibility	80	Vitrification technology can handle a wide variety of wastes without extensive adjustments in operating parameters.
• ability to be shipped	80	Containerization required. Will meet all shipping requirements.
• final wasteform	80	Final vitrified wasteform will meet waste disposal WAC.

Waste Stream Number & Name: SR-W031 Uranium/Chromium Solution
Option Number: SR-W031-1
Facility: M-Area Treatment Technology: Vitrification
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Engineering Parameters		
• system implementability	80	Demonstrated for high-level vitrification.
• availability	50	Normal maintenance requirements apply. This waste stream may require a "clean-out" earlier than anticipated based on curie load.
• scalability	80	Small amount of waste which can be processed easily with other vitrifier feeds.
• remedial measures	80	Failed wasteform can be recycled through the melter.
• schedule for treatment of waste	80	Scheduled with other wastes for vitrification.
Personnel Parameters		
• consequence of unmitigated accident scenarios	90	Not different from waste currently scoped for treatment. Add 10 points because emissions are few and controlled even in accident scenarios.
• non operational worker potential exposure	50	Some additional maintenance required.
• operational worker potential exposure	50	Increased operator handling due to this waste stream so the potential for exposure is increased.
• transportation potential exposure	50	Additional characterization may be required.
Regulatory Parameters		
• need for variance	80	Expect treatment to render a wasteform in compliance with LDR requirements. No variance required.
• ability to obtain a permit	30	Wastewater permit exists though it may require some modification. SCDHEC and/or EPA could require a RCRA Part B application with the change in waste stream. Subtract 20 points from median score of 50 because DHEC has expressed concern about permitting additional waste streams.
• waste disposal	50	Treated wasteform may require disposal in a HW/MW facility due to coprocessing with listed (F006) waste.
Public Acceptance		
• public acceptance	50	Public approves of treatment that results in a glass wasteform.
Cost Considerations		
• life-cycle cost	98	
• funding availability	20	Unbudgeted
Industry Involvement		
• market for technology	20	This is an existing vendor process.
• private sector involvement	80	Technology is available at an existing vendor process.

IDOA Score: Technical 57 **Total** 71

Waste Stream Number & Name: SR-W031 Uranium/Chromium Solution
Option Number: SR-W031-1
Facility: M-Area **Treatment Technology: Vitrification**
Cost Estimate Sheet

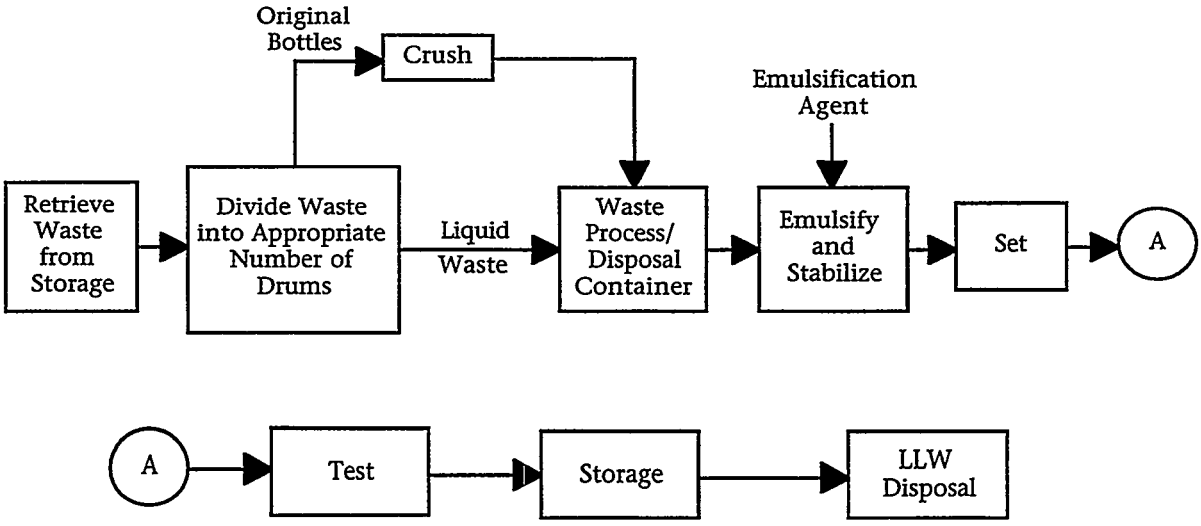
Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled
Module Location: SRS
Module Status: [√] Existing [ ] New [√] Small generator [ ] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 6	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 22	
		1.3.2 Safety Assurance Documentation	$ 6	
		1.3.3 Permitting	$ 125	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 5	
		TOTAL PRE-OPERATIONS		$ 313
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 24	
	2.2	Inspection	$ 7	
	2.3	Project Management	$ 12	
	2.4	Building Construction (inc. indirect)	$ 100	
	2.5	Equipment (inc. indirect)	$ 0	
	2.6	Construction Management	$ 8	
	2.7	Contingency	$ 58	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 209
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 9	
	3.2	Annual Utilities	$ 0	
	3.3	Annual Materials	$ 5	
	3.4	Annual Maintenance	$ 3	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 18	
		X NUMBER OF YEARS OF OPERATION	0.25	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 5
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 0	
	4.2	Closure, Post-Closure, Monitoring	$ 1	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 1
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$ 10	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$ 10
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 10
		SUB COST FOR VITRIFICATION MODULE		$ 547
		ESCALATION		1.23
		TOTAL COST		$ 673

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W031 Uranium/Chromium Solution
Option Number: SR-W031-2
Facility: Vendor/Onsite
Treatment Technology: Polymer Emulsification

Treatment Cycle Flow Diagram



Pros

- No additional treatment is required to meet LDR standards.
- Can accommodate a wide range of similar wastes and radiation levels. Widely used in the commercial world.
- Wasteform meets DOT shipping requirements in the form it exits the treatment process.
- Wasteform meets the expected WAC for disposal. No additional treatment is required. Wasteform is disposable in the form in which it exits the process.
- This is a proven process, used both in DOE Complex and the commercial world.
- This is a mature technology. Vendor will bring onsite and set up with a minimum delay.
- Skid mounted, no D&D, vendor removes upon completion of work. Facility requires more non operational workers than other comparably sized, skid mounted facilities.
- Must demonstrate that waste meets the treatment standards.
- The final waste will meet LDR treatment standards and can be disposed of as non-hazardous radioactive waste.

Cons

- The waste volume will more than double.
- Wasteform is not as permanent as other forms of stabilization.
- Not a budgeted item, will require line item funding.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	10	Subtract 10 points from the median score of 20 because the waste volume will more than double.
• secondary waste generation	80	Containers will require treatment by standard technology.
• destruction removal and demobilization efficiency	80	No additional treatment is required to meet LDR standards.

Waste Stream Number & Name: SR-W031 Uranium/Chromium Solution
Option Number: SR-W031-2
Facility: Vendor/Onsite
Treatment Technology: Polymer Emulsification

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• flexibility	80	Can accommodate a wide range of similar wastes and radiation levels. Widely used in the commercial world.
• ability to be shipped	80	Wasteform meets shipping requirements in the form it exits the treatment process.
• final wasteform	80	Wasteform meets the expected WAC for waste disposal.
Engineering Parameters		
• system implementability	50	Technology is not proven for microemulsification of this waste stream.
• availability	60	Add 10 points to the median score of 50 because system is normally available 50% of the time.
• scalability	50	Throughput is set by design, and not easily expanded except by adding more shifts of operation.
• remedial measures	50	Failed wasteform can be ground up and reprocessed.
• schedule for treatment of waste	80	This is a mature technology. Vendor will bring onsite and set up with a minimum delay.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Process can be installed in a building with adequate emission controls.
• non operational worker potential exposure	80	Requires the same number of non operational workers as comparable skid-mounted units. Most or all initial construction can be done in a vendor shop. Experience in similar facilities indicates that little non-routine maintenance is required.
• operational worker potential exposure	50	Increased operator handling due to this waste stream so the potential for exposure is increased.
• transportation potential exposure	60	No additional characterization needed. Add 10 points to the median score of 50 because waste can be handled readily.
Regulatory Parameters		
• need for variance	80	Full compliance expected without a variance.
• ability to obtain a permit	80	Must demonstrate that waste meets the treatment standards.
• waste disposal	80	The final waste will meet LDR treatment standards and can be disposed of as LLW.
Public Acceptance		
• public acceptance	20	Mature and proven technology, however, wasteform is not as permanent as other forms of stabilization (i.e., vitrification).
Cost Considerations		
• life-cycle cost	98	
• funding availability	20	Not a budgeted item and will require line item funding.

Waste Stream Number & Name: SR-W031 Uranium/Chromium Solution
Option Number: SR-W031-2
Facility: Vendor/Onsite
Treatment Technology: Polymer Emulsification

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Industry Involvement		
• market for technology	20	This is an existing vendor process.
• private sector involvement	50	Technology could be provided by an existing vendor process.

IDOA Score: **Technical** 52 **Total** 65

Waste Stream Number & Name: SR-W031 Uranium/Chromium Solution
Option Number: SR-W031-2
Facility: Vendor/Onsite
Treatment Technology: Polymer Emulsification

Cost Estimate Sheet

INCLUDE COST OF OPTION SR-W041A-3

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled

Module Location: SRS

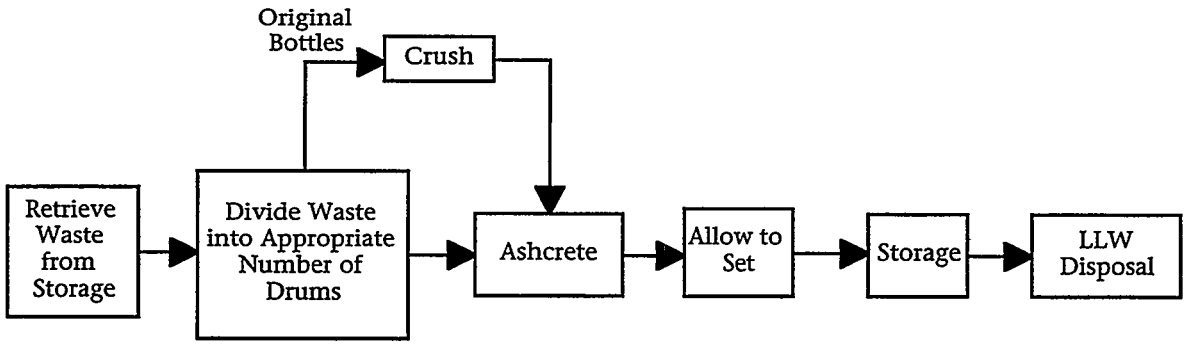
Module Status: [ ] Existing [√] New [√] Small generator [ ] Large generator
[√] Onsite [ ] Offsite [√] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 3	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 14	
		1.3.2 Safety Assurance Documentation	$ 3	
		1.3.3 Permitting	$ 125	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 0	
		TOTAL PRE-OPERATIONS		$ 295
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 0	
	2.2	Inspection	$ 0	
	2.3	Project Management	$ 0	
	2.4	Building Construction (inc. indirect)	$ 0	
	2.5	Equipment (inc. indirect)	$ 0	
	2.6	Construction Management	$ 0	
	2.7	Contingency	$ 0	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 0
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 150	
	3.2	Annual Utilities	$ 6	
	3.3	Annual Materials	$ 90	
	3.4	Annual Maintenance	$ 54	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 300	
		X NUMBER OF YEARS OF OPERATION	0.25	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 75
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 0	
	4.2	Closure, Post-Closure, Monitoring	$ 1	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 1
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$ 135	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$ 135
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 25
		SUB COST FOR POLYMER EMULSIFICATION MODULE		$ 532
		ESCALATION		1.06
		TOTAL COST		$ 563

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W031 Uranium/Chromium Solution
Option Number: SR-W031-3
Facility: CIF
Treatment Technology: Ashcrete Stabilization

Treatment Cycle Flow Diagram



Pros

- No secondary waste produced by the ashcrete process.
- Waste stream is expected to meet all applicable LDR standards through this treatment.
- No abnormal shipping requirements.
- Controls in place to ensure adherence to final wasteform requirements.
- Ashcrete is a current demonstrated technology.
- Reasonably easy to schedule this waste steam assuming current startup schedule.
- The metals in this waste stream will be captured in the ashcrete. There are very little emissions.
- Expect average numbers compared to industrial complex construction and operation. No impact due to this waste stream.
- 100% of the final wasteform expected to go to E-Area Vaults (EAV). Waste not in contact with other waste streams.
- Line item is funded.

Cons

- The process is expected to increase volume by factor of 2.
- Wasteform is not as permanent as other forms of stabilization.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	10	Subtract 10 points from the median score of 20 because the process is expected to increase volume by factor of two.
• secondary waste generation	100	Add 20 points to the median score of 80 because no secondary waste produced by the ashcrete process.
• destruction removal and demobilization efficiency	80	Waste stream is expected to meet all applicable LDR standards through this treatment.
• flexibility	50	Waste handling of waste streams directly in ashcrete is an off-normal process, which lowers efficiency.
• ability to be shipped	80	Wasteform meets shipping requirements.
• final wasteform	80	Wasteform meets expected WAC for disposal.

Waste Stream Number & Name: SR-W031 Uranium/Chromium Solution
Option Number: SR-W031-3
Facility: CIF
Treatment Technology: Ashcrete Stabilization

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Engineering Parameters		
• system implementability	100	Add 20 points to the median score of 80 because ashcrete is a current demonstrated technology.
• availability	50	Ashcrete availability. Normal maintenance requirements apply.
• scalability	50	Limited excess capacity exists.
• remedial measures	70	The presence of metals in the final wasteform might require rework. Subtract 10 points from the median score of 80 because a process failure could create a wasteform that cannot be treated using existing technologies.
• schedule for treatment of waste	80	Reasonably easy to schedule this waste stream assuming current startup schedule.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	The metals in this waste stream will be captured in the ashcrete. There are very little emissions.
• non operational worker potential exposure	70	Subtract 10 points from the median score of 80 because expect average numbers compared to industrial complex construction and operation. No impact due to this waste stream.
• operational worker potential exposure	50	Increased operator handling due to this waste stream so the potential for exposure is increased.
• transportation potential exposure	60	Add 10 points to the median score of 50 because waste requires transportation – but limited risk.
Regulatory Parameters		
• need for variance	80	Full compliance anticipated. No variance required.
• ability to obtain a permit	50	Minor permit modification required. Must demonstrate waste meets treatment standard.
• waste disposal	80	100% of the final wasteform expected to go to LLW disposal. Waste not in contact with other waste streams.
Public Acceptance		
• public acceptance	20	Mature and proven technology, however wasteform is not as permanent as other forms of stabilization (i.e., vitrification).
Cost Considerations		
• life-cycle cost	94	
• funding availability	80	Line item is funded.
Industry Involvement		
• market for technology	20	This is an existing technology.
• private sector involvement	20	Technology is available at an existing DOE facility.

IDOA Score: **Technical** 56 **Total** 69

Waste Stream Number & Name: SR-W031 Uranium/Chromium Solution
Option Number: SR-W031-3
Facility: CIF
Treatment Technology: Ashcrete Stabilization

Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled

Module Location: SRS

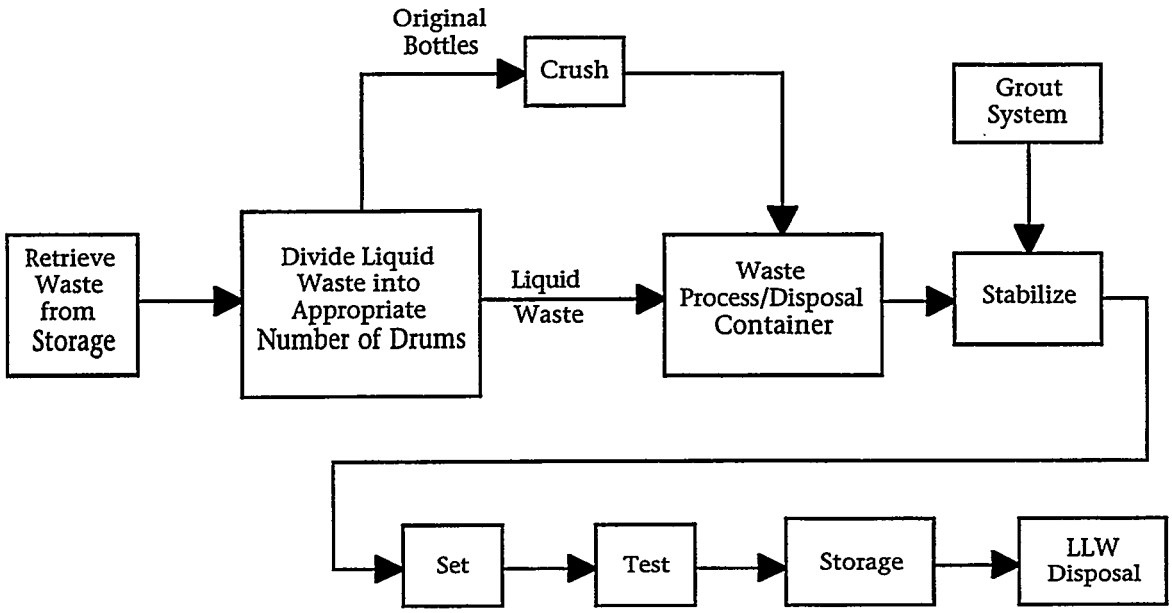
Module Status: [√] Existing [ ] New [√] Small generator [ ] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 0	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Fundéd Activities		
		1.3.1 Conceptual Design	$ 0	
		1.3.2 Safety Assurance Documentation	$ 0	
		1.3.3 Permitting	$ 1,500	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 0	
		TOTAL PRE-OPERATIONS		$ 1,650
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 0	
	2.2	Inspection	$ 0	
	2.3	Project Management	$ 0	
	2.4	Building Construction (inc. indirect)	$ 0	
	2.5	Equipment (inc. indirect)	$ 0	
	2.6	Construction Management	$ 0	
	2.7	Contingency	$ 0	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 0
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 9	
	3.2	Annual Utilities	$ 0	
	3.3	Annual Materials	$ 5	
	3.4	Annual Maintenance	$ 3	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 18	
		X NUMBER OF YEARS OF OPERATION	0.25	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 5
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 0	
	4.2	Closure, Post-Closure, Monitoring	$ 1	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 1
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 10
		SUB COST FOR ASHCRETE STABILIZATION MODULE		$ 1,665
		ESCALATION		1.23
		TOTAL COST		$ 2,048

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W031 Uranium/Chromium Solution
Option Number: SR-W031-4
Facility: Vendor/Onsite
Treatment Technology: Stabilization

Treatment Cycle Flow Diagram



Pros

- No additional treatment is required to meet LDR **standards.**
- Can accommodate a wide range of similar wastes and radiation levels. Widely used in the commercial world.
- Wasteform can be easily shipped as-is.
- Wasteform meets the expected WAC for waste disposal. No additional treatment is required. Wasteform is disposable in the form in which it exits the process.
- This is a proven process, used both in DOE Complex and the commercial world.
- Similar systems in the commercial nuclear industry experience availability of 80%.
- This is a mature technology. This process is not skid mounted as are other vendors.
- Requires fewer non operational workers than comparably sized facilities. Experience in similar facilities indicates that little non-routine maintenance is needed.
- Treated waste will meet treatment standards and be disposed of as non-hazardous LLW.
- No variance is required.

Cons

- The waste volume will more than double.
- Wasteform is not as permanent as other forms of stabilization.
- Not a budgeted item, will require line item funding.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	10	Subtract 10 points from the median score of 20 because the waste volume will more than double.
• secondary waste generation	80	Containers will require treatment by standard technology.

Waste Stream Number & Name: SR-W031 Uranium/Chromium Solution
Option Number: SR-W031-4
Facility: Vendor/Onsite **Treatment Technology: Stabilization**
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• destruction removal and demobilization efficiency	80	No additional treatment is required to meet LDR standards.
• flexibility	80	Can accommodate a wide range of similar wastes and radiation levels. Widely used in the commercial world.
• ability to be shipped	80	Wasteform can be easily shipped as-is.
• final wasteform	80	Final wasteform is anticipated to meet the SRS waste disposal WAC.
Engineering Parameters		
• system implementability	80	This is a proven process, used both in DOE Complex and the commercial world.
• availability	80	Similar systems in the commercial nuclear industry experience availability of 80%.
• scalability	50	Throughput is set by design, and not easily expanded except by adding more shifts of operation.
• remedial measures	50	Failed wasteform can be overpacked, or ground up and reprocessed.
• schedule for treatment of waste	70	This is a mature technology. Subtract 10 points from the median score of 80 because this process is not skid mounted as are other vendors.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Process can be installed in a building with adequate emission controls.
• non operational worker potential exposure	80	Requires fewer non operational workers than comparably sized facilities. Experience in similar facilities indicates that little non-routine maintenance is needed.
• operational worker potential exposure	50	Increased operator handling due to this waste stream so the potential for exposure is increased.
• transportation potential exposure	60	Additional characterization needed. Add 10 points to median score because waste can be handled readily.
Regulatory Parameters		
• need for variance	80	Full LDR compliance without a variance expected.
• ability to obtain a permit	80	Must demonstrate that waste meets the treatment standard.
• waste disposal	80	Treated waste will meet treatment standards and be disposed of as LLW.
Public Acceptance		
• public acceptance	20	Mature and proven technology, however wasteform is not as permanent as other forms of stabilization (i.e., vitrification).
Cost Considerations		
• life-cycle cost	98	
• funding availability	20	Not a budgeted item and will require line item funding.

Waste Stream Number & Name: SR-W031 Uranium/Chromium Solution
Option Number: SR-W031-4
Facility: Vendor/Onsite **Treatment Technology:** Stabilization
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Industry Involvement		
• market for technology	20	This is an existing vendor process.
• private sector involvement	50	Technology could be provided by an existing vendor process.

IDOA Score: **Technical** 56 **Total** 70

Waste Stream Number & Name: SR-W031 Uranium/Chromium Solution
Option Number: SR-W031-4
Facility: Vendor/Onsite **Treatment Technology: Stabilization**
Cost Estimate Sheet INCLUDES COST FOR OPTION SR-W041A-2

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled

Module Location: SRS

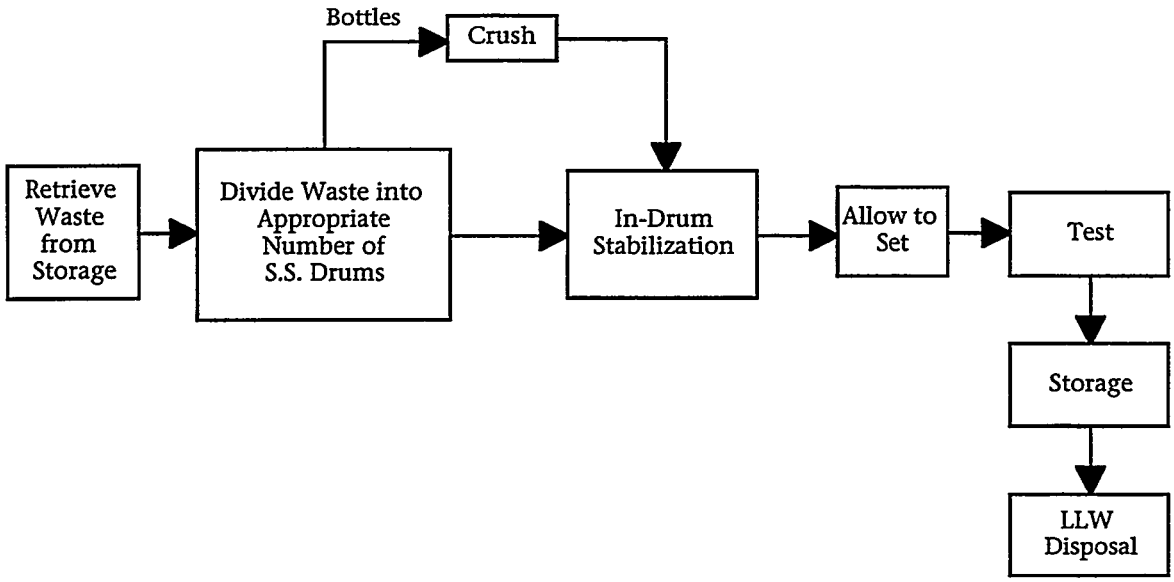
Module Status: [ ] Existing [√] New [√] Small generator [ ] Large generator
[√] Onsite [ ] Offsite [√] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 3	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 14	
		1.3.2 Safety Assurance Documentation	$ 3	
		1.3.3 Permitting	$ 125	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 0	
		TOTAL PRE-OPERATIONS		$ 295
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 0	
	2.2	Inspection	$ 0	
	2.3	Project Management	$ 0	
	2.4	Building Construction (inc. indirect)	$ 0	
	2.5	Equipment (inc. indirect)	$ 0	
	2.6	Construction Management	$ 0	
	2.7	Contingency	$ 0	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 0
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 150	
	3.2	Annual Utilities	$ 6	
	3.3	Annual Materials	$ 90	
	3.4	Annual Maintenance	$ 54	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 300	
		X NUMBER OF YEARS OF OPERATION	0.25	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 75
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 0	
	4.2	Closure, Post-Closure, Monitoring	$ 1	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 1
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$ 135	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$ 135
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 25
		SUB COST FOR CEMENT STABILIZATION MODULE		$ 532
		ESCALATION		1.06
		TOTAL COST		$ 563

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W031 Uranium/Chromium Solution
Option Number: SR-W031-5
Facility: Containment Building **Treatment Technology:** In-Drum Stab

Treatment Cycle Flow Diagram



Pros

- Entire process takes place inside the final disposal container. Little or no secondary waste generated.
- No additional treatment is required to meet LDR standards.
- Wasteform meets DOT shipping requirements in the form it exits the treatment process.
- Wasteform meets the expected WAC for disposal. No additional treatment is required. Wasteform is disposable in the form in which it exits the process.
- A system, which is now in cold standby might be easily adaptable to treatment of this waste stream.
- Process can be installed in a building with adequate emission controls.
- Process will be in full compliance with regulations without a variance.
- Treated waste will meet treatment standards and be disposed of as non-hazardous LLW.

Cons

- Waste is divided among containers and encapsulating material added, which will increase the amount of waste material going to storage.
- Wasteform is not as permanent as other forms of stabilization.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	20	Waste is divided among containers and encapsulating material added, which will increase the amount of waste material going to storage.
• secondary waste generation	100	Entire process takes place inside the final disposal container. Add 20 points to the median score of 80 because no secondary waste generated.

Waste Stream Number & Name: SR-W031 Uranium/Chromium Solution
Option Number: SR-W031-5
Facility: Containment Building Treatment Technology: In-Drum Stab
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• destruction removal and demobilization efficiency	80	No additional treatment is required to meet LDR.
• flexibility	50	Provided the material is compatible with cement stabilization, and is of such a size as to fit in the stabilization container, this process can handle it.
• ability to be shipped	80	Wasteform meets DOT shipping requirements in the form it exits the treatment process.
• final wasteform	80	Wasteform meets the expected WAC for waste disposal.
Engineering Parameters		
• system implementability	80	A system, which is now in cold stand-by might be easily adaptable to treatment of this waste stream.
• availability	50	System is normally available 50% of the time.
• scalability	50	Throughput is set by design, and not easily expanded except by adding more shifts of operation.
• remedial measures	50	Failure of the encapsulating material to set up would necessitate grinding up and reprocessing. The technology is well established.
• schedule for treatment of waste	40	Subtract 10 points from the median score of 50 because central technology is in cold standby, but ancillary containment building process will have to be designed. Installation in a containment building will add uncertainties.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Process can be installed in a building with adequate emission controls.
• non operational worker potential exposure	40	Maintenance of encapsulating material mixing equipment will require an average crew. Subtract 10 points from the median score of 50 because personal protective equipment needed for work in a containment building.
• operational worker potential exposure	50	Increased operator handling due to this waste stream so the potential for exposure is increased.
• transportation potential exposure	60	No additional characterization needed. Add 10 points to the median score of 50 because waste can be handled readily.
Regulatory Parameters		
• need for variance	80	Process will be in full compliance with LDR regulations without a variance.
• ability to obtain a permit	50	Proven process that has been permitted elsewhere.
• waste disposal	80	Treated waste will meet LDR treatment standards and be disposed of as LLW.
Public Acceptance		
• public acceptance	20	Mature and proven technology, however wasteform is not as permanent as other forms of stabilization (i.e., vitrification).

Waste Stream Number & Name: SR-W031 Uranium/Chromium Solution
Option Number: SR-W031-5
Facility: Containment Building **Treatment Technology: In-Drum Stab**
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Cost Considerations		
• life-cycle cost	96	
• funding availability	50	Not a budgeted item. May be covered by operating funds, but an increase in budget will be required.
Industry Involvement		
• market for technology	20	Process is commercially available.
• private sector involvement	50	Technology could be provided by either DOE or vendor.

IDOA Score: **Technical** 51 **Total** 65

Waste Stream Number & Name: SR-W031 Uranium/Chromium Solution
Option Number: SR-W031-5
Facility: Containment Building Treatment Technology: In-Drum Stab
Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled
Module Location: SRS
Module Status: [ ] Existing [√] New [√] Small generator [ ] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 11	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 45	
		1.3.2 Safety Assurance Documentation	$ 11	
		1.3.3 Permitting	$ 125	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 8	
		TOTAL PRE-OPERATIONS		$ 351
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 50	
	2.2	Inspection	$ 14	
	2.3	Project Management	$ 22	
	2.4	Building Construction (inc. indirect)	$ 175	
	2.5	Equipment (inc. indirect)	$ 50	
	2.6	Construction Management	$ 16	
	2.7	Contingency	$ 117	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 444
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 30	
	3.2	Annual Utilities	$ 1	
	3.3	Annual Materials	$ 18	
	3.4	Annual Maintenance	$ 11	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 60	
		X NUMBER OF YEARS OF OPERATION	0.25	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 15
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 180	
	4.2	Closure, Post-Closure, Monitoring	$ 1	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 181
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 25
		SUB COST FOR IN-DRUM STABILIZATION MODULE		$ 1,016
		ESCALATION		1.23
		TOTAL COST		$ 1,249

Waste Stream Number & Name: SR-W031 Uranium/Chromium Solution
Option Number: SR-W031-6
Facility: INEL/WEDF **Treatment Technology: Stabilization**

Treatment Technology

The Idaho National Engineering Laboratory (INEL) Waste Engineering Development Facility (WEDF) Stabilization process will provide treatments for aqueous and organic liquids and debris. The process will stabilize waste in a grout matrix to reduce leachability.

Pros

- No secondary waste streams are generated.
- The facility can treat waste streams similar in composition to those assumed in the design basis without modification.
- The stabilized waste could be shipped without additional treatment.
- Final wasteform is anticipated to meet the SRS waste disposal WAC.
- Stabilization has been demonstrated at the facility.
- The facility is anticipated to have minimal down time.
- Process failure is not anticipated to create a waste stream that cannot be treated.
- Few emissions for the facility are anticipated during normal operation and most accident scenarios.
- The facility could potentially be used to treat numerous waste streams throughout the DOE Complex.

Cons

- Stabilization will increase the overall waste volume by a factor of two or more after processing.
- Throughput is fixed by design. The facility is currently being designed.
- Waste characterization will be required for any waste streams returned to SRS for disposal.
- The majority of the treated waste will be classified as mixed waste which will require disposal in a HW/MW facility.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	10	Subtract 10 points from the median score of 20 because stabilization will increase the overall waste volume by a factor of two or more after processing.
• secondary waste generation	80	No secondary waste streams are generated.
• destruction removal and demobilization efficiency	50	Additional treatment for some waste streams may be required prior to stabilization to ensure LDR standards are met.
• flexibility	80	The facility can treat waste streams similar in composition to those assumed in the design basis without modification.
• ability to be shipped	80	The stabilized waste could be shipped without additional treatment.
• final wasteform	80	Final wasteform is anticipated to meet the SRS waste disposal WAC.
Engineering Parameters		
• system implementability	80	Stabilization has been demonstrated at the facility.
• availability	80	The facility is anticipated to have minimal down time.

Waste Stream Number & Name: SR-W031 Uranium/Chromium Solution
Option Number: SR-W031-6
Facility: INEL/WEDF Treatment Technology: Stabilization
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• scalability	20	Throughput is fixed by design. The facility is currently being designed.
• remedial measures	80	Process failure is not anticipated to create a waste stream that cannot be treated.
• schedule for treatment of waste	50	A schedule for waste treatment cannot be provided. Additionally, acceptance of SRS waste will be contingent upon state-approved permit modifications.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Few emissions for the facility are anticipated during normal operation and most accident scenarios.
• non operational worker potential exposure	50	Processing this material will not increase the exposure to non operational personnel.
• operational worker potential exposure	50	Increased operator handling due to this waste stream so the potential for exposure is increased.
• transportation potential exposure	20	Waste characterization will be required for any waste streams returned to SRS for disposal.
Regulatory Parameters		
• need for variance	80	Process will be in full LDR compliance without needing a variance.
• ability to obtain a permit	50	Permitting process is well defined, however, the state's acceptance of offsite waste treatment is unknown. Approval may be difficult.
• waste disposal	20	The majority of the treated waste will be classified as mixed waste which will require disposal in a HW/MW facility.
Public Acceptance		
• public acceptance	50	Public acceptance for stabilization is positive; however, the treatment of offsite waste is anticipated to reduce the overall public acceptance of this process.
Cost Considerations		
• life-cycle cost	99	
• funding availability	50	Not a budgeted item and line item funding may be required.
Industry Involvement		
• market for technology	80	The facility could potentially be used to treat numerous waste streams throughout the DOE Complex.
• private sector involvement	20	Technology is available at an existing DOE facility.

IDOA Score: **Technical** 52 **Total** 65

Waste Stream Number & Name: SR-W031 Uranium/Chromium Solution
Option Number: SR-W031-6
Facility: INEL/WEDF **Treatment Technology: Stabilization**
Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled
Module Location: INEL
Module Status: [√] Existing [ ] New [√] Small generator [ ] Large generator
[ ] Onsite [√] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ N/A	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ N/A	
		1.3.2 Safety Assurance Documentation	$ N/A	
		1.3.3 Permitting	$ N/A	
		1.3.4 Preparation for Operations	$ N/A	
		1.3.5 Project Management	$ N/A	
		TOTAL PRE-OPERATIONS		$ N/A
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ N/A	
	2.2	Inspection	$ N/A	
	2.3	Project Management	$ N/A	
	2.4	Building Construction (inc. indirect)	$ N/A	
	2.5	Equipment (inc. indirect)	$ N/A	
	2.6	Construction Management	$ N/A	
	2.7	Contingency	$ N/A	
		TOTAL FACILITY CONSTRUCTION COSTS		$ N/A
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ N/A	
	3.2	Annual Utilities	$ N/A	
	3.3	Annual Materials	$ N/A	
	3.4	Annual Maintenance	$ N/A	
	3.5	Annual Contingency	$ N/A	
		TOTAL ANNUAL O & M	$ N/A	
		X NUMBER OF YEARS OF OPERATION		
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ N/A
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ N/A	
	4.2	Closure, Post-Closure, Monitoring	$ N/A	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ N/A
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$ N/A	
	5.2	Mobile Treatment	$ N/A	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$ 3
7.0	Transportation			$ 18
8.0	Disposal			$ 532
		SUB COST FOR STABILIZATION MODULE		$ 553
		ESCALATION		1.06
		TOTAL COST		$ 586

Note: Per DOE directions, this cost carries no overhead burden or capital costs.
If above numbers do not appear to add correctly, it is the result of computer rounding.

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Summary Page

Waste Stream Number & Name: SR-W032 Mercury Contaminated Heavy Water

Background Information

This waste was generated in the Heavy Water Operations Laboratory during analytical testing where mercury (II) chloride was used in the testing procedure.

Volume

- Current volume through 09/30/94 is 9.6 m^3.
- No future waste generation is expected because the laboratory has modified the test using mercury as a tracing agent since the test generated a mixed waste.

Waste Stream Composition

- Aqueous liquid

Waste Code

- D009A (TCLP Hg) wastewater

LDR Treatment Standard

- D009 = concentration based standard = 0.2 mg/l

Waste Characterization

- Sampling and analysis used to characterize the waste stream.
- Confidence level high is due to sample analysis results.

Radiological Characterization

- Calculated activity varies. Average reading is 290 nCi/g.
- Tritium is present.
- Waste is contact handled.
- Mixed low-level waste

Preferred Option

The preferred treatment option for Mercury Contaminated Heavy Water is recycling in the D-Area Heavy Water Operations Facility through utilization of an Ion Exchange resin.

Treatment Justification

In-depth options analysis (IDOA) is not required for this waste stream since a Preferred Option has been identified utilizing an existing facility with existing treatment technology.

Ion exchange and heavy water recycling processes exist in the D-Area facilities. SRS is currently developing a plan to treat SR-W032 prior to October 1995 to take advantage of the facility's processing capability prior to shutdown (scheduled for FY 97). If treatment is completed prior to October 1995, this waste stream will be removed from the STP.

Waste Stream Number & Name: SR-W032 Mercury Contaminated Heavy Water
Facility: D-Area Treatment Technology: Ion Exchange
Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[ ] alpha [√] non-alpha [√] contact handled [ ] remote handled
Module Location: SRS
Module Status: [√] Existing [ ] New [ ] Small generator [√] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ N/A	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ N/A	
		1.3.2 Safety Assurance Documentation	$ N/A	
		1.3.3 Permitting	$ N/A	
		1.3.4 Preparation for Operations	$ N/A	
		1.3.5 Project Management	$ N/A	
		TOTAL PRE-OPERATIONS		$ 0
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ N/A	
	2.2	Inspection	$ N/A	
	2.3	Project Management	$ N/A	
	2.4	Building Construction (inc. indirect)	$ N/A	
	2.5	Equipment (inc. indirect)	$ N/A	
	2.6	Construction Management	$ N/A	
	2.7	Contingency	$ N/A	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 0
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 52	
	3.2	Annual Utilities	$ 0	
	3.3	Annual Materials	$ 0	
	3.4	Annual Maintenance	$ 250	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 302	
		X NUMBER OF YEARS OF OPERATION	.23	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 69
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ N/A	
	4.2	Closure, Post-Closure, Monitoring	$ N/A	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 0
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$ N/A	
	5.2	Mobile Treatment	$ N/A	
		TOTAL CONTRACTED SERVICES		$ 0
6.0	Offsite Treatment (DOE)			$ 0
7.0	Transportation			$ 0
8.0	Disposal			$ 0
		SUB COST FOR ION EXCHANGE MODULE		$ 69
		ESCALATION		1.092
		TOTAL COST		$ 76

Summary Page – Initial Screening

Waste Stream Number & Name: SR-W033 Thirds/TRU Job Control Waste <100 nCi/g

Background Information

The waste stream is composed primarily of solids such as booties, lab coats, floor sweepings, rags, labware, and other job control waste generated primarily through separation activities for plutonium production. The waste stream includes small amounts of transuranic waste from onsite laboratories.

Volume

- Current volume through 09/30/94 is 8.0 m^3.
- Expected 1995-1999 volume will be 30 m^3.

Waste Stream Composition

- Organic debris

Waste Code

- D001C (Ignitable)
- D003D
- D004A
- D006A
- D007A-D009A, D011A (TCLP metals)
- D018-19, D022-26 (characteristic organics)
- P012 (acutely toxic commercial chemical wastes)
- P015
- P048
- P113
- P120
- U002 (commercial chemical wastes)
- U032
- U052
- U080
- U133
- U134
- U144
- U151
- U154
- U161
- U209
- U211
- U220
- U226
- U239

LDR Treatment Standard

- D001 = specified technology = Recovery of Organics or Combustion
- D003 = specified technology = DEACT
- D004 = concentration based standard = 5.0 mg/l
- D006 = concentration based standard = 1.0 mg/l
- D007 = concentration based standard = 5.0 mg/l
- D008 = concentration based standard = 5.0 mg/l
- D009 = concentration based standard = 0.2 mg/l
- D011 = concentration based standard = 5.0 mg/l
- D018* = concentration based standard = 10 mg/kg
- D019* = concentration based standard = 6.0 mg/kg
- D022* = concentration based standard = 6.0 mg/kg

- D023* = concentration based standard = 5.6 mg/kg
- D024* = concentration based standard = 5.6 mg/kg
- D025* = concentration based standard = 5.6 mg/kg
- D026* = concentration based standard = 5.0 mg/kg
- P012 = concentration based standard = 5.0 mg/l
- P015 = specified technology = RMETL or RTHRM
- P048 = concentration based standard = 160 mg/kg
- P113 = specified technology = RTHRM or STABL
- P120 = specified technology = STABL
- U002 = concentration based standard = 160 mg/kg
- U032 = concentration based standard = 0.86 mg/l
- U052 = concentration based standard = 5.6-11.2 mg/kg
- U080 = concentration based standard = 30 mg/kg
- U133 = specified technology = CHOXD, CHRED, or CMBST
- U134 = specified technology = ADGAS fb NEUTR or NEUTR
- U144 = concentration based standard = 037 mg/l
- U151 = concentration based standard = 0.025 mg/l
- U154 = concentration based standard = 0.75 mg/l, or CMBST
- U161 = concentration based standard = 33 mg/kg
- U209 = concentration based standard = 6.0 mg/kg
- U211 = concentration based standard = 6.0 mg/kg
- U220 = concentration based standard = 10 mg/kg
- U226 = concentration based standard = 6.0 mg/kg
- U239 = concentration based standard = 30 mg/kg
- Alternate debris technology

*D012-D043 nonwastewaters must be treated to meet the Universal Treatment Standards (UTS) for any underlying constituents that may be present.

Waste Characterization

- Process knowledge used to characterize the waste stream.
- Confidence level is medium based on the varying composition of the job control waste as it is generated.

Radiological Characterization

- Total activity is 10-100 nCi/g
- Alpha emitters (Pu^{238}, Pu^{239}, Pu^{240}, Pu^{241}, Pu^{242}, Am^{241}, and U^{233}) are present.
- Beta/gamma emitters (H^3, Co^{60}, and Cs^{137}) are present.
- Waste is contact handled.
- Mixed low-level waste

Initial Screening

The initial screening that this waste stream potentially fits into one or more waste classifications (orphan waste) and will require further characterization to determine the portion that is mixed TRU waste. This determination is based on the lack of adequate assay technology to properly classify this waste at the time of generation. Further screening revealed that this waste may contain metal debris or large metal pieces. Therefore, option analyses were prepared on the supposition that the expected waste characterization results will show that the waste consists of both metal debris (or bulk metal) and combustible organic materials.

Initial screening identified several inappropriate treatment options. These options appear in the Initial Rejections Table.

Initial Rejections

Treatment Facility	Treatment Technology	Reasons for Rejection
ETF	Ion Exchange	ETF has no process to treat this waste.
Lab	Lab scale process flowsheet	Volume of waste is too great to handle with laboratory-scale equipment.
LETF	Ion Exchange	LETF has no process to treat this waste.
M Area	Vitrification	This waste has too large a volume for M Area to handle effectively. Waste contains plastics which create vapors during vitrification that the offgas system cannot handle. Moreover, TRU waste characterization is scheduled after the M-Area vitrification mission is complete.
Tritium	Macroencapsulation	Bringing fission products into the tritium production area is prohibited.
Z Area	Stabilization	Z Area can treat only those wastes that come by pipeline from Tank 50 and meet strict waste acceptance criteria. The Z-Area process lacks flexibility to treat and dispose of a variety of waste streams.
INEL/WERF	Incineration/ Stabilization	WERF will not accept alpha waste.
INEL/WEDF	Stabilization	WEDF is in preconceptual design. It is too early to determine if technology is applicable.

Summary Page – Technology Success Factor (TSF) & In-Depth Options Analysis (IDOA)

Waste Stream Number & Name: SR-W033 Thirds/TRU Job Control Waste <100 nCi/g

Feasible Options

Option No.	Treatment Facility	Treatment Technology	TSF Score	IDOA Scores Tech.	IDOA Scores Total	COST (x 1,000)	PO
SR-W033-1	TWCCF/AVF	Characterization/ Vitrification	*	53	53	SR-W025-1	√
SR-W033-2	TWCCF/ Cont. Bldg.	Characterization/ Macroencapsulation	94	56	70	SR-W025-2	√
SR-W033-3	CIF	Incineration/ Stabilization	94	56	70	SR-W025-3	
SR-W033-4	INEL/IWPF	Incineration	*	36	50	SR-W025-4	

* No TSF required for proposed or existing non-Savannah River Site-DOE waste processing facilities.

Options Rejected Due To Low Technology Success Factor (TSF)

- No options were rejected.

Engineering Assessment

Preferred Option Justification

The preferred option for Solvent/TRU Job Control Waste <100 nCi/g is to assay, sort, and characterize the waste stream in the TRU Waste Certification/Characterization Facility (TWCCF). Then, the waste will be either macroencapsulated or vitrified.

This option is preferred because it identifies the mixed TRU portion of this waste stream. Two waste treatment options have been identified to ensure the remaining MLLW portion of this waste stream meets LDR treatment standards of onsite disposal: Macroencapsulation in a stainless steel box and Stabilization by Vitrification.

Macroencapsulation is preferred for treating the metal debris because:

- Final wasteform will meet RCRA, Subtitle C, Disposal WAC.
- Process satisfies requirements of the "debris rule" and meets applicable LDR requirements.
- The technology exists, and the process employs well-known techniques (e.g., welding stainless steel).
- Similar systems have demonstrated availability of greater than 80%.

Stabilization by vitrification is preferred for treating the combustible organic component because:

- Waste volume will be reduced by a factor of 15 to 1.
- Final wasteform will meet LDR treatment standards.
- Cost sharing with equal to or greater than 100 nCi/g mixed and nonmixed TRU waste stream.

This option treats the constituents of concern and listed organics by stabilizing them in a non-leaching class matrix. The vitrification process could concentrate the TRU fraction equal to or above 100 nCi/g, requiring WIPP disposal of the final wasteform.

Options Rejected During IDOA

Incineration and Stabilization at CIF

Incineration and stabilization at CIF was rejected because:

- Public has significant concerns about incineration and publicly expressed concerns about the incinerator safety.
- 100% of final solid wasteform will go to HW/MW facilities disposal.

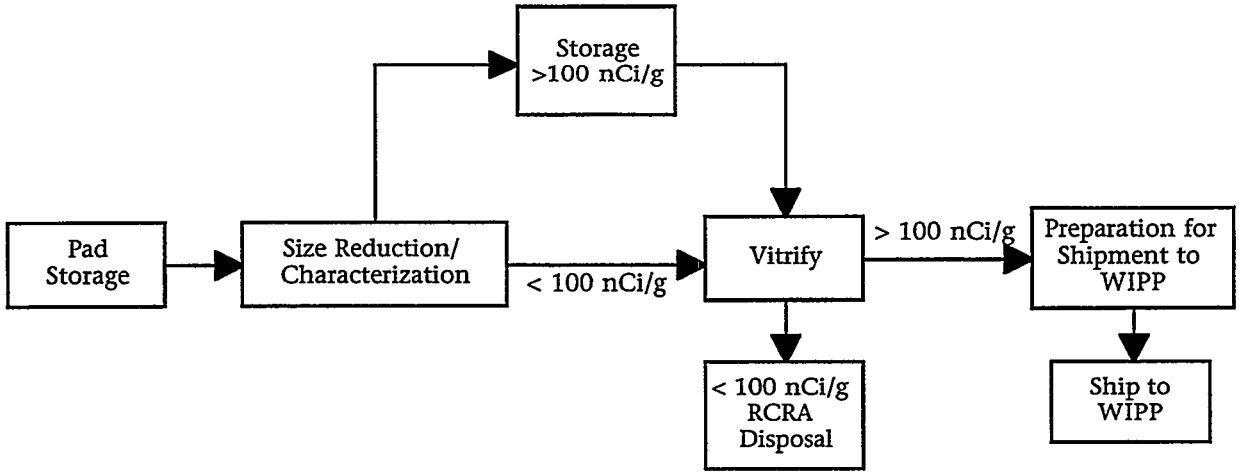
Incineration at INEL/IWPF

Incineration at INEL/IWPF was rejected because:

- INEL/IWPF is planned, but not approved.
- Large volume streams will be treated onsite.

Waste Stream Number & Name: SR-W033 Thirds/TRU Job Control Waste > 100 nCi/g
Option Number: SR-W033-1
Facility: Alpha Vitrification Facility (AVF) Treatment Technology: Stabilization by Vitrification

Treatment Cycle Flow Diagram



Pros

- Volume reduction of 15 to 1.
- All applicable LDR treatment standards are met, and if waste delisted (F-listed waste), final waste will be nonhazardous.
- Treatment destroys organics and stabilizes metals to meet LDR requirements.
- Final vitrified wasteform will meet disposal requirement. No additional treatment required.

Cons

- Cost of technology is in the higher third for treatment technologies.
- Treatment facilities are in the conceptual design phase.
- The scope of the TWCCF will require line-item funding which is not planned at this time.
- Process generates secondary wastes and offgas residuals requiring treatment.
- Technology has not been fully proven for waste stream.
- No full scale operating facility exists for this application.
- Waste stream requires further characterization before a final volume determination can be made.
- Waste stream must be treated first in the TWCCF to avoid higher activity wastes.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	100	Add 20 points to the median score of 80 because volume reduction is 15 to 1.
• secondary waste generation	50	Some secondary waste in the form of a sludge will require further treatment by existing technology.
• destruction removal and demobilization efficiency	100	Add 20 points to the median score of 80 because all applicable LDR treatment standards are met and if waste is delisted, final waste will be non-hazardous.

Waste Stream Number & Name: SR-W033 Thirds/TRU Job Control Waste > 100 nCi/g
Option Number: SR-W033-1
Facility: Alpha Vitrification Facility (AVF) Treatment Technology: Stabilization by Vitrification

In-Depth Options Analysis (IDOA) Score Sheet

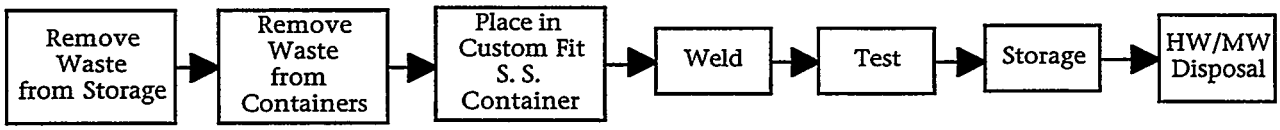
Attribute	Score	Discussion/Notes
• flexibility	80	Vitrification technology can handle a wide variety of wastes without extensive adjustments in operating parameters.
• ability to be shipped	80	Will meet all DOT shipping requirements.
• final wasteform	100	Final vitrified wasteform will meet disposal requirements. Add 20 points to the median score of 80 because no additional treatment required.
Engineering Parameters		
• system implementability	50	Technology has not been fully proven for waste stream.
• availability	20	No full scale operating facility exists.
• scalability	50	Throughput fixed by design.
• remedial measures	80	Recoverable. Recycle through melter.
• schedule for treatment of waste	20	AVF is pre-conceptual.
Personnel Parameters		
• consequence of unmitigated accident scenarios	90	This is not different from waste currently scheduled for treatment here. Add 10 points to the median score of 80 because emissions are few and controlled even in accident scenarios.
• non operational worker potential exposure	50	Additional non-routine maintenance required. Assumed less than 25% downtime required.
• operational worker potential exposure	50	Size reduction and repackaging of waste will require extensive handling.
• transportation potential exposure	50	Nothing unusual about wasteform. Expect low alpha and no liquids. Onsite transport required.
Regulatory Parameters		
• need for variance	80	Process will be in full compliance.
• ability to obtain a permit	50	Both an RCRA Part A and Part B Permits may be required by SCDHEC. The time needed to obtain these permits may be lengthy.
• waste disposal	50	Treated wasteform may require disposal in a HW/MW facility unless delisted.
Public Acceptance		
• public acceptance	50	Public has supported treatment that results in a glass wasteform.
Cost Considerations		
• life-cycle cost	0	Included with SR-W025
• funding availability	20	Not budgeted; pre-conceptual
Industry Involvement		
• market for technology	20	Technology exists, but not fully proven.
• private sector involvement	80	No private sector involvement is anticipated.

IDOA Score: Technical 53 **Total** 53

Cost Estimate: INCLUDED WITH COST ESTIMATE INFORMATION FOR TREATING WASTE STREAM SR-W025. SEE COST ESTIMATE FOR SR-W025.

Waste Stream Number & Name: SR-W033 Thirds/TRU Job Control Waste <100 nCi/g
Option Number: SR-W033-2
Facility: Containment Building
Treatment Technology: Macroencapsulation in a S. S. Box

Treatment Cycle Flow Diagram



Pros

- Process satisfies requirements of the "debris rule" and all applicable LDR standards are met.
- Can process a wide range of materials.
- S.S. containers will meet current DOT shipping requirements.
- Final wasteform will meet RCRA Subtitle C Disposal WAC.
- All processes involved are existing technology.
- Similar systems have demonstrated availability of greater than 80%.
- Process failure does not produce altered wasteform. A failed container is easily fixed.
- Due to process simplicity, a schedule can be developed easily.
- Process does not create emissions related to the waste stream. Process simply involves container welding.
- Simple welding process requiring minimal maintenance. No additional requirements for decommissioning.
- Exposure controlled by design. Number of workers is dependent upon throughput.
- Little secondary waste.

Cons

- All waste will require disposal in HW/MW facilities.
- Not a budget item and will require line item funding.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	40	Subtract 10 points from the median score of 50 because volume of material increases slightly due to packaging in S.S. container.
• secondary waste generation	80	Little secondary waste.
• destruction removal and demobilization efficiency	80	All applicable LDR standards are met.
• flexibility	80	Can process a wide range of materials.
• ability to be shipped	80	S.S. containers will meet current DOT shipping requirements.
• final wasteform	80	Final wasteform will meet RCRA Subtitle C Disposal WAC.
Engineering Parameters		
• system implementability	90	Add 10 points to the median score of 80 because all processes involved are existing technology.
• availability	80	Similar systems have demonstrated availability of greater than 80%.
• scalability	50	Throughput is set by design and not easily expanded except by adding additional shifts of operation.

Waste Stream Number & Name: SR-W033 Thirds/TRU Job Control Waste <100 nCi/g
Option Number: SR-W033-2
Facility: Containment Building
Treatment Technology: Macroencapsulation in a S. S. Box

In-Depth Options Analysis (IDOA) Score Sheet

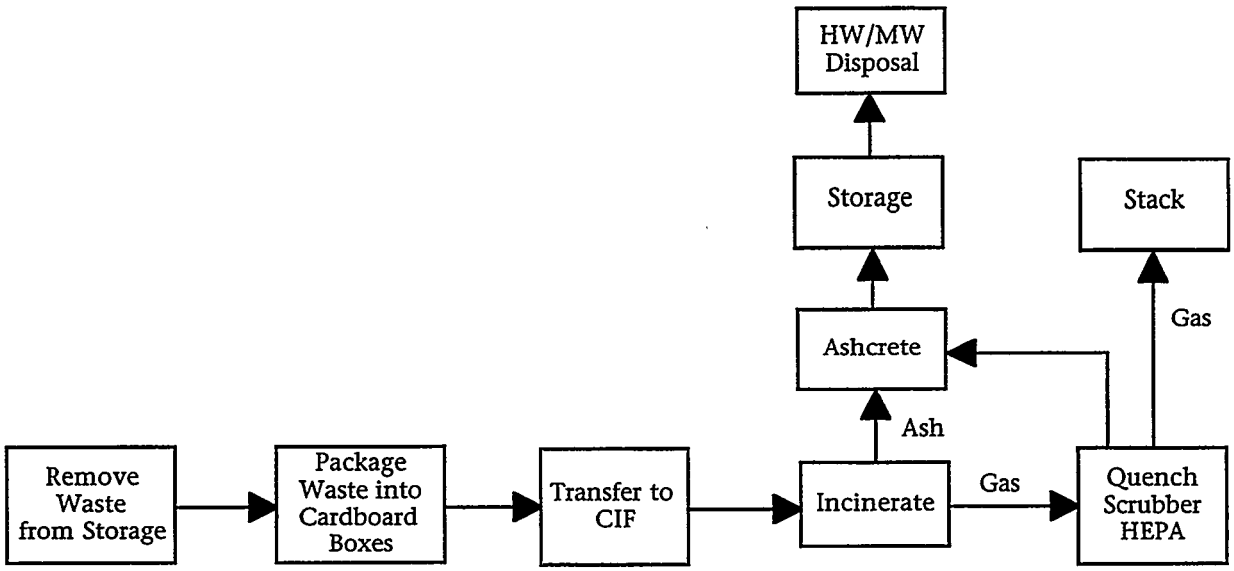
Attribute	Score	Discussion/Notes
• remedial measures	90	Process failure does not produce altered wasteform. Add 10 points to the median score of 80 because a failed container is easily fixed.
• schedule for treatment of waste	80	Due to process simplicity, a schedule can be developed easily.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Process does not create emissions related to the waste stream. Process simply involves container welding.
• non operational worker potential exposure	80	Simple welding process requiring minimal maintenance. No additional requirements for decommissioning.
• operational worker potential exposure	80	Exposure controlled by design. Number of workers is dependent upon throughput.
• transportation potential exposure	60	No additional characterization needed. Add 10 points to the median score of 50 because waste can be handled readily.
Regulatory Parameters		
• need for variance	80	Process satisfies requirements of the "debris rule."
• ability to obtain a permit	40	Subtract 10 points from the median score of 50 because uncertainties surround attaining a permit related to the "debris rule" and the containment building requirements.
• waste disposal	20	All waste will require disposal in HW/MW facilities.
Public Acceptance		
• public acceptance	20	Public may express concern because the wasteform is not unalterably inert.
Cost Considerations		
• life-cycle cost	100	Included with SR-W025.
• funding availability	20	Not a budget item and will require line item funding.
Industry Involvement		
• market for technology	20	This is an existing technology.
• private sector involvement	20	SRS facility evaluated.

IDOA Score: Technical 56 Total 70

Cost Estimate: INCLUDED WITH COST ESTIMATE INFORMATION FOR TREATING WASTE STREAM SR-W025. SEE COST ESTIMATE FOR SR-W025.

Waste Stream Number & Name: SR-W033 Thirds/TRU Job Control Waste <100 nCi/g
Option Number: SR-W033-3
Facility: CIF
Treatment Technology: Incineration/ Stabilization

Treatment Cycle Flow Diagram:



Pros

- Expect at least two to one volume reduction.
- The waste stream is expected to meet all applicable LDR requirements.
- Incinerator designed for a wide range of wastes with some operational limitations.
- Waste does not require additional treatment to meet DOT shipping requirements.
- The wasteform expected to meet the waste disposal WAC in the form it exits the facility.
- Incineration is a current demonstrated technology.
- Process failures will not result in a wasteform that cannot be treated by existing technologies.
- Reasonably easy to schedule this waste stream assuming current startup schedule.
- No additional non operational workers are required.
- No additional operational workers will be required.
- All processes are in full compliance with existing regulations and no variances are required.
- Line item is funded.

Cons

- 100% of the final solid wasteform will go to HW/MW facilities for disposal.
- The public has significant concerns about incineration and publicly expressed concerns about the safety of incinerators.

In-Depth Options Analysis (IDOA)Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	70	Subtract 10 points from the median score of 80 because expect at least two to one reduction but not as much as five to one.

Waste Stream Number & Name: SR-W033 Thirds/TRU Job Control Waste <100 nCi/g
Option Number: SR-W033-3
Facility: CIF
Treatment Technology: Incineration/ Stabilization

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• secondary waste generation	40	Subtract 10 points from the median score of 50 because significant volume of secondary waste due to ash and blowdown solidification.
• destruction removal and demobilization efficiency	80	The waste stream is expected to meet all applicable LDR standards.
• flexibility	80	Incinerator designed for a wide range of wastes with some operational limitations.
• ability to be shipped	80	Waste does not require additional treatment to meet shipping requirements.
• final wasteform	100	Add 20 points to the median score of 80 because the wasteform expected to meet the waste disposal WAC in the form it exits the facility.
Engineering Parameters		
• system implementability	100	Add 20 points to the median score of 80 because incineration is a current demonstrated technology.
• availability	50	Incinerator availability for solids is 50%. Normal maintenance requirements apply.
• scalability	50	Capacity is set by design but the facility can accept a wide range of inputs.
• remedial measures	70	Subtract 10 points from the median score of 80 because process failures will result in a wasteform that will require special treatment.
• schedule for treatment of waste	80	Reasonably easy to schedule this waste steam assuming current startup schedule.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Metals in this waste stream will be immobilized in the ashcrete resulting in little or no emissions from the facility even during most accident scenarios.
• non operational worker potential exposure	70	No additional non operational workers are required. Subtract 10 points from the median score of 80 because additional non routine maintenance will be required.
• operational worker potential exposure	40	Subtract 10 points from median score of 50 because of the labor required to repackage waste in cardboard boxes.
• transportation potential exposure	60	Limited transportation will be required. Add 10 points to the median score of 50 because no additional characterization will be required.
Regulatory Parameters		
• need for variance	80	All processes are in full compliance with existing regulations and no variances are required.
• ability to obtain a permit	50	Permitting incineration of alpha-contaminated waste may be difficult.
• waste disposal	20	100% of the final wasteform will go to HW/MW facilities for disposal.
Public Acceptance		
• public acceptance	20	Incineration has limited acceptance. Public has expressed concerns about the safety of incinerators.

Waste Stream Number & Name: SR-W033 Thirds/TRU Job Control Waste <100 nCi/g
Option Number: SR-W033-3
Facility: CIF
Treatment Technology: Incineration/ Stabilization

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Cost Considerations		
• life-cycle cost		
• funding availability	80	Line item is funded.
Industry Involvement		
• market for technology	80	Treatment has applicability at all DOE complex sites.
• private sector involvement	20	SRS facility evaluated.

IDOA Score: **Technical** 56 **Total** 70

Cost Estimate: INCLUDED WITH COST INFORMATION FOR TREATING WASTE STREAM SR-W025. SEE COST ESTIMATE FOR SR-W025.

Waste Stream Number & Name: SR-W033 Thirds/TRU Job Control Waste <100 nCi/g

Option Number: SR-W033-4
Facility: INEL/IWPF
Treatment Technology: Incineration/ Stabilization

Treatment Technology

INEL IWPF incinerator is in the preliminary design phase. The type of kiln and offgas system have not yet been determined.

Pros

- Incineration will reduce the waste volume by more than 100 to 1.
- The facility will treat waste streams similar in composition to those assumed in the design basis without modification.
- Any ash waste generated, after stabilization, is anticipated to meet the SRS disposal WAC.
- Process failure is not anticipated to result in the creation of a waste that cannot be treated.

Cons

- The facility is in preliminary design phase, uncertain of facility design and secondary waste streams. An ash waste stream and some blowdown type wastes are anticipated.
- The process is currently in the preliminary design phase, final incinerator type has been selected.
- Uncertainties surrounding the design prevent an accurate estimation of availability.
- A schedule for waste treatment cannot be provided; additionally, acceptance of SRS waste will be contingent upon State of Idaho approved permit modifications. In addition facility operation is contingent upon the receipt of DOE funding.
- Waste characterization will be required for any waste streams returned to SRS for disposal.
- The process will require RCRA Part B Permit Application approval from the State of Idaho. State of Idaho approval for treatment of offsite waste may be difficult.
- The majority of the treated waste with be classified as mixed waste which will require disposal in a HW/MW facility.
- Currently stakeholder acceptance of incineration is perceived as low. Public approval of incineration is anticipated to drop with the additional treatment of offsite wastes.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	100	Add 20 points to the median score of 80 because incineration will reduce the waste volume by more than 100 to 1.
• secondary waste generation	20	The facility is in preliminary design phase, uncertain of facility design and secondary waste streams. An ash waste stream and some blowdown type wastes are anticipated.
• destruction removal and demobilization efficiency	50	Additional LDR treatment may be required for waste streams contaminated with non-organic materials.
• flexibility	80	The facility will treat waste streams similar in composition to those assumed in the design basis without modification.
• ability to be shipped	50	The ash waste, when generated, must be stabilized in a grout matrix prior to shipment.
• final wasteform	80	Any ash waste generated, after stabilization, is anticipated to meet the SRS waste disposal WAC.

Waste Stream Number & Name: SR-W033 Thirds/TRU Job Control Waste <100 nCi/g
Option Number: SR-W033-4
Facility: INEL/IWPF
Treatment Technology: Incineration/ Stabilization

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Engineering Parameters		
• system implementability	20	The process is currently in the preliminary design phase, final incinerator type has not been selected.
• availability	20	Uncertainties surrounding the design prevent an accurate estimation of availability.
• scalability	50	The facility is currently in the preliminary design phase. Any modification required for unique waste streams could be incorporated in to the facility design.
• remedial measures	80	Process failure is not anticipated to result in the creation of a waste that cannot be treated.
• schedule for treatment of waste	20	A schedule for waste treatment cannot be provided; additionally, acceptance of SRS waste will be contingent upon State of Idaho approved permit modifications. In addition facility operation is contingent upon the receipt of DOE funding.
Personnel Parameters		
• consequence of unmitigated accident scenarios	50	Emissions from the planned facility could result during potential accident scenarios.
• non operational worker potential exposure	50	Personnel exposure is expected to be average for operations of this type.
• operational worker potential exposure	50	Personnel exposure is anticipated to be average for operations of this type.
• transportation potential exposure	20	Waste characterization will be required for any waste streams returned to SRS for disposal.
Regulatory Parameters		
• need for variance	20	The process will require RCRA Part B Permit application approval from the State of Idaho. State of Idaho approval for treatment of offsite waste may be difficult.
• ability to obtain a permit	50	Permitting process is well defined, however, the State of Idaho's acceptance of offsite waste treatment is unknown. Approval may be difficult.
• waste disposal	20	The majority of the treated waste will be classified as mixed waste which will require disposal in a HW/MW facility.
Public Acceptance		
• public acceptance	20	Currently stakeholder acceptance of incineration is perceived as low. Public approval of incineration is anticipated to drop with the additional treatment of offsite wastes.
Cost Considerations		
• life-cycle cost	17	
• funding availability	50	Funding for treatment cost can be provide using the operating budget, however the additional costs may result in an increase in the budget in excess of 10%. (Line item funding is being pursued by the facility contractor).

Waste Stream Number & Name: SR-W033 Thirds/TRU Job Control Waste <100 nCi/g
Option Number: SR-W033-4
Facility: INEL/IWPF
Treatment Technology: Incineration/ Stabilization

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Industry Involvement		
• market for technology	20	This is an existing commercial technology.
• private sector involvement	20	Technology is being developed at an existing DOE facility.

IDOA Score: **Technical** 36 **Total** 50

Cost Estimate: INCLUDED WITH COST INFORMATION FOR TREATING WASTE STREAM SR-W025. SEE COST ESTIMATE FOR SR-W025.

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Summary Page – Initial Screening

Waste Stream Number & Name: SR-W034 Calcium Metal

Background Information

Material that is used in an FB-Line process and became slightly oxidized and off-specification. The waste is stored in four 55-gallon steel drums.

Volume
- Current volume through 09/30/94 is 0.8 m^3.
- No future waste generation is expected. Off-specification material was stored in an Reactive Materials Management Area (RMMA) before it was discovered that the material was unacceptable to use for its specified purpose. Current procedures for material handling have reduced the likelihood for this situation to recur.

Waste Stream Composition
- Reactive metal

Waste Code
- D003D (water reactive) nonwastewater

LDR Treatment Standard
- D003 = specified technology = Deactivation
- Alternate debris technology may be applied.

Waste Characterization
- Process knowledge was used to characterize the waste stream.
- Confidence level is high based on the fact that this is pure technical grade calcium metal.

Radiological Characterization
- Stored in an RMMA – not likely to be contaminated but confirmation difficult
- Waste is contact handled.
- Mixed low-level waste

Initial Screening

The initial screening identified inappropriate treatment options. These options appear in the Initial Rejections table.

Initial Rejections

Treatment Facility	Treatment Technology	Reasons for Rejection
ETF	Ion Exchange	ETF has no process to treat elemental calcium metal.
CIF	Ashcrete Stabilization	Ashcrete does not remove the characteristic organics. Resulting wasteform would not meet LDR requirements.
Z Area	Stabilization	Z Area can treat only those wastes that come by pipeline from Tank 50 and meet strict waste acceptance criteria. The Z-Area process lacks flexibility to treat and dispose of a variety of waste streams.

Summary Page – Technology Success Factor (TSF) & In-Depth Options Analysis (IDOA)

Waste Stream Number & Name: SR-W034 Calcium Metal

Feasible Options

Option No.	Treatment Facility	Treatment Technology	TSF Score	IDOA Scores Tech.	IDOA Scores Total	COST (x 1,000)	PO
SR-W034-1	DOE Mobile	Water Oxidation	51	68	82	332	√
SR-W034-2	Cont. Bldg.	Water Oxidation	51	68	82	1,642	
SR-W034-3	Vendor	CO_2 Oxidation	100	65	78	3,284	
SR-W034-4	M-Area	Acid Oxidation	88	63	77	1,267	
SR-W034-5	INEL/WEDF	Stabilization	*	51	65	173	
SR-W034-6	Vendor	Plasma Hearth	1				
SR-W034-7	Vendor	Vitrification	26				

* No TSF required for proposed or existing non-Savannah River Site-DOE waste processing facilities.

Options Rejected Due To Low Technology Success Factor (TSF)

Plasma Hearth Process by Vendor

Plasma Hearth Process by vendor was rejected because:

- Plasma hearth incineration is currently still in the laboratory. While prototypes may exist, they have no record of continuous reliable operation in industrial settings, hence, Pm=0.9.
- Control of the process requires sophisticated computerized instrumentation, hence, Pc=0.9.
- It is not expected for this technology to reach a level of reliability suitable for industrial application for 5-10 years.

Vitrification by Vendor (SR-W034-6)

Vitrification by vendor (SR-W034-6) was rejected because:

- The technology proposed has not been demonstrated even at bench scale. It was advanced by the vendor as an idea which the vendor would pursue, given funding, hence, Pm=0.9.
- The complexity of converting an industrial facility to the treatment and disposal of mixed waste, as the vendor proposes, is great, and does not seem to be fully appreciated by the vendor, hence, Pc=0.5.
- Process engenders safety concerns regarding calcium reacting without controls with water in a mixing tank before vitrification.

Engineering Assessment

Preferred Option Justification

The preferred treatment option for the Calcium Metal waste stream is Wet Oxidation in the DOE Mobile Reactive Metals Unit.

This option treats the constituent of concern, calcium, by eliminating the hazardous characteristic, reactivity, by reacting it to calcium hydroxide.

This option is preferred because:

- Process employs simple straightforward chemical reaction.
- Reaction takes place in a carefully controlled setting.

- Reaction products are nonhazardous and can be released to an outfall via a waste water treatment facility.
- No secondary waste is generated.
- Option was selected by the DOE Options Analysis Team.

Treatability Study Requirements

This treatment employs a well known chemical property: elemental calcium reaction with warm water to form calcium hydroxide and hydrogen gas. Although no treatability studies will be required, laboratory-scale, applied research will determine the process train needed to carry-out the reaction.

Options Rejected During IDOA

Reaction of Calcium Metal Waste Stream by Wet Oxidation in a Containment Building

Reaction of calcium metal waste stream by wet oxidation in a containment building was rejected because:

- The design is less advanced than that for DOE Mobile Treatment Facility.
- This option is less cost-effective than the selected option.

Reaction of Calcium with Carbon Dioxide by a Vendor

Reaction of calcium with carbon dioxide by a vendor was rejected because:

- Process produces a solid waste that requires disposal as low-level waste.

Dissolving with Acid in M Area

Dissolving with acid in M Area was rejected because:

- Process employs nitric acid, causing additional concerns about personnel exposure and respiratory hazard.
- Process is more complex than the preferred option, but offers no environmental or technological advantage.

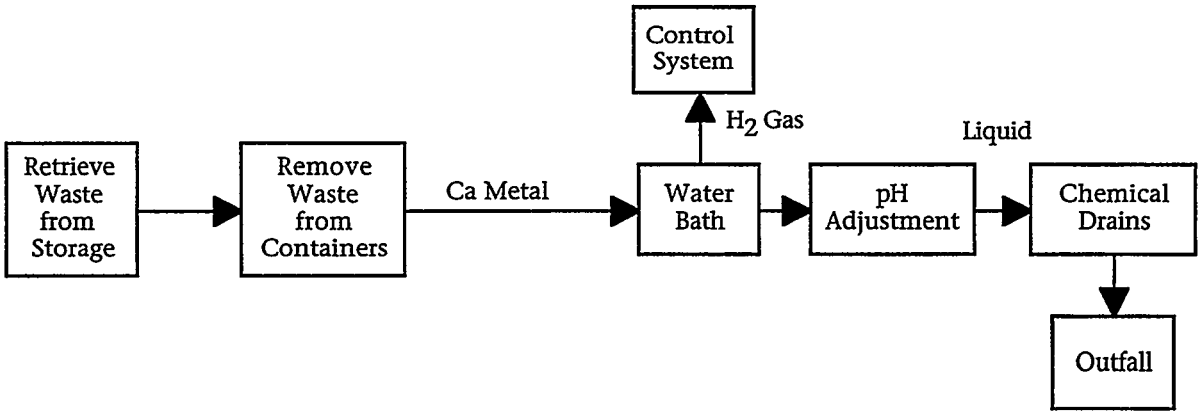
Stabilization at INEL/WEDF

Stabilization at INEL/WEDF (encapsulating the waste with a grout matrix) was rejected because:

- Process does not eliminate hazardous characteristic (i.e., reactivity) of the waste.
- Final wasteform will not meet LDR standards.

Waste Stream Number & Name: SR-W034 Calcium Metal
Option Number: SR-W034-1
Facility: DOE Mobile Unit **Treatment Technology: Water Oxidation**

Treatment Cycle Flow Diagram



Pros

- Total volume will be discharged to outfall.
- Little secondary waste. Reactor will require disposal after processing is complete.
- No additional treatment is required to meet LDR.
- Will handle expected waste stream. The waste stream is not expected to vary.
- Treatment eliminates hazardous characteristic (i.e., reactivity).
- Meets the expected WAC for waste disposal. No additional secondary waste treatment is required. Wasteform is disposable in the form in which it exits the process.
- Simple process employing a straightforward chemical reaction process.
- Lack of moving parts in the treatment process suggests that availability will be greater than 80%.
- Simple process employing a straightforward chemical reaction process. No difficulty is expected in developing a schedule.
- Operational worker exposure will be small. Radiation levels are scarcely above background.
- Process will be designed to comply with applicable regulations without seeking a variance.
- Process eliminates hazardous characteristic.
- Disposal of primary wastes will be discharged to outfall. Secondary waste can be decontaminated and disposed of as scrap.
- Because the process eliminates the hazardous characteristic, and the final wasteform is calcium hydroxide (Ca(OH)2), the public should have few concerns that cannot be resolved.

Cons

- Funding to construct a mobile unit has not been approved.
- H^2 gas evolved during the reaction must be controlled to reduce potential for a hydrogen explosion.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	80	Total volume will be discharged to outfall.
• secondary waste generation	80	Little secondary waste.

Waste Stream Number & Name: SR-W034 Calcium Metal
Option Number: SR-W034-1
Facility: DOE Mobile Unit **Treatment Technology: Water Oxidation**

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• destruction removal and demobilization efficiency	100	Add 20 points to the median score of 80 because no additional treatment is required to meet LDR standards.
• flexibility	80	Will handle expected waste stream. The waste stream is not expected to vary.
• ability to be shipped	80	Treatment eliminates hazardous characteristic (i.e., reactivity).
• final wasteform	80	Meets the expected WAC for waste disposal. No additional secondary waste treatment is required. Wasteform is disposable in the form in which it exits the process.
Engineering Parameters		
• system implementability	80	Simple process employing a straightforward chemical reaction process. Detailed design complete.
• availability	80	Lack of moving parts in the treatment process suggests that availability will be greater than 80%.
• scalability	50	Throughput is set by design, and not easily expanded except by adding more shifts of operation.
• remedial measures	80	Failed wasteform would require retreatment.
• schedule for treatment of waste	80	Simple process employing a straightforward chemical reaction process. No difficulty is expected in developing a schedule.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Process can be installed in a mobile unit with adequate emission controls.
• non operational worker potential exposure	80	Process has few moving parts. Little non operational worker involvement will be required.
• operational worker potential exposure	80	Operational worker exposure will be small. Radiation levels are scarcely above background.
• transportation potential exposure	80	Little characterization of treated waste is needed.
Regulatory Parameters		
• need for variance	80	Process will be designed to comply with applicable regulations without seeking a variance.
• ability to obtain a permit	80	Process eliminates hazardous characteristic.
• waste disposal	80	Disposal of primary wastes will be discharged to outfall. Secondary waste can be decontaminated and disposed of as scrap.
Public Acceptance		
• public acceptance	80	Because the process eliminates the hazardous characteristic, and the final wasteform is calcium hydroxide (Ca(OH)2), the public should have few concerns that cannot be resolved.

Waste Stream Number & Name: SR-W034 Calcium Metal
Option Number: SR-W034-1
Facility: DOE Mobile Unit **Treatment Technology: Water Oxidation**
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Cost Considerations		
• life-cycle cost		
• funding availability	20	Funding to construct mobile unit has not been approved.
Industry Involvement		
• market for technology	50	Although calcium metal is not usually a waste, the mobile unit's versatility in treating reactive metals may result in the technology being marketable.
• private sector involvement	50	Vendors have expressed interest in treating this waste.

IDOA Score: **Technical** 68 **Total** 82

Waste Stream Number & Name: SR-W034 Calcium Metal
Option Number: SR-W034-1
Facility: DOE Mobile Unit **Treatment Technology: Water Oxidation**
Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[ ] alpha [√] non-alpha [√] contact handled [ ] remote handled

Module Location: SRS

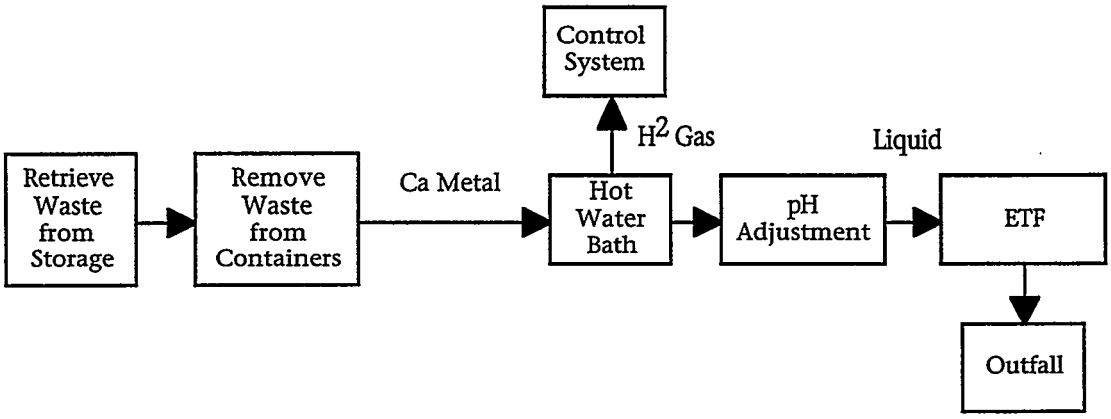
Module Status: [ ] Existing [√] New [√] Small generator [ ] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$	
		1.3.2 Safety Assurance Documentation	$	
		1.3.3 Permitting	$ 0	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$	
		TOTAL PRE-OPERATIONS		$ 150
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 0	
	2.2	Inspection	$ 0	
	2.3	Project Management	$ 0	
	2.4	Building Construction (inc. indirect)	$ 0	
	2.5	Equipment (inc. indirect)	$ 0	
	2.6	Construction Management	$ 0	
	2.7	Contingency	$ 0	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 0
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 38	
	3.2	Annual Utilities	$ 2	
	3.3	Annual Materials	$ 23	
	3.4	Annual Maintenance	$ 14	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 75	
		X NUMBER OF YEARS OF OPERATION	1.0	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 75
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 0	
	4.2	Closure, Post-Closure, Monitoring	$ 0	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 0
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$ 15	
		TOTAL CONTRACTED SERVICES		$ 15
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 0
		SUB COST FOR WATER OXIDATION MODULE		$ 240
		ESCALATION		1.384
		TOTAL COST		$ 332

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W034 Calcium Metal
Option Number: SR-W034-2
Facility: Containment Building
Treatment Technology: Water Oxidation

Treatment Cycle Flow Diagram



Pros

- Total volume will be discharged to outfall.
- Little secondary waste. Reactor will require disposal after processing is complete.
- No additional treatment is required to meet LDR.
- Will handle expected waste stream. The waste stream is not expected to vary.
- Treatment eliminates hazardous characteristic (i.e., reactivity).
- Meets the expected WAC for waste disposal. No additional secondary waste treatment is required. Wasteform is disposable in the form in which it exits the process.
- Simple process employing a straightforward chemical reaction process.
- Lack of moving parts in the treatment process suggests that availability will be greater than 80%.
- Simple process employing a straightforward chemical reaction process. No difficulty is expected in developing a schedule.
- Operational worker exposure will be small. Radiation levels are scarcely above background.
- Process will be designed to comply with applicable regulations without seeking a variance.
- Process eliminates hazardous characteristic.
- Disposal of primary wastes will be discharged to outfall. Secondary waste can be decontaminated and disposed of as scrap.
- Because the process eliminates the hazardous characteristic, and the final wasteform is calcium hydroxide (Ca(OH)2), the public should have few concerns that cannot be resolved.

Cons

- Not a budgeted item, will require line item funding.
- H^2 gas evolved during the reaction must be controlled to reduce potential for a hydrogen explosion.

Waste Stream Number & Name: SR-W034 Calcium Metal
Option Number: SR-W034-2
Facility: Containment Building Treatment Technology: Water Oxidation
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	100	Add 20 points to the median score of 80 because total volume will be discharged to outfall.
• secondary waste generation	80	Reactor will require disposal after processing is complete. No additional secondary waste treatment is required.
• destruction removal and demobilization efficiency	80	No additional treatment is required to meet LDR.
• flexibility	80	Will handle expected waste stream. The waste stream is not expected to vary.
• ability to be shipped	80	Treatment eliminates hazardous characteristic (i.e., reactivity).
• final wasteform	80	Meets the expected WAC for waste disposal. Wasteform is disposable in the form in which it exits the process.
Engineering Parameters		
• system implementability	80	Simple process employing a straightforward chemical reaction process.
• availability	80	Lack of moving parts in the treatment process suggests that availability will be greater than 80%.
• scalability	50	Throughput is set by design, and not easily expanded except by adding more shifts of operation.
• remedial measures	80	Failed wasteform would require retreatment.
• schedule for treatment of waste	80	Simple process employing a straightforward chemical reaction process. No difficulty is expected in developing a schedule.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Process can be installed in a containment building with adequate emission controls.
• non operational worker potential exposure	80	Little non operational worker involvement will be required.
• operational worker potential exposure	80	Operational worker exposure will be small. Radiation levels are scarcely above background.
• transportation potential exposure	80	Little characterization of treated waste is needed.
Regulatory Parameters		
• need for variance	80	Process will be designed to comply with applicable regulations without seeking a variance.
• ability to obtain a permit	80	Process eliminates hazardous characteristic.
• waste disposal	80	Disposal of primary wastes will be discharged to outfall. Secondary waste can be decontaminated and disposed of as scrap.
Public Acceptance		
• public acceptance	80	Because the process eliminates the hazardous characteristic, and the final wasteform is calcium hydroxide (Ca(OH)2), the public should have few concerns that cannot be resolved.

Waste Stream Number & Name: SR-W034 Calcium Metal
Option Number: SR-W034-2
Facility: Containment Building **Treatment Technology:** Water Oxidation
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Cost Considerations		
• life-cycle cost	95	
• funding availability	20	Not a budgeted item and will require line item funding.
Industry Involvement		
• market for technology	20	This material is not usually a waste.
• private sector involvement	50	Vendors have expressed interest in treating this waste.

IDOA Score: **Technical** 68 **Total** 82

Waste Stream Number & Name: SR-W034 Calcium Metal
Option Number: SR-W034-2
Facility: Containment Building **Treatment Technology: Water Oxidation**
Cost Estimate Sheet

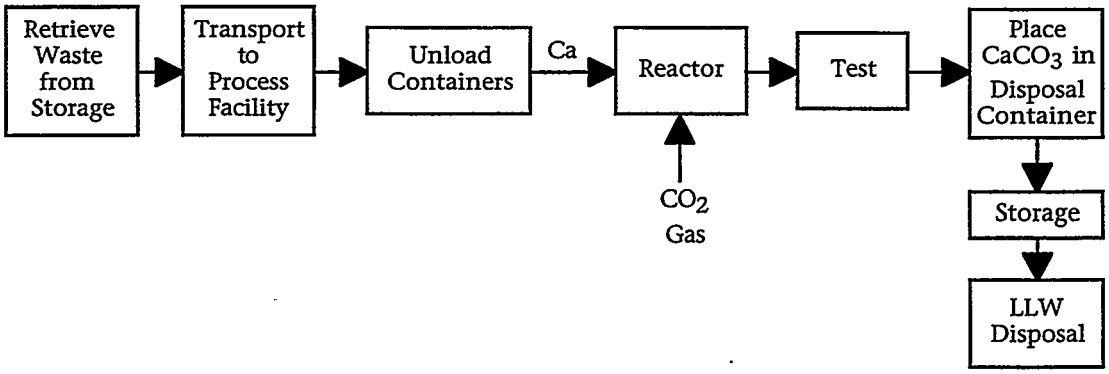
Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[ ] alpha [√] non-alpha [√] contact handled [ ] remote handled
Module Location: SRS
Module Status: [ ] Existing [√] New [√] Small generator [ ] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 17	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 67	
		1.3.2 Safety Assurance Documentation	$ 17	
		1.3.3 Permitting	$ 125	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 5	
		TOTAL PRE-OPERATIONS		$ 380
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 77	
	2.2	Inspection	$ 17	
	2.3	Project Management	$ 22	
	2.4	Building Construction (inc. indirect)	$ 100	
	2.5	Equipment (inc. indirect)	$ 250	
	2.6	Construction Management	$ 25	
	2.7	Contingency	$ 173	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 663
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 35	
	3.2	Annual Utilities	$ 1	
	3.3	Annual Materials	$ 21	
	3.4	Annual Maintenance	$ 13	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 70	
		X NUMBER OF YEARS OF OPERATION	0.75	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 53
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 280	
	4.2	Closure, Post-Closure, Monitoring	$ 0	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 280
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 0
		SUB COST FOR WATER OXIDATION MODULE		$ 1,375
		ESCALATION		1.194
		TOTAL COST		$ 1,642

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W034 Calcium Metal
Option Number: SR-W034-3
Facility: Vendor
Treatment Technology: CO_2 Oxidation

Treatment Cycle Flow Diagram



Pros

- Little secondary waste. Reactor will require disposal after processing is complete.
- No additional treatment is required to meet LDR standards.
- Will handle expected waste stream. The waste stream is not expected to vary.
- Treatment eliminates hazardous characteristic (i.e., reactivity).
- Meets the expected WAC for waste disposal. No additional treatment secondary waste treatment is required. Wasteform is disposable in the form in which it exits the process.
- Simple process employing a straightforward chemical reaction process.
- Lack of moving parts in the treatment process suggests that availability will be greater than 80%.
- Failed wasteform would require retreatment.
- Simple process employing a straightforward chemical reaction. No difficulty is expected in developing a schedule.
- Operational worker exposure will be small. Radiation levels are scarcely above background.
- Little characterization of treated waste is needed.
- Process will be designed to comply with applicable regulations without seeking a variance.
- Process eliminates hazardous characteristic.
- Because the process eliminates the hazardous characteristic, and the final wasteform is calcium carbonate ($CaCO_3$)(i.e., limestone), the public should have few concerns that cannot be resolved.

Cons

- Not a budgeted item and will require line item funding.
- Final wasteform requires disposal as LLW.

Waste Stream Number & Name: SR-W034 Calcium Metal
Option Number: SR-W034-3
Facility: Vendor **Treatment Technology: CO_2 Oxidation**
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	40	Subtract 10 points from the median score of 50 because volume of treated waste will be slightly greater than original volume, decrease in bulk density.
• secondary waste generation	80	Tank will require disposal after processing is complete. No additional secondary waste treatment is required.
• destruction removal and demobilization efficiency	80	No additional treatment is required to meet LDR standards.
• flexibility	80	Will handle expected waste stream. The waste stream is not expected to vary.
• ability to be shipped	80	Treatment eliminates hazardous characteristic (i.e., reactivity).
• final wasteform	80	Meets the expected WAC for waste disposal. Wasteform is disposable in the form in which it exits the process.
Engineering Parameters		
• system implementability	80	Simple process employing a straightforward chemical reaction process.
• availability	80	Lack of moving parts in the treatment process suggests that availability will be greater than 80%.
• scalability	50	Throughput is set by design, and not easily expanded except by adding more shifts of operation.
• remedial measures	80	Failed wasteform would require retreatment.
• schedule for treatment of waste	80	Simple process employing a straightforward chemical reaction process. No difficulty is expected in developing a schedule.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Process can be installed in a building with adequate emission controls.
• non operational worker potential exposure	80	Little non operational worker involvement will be required.
• operational worker potential exposure	80	Operational worker exposure will be small. Radiation levels are scarcely above background.
• transportation potential exposure	80	Little characterization of treated waste is needed.
Regulatory Parameters		
• need for variance	80	Process will be designed to comply with applicable regulations without seeking a variance.
• ability to obtain a permit	80	Process eliminates hazardous characteristic.
• waste disposal	80	Disposal of primary and secondary wastes will be as LLW.
Public Acceptance		
• public acceptance	80	Because the process eliminates the hazardous characteristic, and the final wasteform is calcium carbonate ($CaCO_3$) (i.e., limestone), the public should have few concerns that cannot be resolved.

Waste Stream Number & Name: SR-W034 Calcium Metal
Option Number: SR-W034-3
Facility: Vendor **Treatment Technology:** CO_2 Oxidation
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Cost Considerations		
• life-cycle cost	91	
• funding availability	20	Not a budgeted item and will require line item funding.
Public Acceptance		
• public acceptance	80	Because the process eliminates the hazardous characteristic, and the final wasteform is $CaCO_3$ (i.e., limestone), the public should have few concerns that cannot be resolved.
Industry Involvement		
• market for technology	20	Material is not usually a waste.
• private sector involvement	50	A proposed vendor process has been evaluated.

IDOA Score: **Technical** 65 **Total** 78

Waste Stream Number & Name: SR-W034 Calcium Metal
Option Number: SR-W034-3
Facility: Vendor **Treatment Technology: CO_2 Oxidation**
Cost Estimate Sheet

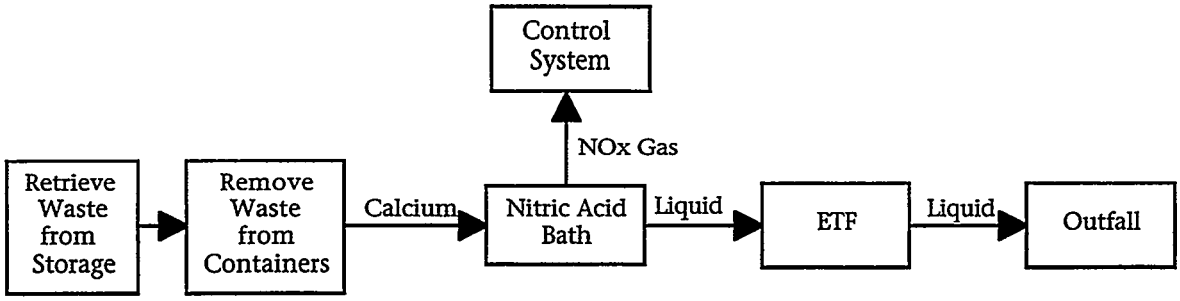
Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[ ] alpha [√] non-alpha [√] contact handled [ ] remote handled
Module Location: SRS
Module Status: [ ] Existing [√] New [√] Small generator [ ] Large generator
[√] Onsite [ ] Offsite [√] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
1.1	Studies and Bench Scale Tests		$ 60	
1.2	Demonstration Costs		$ N/A	
1.3	Operations Budget Funded Activities			
1.3.1	Conceptual Design		$ 239	
1.3.2	Safety Assurance Documentation		$ 60	
1.3.3	Permitting		$ 125	
1.3.4	Preparation for Operations		$ 150	
1.3.5	Project Management		$ 45	
	TOTAL PRE-OPERATIONS			$ 678
2.0	Facility Construction Cost			
2.1	Design (Title I and II)		$ 220	
2.2	Inspection		$ 70	
2.3	Project Management		$ 115	
2.4	Building Construction (inc. indirect)		$ 1,000	
2.5	Equipment (inc. indirect)		$ 0	
2.6	Construction Management		$ 70	
2.7	Contingency		$ 620	
	TOTAL FACILITY CONSTRUCTION COSTS			$ 2,095
3.0	Operation and Maintenance			
3.1	Annual Operating Labor		$ 50	
3.2	Annual Utilities		$ 2	
3.3	Annual Materials		$ 30	
3.4	Annual Maintenance		$ 18	
3.5	Annual Contingency		$ 0	
	TOTAL ANNUAL O & M		$ 100	
	X NUMBER OF YEARS OF OPERATION		0.75	
	TOTAL OPERATIONS AND MAINTENANCE COSTS			$ 75
4.0	Decontamination & Decommissioning			
4.1	Facility D&D		$ 0	
4.2	Closure, Post-Closure, Monitoring		$ 0	
	TOTAL DECONTAMINATION & DECOMMISSIONING			$
5.0	Contracted Services			
5.1	Commercial Treatment/Disposal		$ 250	
5.2	Mobile Treatment		$	
	TOTAL CONTRACTED SERVICES			$ 250
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 0
	SUB COST FOR $CaCO_3$ OXIDATION MODULE			$ 3,098
	ESCALATION			1.06
	TOTAL COST			$ 3,284

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W034 Calcium Metal
Option Number: SR-W034-4
Facility: M-Area
Treatment Technology: Acid Oxidation

Treatment Cycle Flow Diagram



Pros

- Volume reduction is greater than 5:1.
- Expect full conversion to calcium nitrate, a non-hazardous form – no secondary waste.
- Expect 100% conversion to nonreactive material.
- Can treat more than one kind of metal. No equipment changes would be required.
- No shipping required.
- Liquid ends up in NPDES outfall. Filtercake will meet LDR standards and disposal WAC.
- Have demonstrated on aluminum. Some concern about reactivity of calcium metal.
- >80% availability of system by experience.
- Few or no emissions even under accident conditions.
- No increase in non operational worker crew.
- Fully in compliance with LDR requirements without needing variance.
- Public approves of treatment that eliminates hazardous characteristic.

Cons

- Existing facility would be difficult to expand. Fixed by design, but operation is a one-time effort.
- Line item will require funding.
- It is a unique process. Metallic calcium not usually considered a waste.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	90	Add 10 points to the median score of 80 because volume reduction greater than 5:1, and processed waste can go to outfall.
• secondary waste generation	80	Tank will require a disposal after processing is complete.
• destruction removal and demobilization efficiency	80	Expect 100% conversion to nonreactive material.
• flexibility	90	Can treat more than one kind of metal. Add 10 points to the median score of 80 because no equipment changes would be required.
• ability to be shipped	90	Add 10 points to the median score of 80 because no shipping required.
• final wasteform	100	Liquid discharged through an NPDES outfall. Add 20 points to the median score of 80 because filtercake will meet LDR standards and waste disposal WAC.

Waste Stream Number & Name: SR-W034 Calcium Metal
Option Number: SR-W034-4
Facility: M-Area **Treatment Technology: Acid Oxidation**
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Engineering Parameters		
• system implementability	70	Process has been demonstrated on aluminum. Subtract 10 points from the median score of 80 because some concern about reactivity of calcium metal.
• availability	80	Greater than 80% availability of system by experience.
• scalability	20	Existing facility would be difficult to expand. Fixed by design.
• remedial measures	80	Totally recoverable if problem.
• schedule for treatment of waste	50	DOE has directed facility to shut down. May not be available beyond three years.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Few or no emissions even under accident conditions.
• non operational worker potential exposure	80	No increase in non operational worker crew.
• operational worker potential exposure	50	Some potential safety concerns about dissolving a reactive metal in a strong acid.
• transportation potential exposure	60	Limited number of waste transports required. Add 10 points to the median score because no additional characterization is needed.
Regulatory Parameters		
• need for variance	80	Process in full compliance without needing variance.
• ability to obtain a permit	50	Straight forward process should present few concerns to regulators.
• waste disposal	60	Majority of waste is released to a permitted outfall. Subtract 20 points from the median score of 80 because filtercake must be disposed of in HW/MW facility.
Public Acceptance		
• public acceptance	80	Public approves of treatment that eliminates hazardous characteristic.
Cost Considerations		
• life-cycle cost	96	
• funding availability	20	Line item will require funding.
Industry Involvement		
• market for technology	20	This is a unique application. Calcium metal is not usually a waste.
• private sector involvement	80	Has been evaluated for M-Area vendor.

IDOA Score: **Technical** 63 **Total** 77

Waste Stream Number & Name: SR-W034 Calcium Metal
Option Number: SR-W034-4
Facility: M Area **Treatment Technology: Acid Oxidation**
Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[ ] alpha [√] non-alpha [√] contact handled [ ] remote handled
Module Location: SRS
Module Status: [√] Existing [ ] New [√] Small generator [ ] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 14	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 56	
		1.3.2 Safety Assurance Documentation	$ 14	
		1.3.3 Permitting	$ 125	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 2	
		TOTAL PRE-OPERATIONS		$ 362
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 66	
	2.2	Inspection	$ 14	
	2.3	Project Management	$ 16	
	2.4	Building Construction (inc. indirect)	$ 50	
	2.5	Equipment (inc. indirect)	$ 250	
	2.6	Construction Management	$ 21	
	2.7	Contingency	$ 146	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 563
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 150	
	3.2	Annual Utilities	$ 6	
	3.3	Annual Materials	$ 90	
	3.4	Annual Maintenance	$ 54	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 300	
		X NUMBER OF YEARS OF OPERATION	0.25	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 75
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 0	
	4.2	Closure, Post-Closure, Monitoring	$ 0	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 0
		SUB COST FOR ACID OXIDATION MODULE		$ 1,000
		ESCALATION		1.267
		TOTAL COST		$ 1,267

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W034 Calcium Metal
Option Number: SR-W034-5
Facility: INEL/WEDF **Treatment Technology: Stabilization**

Treatment Technology

The Idaho National Engineering Laboratory (INEL) Waste Engineering Development Facility (WEDF) Stabilization process provides treatments for aqueous and organic liquids and debris. The process stabilizes waste in a grout matrix to reduce leachability.

Pros

- No secondary waste streams are generated.
- The facility can treat waste streams similar in composition to those assumed in the design basis without modification.
- The stabilized waste could be shipped without additional treatment.
- Final wasteform is anticipated to meet the SRS waste disposal WAC.
- Stabilization has been demonstrated.
- The facility is anticipated to have minimal down time.
- Process failure is not anticipated to create a waste stream that cannot be treated.
- Few emissions from the facility are anticipated during normal operation and most accident scenarios.
- The facility could potentially be used to treat numerous waste streams throughout the DOE Complex.

Cons

- Stabilization will increase the overall waste volume by a factor of two or more after processing.
- The process currently exists, so any expansion would require process modifications.
- Waste characterization will be required for any waste streams returned to SRS for disposal.
- The majority of the treated waste will be classified as mixed waste which will require disposal in a HW/MW facility.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	10	Subtract 10 points from the median score of 20 because stabilization will increase the overall waste volume by a factor of two or more after processing.
• secondary waste generation	80	No secondary waste streams are generated.
• destruction removal and demobilization efficiency	50	Additional treatment for some waste streams may be required prior to stabilization to ensure LDR standards are met.
• flexibility	80	The facility can treat waste streams similar in composition to those assumed in the design basis without modification.
• ability to be shipped	80	The stabilized waste could be shipped without additional treatment.
• final wasteform	80	Final wasteform is anticipated to meet the SRS disposal WAC.
Engineering Parameters		
• system implementability	80	Stabilization has been demonstrated at the facility.
• availability	80	The facility is anticipated to have minimal down time.

Waste Stream Number & Name: SR-W034 Calcium Metal
Option Number: SR-W034-5
Facility: INEL/WEDF **Treatment Technology: Stabilization**
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• scalability	20	The process currently exists, so any expansion would require process modifications.
• remedial measures	80	Process failure is not anticipated to create a waste stream that cannot be treated.
• schedule for treatment of waste	50	A schedule for waste treatment cannot be provided. Additionally, acceptance of SRS waste will be contingent upon State of Idaho-approved permit modifications.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Few emissions for the facility are anticipated during normal operation and most accident scenarios.
• non operational worker potential exposure	50	Processing this material will not increase the exposure to non operational personnel.
• operational worker potential exposure	50	Personnel exposure is average for operations of this type. Processing this material will not increase the exposure to operational personnel.
• transportation potential exposure	20	Waste characterization will be required for any waste streams returned to SRS for disposal.
Regulatory Parameters		
• need for variance	80	Process will be in full LDR compliance without having a variance.
• ability to obtain a permit	50	Permitting process is well defined, however, the State of Idaho's acceptance of offsite waste treatment is unknown. Approval may be difficult.
• waste disposal	20	The majority of the treated waste will be classified as mixed waste which will require disposal in a HW/MW facility.
Public Acceptance		
• public acceptance	50	Public acceptance for stabilization is positive; however, the treatment of offsite waste is anticipated to reduce the overall public acceptance of this process.
Cost Considerations		
• life-cycle cost	99	
• funding availability	50	Not a budgeted item though line item funding may be required.
Industry Involvement		
• market for technology	20	The facility could potentially be used to treat numerous waste streams throughout the DOE Complex. Unique treatment. Metallic calcium not usually considered a waste.
• private sector involvement	20	Technology is available at an existing DOE facility.

IDOA Score: **Technical** 51 **Total** 65

Waste Stream Number & Name: SR-W034 Calcium Metal
Option Number: SR-W034-5
Facility: INEL/WEDF **Treatment Technology: Stabilization**
Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[ ] alpha [√] non-alpha [√] contact handled [ ] remote handled

Module Location: INEL

Module Status: [√] Existing [ ] New [√] Small generator [ ] Large generator
[ ] Onsite [√] Offsite [ ] Commercial [ ] Portable [ ] R&D

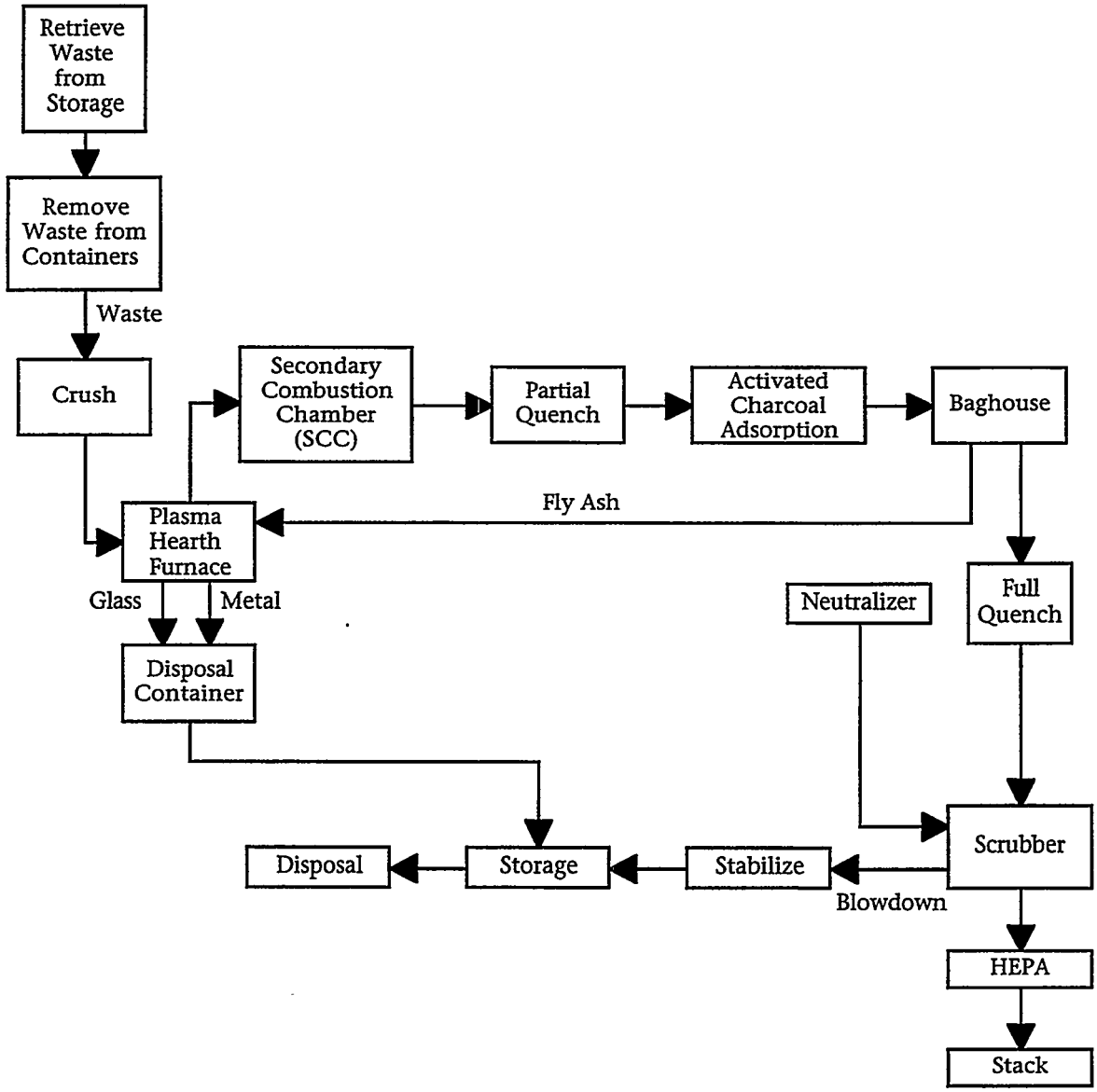
WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ N/A	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ N/A	
		1.3.2 Safety Assurance Documentation	$ N/A	
		1.3.3 Permitting	$ N/A	
		1.3.4 Preparation for Operations	$ N/A	
		1.3.5 Project Management	$ N/A	
		TOTAL PRE-OPERATIONS		$ N/A
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ N/A	
	2.2	Inspection	$ N/A	
	2.3	Project Management	$ N/A	
	2.4	Building Construction (inc. indirect)	$ N/A	
	2.5	Equipment (inc. indirect)	$ N/A	
	2.6	Construction Management	$ N/A	
	2.7	Contingency	$ N/A	
		TOTAL FACILITY CONSTRUCTION COSTS		$ N/A
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ N/A	
	3.2	Annual Utilities	$ N/A	
	3.3	Annual Materials	$ N/A	
	3.4	Annual Maintenance	$ N/A	
	3.5	Annual Contingency	$ N/A	
		TOTAL ANNUAL O & M	$ N/A	
		X NUMBER OF YEARS OF OPERATION		
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ N/A
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ N/A	
	4.2	Closure, Post-Closure, Monitoring	$ N/A	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ N/A
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$ N/A	
	5.2	Mobile Treatment	$ N/A	
		TOTAL CONTRACTED SERVICES		$ N/A
6.0	Offsite Treatment (DOE)			$ 45
7.0	Transportation			$ 18
8.0	Disposal			$ 100
		SUB COST FOR STABILIZATION MODULE		$ 163
		ESCALATION		1.06
		TOTAL COST		$ 173

Note: Per DOE directions, this cost estimate is the incremental cost for treatment at an offsite DOE facility; therefore, it carries no overhead burden or capital costs..

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W034 Calcium Metal
Option Number: SR-W034-6
Facility: Vendor
Treatment Technology: Plasma Hearth

Treatment Cycle Flow Diagram:



Option rejected during technical success factor evaluation. No further analysis performed.

Summary Page

Waste Stream Number & Name: SR-W035 Mixed Waste Oil – Sitewide

Background Information

Waste generated from a preventative maintenance program for changing the refrigeration oil in some of the Separations Area chillers. Routinely, this is a nonradioactive used oil that could be recycled for energy recovery. Current inventory of nine drums has detectable levels of tritium (H^3) which prevented recycling. Contaminants in the Freon® (D019, D039, D040) also have been determined to make the waste oil a mixed waste.

Volume

- Current volume through 09/30/94 is 2.2 m^3.
- Expected 1995-1999 volume will be 2.0 m^3.

Waste Stream Composition

- Organic liquid

Waste Code

- D007 (TCLP Cr)
- D008 (TCLP Pb)
- D019 (carbon tetrachloride)
- D022 (chloroform)
- D039 (tetrachloroethylene)
- D040 (trichloroethylene)

LDR Treatment Standard

- D007 = concentration based standard = 5.0 mg/kg
- D008 = concentration based standard = 5.0 mg/kg
- D019* = concentration based standard = 6.0 mg/kg
- D022* = concentration based standard = 6.0 mg/kg
- D039* = concentration based standard = 6.0 mg/kg
- D040* = concentration based standard = 6.0 mg/kg

*D012-D043 nonwastewaters must be treated to meet the Universal Treatment Standards (UTS) for any underlying constituents that may be present.

Waste Characterization

- Sampling and analysis used to characterize the waste stream.
- Confidence level is high because of TCLP results.
- TCLP has been run on nonradioactive Freon® 11 but not on radioactive Freon® 11.

Radiological Characterization

- Typical activity is 8.75 x 10^{-2} nCi/g.
- Tritium is present in waste stream.
- Waste is contact handled.
- Mixed low-level waste

Preferred Option

The preferred treatment option for the Mixed Waste Oil – Sitewide waste stream is Incineration in the Consolidated Incineration Facility (CIF).

Treatment Justification

In-depth options analysis (IDOA) was not performed for this waste stream.

During development of the Consolidated Incineration Facility (CIF) design basis, a determination was made of the types and volumes of hazardous, low level radioactive, and mixed Savannah River Site (SRS) waste streams that would be generated in the future or were in storage for which treatment by incineration would be beneficial. The determination to initiate development of CIF was based on the facts that incineration was recommended or required by environmental regulations and a significant volume or toxicity reduction would be achieved. The wastes amenable to incineration were grouped by physical state, solid or liquid, and type of contamination, hazardous and/or radioactive. Some wastes such as Defense Waste Processing Facility (DWPF) benzene and low level radioactive job control waste were individually designated a waste group. The waste groups and current/future volume data were adopted as a design basis for the CIF Functional Performance Requirements (FPR) (OPS-WMP-90-4140). The FPR serves as the baseline design document for the initiation of project development at the SRS.

Based on physical and chemical characteristics, SRS mixed wastes already designated for treatment at CIF fall into one of the CIF design basis waste groups listed as follows:

FPR Waste Group	SRS Mixed Waste Streams
Beta/Gamma Boxed (Solid)	Solvent Contaminated Debris (LLW) (SR-W003) Incinerable Toxic Characteristic (TC) Material (SR-W012)
High BTU (Liquid)	Scintillation Solution (SR-W010) Mixed Waste Oil – Sitewide (SR-W035)
Chlorinated (Liquid)	Rad-Contaminated Solvents (SR-W001) Rad-Contaminated Chlorofluorocarbons (SR-W002)
DWPF Organic	DWPF Benzene (SR-W022)
Naval Fuel Organic	Spent Methanol Solution (SR-W030)

Some of the CIF design basis waste groups listed in the table are designated in the FPR as nonradioactive hazardous waste. The radioactive nature of the waste does not impact its combustion characteristics. The operation and efficiency of the CIF combustion and air pollution control systems are not influenced by the presence of radioactivity. A mixed waste that meets the chemical and physical criteria of a design basis nonradioactive waste group can be treated in the CIF as effectively as the nonradioactive waste.

The CIF Mission Need and Design Capacity Review (July 7, 1993) and the supporting Alternative Treatment Technologies for SRS Hazardous, Mixed and Job Control Wastes (SWE-CIF-93020, July 29, 1993) re-evaluated the treatment of certain existing and future SRS wastes in the CIF. The review was structured to generally re-examine the appropriateness of each FPR design basis waste group and additional mixed waste groups that are not listed in the FPR but are chemically and physically similar to an FPR nonradioactive waste group. The review compared the incineration of each waste group to treatment by other candidate technologies using comparison criteria such as waste volume and toxicity reduction, treatment and disposal costs, and RCRA Land Disposal Restrictions (LDR) requirements. The review program concluded that the waste groups originally designated for CIF and the additional mixed waste groups are most effectively treated by incineration.

Alternative Technologies Investigated

Chemical Oxidation

Chemical oxidation involves the addition of a chemical oxidizing agent such as ozone to the waste stream. The organic material in the waste is oxidized to carbon dioxide and water vapor. The offgas would be passed through carbon filters to remove any volatile organic vapors generated. This process has not been used to treat concentrated organic waste streams. Formation of incomplete oxidation byproducts would be difficult to prevent. The time required for complete oxidation of the waste could be unacceptably long. Also, this treatment has not

been demonstrated or developed for this waste stream. Until such technology development work is completed, this technology is not considered a viable treatment alternative for this waste type.

Selected Treatment Technology

Since no acceptable alternative treatment technology for this waste was identified, the selected technology is incineration followed by stabilization of the residuals. Incineration destroys organic constituents, generates a residual which is easily stabilized, and significantly reduces the waste volume requiring permanent disposal. With increased concerns over release of Freon® to the environment, a treatment technology that destroys Freon®, instead of stabilizing it for disposal, was considered essential. Incineration, or thermal oxidation destruction, is the technology typically used for treatment of this waste type.

Cost Estimate: INCLUDED WITH COST INFORMATION FOR TREATING WASTE STREAM SR-W001. SEE COST ESTIMATE SHEET FOR SR-W001.

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Summary Page – Initial Screening

Waste Stream Number & Name: SR-W036 Tritiated Oil with Mercury

Background Information

This waste stream consists of used oil from pumps and compressors in the tritium facilities. The oil is contaminated with tritium and possibly with mercury. Reliable characterization is hindered because of concerns about exposure of laboratory personnel to the high levels of radiation in the oil. Moreover, the radiation has the potential to cause scintillation counting interferences. The possibility of mercury contamination has been established, but the concentrations have not been quantified.

Volume
- Current volume through 09/30/94 is 17.2 m^3.
- Expected 1995-1999 generation volume will be 2.2 m^3.

Waste Stream Composition
- Organic liquid

Waste Code
- D009E (hydraulic oil contaminated with Hg and radioactive materials)

LDR Treatment Standard
- D009 = specified technology = Incineration of wastes containing organics and mercury

Waste Characterization
- Process knowledge used to characterize the waste stream.
- Confidence level is low based on the fact that waste cannot be sampled for mercury level due to ALARA concerns.

Radiological Characterization
- Extent of tritium contamination is variable (background to ~185 Ci/l).
- Waste is contact handled.
- Mixed low-level waste

Initial Screening

The initial screening identified inappropriate treatment options. These options appear in the Initial Rejections table.

Initial Rejections

Treatment Facility	Treatment Technology	Reasons for Rejection
CIF	Ashcrete Stabilization	Ashcrete does not have the facilities to mix oil with cement.
CIF	Incineration/ Stabilization	This oil contains more curies of radioactivity than allowed by CIF's permit.
ETF	Ion Exchange	ETF has no process to treat waste oil.
Lab.	Lab-scale process flowsheet	Volume of waste too great to handle with laboratory-scale equipment.
LETF	Ion Exchange	Oil contains more curies of radioactivity than LETFs permit will allow. Also, LETF has no equipment to treat waste oil.

Initial Rejections (contd)

Treatment Facility	Treatment Technology	Reasons for Rejection
M Area	Vitrification	Oil contains more curies that vitrifier can handle. Vitrifier not configured for liquid waste feed.
Z Area	Stabilization	Z Area can treat only those wastes that come by pipeline from Tank 50 and meet strict waste acceptance criteria. The Z-Area process lacks flexibility to treat and dispose of a variety of waste streams.
Vendor	Thermal Destruction	This option is rejected because the vendor's permit will not allow incineration of waste with this level of radioactivity to be incinerated there.
INEL/WEDF	Stabilization	This option was rejected because of: • Uncertainties surrounding the process for stabilizing large volumes of oil. • Increase in volume of material requiring disposal.
INEL/WERF	Incineration/ Stabilization	This option is rejected because the WERF permit will not allow incineration of material with this level or radioactivity.

Summary Page – Technology Success Factor (TSF) & In-Depth Options Analysis (IDOA)

Waste Stream Number & Name: SR-W036 Tritiated Oil with Mercury

Feasible Options

Option No.	Treatment Facility	Treatment Technology	TSF Score	IDOA Scores Tech.	IDOA Scores Total	COST (x 1,000)	PO
SR-W036-1	DOE Mobile Unit	Packed-Bed Incineration	13	38	51	4,920	√
SR-W036-2	Storage and CIF	Incineration after aging	94	64	75	6,087	
SR-W036-3	None	Treatability variance	100	45	59	707	

Options Rejected Due To Low Technology Success Factor (TSF)

- No options were rejected.

Engineering Assessment

Preferred Option Justification

The preferred treatment for tritiated oil with mercury is treatment in a DOE Mobile Packed-Bed Incinerator.

This option burns the oil in a packed bed incinerator and captures the radioactive constituent of concern, tritium, and stabilizes the hazardous constituent mercury in the offgas scrubber effluent.

This option is preferred because:
- It is the preferred option of the DOE Option Analysis Team (OAT).
- Incineration in a packed-bed incinerator should reduce the volume of waste going to disposal by 5:1.
- DOE mobile units will be designed to handle a variety of waste streams.
- Mobile treatment system will minimize the potential for exposure during transportation.
- This process has potential application in the commercial world.

Options Rejected During IDOA

Incineration followed by Stabilization in CIF after aging to reduce tritium concentration

Incineration followed by Stabilization in CIF after aging to reduce tritium concentration was rejected because:
- Aging will require storage for 65 years.
- Storage period exceeds the projected service life of CIF.

Disposal in current wasteform after obtaining a treatability variance.

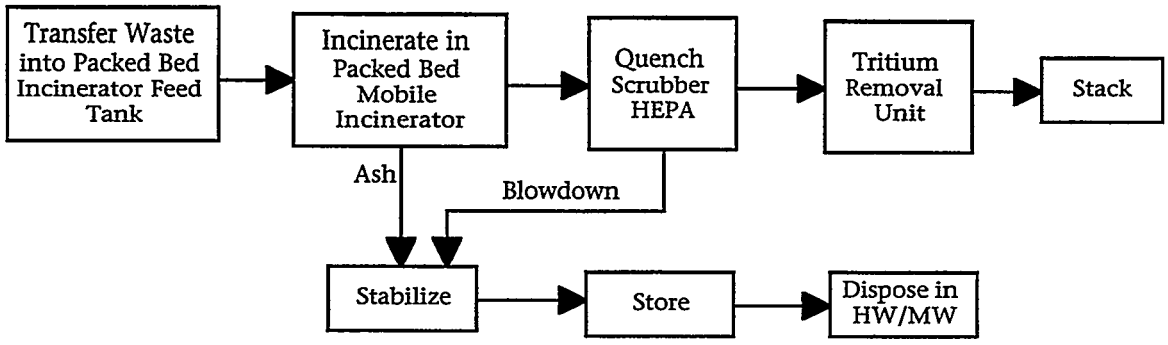
Disposal in current wasteform after obtaining a treatability variance was rejected because:
- Process will require a variance.
- Convincing SCDHEC that a "do-nothing" alternative is preferable will be difficult.
- All waste will require disposal in a HW/MW vault.
- Public is expected to have concerns about disposal of untreated oil in storage vaults.

Waste Stream Number & Name: SR-W036 **Tritiated Oil with Mercury**
Option Number: SR-W036-1
Facility: DOE Mobile Unit
Treatment Technology: Incineration/ Stabilization

Treatment Technology

This technology incinerates the oil in a packed bed incinerator and captures the tritium released during the process. The hazardous constituent, mercury, will be vaporized in the incinerator, so it must be captured in the offgas scrubber, and scrubber effluent stabilized.

Treatment Cycle Flow Diagram:



Pros

- Incineration should reduce the volume by 5:1.
- DOE mobile units will be designed to handle a variety of waste streams.
- A mobile treatment system will minimize the potential for exposure during transportation.
- This process has potential application in the commercial world.

Cons

- Project is unbudgeted. Uncertainties surround obtaining development funds.
- Public acceptance for incineration is low.
- Permitting a mobile treatment facility, which will be unproved technology in a new application, may result in difficulties.
- Uncertainties surrounding laboratory tests and process design make a schedule difficult to project.
- Large uncertainties exist in the ability to predict downtime.
- System currently exists as a bench-scale experimental unit, which is experiencing operational problems. The original concept of the packed bed incinerator was to burn polychlorinated biphenyls (PCBs); tritium capture has not been considered.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	80	Incineration should reduce the volume by 5:1.
• secondary waste generation	50	Ash must be stabilized as a secondary waste. Also, tritium must be captured.
• destruction removal and demobilization efficiency	80	No additional treatment would be required after D&D to ensure LDR standards are met.

Waste Stream Number & Name: SR-W036 Tritiated Oil with Mercury
Option Number: SR-W036-1
Facility: DOE Mobile Unit
Treatment Technology: Incineration/ Stabilization

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• flexibility	80	DOE mobile units will be designed to handle a variety of waste streams.
• ability to be shipped	80	The stabilized waste could be shipped without additional treatment.
• final wasteform	80	Final wasteform is anticipated to meet the SRS waste disposal WAC.
Engineering Parameters		
• system implementability	0	System currently exists as a bench-scale experimental unit. Subtract 10 points from median score of 20 because bench-scale unit is experiencing operational problems. Subtract another 10 points from the median score of 20 because the original concept of the packed bed incinerator was to burn PCBs. Tritium capture has not been considered.
• availability	20	Large uncertainties exist in the ability to predict downtime.
• scalability	50	Throughput will be fixed by design. The necessity of being mobile further limits scalability.
• remedial measures	50	Process failure may result in costly and time-consuming remedial measures.
• schedule for treatment of waste	20	Uncertainties surrounding laboratory tests and process design make a schedule difficult to project.
Personnel Parameters		
• consequence of unmitigated accident scenarios	50	Few emissions for the facility are anticipated during normal operation, but significant releases of tritium could occur during accident scenarios.
• non operational worker potential exposure	50	Processing this material will not increase the exposure to non operational personnel.
• operational worker potential exposure	50	Personnel exposure is average for operations of this type. Processing this material will not increase the exposure to operational personnel.
• transportation potential exposure	80	A mobile treatment system will minimize the potential for exposure during transportation.
Regulatory Parameters		
• need for variance	80	Process will comply with regulations without requiring a variance.
• ability to obtain a permit	20	Permitting a mobile treatment facility, which will be unproved technology in a new application, may result in difficulties.
• waste disposal	80	Secondary waste (stabilized ash) can go to LLW disposal.
Public Acceptance		
• public acceptance	10	Public acceptance for incineration is low. Subtract 10 points because of additional concerns about tritium releases from a mobile facility.
Cost Considerations		
• life-cycle cost	86	
• funding availability	10	Project is unbudgeted. Subtract 10 points because of uncertainties surrounding development funds.

Waste Stream Number & Name: SR-W036 **Tritiated Oil with Mercury**
Option Number: SR-W036-1
Facility: DOE Mobile Unit **Treatment Technology:** Incineration/ Stabilization

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Industry Involvement		
• market for technology	80	This process has potential application in the commercial world.
• private sector involvement	20	This is a DOE-sponsored process development.

IDOA Score: **Technical** 38 **Total** 51

Waste Stream Number & Name: SR-W036 Tritiated Oil with Mercury
Option Number: SR-W036-1
Facility: DOE Mobile Unit
Treatment Technology: Incineration/ Stabilization

Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[ ] alpha [ ] non-alpha [ ] contact handled [ ] remote handled

Module Location: DOE Mobile Unit

Module Status: [ ] Existing [√] New [√] Small generator [ ] Large generator
[ ] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 24	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 96	
		1.3.2 Safety Assurance Documentation	$ 24	
		1.3.3 Permitting	$ 2,000	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 7	
		TOTAL PRE-OPERATIONS		$ 2300
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 110	
	2.2	Inspection	$ 25	
	2.3	Project Management	$ 31	
	2.4	Building Construction (inc. indirect)	$ 150	
	2.5	Equipment (inc. indirect)	$ 150	
	2.6	Construction Management	$ 35	
	2.7	Contingency	$ 248	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 748
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 150	
	3.2	Annual Utilities	$ 6	
	3.3	Annual Materials	$ 90	
	3.4	Annual Maintenance	$ 54	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 300	
		X NUMBER OF YEARS OF OPERATION	1.0	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 300
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 0	
	4.2	Closure, Post-Closure, Monitoring	$ 0	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$ 200	
		TOTAL CONTRACTED SERVICES		$ 200
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 6
		SUB COST FOR INCINERATION MODULE		$ 3,555
		ESCALATION		1.384
		TOTAL COST		$ 4,920

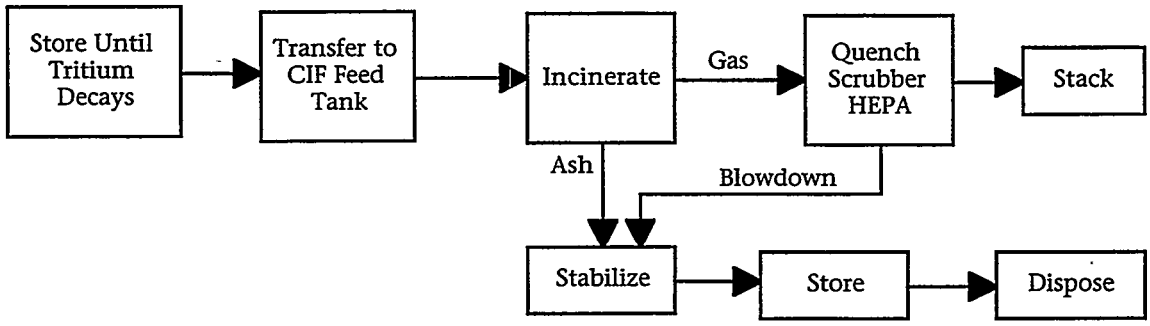
If above numbers do not appear to add correctly, it is the result of computer rounding.

Note: Per DOE directions, this cost estimate is the incremental cost for treatment at an offsite DOE facility; therefore, it carries no burden or capital costs.

Waste Stream Number & Name: SR-W036 Tritiated Oil with Mercury
Option Number: SR-W036-2
Facility: CIF

Treatment Technology: Incineration/ Stabilization after Aging

Treatment Cycle Flow Diagram:



Pros

- Rotary kiln is very mature and well known.
- Volume will decrease by a factor of 5.
- Treatment residuals are immobilized with cement.
- Shipping requirements are met for treatment residuals.
- Availability of greater than 80% is easily achievable with this technology.
- Few or no emissions during normal operations. Accident scenarios do not cause an increase in emissions.
- Fewer than average number of operational workers and non operational workers will be required to tend this process.
- Only a small percentage of the final waste will require disposal as mixed waste.

Cons

- Public has expressed concern about incineration as a waste treatment process.
- Aging will require storage for 65 years.
- Storage period exceeds the projected service life of CIF.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	80	Volume requiring disposal will be reduced by a factor of approximately 5:1.
• secondary waste generation	50	Ash may contain minute amounts of mercury.
• destruction removal and demobilization efficiency	80	Treatment residuals are immobilized with cement. All applicable LDR standards are met.
• flexibility	100	Add 20 points to the high median score of 80 because of the variety of constituents in this in this waste stream that incineration can accommodate.
• ability to be shipped	80	Shipping requirements are met for treatment residuals.
• final wasteform	80	Final wasteform will meet waste disposal WAC.

Waste Stream Number & Name: SR-W036 Tritiated Oil with Mercury
Option Number: SR-W036-2
Facility: CIF

Treatment Technology: Incineration/ Stabilization after Aging

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Engineering Parameters		
• system implementability	100	Commercial process. Add 10 points to high median score of 80 because rotary kiln technology is very mature and well known.
• availability	80	Availability of 80% is easily achievable with this technology.
• scalability	50	Total throughput is fixed by design.
• remedial measures	70	Only the solidified treatment residuals can fail. Subtract 10 points from high median score of 80 because of the difficulty in size-reducing the stabilized wasteform that has failed.
• schedule for treatment of waste	20	Aging will require storage for 65 years.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Few or no emissions during normal operations. Accident scenarios do not cause an increase in emissions.
• non operational worker potential exposure	80	Fewer than average number of non operational workers will be required to tend this process.
• operational worker potential exposure	80	Fewer than average number of operational workers will be required to tend this process.
• transportation potential exposure	80	Waste will require characterization before transport to CIF.
Regulatory Parameters		
• need for variance	80	Process will comply with regulations without requiring a variance.
• ability to obtain a permit	80	The process is well-defined.
• waste disposal	80	Only a small percentage of the final waste will require disposal as mixed waste.
Public Acceptance		
• public acceptance	20	Public has expressed concern about incineration as a waste treatment process.
Cost Considerations		
• life-cycle cost	83	
• funding availability	50	Life-cycle cost will require an increase in budget for long-term storage.
Industry Involvement		
• market for technology	20	This is an existing technology. DOE has nothing new to market.
• private sector involvement	20	SRS facility evaluated.

IDOA Score: **Technical** 64 **Total** 75

Waste Stream Number & Name: SR-W036 Tritiated Oil with Mercury
Option Number: SR-W036-2
Facility: CIF
Treatment Technology: Incineration/ Stabilization after Aging

Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[ ] alpha [√] non-alpha [ ] contact handled [ ] remote handled
Module Location: DOE Mobile Unit
Module Status: [ ] Existing [√] New [√] Small generator [ ] Large generator
[ ] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$	
		1.3.2 Safety Assurance Documentation	$ 6	
		1.3.3 Permitting	$	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$	
		TOTAL PRE-OPERATIONS		$ 156
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$	
	2.2	Inspection	$	
	2.3	Project Management	$	
	2.4	Building Construction (inc. indirect)	$	
	2.5	Equipment (inc. indirect)	$	
	2.6	Construction Management	$	
	2.7	Contingency	$ 17	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 17
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 54	
	3.2	Annual Utilities	$ 7	
	3.3	Annual Materials	$ 52	
	3.4	Annual Maintenance	$ 19	
	3.5	Annual Contingency	$	
		TOTAL ANNUAL O & M	$ 128	
		X NUMBER OF YEARS OF OPERATION	1.0	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 128
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 16	
	4.2	Closure, Post-Closure, Monitoring	$ 82	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 98
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 1,631
		SUB COST FOR INCINERATION AFTER AGING MODULE		$ 2,029
		ESCALATION		3
		TOTAL COST		$ 6,087

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W036 Tritiated Oil with Mercury
Option Number: SR-W036-3
Facility: HW/MW Disposal Facility
Treatment Technology: None. Disposal As-Is Under a Treatability Variance

Treatment Technology

This option considers disposal of the waste in HW/MW vaults without treatment. Such disposal would have to be granted by SCDHEC under a variance.

Pros

- No secondary waste is generated.
- No additional treatment would be required.
- Few emissions for the facility are anticipated during normal operation or accident scenarios.
- Storage costs can be supported within target budgets.
- No additional treatment required for shipment.

Cons

- Process will require a treatability variance.
- Convincing SCDHEC that a "do-nothing" alternative is preferable will be difficult.
- All waste will require disposal in a HW/MW vault.
- Public is expected to have concerns about disposal of untreated oil in storage vaults.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	50	Volume will not change.
• secondary waste generation	80	No secondary waste is generated.
• destruction removal and demobilization efficiency	80	No additional treatment would be required.
• flexibility	80	Not a process, *per se*.
• ability to be shipped	80	No additional treatment required for shipment.
• final wasteform	80	Final wasteform is anticipated to meet the SRS waste disposal WAC.
Engineering Parameters		
• system implementability	50	HW/MW vaults have been designed, but not constructed.
• availability	80	Vault downtime expected to be less than 20%.
• scalability	50	Vault capacity fixed by design.
• remedial measures	50	Failure of disposal vault could require extensive time and resources to correct.
• schedule for treatment of waste	50	Uncertainties surround construction of the vault and obtaining the permit.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Few emissions for the facility are anticipated during normal operation or accident scenarios.
• non operational worker potential exposure	50	Processing this material will not increase the exposure to non operational personnel.
• operational worker potential exposure	50	Personnel exposure is average for operations of this type. Processing this material will not increase the exposure to operational personnel.
• transportation potential exposure	80	Minimal potential for exposure during transportation.

Waste Stream Number & Name: SR-W036 Tritiated Oil with Mercury
Option Number: SR-W036-3
Facility: HW/MW Disposal Facility
Treatment Technology: None. Disposal As-Is Under a Treatability Variance

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Regulatory Parameters		
• need for variance	20	Process will require a variance.
• ability to obtain a permit	20	Convincing SCDHEC that a do-nothing alternative is preferable will be difficult.
• waste disposal	20	All waste will require disposal in a HW/MW vault.
Public Acceptance		
• public acceptance	20	Public is expected to have concerns about disposal of untreated oil in storage vaults.
Cost Considerations		
• life-cycle cost	98	
• funding availability	80	Storage costs can be supported within target budgets.
Industry Involvement		
• market for technology	20	Site specific solution to this waste stream.
• private sector involvement	20	No private sector involvement is expected for this option.

IDOA Score: **Technical** 45 **Total** 59

Waste Stream Number & Name: SR-W036 Tritiated Oil with Mercury
Option Number: SR-W036-3
Facility: HW/MW Disposal Facility
Treatment Technology: None. Disposal As-Is Under a Treatability Variance

Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[ ] alpha [√] non-alpha [ ] contact handled [ ] remote handled

Module Location: DOE Mobile Unit

Module Status: [ ] Existing [√] New [√] Small generator [ ] Large generator
[ ] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$	
		1.3.2 Safety Assurance Documentation	$	
		1.3.3 Permitting	$ 200	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$	
		TOTAL PRE-OPERATIONS		$ 350
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$	
	2.2	Inspection	$	
	2.3	Project Management	$	
	2.4	Building Construction (inc. indirect)	$	
	2.5	Equipment (inc. indirect)	$	
	2.6	Construction Management	$	
	2.7	Contingency	$	
		TOTAL FACILITY CONSTRUCTION COSTS		$
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 54	
	3.2	Annual Utilities	$ 2	
	3.3	Annual Materials	$ 32	
	3.4	Annual Maintenance	$ 19	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 108	
		X NUMBER OF YEARS OF OPERATION	1.0	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 108
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$	
	4.2	Closure, Post-Closure, Monitoring	$ 3	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 3
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 50
		SUB COST FOR DISPOSAL AS-IS MODULE		$ 511
		ESCALATION		1.384
		TOTAL COST		$ 707

If above numbers do not appear to add correctly, it is the result of computer rounding.

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Summary Page

Waste Stream Number & Name: SR-W037 M-Area High Nickel Plating Line Sludge

Background Information

This waste stream is an inorganic sludge generated from the treatment of M-Area production wastewaters containing elevated quantities of metals (mostly nickel) in the M-Area Dilute LETF. The sludge is currently stored in the Process Waste Interim Treatment/Storage Facility (PWIT/SF). On June 28, 1994, waste stream SR-W054, Enriched Uranium Contaminated with Lead, was added to this waste stream. A study has shown that M-Area Vendor Treatment Process can treat the SR-W054 waste to meet treatment standards for lead. However, since the lead in SR-W054 is also a component that is found in F006, and since the F006 treatment standard for lead is lower, the waste code for SR-W054 is not listed here.

Volume
- Current volume through 09/30/94 is 1579 m^3.
- No future waste generation is expected because the manufacturing process which generated this waste is no longer operational.

Waste Stream Composition
- Inorganic sludge/particulate

Waste Code
- F006 (metal plating line waste without cyanide) nonwastewater

LDR Treatment Standard
- F006 = concentration based standards = 0.19-5.0 mg/l

Waste Characterization
- Process knowledge and sampling and analysis used to characterize the waste.
- Confidence level high based on availability of analytical results and knowledge that the process generates a listed hazardous waste.

Radiological Characterization
- Total activity is 11.05 Ci.
- Alpha emitters are U^{234}, U^{235}, and U^{238}.
- Waste is contact handled.
- Mixed low-level waste

Preferred Option

The preferred treatment option for M-Area High Nickel Plating Line Sludge is Stabilization by Vitrification in the M-Area Vendor Treatment Process.

Treatment Justification

In-depth options analysis (IDOA) is not required for this waste stream since a Preferred Option has been identified utilizing an existing facility with existing treatment technology.

The proposed action is to stabilize the M-Area mixed wastes utilizing a thermal vitrification process. The process facility would be constructed and operated by a subcontractor to the Westinghouse Savannah River Company (WSRC). The vitrification process would result in the lowest volume of stabilized waste for final disposal, provide the most durable final wasteform, and could be completed for the lowest cost (including final disposal costs) of all treatment alternatives for wastes needing to be treated in M Area.

The proposed action was evaluated with respect to the technical ability to meet the Land Disposal Restrictions (LDR) criteria for the final stabilized wasteform, and for the overall cost of the

treatment activities. The ability to meet the durability requirements, that is, Toxicity Characteristic Leaching Procedure (TCLP) testing requirements, for constituents of concern in the final wasteform was a critical consideration. The total life-cycle cost, including the cost of treating the waste itself, the cost to treat any effluents generated by the vendor, and the cost to dispose of the final wasteform were also considered. In addition, the environmental impacts, onsite and offsite health effects, and occupational health and safety concerns for this treatment method were evaluated.

Treatability studies were performed on M-Area waste streams to determine the treatment technology most likely to meet the treatment standard required in the land disposal restriction standards. Methods determined to be most effective in meeting the treatment standards involved the isolation of the metal contaminants in a cementatious or a glass matrix. Investigation was made into the alternatives for providing such treatment. Treatment options investigated included:

- Onsite treatment by a subcontractor at a temporary facility
- Onsite treatment at a permanent facility located in M Area and operated by SRS
- Onsite treatment at a permanent facility located at some central SRS location and operated by SRS
- Transport to an offsite location for treatment by a vendor
- Taking no action

The no action alternative was rejected because of the LDR-FFCA requirement for treatment of the M-Area waste streams.

Evaluation of the treatment option was made for both a cement-based stabilization process and a glass/vitrification process. An initial determination was made that vendor processes were cheaper than construction and operation of a permanent, onsite facility by SRS. Cost studies performed in 1991 showed that onsite treatment in facilities constructed at SRS would cost an estimated $46 million if constructed in M Area or $75 million if constructed at a central SRS location. A vendor operated cementatious waste stabilization treatment process would cost $28 million. A request for bids was made to vendors utilizing both cement and glass isolation processes. A stipulation was made in the bid that the vendor must demonstrate that this process was capable of meeting the land disposal restriction treatment standards for the waste streams to receive treatment at M Area.

The award of a contract for the treatment of M-Area waste was based on demonstration on the part of the bidder of a technically valid treatment process, previous treatment experience, and adequate company resources to carry out the work.

Review of the bids determined that the proposal for treating M-Area Wastes by vitrification in a temporary facility operated at SRS by a vendor was the lowest cost alternative. This alternative would also result in the least amount of liquid requiring treatment and discharge at the M-Area wastewater treatment facility and produce the lowest volume of treated waste meeting land disposal restriction standards that would require eventual disposal in a RCRA disposal facility.

When blending and treatment of the Process Waste Intermediate Treatment/Storage Facility (PWIT/SF) sludge is begun, it is projected that approximately 700,000 gallons of F006 listed mixed waste will be in storage in the tanks. This includes an estimated 50,000 gallons of supernate which cannot be separated from the sludge. Waste streams stored in the tanks include SR-W004, M-Area Plating Line Sludges from Supernate Treatment and SR-W037, M-Area High Nickel Plating Line Sludge. One waste stream (SR-W054 – Enriched Uranium Contaminated with Lead, total volume 35 gallons) has been combined with waste stream SR-W037. SR-W054 is now indistinguishable from SR-W037 and will be treated identically.

Other M-Area mixed wastes to be treated are stored in 55-gallon drums in the Mixed Waste Storage Shed in M Area. These wastes include:

- A Watts Plating bath, California list waste solution, SR-W039, Nickel Plating Line Solution
- Mark 15 sludge filtercake, waste stream SR-W005, Mark 15 Filtercake
- Solid treatability sample residues, waste stream SR-W029, M-Area Sludge Treatability Samples

Two drums of Plating Line Sump Material (SR-W038) are stored in the 645-2N storage facility.

Equipment required for treatment of the M-Area waste would continue to belong to the vendor and, if the equipment could meet Department of Transportation (DOT) shipping criteria for radioactivity, would be removed from SRS. If equipment could not be successfully decontaminated, it would be disposed onsite. The cost of disposal was a part of the total contract cost.

The M-Area Vendor Treatment Process is capable of effectively treating all of these waste streams to meet regulatory requirements. As a result, upon completion of treatment, all listed and characteristically hazardous waste sludges and liquids from M-Area operations will be eliminated.

Cost Estimate: INCLUDED WITH COST INFORMATION FOR TREATING WASTE STREAM SR-W004. SEE COST ESTIMATE SHEET FOR SR-W004.

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Summary Page

Waste Stream Number & Name: SR-W038 Plating Line Sump Material

Background Information

A mixed waste stream generated as a one time clean out of the sump at a building in M Area.

Volume
- Current volume through 09/30/94 is 0.4 m^3.
- No future waste generation is expected because manufacturing process which generated this waste is no longer operational.

Waste Stream Composition
- Inorganic sludge

Waste Code
- D007A (TCLP Cr) nonwastewater

LDR Treatment Standard
- D007 = concentration based standard = 5.0 mg/l

Waste Characterization
- Sampling and analysis used to characterize the waste stream.
- Confidence level is high based on availability of analytical results.

Radiological Characterization
- Total activity is less than 10 nCi/g.
- Alpha emitters are U^{234}, U^{235}, and U^{238}.
- Waste is contact handled.
- Mixed low-level waste

Preferred Option

The preferred treatment option for M-Area Plating Line Sump Material is Stabilization by Vitrification in the M-Area Vendor Treatment Process.

Treatment Justification

In-depth options analysis (IDOA) is not required for this waste stream since a Preferred Option has been identified utilizing an existing facility with existing treatment technology.

The proposed action is to stabilize the M-Area mixed wastes utilizing a thermal vitrification process. The process facility would be constructed and operated by a subcontractor to the Westinghouse Savannah River Company (WSRC). The vitrification process would result in the lowest volume of stabilized waste for final disposal, provide the most durable final wasteform, and could be completed for the lowest cost (including final disposal costs) of all treatment alternatives for wastes needing to be treated in M Area.

The proposed action was evaluated with respect to the technical ability to meet the Land Disposal Restrictions (LDR) criteria for the final stabilized wasteform, and for the overall cost of the treatment activities. The ability to meet the durability requirements, that is, Toxicity Characteristic Leaching Procedure (TCLP) testing requirements, for constituents of concern in the final wasteform was a critical consideration. The total life-cycle cost, including the cost of treating the waste itself, the cost to treat any effluents generated by the vendor, and the cost to dispose of the final wasteform were also considered. In addition, the environmental impacts, onsite and offsite health effects, and occupational health and safety concerns for this treatment method were evaluated.

Treatability studies were performed on M-Area waste streams to determine the treatment technology most likely to meet the treatment standard required in the land disposal restriction standards. Methods determined to be most effective in meeting the treatment standards involved the isolation of the metal contaminants in a cementatious or a glass matrix. Investigation was made into the alternatives for providing such treatment. Treatment options investigated included:

- Onsite treatment by a subcontractor at a temporary facility
- Onsite treatment at a permanent facility located in M Area and operated by SRS
- Onsite treatment at a permanent facility located at some central SRS location and operated by SRS
- Transport to an offsite location for treatment by a vendor
- Taking no action

The no action alternative was rejected because of the LDR-FFCA requirement for treatment of the M-Area waste streams.

Evaluation of the treatment option was made for both a cement-based stabilization process and a glass/vitrification process. An initial determination was made that vendor processes were cheaper than construction and operation of a permanent, onsite facility by SRS. Cost studies performed in 1991 showed that onsite treatment in facilities constructed at SRS would cost an estimated $46 million if constructed in M Area or $75 million if constructed at a central SRS location. A vendor operated cementatious waste stabilization treatment process would cost $28 million. A request for bids was made to vendors utilizing both cement and glass isolation processes. A stipulation was made in the bid that the vendor must demonstrate that this process was capable of meeting the land disposal restriction treatment standards for the waste streams to receive treatment at M Area.

The award of a contract for the treatment of M-Area waste was based on demonstration on the part of the bidder of a technically valid treatment process, previous treatment experience, and adequate company resources to carry out the work.

Review of the bids determined that the proposal for treating M-Area wastes by vitrification in a temporary facility operated at SRS by a vendor was the lowest cost alternative. This alternative would also result in the least amount of liquid requiring treatment and discharge at the M-Area wastewater treatment facility and produce the lowest volume of treated waste meeting land disposal restriction standards that would require eventual disposal in a RCRA disposal facility.

When blending and treatment of the Process Waste Intermediate Treatment/Storage Facility (PWIT/SF) sludge is begun, it is projected that approximately 700,000 gallons of F006 listed mixed waste will be in storage in the tanks. This includes an estimated 50,000 gallons of supernate which cannot be separated from the sludge. Waste streams stored in the tanks include SR-W004, M-Area Plating Line Sludges from Supernate Treatment and SR-W037, M-Area High Nickel Plating Line Sludge. One waste stream (SR-W054 – Enriched Uranium Contaminated with Lead, total volume 35 gallons) has been combined with waste stream SR-W037. SR-W054 is now indistinguishable from form SR-W037 and will be treated identically.

Other M-Area mixed wastes to be treated are stored in 55-gallon drums in the Mixed Waste Storage Shed in M Area. These wastes include:

- A Watts Plating bath, California list waste solution, SR-W039, Nickel Plating Line Solution
- Mark 15 sludge filtercake, waste stream SR-W005, Mark 15 Filtercake
- Solid treatability sample residues, waste stream SR-W029, M-Area Sludge Treatability Samples

Two drums of Plating Line Sump Material (SR-W038) are stored in the 645-2N storage facility.

Equipment required for treatment of the M-Area waste would continue to belong to the vendor and, if the equipment could meet Department of Transportation (DOT) shipping criteria for radioactivity, would be removed from SRS. If equipment could not be successfully decontaminated, it would be disposed of onsite. The cost of disposal was a part of the total contract cost.

The M-Area Vendor Treatment Process is capable of effectively treating all of these waste streams to meet regulatory requirements. As a result, upon completion of treatment, all listed and characteristically hazardous waste sludges and liquids from M-Area operations will be eliminated.

Cost Estimate: INCLUDED WITH COST INFORMATION FOR TREATING WASTE STREAM SR-W004. SEE COST ESTIMATE SHEET FOR SR-W004.

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Summary Page

Waste Stream Number & Name: SR-W039 Nickel Plating Line Solution

Background Information

This waste is plating line solution generated by the shut down of the M-Area process line.

Volume
- Current volume through 09/30/94 is 5.0 m^3.
- No future waste generation is expected because the manufacturing process which generated this waste is no longer operational.

Waste Stream Composition
- Aqueous liquid

Waste Code
- D002A (corrosive)
- D008A (TCLP Pb) wastewater

LDR Treatment Standard
- D002 = specified technology = Deactivation
- D008 = concentration based standard = 5.0 mg/l
- California list = render non-liquid

Waste Characterization
- Sampling and analysis used to characterize the waste stream.
- Confidence level is high because EP toxicity test was run.
- No TCLP was performed.
- The primary contaminant is Ni with trace amounts of Pb.

Radiological Characterization
- Total activity is 6.56×10^{-5} Ci.
- Alpha emitters are U^{234}, U^{235}, and U^{238}.
- Waste is contact handled.
- Mixed low-level waste

Preferred Option

The preferred treatment option for M-Area Nickel Plating Line Solution is Stabilization by Vitrification in the M-Area Vendor Treatment Process.

Treatment Justification

In-depth options analysis (IDOA) is not required for this waste stream since a Preferred Option has been identified utilizing an existing facility with existing treatment technology.

The proposed action is to stabilize the M-Area mixed wastes utilizing a thermal vitrification process. The process facility would be constructed and operated by a subcontractor to the Westinghouse Savannah River Company (WSRC). The vitrification process would result in the lowest volume of stabilized waste for final disposal, provide the most durable final wasteform, and could be completed for the lowest cost (including final disposal costs) of all treatment alternatives for wastes needing to be treated in M-Area.

The proposed action was evaluated with respect to the technical ability to meet the Land Disposal Restrictions (LDR) criteria for the final stabilized wasteform and for the overall cost of the treatment activities. The ability to meet the durability requirements, that is, Toxicity Characteristic Leaching Procedure (TCLP) testing requirements, for constituents of concern in the final wasteform was a critical consideration. The total life-cycle cost, including the cost of

treating the waste itself, the cost to treat any effluents generated by the vendor, and the cost to dispose of the final wasteform also were considered. In addition, the environmental impacts, onsite and offsite health effects, and occupational health and safety concerns for this treatment method were evaluated.

Treatability studies were performed on M-Area waste streams to determine the treatment technology most likely to meet the treatment standard required in the land disposal restriction standards. Methods determined to be most effective in meeting the treatment standards involved the isolation of the metal contaminants in a cementatious or a glass matrix. Investigation was made into the alternatives for providing such treatment. Treatment options investigated included:

- Onsite treatment by a subcontractor at a temporary facility
- Onsite treatment at a permanent facility located in M-Area and operated by SRS
- Onsite treatment at a permanent facility located at some central SRS location and operated by SRS
- Transport to an offsite location for treatment by a vendor
- Taking no action

The no action alternative was rejected because of the LDR-FFCA requirement for treatment of the M-Area waste streams.

Evaluation of the treatment option was made for both a cement based stabilization process and a glass/vitrification process. An initial determination was made that vendor processes were cheaper than construction and operation of a permanent, onsite facility by SRS. Cost studies performed in 1991 showed that onsite treatment in facilities constructed at SRS would cost an estimated $46 million if constructed in M Area or $75 million if constructed at a central SRS location. A vendor operated cementatious waste stabilization treatment process would cost $28 million. A request for bids was made to vendors utilizing both cement and glass isolation processes. A stipulation was made in the bid that the vendor must demonstrate that this process was capable of meeting the land disposal restriction treatment standards for the waste streams to receive treatment at M Area.

The award of a contract for the treatment of M-Area waste was based on demonstration on the part of the bidder of a technically valid treatment process, previous treatment experience, and adequate company resources to carry out the work.

Review of the bids determined that the proposal for treating M-Area Wastes by vitrification in a temporary facility operated at SRS by a vendor was the lowest cost alternative. This alternative would also result in the least amount of liquid requiring treatment and discharge at the M-Area wastewater treatment facility and produce the lowest volume of treated waste meeting land disposal restriction standards that would require eventual disposal in a RCRA disposal facility.

When blending and treatment of the Process Waste Intermediate Treatment/Storage Facility (PWIT/SF) sludge is begun, it is projected that approximately 700,000 gallons of F006 listed mixed waste will be in storage in the tanks. This includes an estimated 50,000 gallons of supernate which cannot be separated from the sludge. Waste streams stored in the tanks include SR-W004, M-Area Plating Line Sludges from Supernate Treatment and SR-W037, M-Area High Nickel Plating Line Sludge. One waste stream (SR-W054 – Enriched Uranium Contaminated with Lead, total volume 35 gallons) has been combined with waste stream SR-W037. SR-W054 is now indistinguishable from form SR-W037 and will be treated identically.

Other M-Area mixed wastes to be treated are stored in 55-gallon drums in the Mixed Waste Storage Shed in M Area. These wastes include:

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- Mark 15 sludge filtercake, waste stream SR-W005, Mark 15 Filtercake

- Solid treatability sample residues, waste stream SR-W029, M-Area Sludge Treatability Samples

Two drums of Plating Line Sump Material (SR-W038) are stored in the 645-2N storage facility.

Equipment required for treatment of the M-Area waste would continue to belong to the vendor and, if the equipment could meet Department of Transportation (DOT) shipping criteria for radioactivity, would be removed from SRS. If equipment could not be successfully decontaminated, it would be disposed of onsite. The cost of disposal was a part of the total contract cost.

The M-Area Vendor Treatment Process is capable of effectively treating all of these waste streams to meet regulatory requirements. As a result, upon completion of treatment, all listed and characteristically hazardous waste sludges and liquids from M-Area operations will be eliminated.

Cost Estimate: INCLUDED WITH COST INFORMATION FOR TREATING WASTE STREAM SR-W004. SEE COST ESTIMATE SHEET FOR SR-W004.

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Summary Page

Waste Stream Number & Name: SR-W040 M-Area Stabilized Sludge

Background Information

A future waste stream resulting from vitrification of M-Area waste plating line solutions and sludges after stabilization by vitrification in the M-Area Vendor Treatment Process.

This future waste stream will be in its final stabilized form following vitrification. Since additional treatment is not required, no further tracking of this waste stream will be provided. This waste stream will be deleted from the Mixed Waste Inventory Report (MWIR) and the Site Treatment Plan (STP).

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Summary Page – Initial Screening

Waste Stream Number & Name: SR-W041 Aqueous Mercury and Lead

Background Information

A portion of the waste stream consists of one 6-liter and one 2-liter bottle of aqueous mercury and one 4-liter bottle of aqueous lead generated from analytical support for the Naval Fuels Development Facility (779-A). The other portion is a drum of rinsate transferred from SR-W049 (Tank E-3-1 Cleanout Material) with a low level of mercury.

Volume
- Current volume through 09/30/94 is 0.3 m^3.
- No future waste generation is expected because waste was generated from a one time cleanouts.

Waste Stream Composition
- Aqueous liquid

Waste Code
- D008A (TCLP Pb)
- D009A (TCLP Hg)
- D009C (high Hg contains inorganics) wastewater

LDR Treatment Standard
- D008 = concentration based standard = 5.0 mg/l
- D009 = concentration based standard = 0.2 mg/l; or RMERC

Waste Characterization
- Sampling and analysis used to characterize the waste stream.
- Confidence level is high because sampling and analysis for mercury and lead is available.

Radiological Characterization
- Sampling and analysis indicates the average activity level is 2.9 nCi/g.
- Beta/gamma emitter, alpha emitter, U^{238}, and tritium are present.
- Waste is contact handled.
- Mixed low-level waste

Initial Screening

The initial screening identified inappropriate treatment options. These options appear in the Initial Rejections table.

Initial Rejections

Treatment Facility	Treatment Technology	Reasons for Rejection
CIF	Combustion	CIF has no equipment to control mercury vapors.
CIF	Ashcrete Stabilization	Ashcrete will not immobilize the constituents of concern to pass TCLP.
Z Area	Stabilization	Z-Area can treat only those wastes that come by pipeline from Tank 50 and meet strict waste acceptance criteria. The Z-Area process lacks flexibility to treat and dispose of a variety of waste streams.
M Area	Vitrification	Vitrifier has no provision to control volatized mercury.

Summary Page – Technology Success Factor (TSF) & In-Depth Options Analysis (IDOA)

Waste Stream Number & Name: SR-W041 Aqueous Mercury and Lead

Feasible Options

Option No.	Treatment Facility	Treatment Technology	TSF Score	IDOA Scores Tech.	IDOA Scores Total	COST (x 1,000)	PO
SR-W041-1	ETF	Ion Exchange	94	66	80	307	√
SR-W041-2	Vendor/Onsite	Stabilization	75	59	73	SR-W031-4	
SR-W041-3	Vendor/Onsite	Polymer Encapsulation	88	58	72	SR-W031-2	
SR-W041-4	Cont. Bldg.	In-Drum Stabilization	51	52	65	1,249	
SR-W041-5	Vendor	Precipitation	88	44	56	4,590	
SR-W041-6	INEL/WEDF	Stabilization	*	52	65	377	

* No TSF required for proposed or existing non-Savannah River Site-DOE waste processing facilities.

Options Rejected Due To Low Technology Success Factor (TSF)

- No options were rejected.

Engineering Assessment

Preferred Option Justification

The preferred option for the Aqueous Mercury and Lead waste stream is treatment in the F-Area and H-Area Effluent Treatment Facility using Ion Exchange.

This option treats the constituents of concern, aqueous mercury and lead, by absorption on ion exchange resin.

This option is preferred because:
- Final waste volume is reduced by a factor of more than 20 to 1.
- The constituents of concern are adsorbed so tightly on the resin, the resin meets LDR requirements.
- ETF has successfully treated wastes of this type.
- Treated liquid effluent can ultimately be released to a permitted outfall.

Treatability Study Requirements

A representative sample of the material will be mixed with ion exchange resin in the laboratory to determine:

- Mercury and lead removal from the liquid stream.
- Ability of the resin to bind with mercury and lead and not become hazardous waste.

Options Rejected During IDOA

Emulsification or Stabilization by a Vendor in a Containment Building

Emulsification or stabilization by a vendor in a containment building was rejected because:
- The emulsification or stabilization processes are not cost-effective.
- Minute volume of waste does not warrant a complex treatment process which offers no technological advantage over preferred option.

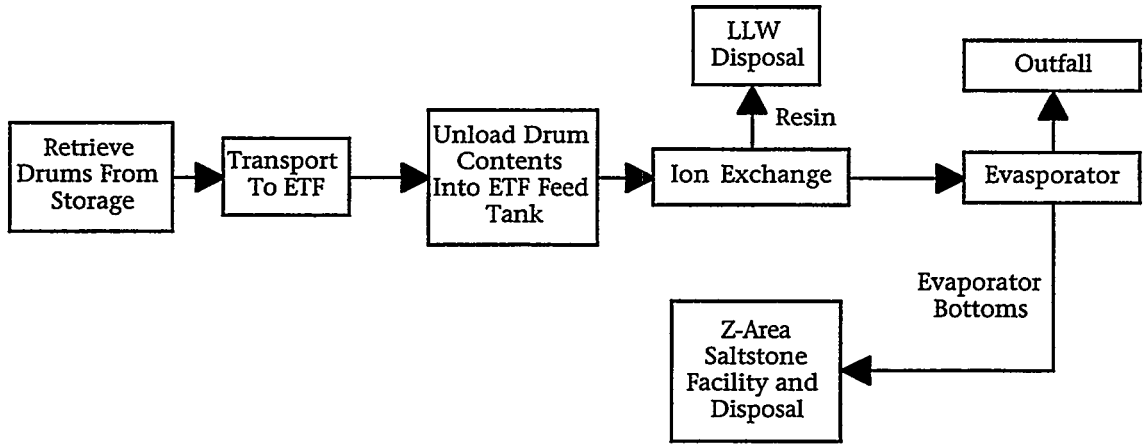
Stabilization at INEL/WEDF

Stabilization at Idaho National Engineering Laboratory (INEL) Waste Engineering Development (WEDF) (encapsulating the waste with a grout matrix) was rejected because:

- Rejected process is not cost-effective.
- Minute volume of waste does not warrant a complex treatment process, which offers no technological advantage over preferred option.
- DOE guidance specifies that liquid waste be treated onsite.

Waste Stream Number & Name: SR-W041 Aqueous Mercury and Lead
Option Number: SR-W041-1
Facility: ETF
Treatment Technology: Ion Exchange

Treatment Cycle Flow Diagram:



Pros

- Normal maintenance requirements apply. This waste stream may require a "clean-out" earlier than anticipated based on curie load. Normal availability greater than 80%.
- Expect greater than 20:1 reduction. Treated liquid waste goes to outfall.
- No secondary waste generated. No increase in secondary waste attributable to this waste.
- Expect 100% conversion to nonhazardous form.
- Can treat waste with no changes to process, main line, or evaporator.
- No shipping required. Released to outfall.
- Resins do not require RCRA disposal.
- This is an already proven technology. Process is installed and operational.
- All wastes are batched and analyzed before release.
- Existing equipment. Permission from SCDHEC predictable based on past experience.
- Small waste stream. Minimal emissions even during accident scenarios.
- No increase in non operational work force.
- No change in operational work force. Slight potential for exposure while emptying bottles.
- Expect treatment to render wasteform in full compliance with LDR.
- This can be done with no increase in operating budget.

Cons

- Aqueous mercury waste contains >260 mg/kg Hg, but mercury is not suspended elemental Hg. Will need to seek SCDHEC approval of this treatment method for the aqueous mercury portion.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	90	Add 10 points to the median score of 80 because expect greater than 20:1 reduction. Liquid goes to outfall.
• secondary waste generation	100	No secondary waste generated. Add 20 points to the median score of 80 because no increase in secondary waste attributable to this waste.

Waste Stream Number & Name: SR-W041 Aqueous Mercury and Lead
Option Number: SR-W041-1
Facility: ETF **Treatment Technology:** Ion Exchange
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• destruction removal and demobilization efficiency	80	Expect 100% conversion to nonhazardous form. No additional treatment is required to meet LDR (for filtrate).
• flexibility	80	Can treat with no changes to process, main line or evaporator.
• ability to be shipped	80	No shipping required. Released to outfall.
• final wasteform	80	Resins pass TCLP.
Engineering Parameters		
• system implementability	100	This is an already proven technology. Add 20 points to the median score of 80 because process is installed and operational.
• availability	80	Normal maintenance requirements apply. This waste stream may require a "clean-out" earlier than anticipated based on curie load. Normal availability greater than 80%.
• scalability	50	Can handle this small volume stream easily.
• remedial measures	80	All wastes are batched and analyzed before release.
• schedule for treatment of waste	80	Existing equipment. Permission from SCDHEC expected based on past experience.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Small waste stream. Minimal emissions even during accident scenarios.
• non operational worker potential exposure	80	No increase in non operational work force.
• operational worker potential exposure	70	No change in operational work force. Subtract 10 points from the median score of 80 because slight potential for exposure while emptying bottles.
• transportation potential exposure	80	None required.
Regulatory Parameters		
• need for variance	20	Expect treatment to render wasteform in full compliance with LDR requirements, but SCDHEC approval needed.
• ability to obtain a permit	80	Will require SCDHEC approval, but Site has experience with these requests.
• waste disposal	80	Solid waste (resin) will require LLW disposal. Treated liquid waste will go to a permitted outfall.
Public Acceptance		
• public acceptance	50	Good public acceptance five years ago, no indication that support has eroded in the meanwhile.

Waste Stream Number & Name: SR-W041 Aqueous Mercury and Lead
Option Number: SR-W041-1
Facility: ETF **Treatment Technology:** Ion Exchange
In-Depth Options Analysis (IDOA) Score Sheet

Cost Considerations		
• life-cycle cost	99	
• funding availability	100	Add 20 points to the median score of 80 because this can be done with no increase in operating budget.
Industry Involvement		
• market for technology	20	Application of existing technology.
• private sector involvement	20	SRS facility evaluated.

IDOA Score: **Technical** 66 **Total** 80

Waste Stream Number & Name: SR-W041 Aqueous Mercury and Lead
Option Number: SR-W041-1
Facility: ETF **Treatment Technology: Ion Exchange**
Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled

Module Location: SRS

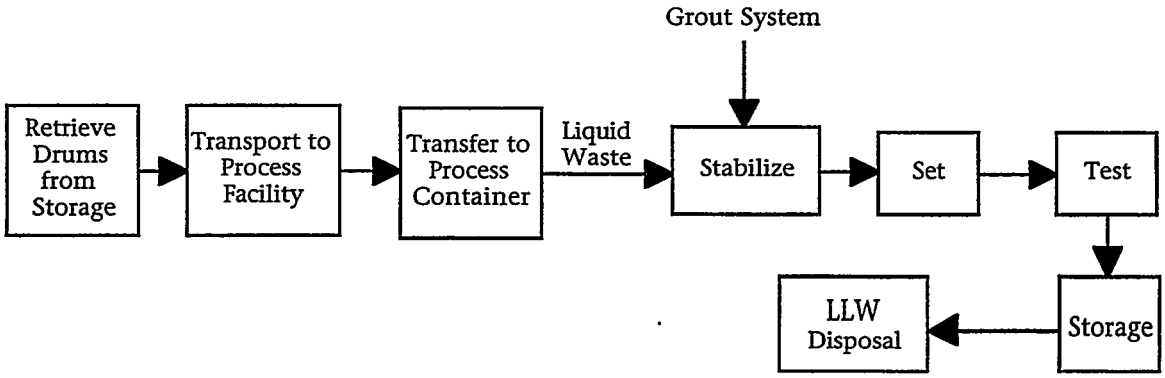
Module Status: [√] Existing [ ] New [√] Small generator [ ] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 0	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 0	
		1.3.2 Safety Assurance Documentation	$ 0	
		1.3.3 Permitting	$ 125	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 0	
		TOTAL PRE-OPERATIONS		$ 275
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 0	
	2.2	Inspection	$ 0	
	2.3	Project Management	$ 0	
	2.4	Building Construction (inc. indirect)	$ 0	
	2.5	Equipment (inc. indirect)	$ 0	
	2.6	Construction Management	$ 0	
	2.7	Contingency	$ 0	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 0
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 30	
	3.2	Annual Utilities	$ 1	
	3.3	Annual Materials	$ 18	
	3.4	Annual Maintenance	$ 11	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 60	
		X NUMBER OF YEARS OF OPERATION	0.25	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 15
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 0	
	4.2	Closure, Post-Closure, Monitoring	$ 0	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 0
		SUB COST FOR ION EXCHANGE MODULE		$ 290
		ESCALATION		1.06
		TOTAL COST		$ 307

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W041 Aqueous Mercury and Lead
Option Number: SR-W041-2
Facility: Vendor/Onsite
Treatment Technology: Stabilization

Treatment Cycle Flow Diagram:



Pros

- Little secondary waste generated.
- No additional treatment is required to meet LDR requirements.
- Can accommodate a wide range of similar wastes and radiation levels. Widely used in the commercial world.
- The wasteform meets the expected WAC for waste disposal. No additional treatment is required. Wasteform is disposable in the form in which it exits the process.
- Proven process, used both in DOE Complex and the commercial world.
- Similar systems in the commercial nuclear industry experience availability of 80%.
- Requires fewer non operational workers than comparably sized facilities. Experience in similar facilities indicates that little non-routine maintenance is needed.
- Well accepted wasteform. Similar processes result in wasteforms that meet stability requirements for radionuclides for class A stable waste.
- All wastes are LLW because will meet treatment standard.
- Process will be in compliance without requiring a treatability variance.

Cons

- The waste volume will more than double.
- Wasteform is not as permanent as other forms of stabilization.
- Not a budgeted item and will require line item funding.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	10	Subtract 10 points from the median score of 20 because the waste volume will more than double.
• secondary waste generation	80	Little secondary waste generated.
• destruction removal and demobilization efficiency	80	No additional treatment is required to meet LDR requirements.
• flexibility	80	Can accommodate a wide range of similar wastes and radiation levels. Widely used in the commercial world.
• ability to be shipped	80	Wasteform can be easily shipped as-is. Similar processes result in wasteforms that meet stability requirements for radionuclides for class A stable waste.

Waste Stream Number & Name: SR-W041 Aqueous Mercury and Lead
Option Number: SR-W041-2
Facility: Vendor/Onsite **Treatment Technology: Stabilization**
In-Depth Options Analysis (IDOA) Score Sheet

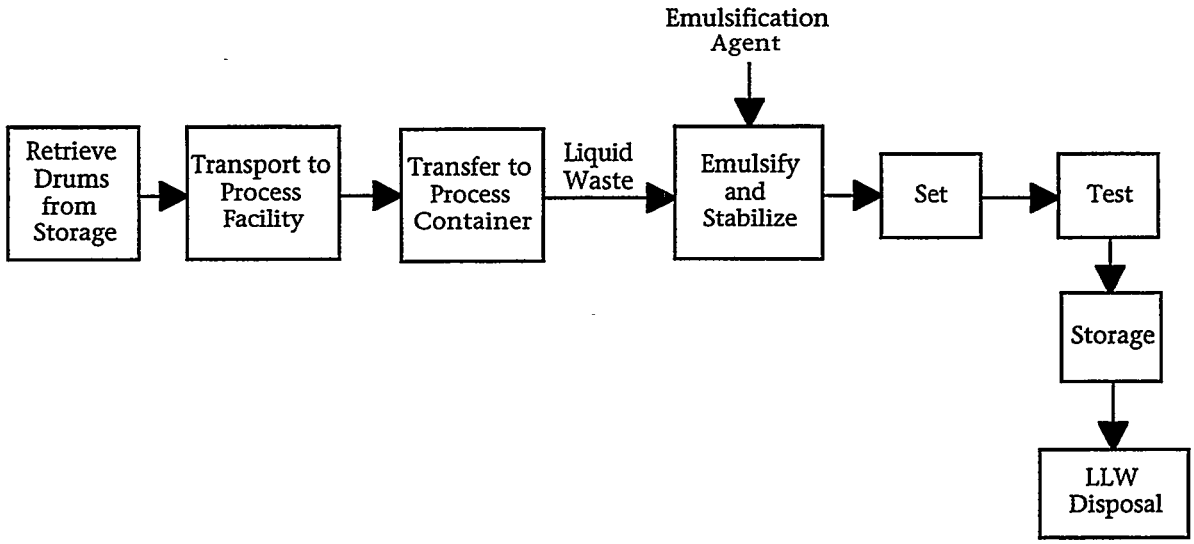
Attribute	Score	Discussion/Notes
• final wasteform	80	The wasteform meets the expected WAC for waste disposal.
Engineering Parameters		
• system implementability	100	Add 20 points to the median score of 80 because proven process, used both in DOE Complex and the commercial world.
• availability	80	Similar systems in the commercial nuclear industry experience availability of 80%.
• scalability	50	Throughput is set by design, and not easily expanded except by adding more shifts of operation.
• remedial measures	50	Failed wasteform can be ground up and reprocessed.
• schedule for treatment of waste	70	This is a mature technology. Subtract 10 points from the median score of 80 because the process is neither skid-mounted nor currently available in the U. S.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Process can be installed in a containment building with adequate emission controls.
• non operational worker potential exposure	80	Requires fewer non operational workers than comparably-sized facilities. Experience in similar facilities indicates that little nonroutine maintenance is needed.
• operational worker potential exposure	50	Facility requires about the same number of operational workers as comparably-sized, skid-mounted facilities.
• transportation potential exposure	60	Additional characterization needed. Add 10 points to median score because waste can be handled readily.
Regulatory Parameters		
• need for variance	80	Process will be in compliance without requiring a variance.
• ability to obtain a permit	80	Must demonstrate that waste meets treatment standards.
• waste disposal	80	All wastes disposed of as LLW.
Public Acceptance		
• public acceptance	20	Mature and proven technology, however wasteform is not as permanent as other forms of stabilization (i.e., vitrification).
Cost Considerations		
• life-cycle cost	100	
• funding availability	20	Not a budgeted item and will require line item funding.
Industry Involvement		
• market for technology	20	This is an existing technology.
• private sector involvement	50	Technology could be provided by an existing vendor process.

IDOA Score: Technical 59 **Total** 73

Cost Estimate: INCLUDED WITH COST OF OPTION SR-W031-4

Waste Stream Number & Name: SR-W041 Aqueous Mercury and Lead
Option Number: SR-W041-3
Facility: Vendor/Onsite
Treatment Technology: Polymer Encapsulation

Treatment Cycle Flow Diagram:



Pros

- Little secondary waste generated.
- No additional treatment is required to meet LDR requirements.
- Can accommodate a wide range of similar wastes and radiation levels. Widely used in the commercial world.
- Wasteform meets DOT shipping requirements in the form it exits the treatment process
- The wasteform meets the expected WAC for waste disposal. No additional treatment is required. Wasteform is disposable in the form in which it exits the process.
- This is a proven process, used both in DOE Complex and the commercial world.
- Mature technology. Vendor will bring onsite and set up with a minimum delay.
- Process can be installed in a containment building with adequate emission controls.
- Skid mounted, no D&D, vendor removes upon completion of work. Facility requires more non operational workers than other comparably-sized, skid-mounted facilities.
- Full LDR compliance without requiring a variance.
- Waste can be disposed as LLW.

Cons

- The waste volume will more than double.
- Mature and proven technology, however wasteform is not as permanent as other forms of stabilization (i.e., vitrification).
- Not a budgeted item and will require line item funding.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	10	Subtract 10 points from the median score of 20 because the waste volume will more than double.
• secondary waste generation	80	Little secondary waste generated.
• destruction removal and demobilization efficiency	80	No additional treatment is required to meet LDR requirements.

Waste Stream Number & Name: SR-W041 Aqueous Mercury and Lead
Option Number: SR-W041-3
Facility: Vendor/Onsite
Treatment Technology: Polymer Encapsulation

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• flexibility	80	Can accommodate a wide range of similar wastes and radiation levels. Widely used in the commercial world.
• ability to be shipped	80	Wasteform meets shipping requirements in the form it exits the treatment process.
• final wasteform	80	The wasteform meets the expected WAC for waste disposal.
Engineering Parameters		
• system implementability	100	This is a proven process used in the DOE Complex. Add 20 points to the median score of 80 because it is used in the commercial world.
• availability	60	Add 10 points to the median score of 50 because although operator error can cause downtime, system is normally available 50% of the time.
• scalability	50	Throughput is set by design, and not easily expanded except by adding more shifts of operation.
• remedial measures	50	Failed wasteform can be ground up and reprocessed by existing technology.
• schedule for treatment of waste	80	Mature technology. Vendor will bring onsite and set up with a minimum delay.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Process can be installed in a containment building with adequate emission controls.
• non operational worker potential exposure	80	Requires the same number of non operational workers as comparable skid-mounted units. Most or all initial construction can be done in a vendor shop. Experience in similar facilities indicates that little non-routine maintenance is required.
• operational worker potential exposure	40	Subtract 10 points from the median score of 50 because the facility requires more operational workers than other comparably-sized, skid-mounted facilities.
• transportation potential exposure	60	There is a no additional characterization needed. Add 10 points to the median score of 50 because waste can be handled readily.
Regulatory Parameters		
• need for variance	80	Full LDR compliance without requiring variance.
• ability to obtain a permit	80	Must demonstrate that waste meets treatment standards.
• waste disposal	80	Waste can be disposed as LLW.
Public Acceptance		
• public acceptance	20	Mature and proven technology, however wasteform is not as permanent as other forms of stabilization (i.e., vitrification).
Cost Considerations		
• life-cycle cost	100	
• funding availability	20	Not a budgeted item and will require line item funding.

Waste Stream Number & Name: SR-W041 Aqueous Mercury and Lead
Option Number: SR-W041-3
Facility: Vendor/Onsite
Treatment Technology: Polymer Encapsulation

In-Depth Options Analysis (IDOA) Score Sheet

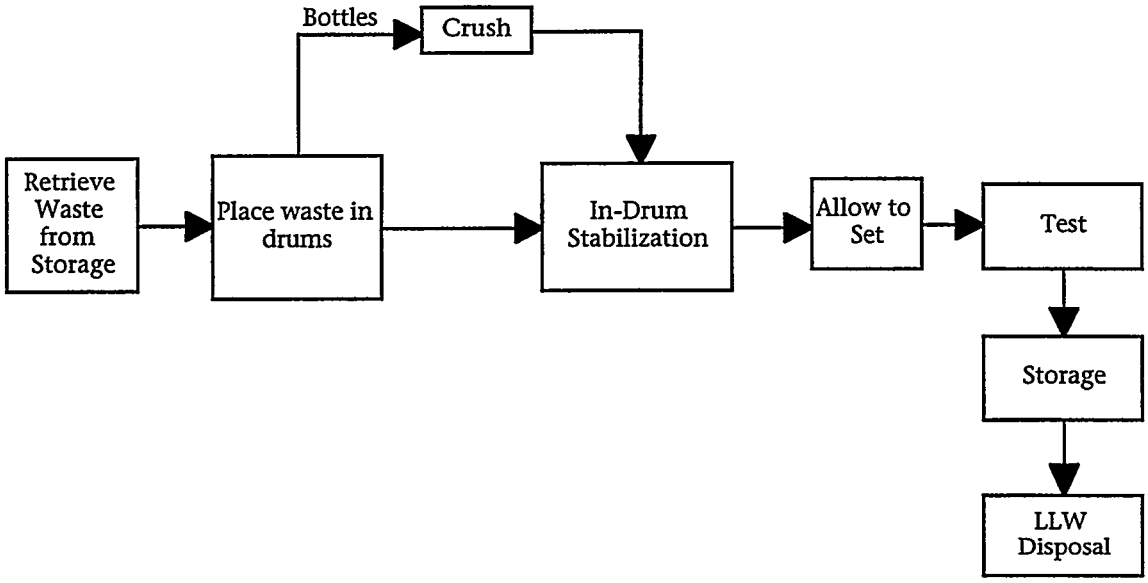
Attribute	Score	Discussion/Notes
Industry Involvement		
• market for technology	20	This is an existing technology.
• private sector involvement	50	Technology could be provided by an existing vendor process.

IDOA Score: Technical 58 Total 72

Cost Estimate: INCLUDED WITH COST OF OPTION SR-W031-2

Waste Stream Number & Name: SR-W041 Aqueous Mercury and Lead
Option Number: SR-W041-4
Facility: Containment Building **Treatment Technology: In-Drum Stab.**

Treatment Cycle Flow Diagram:



Pros

- The entire process takes place inside the final disposal container. No secondary waste generated.
- No additional treatment is required to meet LDR requirements.
- Wasteform meets shipping requirements in the form it exits the treatment process.
- Wasteform meets the expected WAC for waste disposal. No additional treatment is required. Wasteform is disposable in the form in which it exits the process.
- Proven process, used in both DOE & commercial world.
- Process will be in full compliance with LDR regulations without a variance.
- Disposal will be as non-hazard radioactive waste. Meets treatment standards.

Cons

- Waste is divided among containers and encapsulating material added, which will increase the amount of waste material going to storage.
- Wasteform is not as permanent as other forms of stabilization.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	20	Waste is divided among containers and encapsulating material added, which will increase the amount of waste material going to storage.
• secondary waste generation	100	The entire process takes place inside the final disposal container. Add 20 points to the median score of 80 because no secondary waste generated.
• destruction removal and demobilization efficiency	80	No additional treatment is required to meet LDR requirements.
• flexibility	50	Provided the material is compatible with cement stabilization, and is of such a size as to fit in the stabilization container, this process can handle it.

Waste Stream Number & Name: SR-W041 Aqueous Mercury and Lead
Option Number: SR-W041-4
Facility: Containment Building Treatment Technology: In-Drum Stab.
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• ability to be shipped	80	Wasteform meets shipping requirements in the form it exits the treatment process.
• final wasteform	80	Wasteform meets the expected WAC for waste disposal.
Engineering Parameters		
• system implementability	80	A system which is now in cold standby might be easily adaptable to treatment of this waste stream.
• availability	50	System is normally available 50% of the time.
• scalability	50	Throughput is set by design, and not easily expanded except by adding more shifts of operation.
• remedial measures	50	Failure of the encapsulating material to setup would necessitate grinding up and reprocessing. The technology is well-established.
• schedule for treatment of waste	40	Ancillary containment building process will have to be designed. Subtract 10 points from the median score of 50 because installation in a containment building will add uncertainties.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Process can be installed in a containment building with adequate emission controls.
• non operational worker potential exposure	40	Subtract 10 points from the median score of 50 because maintenance of encapsulating material mixing equipment will require an average crew. Personal protective equipment needed for work in a containment building.
• operational worker potential exposure	60	An average crew is required to operate the equipment. Add 10 points to the median score of 50 because small quantity of waste to be treated.
• transportation potential exposure	60	No additional characterization needed. Add 10 points to the median score of 50 because waste can be handled readily.
Regulatory Parameters		
• need for variance	80	Process will be in full compliance with LDR regulations without a variance.
• ability to obtain a permit	50	Proven process that has been permitted elsewhere.
• waste disposal	80	Treated waste will meet treatment standards and be disposed of as LLW.
Public Acceptance		
• public acceptance	20	Mature and proven technology, however wasteform is not as permanent as other forms of stabilization (i.e., vitrification).
Cost Considerations		
• life-cycle cost	96	
• funding availability	50	Not a budgeted item. May be covered by operating funds, but an increase in budget will be required.

Waste Stream Number & Name: SR-W041 Aqueous Mercury and Lead
Option Number: SR-W041-4
Facility: Containment Building **Treatment Technology:** In-Drum Stab.
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Industry Involvement		
• market for technology	20	Process is commercially available.
• private sector involvement	50	Technology could be provided by either DOE or vendor.

IDOA Score: **Technical** 52 **Total** 65

Waste Stream Number & Name: SR-W041 Aqueous Mercury and Lead
Option Number: SR-W041-4
Facility: Containment Building Treatment Technology: In-Drum Stab.
Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled

Module Location: SRS

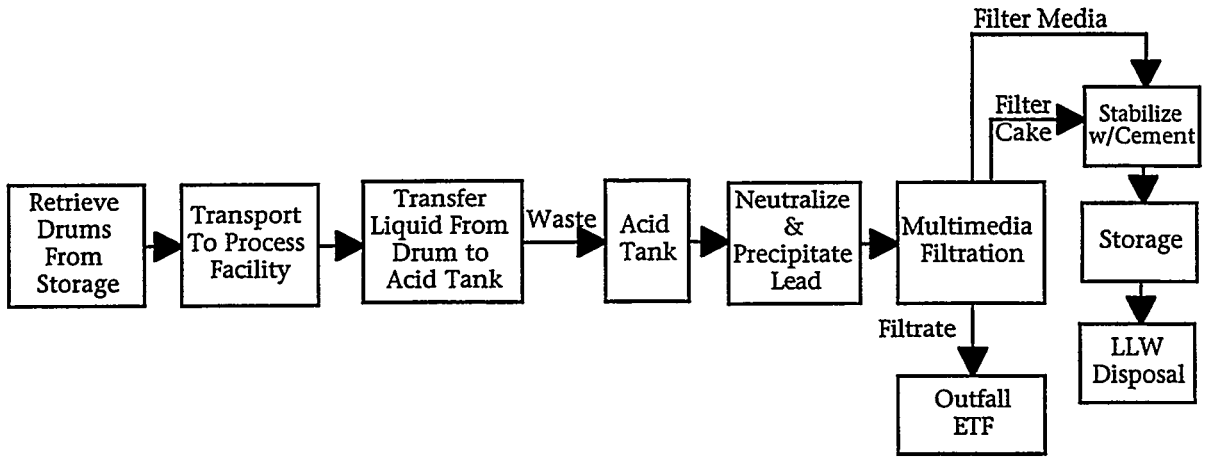
Module Status: [ ] Existing [√] New [√] Small generator [ ] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 11	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 45	
		1.3.2 Safety Assurance Documentation	$ 11	
		1.3.3 Permitting	$ 125	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 8	
		TOTAL PRE-OPERATIONS		$ 351
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 50	
	2.2	Inspection	$ 14	
	2.3	Project Management	$ 22	
	2.4	Building Construction (inc. indirect)	$ 175	
	2.5	Equipment (inc. indirect)	$ 50	
	2.6	Construction Management	$ 16	
	2.7	Contingency	$ 117	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 444
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 30	
	3.2	Annual Utilities	$ 1	
	3.3	Annual Materials	$ 18	
	3.4	Annual Maintenance	$ 11	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 60	
		X NUMBER OF YEARS OF OPERATION	0.25	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 15
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 180	
	4.2	Closure, Post-Closure, Monitoring	$ 1	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 181
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 25
		SUB COST FOR IN-DRUM STABILIZATION MODULE		$ 1,016
		ESCALATION		1.23
		TOTAL COST		$ 1,249

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W041 Aqueous Mercury and Lead
Option Number: SR-W041-5
Facility: Vendor
Treatment Technology: Precipitation

Treatment Cycle Flow Diagram:



Pros

- No additional treatment is required to meet LDR standards.
- Wasteform meets shipping requirements in the form it exits the treatment process.
- Process can be installed in a containment building with adequate emission controls.
- Process will be designed to comply with applicable LDR regulations without seeking a variance.
- Waste can be disposed as LLW.

Cons

- Common technology. Scale-up problems could cause uncertainties in the schedule.
- Process without directly applicable operating history to demonstrate environmental acceptability will concern the public.
- Not a budgeted item and will require line item funding.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	40	Subtract 10 points from the median score of 50 because of the volume of secondary waste. Volume is greater than 1:1.
• secondary waste generation	40	Subtract 10 points from the median score of 50 because aqueous technology generates secondary waste streams that require treatment.
• destruction removal and demobilization efficiency	80	No additional treatment is required to meet LDR standards (for filtrate).
• flexibility	50	Designed to precipitate heavy metal from wastewater. Could be used to treat acid effluent from heavy metal dissolving. Would require further bench and pilot scale testing.

Waste Stream Number & Name: SR-W041 Aqueous Mercury and Lead
Option Number: SR-W041-5
Facility: Vendor **Treatment Technology:** Precipitation
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• ability to be shipped	80	Wasteform meets DOT shipping requirements in the form it exits the treatment process.
• final wasteform	50	Meets the expected WAC for waste disposal. Additional secondary waste treatment is required. Wasteform is disposable in the form in which it exits the secondary process.
Engineering Parameters		
• system implementability	50	Common process. May require further process development to handle site-specific waste streams.
• availability	50	Availability expected to equal that of other precipitation processes. Cleaning the multi-media filters will reduce availability.
• scalability	50	Throughput is set by design, and not easily expanded except by adding more shifts of operation.
• remedial measures	50	Failed wasteform would require additional macroencapsulation.
• schedule for treatment of waste	20	Common technology. Scale-up problems could cause uncertainties in the schedule.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Process can be installed in a containment building with adequate emission controls.
• non operational worker potential exposure	50	Expect process would require a number of non operational workers similar to a wastewater treatment plant.
• operational worker potential exposure	50	Expect process would require a number of operational works similar to a wastewater treatment plant.
• transportation potential exposure	50	Some additional characterization needed.
Regulatory Parameters		
• need for variance	80	Process will be designed to comply with applicable LDR regulations without seeking a variance.
• ability to obtain a permit	50	Must demonstrate that waste meets LDR treatment standards. Lack of operating background from other facilities may engender concerns.
• waste disposal	80	Waste can be disposed as LLW.
Public Acceptance		
• public acceptance	20	Process without directly applicable operating history to demonstrate environmental acceptability will concern the public.
Cost Considerations		
• life-cycle cost	87	
• funding availability	20	Not a budgeted item, will require line item funding.
Industry Involvement		
• market for technology	20	This is a vendor process.
• private sector involvement	50	Vendor process evaluated, but not existing at SRS.

IDOA Score: **Technical** 44 **Total** 56

Waste Stream Number & Name: SR-W041 Aqueous Mercury and Lead
Option Number: SR-W041-5
Facility: Vendor **Treatment Technology: Precipitation**
Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled
Module Location: SRS
Module Status: [ ] Existing [√] New [√] Small generator [ ] Large generator
[√] Onsite [ ] Offsite [√] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 60	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 239	
		1.3.2 Safety Assurance Documentation	$ 60	
		1.3.3 Permitting	$ 125	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 45	
		TOTAL PRE-OPERATIONS		$ 678
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 220	
	2.2	Inspection	$ 70	
	2.3	Project Management	$ 115	
	2.4	Building Construction (inc. indirect)	$ 1,000	
	2.5	Equipment (inc. indirect)	$ 250	
	2.6	Construction Management	$ 70	
	2.7	Contingency	$ 620	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 2,345
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 150	
	3.2	Annual Utilities	$ 6	
	3.3	Annual Materials	$ 90	
	3.4	Annual Maintenance	$ 54	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 300	
		X NUMBER OF YEARS OF OPERATION	0.25	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 75
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 1,000	
	4.2	Closure, Post-Closure, Monitoring	$ 5	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 1,005
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 100
		SUB COST FOR PRECIPITATION MODULE		$ 4,203
		ESCALATION		1.092
		TOTAL COST		$ 4,590

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W041 Aqueous Mercury and Lead
Option Number: SR-W041-6
Facility: INEL/WEDF **Treatment Technology: Stabilization**

Treatment Technology

The Idaho National Engineering Laboratory (INEL) Waste Engineering Development Facility (WEDF) Stabilization process will provide treatments for aqueous and organic liquids and debris. The process will stabilize waste in a grout matrix to reduce leachability.

Pros

- No secondary waste streams will be generated.
- The facility can treat waste streams similar in composition to those assumed in the design basis without modification.
- The stabilized waste could be shipped without additional treatment.
- Final wasteform is anticipated to meet the SRS waste disposal WAC.
- Stabilization has been demonstrated at the facility.
- The facility is anticipated to have minimal down time.
- Process failure is not anticipated to create a waste stream that cannot be treated.
- Few emissions from the facility are anticipated during normal operation and most accident scenarios.
- The facility could potentially be used to treat numerous waste streams throughout the DOE Complex.

Cons

- Stabilization will increase the overall waste volume by a factor of two or more after processing.
- Throughput is fixed by design. The facility is currently being designed.
- Waste characterization will be required for any waste streams returned to SRS for disposal.
- The majority of the treated waste will be classified as mixed waste which will require disposal in a RCRA facility.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	10	Subtract 10 points from the median score of 20 because stabilization will increase the overall waste volume by a factor of two or more after processing.
• secondary waste generation	80	No secondary waste streams are generated.
• destruction removal and demobilization efficiency	50	Additional treatment for some waste streams may be required prior to stabilization to ensure LDR standards are met.
• flexibility	80	The facility can treat waste streams similar in composition to those assumed in the design basis without modification.
• ability to be shipped	80	The stabilized waste could be shipped without additional treatment.
• final wasteform	80	Final wasteform is anticipated to meet the SRS waste disposal WAC.
Engineering Parameters		
• system implementability	80	Stabilization has been demonstrated at the facility.
• availability	80	The facility is anticipated to have minimal down time.
• scalability	20	Throughput is fixed by design. The facility is currently being designed.
• remedial measures	80	Process failure is not anticipated to create a waste stream that cannot be treated.

Waste Stream Number & Name: SR-W041 Aqueous Mercury and Lead

Option Number: SR-W041-6
Facility: INEL/WEDF **Treatment Technology: Stabilization**
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• schedule for treatment of waste	50	A schedule for waste treatment cannot be provided. Additionally, acceptance of SRS waste will be contingent upon state-approved permit modifications.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Few emissions for the facility are anticipated during normal operation and most accident scenarios.
• non operational worker potential exposure	50	Processing this material will not increase the exposure to non operational personnel.
• operational worker potential exposure	50	Personnel exposure is average for operations of this type. Processing this material will not increase the exposure to operational personnel.
• transportation potential exposure	20	Waste characterization will be required for any waste streams returned to SRS for disposal.
Regulatory Parameters		
• need for variance	80	Process will be in full LDR compliance without needing a variance.
• ability to obtain a permit	50	Permitting process is well-defined, however, the state's acceptance of offsite waste treatment is unknown. Approval may be difficult.
• waste disposal	20	The majority of the treated waste will be classified as mixed waste which will require disposal in a HW/MW facility.
Public Acceptance		
• public acceptance	50	Public acceptance for stabilization is positive; however, the treatment of offsite waste is anticipated to reduce the overall public acceptance of this process.
Cost Considerations		
• life-cycle cost	99	
• funding availability	50	Not a budgeted item though line item funding may be required.
Industry Involvement		
• market for technology	80	The facility could potentially be used to treat numerous waste streams throughout the DOE Complex.
• private sector involvement	20	Technology is available at an existing DOE facility.

IDOA Score: **Technical** 52 **Total** 65

Waste Stream Number & Name: SR-W041 Aqueous Mercury and Lead
Option Number: SR-W041-6
Facility: INEL/WEDF **Treatment Technology: Stabilization**
Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled

Module Location: INEL

Module Status: [√] Existing [ ] New [√] Small generator [ ] Large generator
[ ] Onsite [√] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 100	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ N/A	
		1.3.2 Safety Assurance Documentation	$ N/A	
		1.3.3 Permitting	$ N/A	
		1.3.4 Preparation for Operations	$ N/A	
		1.3.5 Project Management	$ N/A	
		TOTAL PRE-OPERATIONS		$ 100
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ N/A	
	2.2	Inspection	$ N/A	
	2.3	Project Management	$ N/A	
	2.4	Building Construction (inc. indirect)	$ N/A	
	2.5	Equipment (inc. indirect)	$ N/A	
	2.6	Construction Management	$ N/A	
	2.7	Contingency	$ N/A	
		TOTAL FACILITY CONSTRUCTION COSTS		$ N/A
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ N/A	
	3.2	Annual Utilities	$ N/A	
	3.3	Annual Materials	$ N/A	
	3.4	Annual Maintenance	$ N/A	
	3.5	Annual Contingency	$ N/A	
		TOTAL ANNUAL O & M	$ N/A	
		X NUMBER OF YEARS OF OPERATION		
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ N/A
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ N/A	
	4.2	Closure, Post-Closure, Monitoring	$ N/A	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ N/A
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$ N/A	
	5.2	Mobile Treatment	$ N/A	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$ 1
7.0	Transportation			$ 156
8.0	Disposal			$ 100
		SUB COST FOR STABILIZATION MODULE		$ 356
		ESCALATION		1.06
		TOTAL COST		$ 377

Note: Per DOE directions, this cost estimate is the incremental cost for treatment at an offsite DOE facility; therefore, it carries no overhead burden or capital costs.

If above numbers do not appear to add correctly, it is the result of computer rounding.

Summary Page – Initial Screening

Waste Stream Number & Name: SR-W042 Paints and Thinners

Background Information

This waste stream consists of radioactively contaminated, off-specification waste paint, spent paint solvents, and paint chips from paint removal activities.

Volume
- Current volume through 09/30/94 is 5.4 m^3.
- Expected 1995-1999 volume will be 7.0 m^3.

Waste Stream Composition
- Organic sludge/particulate

Waste Code
- D001A (ignitable high TOC)
- D005A (TCLP Ba)
- D006A (TCLP Cd)
- D007A (TCLP Cr)
- D008A (TCLP Pb)
- D009A (TCLP Hg)
- D011A (TCLP Ag)
- D018 (benzene)
- D035 (methyl ethyl ketone)
- D038 (pyridine)
- F003 (xylene, acetone)
- F005A (nonhalogenated spent solvents)

LDR Treatment Standard
- D001 specified technology = Recovery of Organics or Combustion
- D005 = concentration based standard = 100 mg/l
- D006 = concentration based standard = 1 mg/l
- D007 = concentration based standard = 5 mg/l
- D008 = concentration based standard = 5 mg/l
- D009 = concentration based standard = 0.2 mg/l
- D011 = concentration based standard = 5 mg/l
- D018* = concentration based standard = 10 mg/kg
- D035* = concentration based standard = 36 mg/kg
- D038* = concentration based standard = 16 mg/kg
- F003 = concentration based standards = 2.6-180 mg/kg
- F005 = concentration based standards = 10-170 mg/kg, except 2-Ethoxyethanol and 2-Nitropropane = Incineration

*D012-D043 nonwastewaters must be treated to meet the Universal Treatment Standards (UTS) for any underlying constituents that may be present.

Waste Characterization
- Sampling and analysis used to characterize the waste stream.
- Confidence level is high because sample and analysis available.

Radiological Characterization
- Total activity is 0.45 nCi/g.
- Waste is contact handled.
- Mixed low-level waste

Initial Screening

The initial screening identified inappropriate treatment options. These options appear in the Initial Rejections table.

Initial Rejections

Treatment Facility	Treatment Technology	Rationale for Rejection
CIF	Ashcrete Stabilization	Ashcrete does not remove the characteristic organics. Resulting wasteform would not meet LDR requirements.
ETF	Ion Exchange	ETF has no process to treat organic solvents.
LETF	Ion Exchange	LETF is not designed to treat an organic solvent stream.
M Area	Vitrification	Vitrifier is not an incinerator. It is not designed to burn an organic stream.
Z Area	Stabilization	Z Area can treat only those wastes that come by pipeline from Tank 50 and meet strict waste acceptance criteria. The Z-Area process lacks flexibility to treat and dispose of a variety of waste streams.

Summary Page – Technology Success Factor (TSF) & In-Depth Options Analysis (IDOA)

Waste Stream Number & Name: SR-W042 Paints and Thinners

Feasible Options

Option No.	Treatment Facility	Treatment Technology	TSF Score	IDOA Scores Tech.	IDOA Scores Total	COST (x 1,000)	PO
SR-W042-1	CIF	Incineration/ Stabilization	94	60	74	610	√
SR-W042-2	INEL/WEDF	Stabilization	*	52	65	243	
SR-W042-3	INEL/WERF	Incineration/ Stabilization	*	49	63	601	

* No TSF required for proposed or existing non-Savannah River Site-DOE waste processing facilities.

Options Rejected Due To Low Technology Success Factor (TSF)

- No options were rejected.

Engineering Assessment

Preferred Option Justification

The preferred treatment option for the Paints and Thinners waste stream is preparation for treatment by source separation followed by Incineration followed by Stabilization in the Consolidated Incineration Facility (CIF).

This option treats the constituents of concern, listed wastes and the hazardous characteristic, ignitability, by conversion of the combustible fraction to carbon dioxide and water, and stabilizing ash with cement.

This option is preferred because:
- Waste volume will be reduced by a factor of at least two.
- Final wasteform will meet LDR standards.
- Incineration and ash stabilization are demonstrated technologies.
- CIF is currently under construction.
- Residual solids are stabilized with cement.
- It is a cost-effective option.
- No treatability studies will be needed.

Options Rejected During IDOA

Stabilization at INEL/WEDF

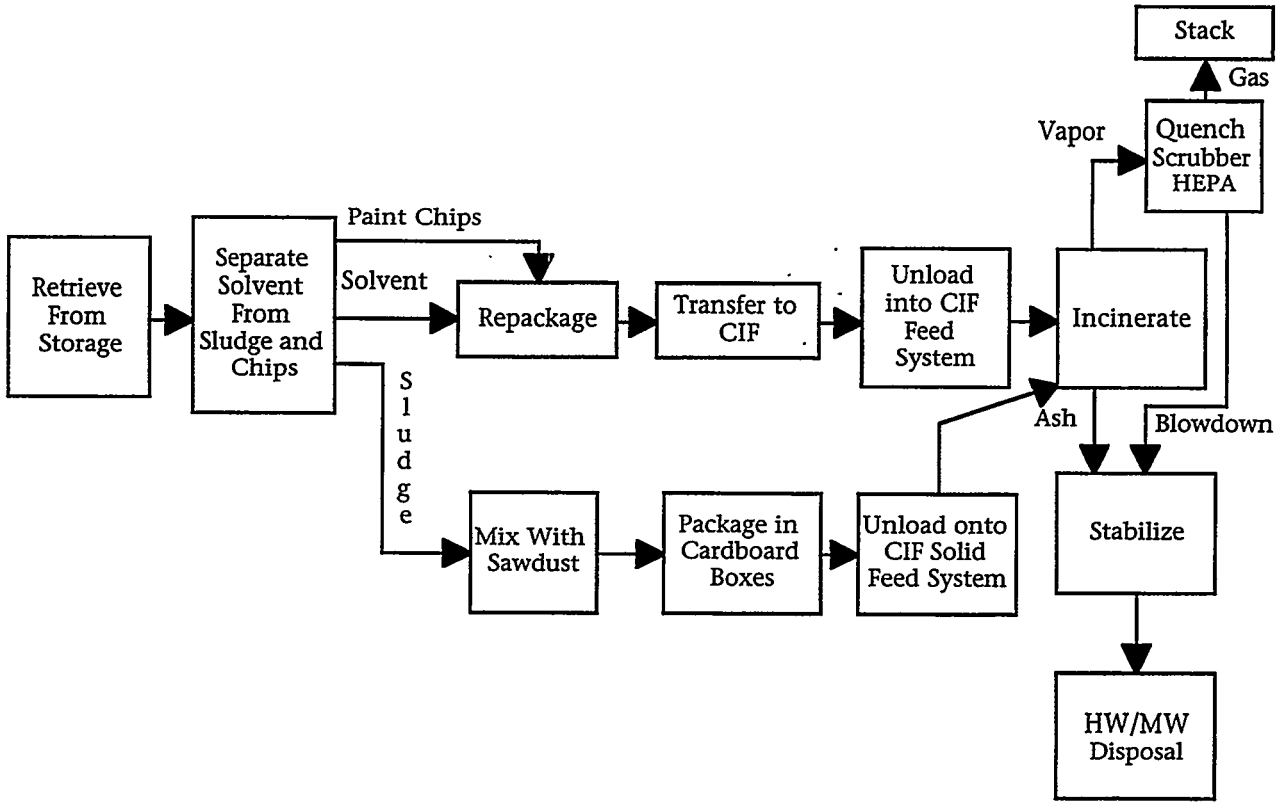
Stabilization at INEL/WEDF (encapsulating the waste with a grout matrix) was rejected because:
- Stabilization is not the specified technology for this waste stream.

Incineration at INEL/WERF

Incineration at INEL/WERF was rejected because:
- Cost of preparation (shredding and packaging) will not be avoided
- Offsite incineration offers neither technological nor environmental advantage over the preferred option.
- Apparent cost advantage over the preferred option is a consequence of the accounting methods stipulated, which do not consider overhead and capital costs of offsite facilities.

Waste Stream Number & Name: SR-W042 Paints and Thinners
Option Number: SR-W042-1
Facility: CIF
Treatment Technology: Incineration/ Stabilization

Treatment Cycle Flow Diagram:



Pros

- Expect at least 40:1 reduction.
- Low ash content of solvents results in small quantity of secondary waste being generated.
- The waste stream is expected to meet all applicable LDR standards after treatment with this process.
- Incinerator designed for a wide range of wastes with some operational limitations.
- Wasteform meets the DOT shipping requirements without additional treatment.
- The final wasteform meets expected WAC for waste disposal in the form it exits the facility.
- Incineration is a current demonstrated technology.
- Incinerator availability for liquids is 70%. Normal maintenance requirements apply.
- Very little potential for waste stream to require rework; process failure does not create a waste that can not be treated by this facility.
- Reasonably easy to schedule this waste steam assuming current startup schedule.
- Little increase in risk to the environment or public health is expected from this waste stream because there are little facility emissions even in most accidents.
- There is no increase in the number of non operational workers, but there will be additional non-routine maintenance.

Waste Stream Number & Name: SR-W042 Paints and Thinners
Option Number: SR-W042-1
Facility: CIF
Treatment Technology: Incineration/ Stabilization

Pros (contd)

- No impact because there is no additional operational workers required and no increase in exposure potential.
- Process is in full compliance with existing regulations and no variance is required to treat this waste.
- Line item is funded.

Cons

- 100% of the final wasteform will go to the HW/MW Vaults.
- Incineration is the BDAT for this waste stream. Public has expressed disapproval of incineration and questioned the safety of incineration.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	90	Add 10 points to the median score of 80 because expect at least 40:1 reduction.
• secondary waste generation	80	Low ash content of solvents results in small quantity of secondary waste being generated.
• destruction removal and demobilization efficiency	80	Waste stream is expected to meet all applicable LDR standards after treatment with this process.
• flexibility	80	Incinerator designed for a wide range of wastes with some operational limitations.
• ability to be shipped	80	Wasteform meets the shipping requirements without additional treatment.
• final wasteform	80	The final wasteform meets expected WAC for disposal.
Engineering Parameters		
• system implementability	100	Add 20 points to the median score of 80 because incineration is a current demonstrated technology.
• availability	70	Incinerator availability for liquids is 70%. Normal maintenance requirements apply. Subtract 10 points from the median score of 80 because this waste stream may require a "clean-out" earlier than anticipated based on curie load.
• scalability	50	Process capacity is set by design and it will accept a wide range of inputs. Excess capacity does exist at this time.
• remedial measures	80	Very little potential for waste stream to require rework; process failure does not create a waste that can not be treated by existing technologies.
• schedule for treatment of waste	80	Reasonably easy to schedule this waste steam assuming current startup schedule.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Little increase to the environmental or public health risk is expected from this waste stream because there are little facility emissions even in most accidents.
• non operational worker potential exposure	50	Processing this material will not increase the exposure to non operational personnel.

Waste Stream Number & Name: SR-W042 **Paints and Thinners**
Option Number: SR-W042-1
Facility: CIF
Treatment Technology: **Incineration/ Stabilization**

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• operational worker potential exposure	50	Personnel exposure is average for operations of this type. Processing this material will not increase the exposure to operational personnel.
• transportation potential exposure	60	Limited transportation will be required. Add 10 points to the median score of 50 because no additional characterization will be required.
Regulatory Parameters		
• need for variance	80	Process is in full compliance with existing regulations and no variance is required to treat this waste.
• ability to obtain a permit	100	Add 20 points to the median score of 80 because this waste is part of the basis for permitting.
• waste disposal	20	100% of the final wasteform will go to the HW/MW vaults.
Public Acceptance		
• public acceptance	20	Incineration is the BDAT for this waste stream. Public has expressed disapproval of incineration and questioned the safety of incineration.
Cost Considerations		
• life-cycle cost	98	
• funding availability	80	Line item is funded.
Industry Involvement		
• market for technology	20	This is an existing technology.
• private sector involvement	20	SRS facility evaluated.

IDOA Score: **Technical** 60 **Total** 74

Waste Stream Number & Name: SR-W042 Paints and Thinners
Option Number: SR-W042-1
Facility: CIF
Treatment Technology: Incineration/ Stabilization

Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled

Module Location: SRS

Module Status: [√] Existing [ ] New [ ] Small generator [√] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 2	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 9	
		1.3.2 Safety Assurance Documentation	$ 2	
		1.3.3 Permitting	$ 0	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 0	
		TOTAL PRE-OPERATIONS		$ 164
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 11	
	2.2	Inspection	$ 2	
	2.3	Project Management	$ 2	
	2.4	Building Construction (inc. indirect)	$ 0	
	2.5	Equipment (inc. indirect)	$ 50	
	2.6	Construction Management	$ 4	
	2.7	Contingency	$ 24	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 92
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 53	
	3.2	Annual Utilities	$ 2	
	3.3	Annual Materials	$ 32	
	3.4	Annual Maintenance	$ 19	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 105	
		X NUMBER OF YEARS OF OPERATION	1.00	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 105
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 40	
	4.2	Closure, Post-Closure, Monitoring	$ 3	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 43
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 50
		SUB COST FOR INCINERATOR MODULE		$ 454
		ESCALATION		1.344
		TOTAL COST		$ 610

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W042 Paints and Thinners
Option Number: SR-W042-2
Facility: INEL/WEDF **Treatment Technology: Stabilization**

Treatment Technology

The INEL WEDF Stabilization process provides treatments for aqueous and organic liquids and debris. The process stabilizes waste in a grout matrix to reduce leachability.

Pros

- No secondary waste streams are generated.
- The facility can treat waste streams similar in composition to those assumed in the design basis without modification.
- The stabilized waste could be shipped without additional treatment.
- Final wasteform is anticipated to meet the SRS disposal WAC.
- Stabilization has been demonstrated at the facility.
- The facility is anticipated to have minimal down time.
- Process failure is not anticipated to create a waste stream that cannot be treated.
- Few emissions for the facility are anticipated during normal operation and most accident scenarios.
- The facility could potentially be used to treat numerous waste streams throughout the DOE Complex.

Cons

- Stabilization will increase the overall waste volume by a factor of 2 or more after processing.
- The process currently exists, so any expansion would require process modifications.
- Waste characterization will be required for any waste streams returned to SRS for disposal.
- The majority of the treated waste will be classified as mixed waste which will require disposal in a HW/MW facility.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	10	Subtract 10 points from the median score of 20 because stabilization will increase the overall waste volume by a factor of 2 or more after processing.
• secondary waste generation	80	No secondary waste streams are generated.
• destruction removal and demobilization efficiency	50	Additional treatment for some waste streams may be required prior to stabilization to ensure LDR standards are met.
• flexibility	80	The facility can treat waste streams similar in composition to those assumed in the design basis without modification.
• ability to be shipped	80	The stabilized waste could be shipped without additional treatment.
• final wasteform	80	Final wasteform is anticipated to meet the SRS disposal WAC.
Engineering Parameters		
• system implementability	80	Stabilization has been demonstrated at the facility.
• availability	80	The facility is anticipated to have minimal down time.
• scalability	20	The process currently exists, so any expansion would require process modifications.
• remedial measures	80	Process failure is not anticipated to create a waste stream that cannot be treated.

Waste Stream Number & Name: SR-W042 Paints and Thinners
Option Number: SR-W042-2
Facility: INEL/WEDF **Treatment Technology:** Stabilization

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• schedule for treatment of waste	50	A schedule for waste treatment cannot be provided. Additionally, acceptance of SRS waste will be contingent upon state-approved permit modifications.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Few emissions for the facility are anticipated during normal operation and most accident scenarios.
• non operational worker potential exposure	50	Processing this material will not increase the exposure to non operational personnel.
• operational worker potential exposure	50	Personnel exposure is average for operations of this type. Processing this material will not increase the exposure to operational personnel.
• transportation potential exposure	20	Waste characterization will be required for any waste streams returned to SRS for disposal.
Regulatory Parameters		
• need for variance	80	Process will be in full compliance with all applicable regulations without needing a variance.
• ability to obtain a permit	50	Permitting process is well defined, however, the State of Idaho acceptance of offsite waste treatment is unknown. Approval may be difficult.
• waste disposal	20	The majority of the treated waste will be classified as mixed waste which will require disposal in a HW/MW facility.
Public Acceptance		
• public acceptance	50	Public acceptance for stabilization is positive; however, the treatment of offsite waste is anticipated to reduce the overall public acceptance of this process.
Cost Considerations		
• life-cycle cost	99	
• funding availability	50	Not a budgeted item though line item funding may be required.
Industry Involvement		
• market for technology	80	The facility could potentially be used to treat numerous waste streams throughout the DOE Complex.
• private sector involvement	20	Technology is available at an existing DOE facility.

IDOA Score: **Technical** 52 **Total** 65

Waste Stream Number & Name: SR-W042 Paints and Thinners
Option Number: SR-W042-2
Facility: INEL/WEDF **Treatment Technology: Stabilization**
Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled

Module Location: INEL

Module Status: [√] Existing [ ] New [ ] Small generator [√] Large generator
[ ] Onsite [√] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ N/A	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ N/A	
		1.3.2 Safety Assurance Documentation	$ N/A	
		1.3.3 Permitting	$ N/A	
		1.3.4 Preparation for Operations	$ N/A	
		1.3.5 Project Management	$ N/A	
		TOTAL PRE-OPERATIONS		$ N/A
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ N/A	
	2.2	Inspection	$ N/A	
	2.3	Project Management	$ N/A	
	2.4	Building Construction (inc. indirect)	$ N/A	
	2.5	Equipment (inc. indirect)	$ N/A	
	2.6	Construction Management	$ N/A	
	2.7	Contingency	$ N/A	
		TOTAL FACILITY CONSTRUCTION COSTS		$ N/A
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ N/A	
	3.2	Annual Utilities	$ N/A	
	3.3	Annual Materials	$ N/A	
	3.4	Annual Maintenance	$ N/A	
	3.5	Annual Contingency	$ N/A	
		TOTAL ANNUAL O & M	$ N/A	
		X NUMBER OF YEARS OF OPERATION		
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ N/A
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ N/A	
	4.2	Closure, Post-Closure, Monitoring	$ N/A	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ N/A
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$ N/A	
	5.2	Mobile Treatment	$ N/A	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$ 11
7.0	Transportation			$ 18
8.0	Disposal			$ 200
		SUB COST FOR STABILIZATION MODULE		$ 229
		ESCALATION		1.06
		TOTAL COST		$ 243

Note: Per DOE directions this cost carries no overhead burden or capital costs.
If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W042 Paints and Thinners
Option Number: SR-W042-3
Facility: INEL/WERF
Treatment Technology: Incineration/ Stabilization

Treatment Technology

Idaho National Engineering Laboratory (INEL) Waste Engineering Development Facility (WERF) Incinerator is a ram feed, stationary kiln incinerator. The facility is used to treat both solid and liquid waste. The system offgas is passes through a dry quench tower to remove particulates before release of the gas effluents. The facility cannot be used to treat wastes contaminated with chlorides. Chlorides react to create acids which, over time, will disintegrate the dry offgas system. The ash solids are removed and stabilized for disposal.

Pros

- Incineration will reduce the waste volume by a factor of 100 to 1.
- The facility can treat waste streams similar in composition to those assumed in the design basis without modification.
- The process has been demonstrated on similar waste types.
- 20% or less down time is anticipated when using this process.
- Process failure is not anticipated to result in the creation of a waste that cannot be treated.

Cons

- The process currently exists, so any expansion would require process modifications.
- Waste characterization will be required for any waste streams returned to SRS for disposal.
- Greater than 80% of the treated waste will be classified as mixed waste which will require disposal in a HW/MW facility.
- Currently stakeholder acceptance of incineration is perceived as low. Public approval of incineration at INEL is anticipated to drop with the additional treatment of offsite wastes.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	100	Add 20 points to the median score of 80 because incineration will reduce the waste volume by a factor of 100 to 1.
• secondary waste generation	50	An additional amount of ash waste in the range of 10% is generated, which can be handled by existing technologies.
• destruction removal and demobilization efficiency	50	Additional LDR treatments required for waste streams contaminated with non-organic contaminants (heavy metals).
• flexibility	80	The facility can treat waste streams similar in composition to those assumed in the design basis without modification.
• ability to be shipped	50	The ash waste must be stabilized in a grout matrix prior to shipment.
• final wasteform	80	The ash waste after stabilization is anticipated to meet the SRS waste disposal WAC.
Engineering Parameters		
• system implementability	80	The process has been demonstrated on similar waste types.
• availability	80	Down time is anticipated to be 20% or less when using this process.
• scalability	20	The process currently exists, so any expansion would require process modifications.

Waste Stream Number & Name: SR-W042 Paints and Thinners
Option Number: SR-W042-3
Facility: INEL/WERF
Treatment Technology: Incineration/ Stabilization

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• remedial measures	80	Process failure is not anticipated to result in the creation of a waste that cannot be treated by existing technology.
• schedule for treatment of waste	50	A schedule for waste treatment cannot be provided. Additionally, acceptance of SRS waste will be contingent upon state-approved permit modifications.
Personnel Parameters		
• consequence of unmitigated accident scenarios	50	Emissions from the facility could result during potential accident scenarios.
• non operational worker potential exposure	50	Processing this material will not increase the exposure to non operational personnel.
• operational worker potential exposure	50	Personnel exposure is average for operations of this type. Processing this material will not increase the exposure to operational personnel.
• transportation potential exposure	20	Waste characterization will be required for any waste streams returned to SRS for disposal.
Regulatory Parameters		
• need for variance	80	Process is in compliance with all applicable regulations and no variance is needed.
• ability to obtain a permit	50	Permitting process is well-defined, however, the state's acceptance of offsite waste treatment is unknown. Approval may be difficult.
• waste disposal	20	The majority of the treated waste will be classified as mixed waste which will require disposal in a HW/MW facility.
Public Acceptance		
• public acceptance	20	Currently, stakeholder acceptance of incineration is perceived as low. Public approval of incineration at INEL is anticipated to drop with the additional treatment of offsite wastes.
Cost Considerations		
• life-cycle cost	99	
• funding availability	50	Funding for treatment cost can be provide using the operating budget, however the additional costs may result in an increase in the budget in excess of 10%.
Industry Involvement		
• market for technology	20	Existing commercial technology.
• private sector involvement	20	Technology is available at an existing DOE facility.

IDOA Score: **Technical** 49 **Total** 63

Waste Stream Number & Name: SR-W042 Paints and Thinners
Option Number: SR-W042-3
Facility: INEL/WERF
Treatment Technology: Incineration/ Stabilization

Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled

Module Location: INEL

Module Status: [√] Existing [ ] New [ ] Small generator [√] Large generator
[ ] Onsite [√] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ N/A	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ N/A	
		1.3.2 Safety Assurance Documentation	$ N/A	
		1.3.3 Permitting	$ N/A	
		1.3.4 Preparation for Operations	$ N/A	
		1.3.5 Project Management	$ N/A	
		TOTAL PRE-OPERATIONS		$ N/A
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ N/A	
	2.2	Inspection	$ N/A	
	2.3	Project Management	$ N/A	
	2.4	Building Construction (inc. indirect)	$ N/A	
	2.5	Equipment (inc. indirect)	$ N/A	
	2.6	Construction Management	$ N/A	
	2.7	Contingency	$ N/A	
		TOTAL FACILITY CONSTRUCTION COSTS		$ N/A
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ N/A	
	3.2	Annual Utilities	$ N/A	
	3.3	Annual Materials	$ N/A	
	3.4	Annual Maintenance	$ N/A	
	3.5	Annual Contingency	$ N/A	
		TOTAL ANNUAL O & M	$ N/A	
		X NUMBER OF YEARS OF OPERATION		
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ N/A
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ N/A	
	4.2	Closure, Post-Closure, Monitoring	$ N/A	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ N/A
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$ N/A	
	5.2	Mobile Treatment	$ N/A	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$ 80
7.0	Transportation			$ 387
8.0	Disposal			$ 100
		SUB COST FOR INCINERATOR MODULE		$ 567
		ESCALATION		1.06
		TOTAL COST		$ 601

Note: Per DOE directions, this cost estimate is the incremental cost for treatment at an offsite DOE facility; therefore, it carries no overhead or capital costs.

If above numbers do not appear to add correctly, it is the result of computer rounding.

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Summary Page – Initial Screening – THIS WASTE STREAM HAS BEEN CONSOLIDATED WITH WASTE STREAM SR-W012

Waste Stream Number & Name: SR-W043 Laboratory Waste with Tetraphenyl Borate

Background Information

This waste stream's data has been consolidated and reported under SR-W012, Incinerable Toxic Characteristic (TC) Material. This decision to classify this waste as SR-W012 was made during the MWIR inventory update as of 9/30/94 due to their similar treatment.

This waste stream was formerly defined as laboratory waste including filters, wipes, plastic and glassware resulting from analytical testing activities. The lab waste is coated with tetraphenyl borate which degrades to form benzene.

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Summary Page

Waste Stream Number & Name: SR-W044 Tri-Butyl-Phosphate and n-Paraffin – TRU

Background Information

Part of the Plutonium Uranium Extraction (PUREX) Process in the separations areas, this waste stream is an organic solvent. This waste stream has been combined with waste stream SR-W045, Mixed Low-Level Waste Tri-Butyl-Phosphate and n-Paraffin, because of similar treatment requirements.

This waste stream has been combined with waste stream SR-W045, Tri-Butyl-Phosphate and n-Paraffin.

This waste stream will be deleted from the Mixed Waste Inventory Report (MWIR) and the Site Treatment Plan (STP).

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Summary Page – Initial Screening

Waste Stream Number & Name: SR-W045 Tri-Butyl-Phosphate and n-Paraffin

Background Information

An organic solvent generated in the Plutonium/Uranium Extraction Process (PUREX) used in the Separations areas.

Volume
- Current volume through 09/30/94 is 119.6 m^3.
- Expected 1995-1999 volume generation is 54.5 m^3.

Waste Stream Composition
- Organic liquid

Waste Code
- D008A (TCLP Pb)
- D009A (TCLP Hg)
- D011A (TCLP Ag), D018 (benzene)
- D040 (trichloroethylene) nonwastewater

LDR Treatment Standard
- D008 = concentration based standard = 5 mg/l
- D009 = concentration based standard = 0.2 mg/l
- D011 = concentration based standard = 5 mg/l
- D018* = concentration based standard = 10 mg/kg
- D040* = concentration based standard = 6 mg/kg

*D012-D043 nonwastewaters must be treated to meet the Universal Treatment Standards (UTS) for any underlying constituents that may be present.

Waste Characterization
- Sampling and analysis used to characterize the waste stream.
- Confidence level is high because sampling and analysis is available.

Radiological Characterization
- Total activity is 8-16 nCi/g.
- Cm^{244}, Am^{241}, Pu^{239}, Eu^{154}, Eu^{155}, and Pu^{238}, lesser amounts of Zr^{95}, Sb^{125}, Cs^{137}, and Co^{60}.
- Waste is contact handled.
- Mixed low-level waste

Initial Screening

The initial screening identified inappropriate treatment options. These options appear in the Initial Rejections table.

Initial Rejections

Treatment Facility	Treatment Technology	Reasons for Rejection
CIF	Ashcrete Stabilization	Ashcrete does not remove the characteristic organics. Resulting wasteform would not meet LDR requirements.
ETF	Ion Exchange	ETF has no process to treat solvents.
Lab.	Lab-scale process flowsheet	Volume of waste too great to handle with laboratory-scale equipment.

Initial Rejections (contd)

Treatment Facility	Treatment Technology	Reasons for Rejection
LETF	Ion Exchange	LETF is not designed to treat a solvent stream.
M-Area	Vitrification	Vitrifier is not an incinerator. It is not designed to burn an organic stream.
Z Area	Stabilization	Z Area can treat only those wastes that come by pipeline from Tank 50 and meet strict waste acceptance criteria. The Z-Area process lacks flexibility to treat and dispose of a variety of waste streams.

Summary Page – Technology Success Factor (TSF) & In-Depth Options Analysis (IDOA)

Waste Stream Number & Name: SR-W045 Tri-Butyl-Phosphate and n-Paraffin

Feasible Options

Option No.	Treatment Facility	Treatment Technology	TSF Score	IDOA Scores Tech.	IDOA Scores Total	COST (x 1,000)	PO
SR-W045-1	CIF	Incineration/ Stabilization	94	61	75	92	√
SR-W045-2	Vendor	Fluidized Bed Combustion	13				
SR-W045-3	Vendor	Catalyzed Wet Oxidation	1				
SR-W045-4	Vendor	Pyrolysis	1				

Options Rejected Due To Low Technology Success Factor (TSF)

Catalyzed Wet Oxidation by Vendor

Catalyzed wet oxidation by vendor was rejected because:

- Catalyzed wet oxidation is a bench-scale chemical reaction that has no current field application.
- It is unknown whether this reaction can be scaled up to an industrial facility, hence Pm=0.9.
- Control of such a reactor is undefined and must be assumed to require complex systems, hence Pc=0.9.

Pyrolysis by Vendor

Pyrolysis by vendor was rejected because:

- The pyrolyzer in this system is pilot scale, hence Pm=0.9.
- Control of cutting-edge incineration technology is far more complex than that required by standard incineration systems, which in itself is not simple, hence, Pc=0.9.

Fluidized Bed Combustion by Vendor

Fluidized bed combustion by vendor was rejected because:

- Fluidized bed combustion is an emerging technology.
- Although it has application in other areas, vendors currently have no units operating in the field burning mixed waste, hence Pm=0.8.
- Controls for cutting-edge incineration equipment can be expected to be highly complex, hence, Pc=0.8.

Engineering Assessment

Preferred Option Justification

The preferred treatment option for the Tri-Butyl-Phosphate and n-Paraffin is Incineration followed by Stabilization in the Consolidated Incineration Facility (CIF).

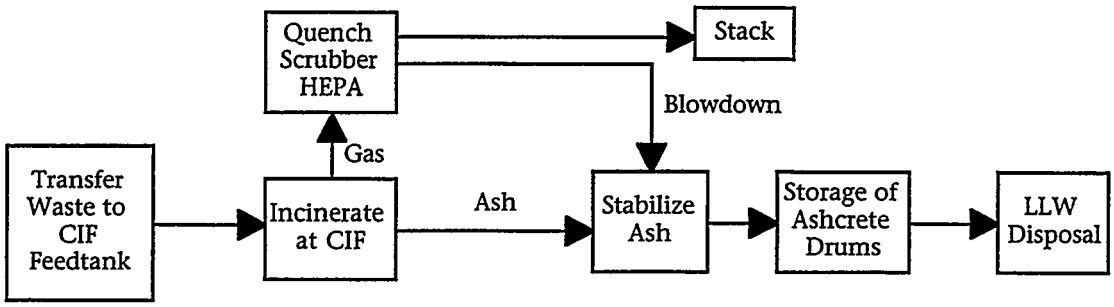
This option treats the constituents of concern, heavy metals and the hazardous characteristic, ignitability, by conversion of the combustible fraction to carbon dioxide and water, and stabilizing residuals with cement.

This option is preferred because:

- Waste volume will be reduced by a factor of at least two.
- Final wasteform will meet LDR standards.
- Incineration and ash stabilization are demonstrated technologies.
- CIF is currently under construction.
- Residual solids are stabilized with cement.
- It is a cost-effective option.
- No treatability studies are needed.

Waste Stream Number & Name: SR-W045 **Tri-Butyl-Phosphate and n-Paraffin**
Option Number: SR-W045-1
Facility: CIF
Treatment Technology: Incineration/ Stabilization

Treatment Cycle Flow Diagram:



Pros

- Expect at least 30:1 reduction.
- Fairly low ash content waste stream results in a small quantity of secondary waste being generated that can be treated by existing technologies.
- The waste stream is expected to meet all applicable LDR standards after treatment with the processes in this facility.
- Incinerator designed for a wide range of wastes with some operational limitations.
- Waste does not require any additional treatment to meet shipping requirements.
- The wasteform meets the expected WAC for disposal in the form it exits the facility.
- Incineration is a current demonstrated technology.
- Incinerator availability for liquids is 70%. Normal maintenance requirements apply.
- Process failure should not create a waste that cannot be treated by existing technologies.
- Little increase in the risk to the environment or public health is expected from this waste stream because little or no facility emissions even during most accidents. The waste will be treated over a long period by blending small amounts with other wastes.
- No additional non operational workers are required for treatment of this waste but additional non-routine maintenance will be required.
- Process is in full compliance with all applicable regulations and no variances are required to treat this waste.
- 100% of the final wasteform will go to the LLW disposal.

Cons

- The public has significant concerns about this process and has publicly expressed concern about the safety of the process.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	90	Add 10 points to the median score of 80 because expect at least 30:1 reduction.
• secondary waste generation	80	Fairly low ash content waste stream results in a small quantity of secondary waste being generated that can be treated by existing technologies.
• destruction removal and demobilization efficiency	80	The waste stream is expected to meet all applicable LDR standards after treatment with the processes in this facility.

Waste Stream Number & Name: SR-W045 Tri-Butyl-Phosphate and n-Paraffin
Option Number: SR-W045-1
Facility: CIF
Treatment Technology: Incineration/ Stabilization

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• flexibility	80	Incinerator designed for a wide range of wastes with some operational limitations.
• ability to be shipped	80	Waste does not require any additional treatment to meet shipping requirements.
• final wasteform	80	The wasteform meets the expected WAC for waste disposal.
Engineering Parameters		
• system implementability	100	Add 20 points to the median score of 80 because incineration is a current demonstrated technology.
• availability	70	Incinerator availability for liquids is 70%. Normal maintenance requirements apply. Subtract 10 points from the median score of 80 because this waste stream may require a "clean-out" earlier than anticipated based on curie load.
• scalability	50	Capacity is set by design and existing design will accept a wide range of inputs, but it is not easily expanded. Excess capacity does exist at this time.
• remedial measures	70	Subtract 10 points from the median score of 80 because presence of metals in the secondary wastes might require rework. Process failure should not create a waste that cannot be treated by existing technologies.
• schedule for treatment of waste	40	Subtract 10 points from the median score of 50 because of the high rad. content, will have to work off waste over a number of years.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Little increase in the risk to the environment or public health is expected from this waste stream because little or no facility emissions even during most accidents. The waste will be treated over a long period by blending small amounts with other wastes.
• non operational worker potential exposure	50	Processing this material will not increase exposure to non operational personnel.
• operational worker potential exposure	40	Subtract 10 points from the median score of 50 because additional system clean-outs will be required due to the high rad content of this waste stream increasing the potential for exposure.
• transportation potential exposure	60	Transportation is required but it will be in small volumes. Add 10 points to median score of 50 because no additional characterization is needed.
Regulatory Parameters		
• need for variance	80	Process is in full compliance with all applicable regulations and no variances are required to treat this waste.
• ability to obtain a permit	100	Add 20 points to the median score of 80 because this waste is part of the basis for permitting.

Waste Stream Number & Name: SR-W045 Tri-Butyl-Phosphate and n-Paraffin
Option Number: SR-W045-1
Facility: CIF
Treatment Technology: Incineration/ Stabilization

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• waste disposal	80	100% of the final wasteform will go to the LLW disposal.
Public Acceptance		
• public acceptance	20	Process has limited public acceptance. Public has expressed concern about the safety of the process.
Cost Considerations		
• life-cycle cost	100	
• funding availability	80	Line item is funded.
Industry Involvement		
• market for technology	20	Technology is being purchased.
• private sector involvement	20	Technology is available at an existing DOE facility.

IDOA Score: **Technical** 61 **Total** 75

Waste Stream Number & Name: SR-W045 Tri-Butyl-Phosphate and n-Paraffin
Option Number: SR-W045-1
Facility: CIF
Treatment Technology: Incineration/ Stabilization

Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled

Module Location: SRS

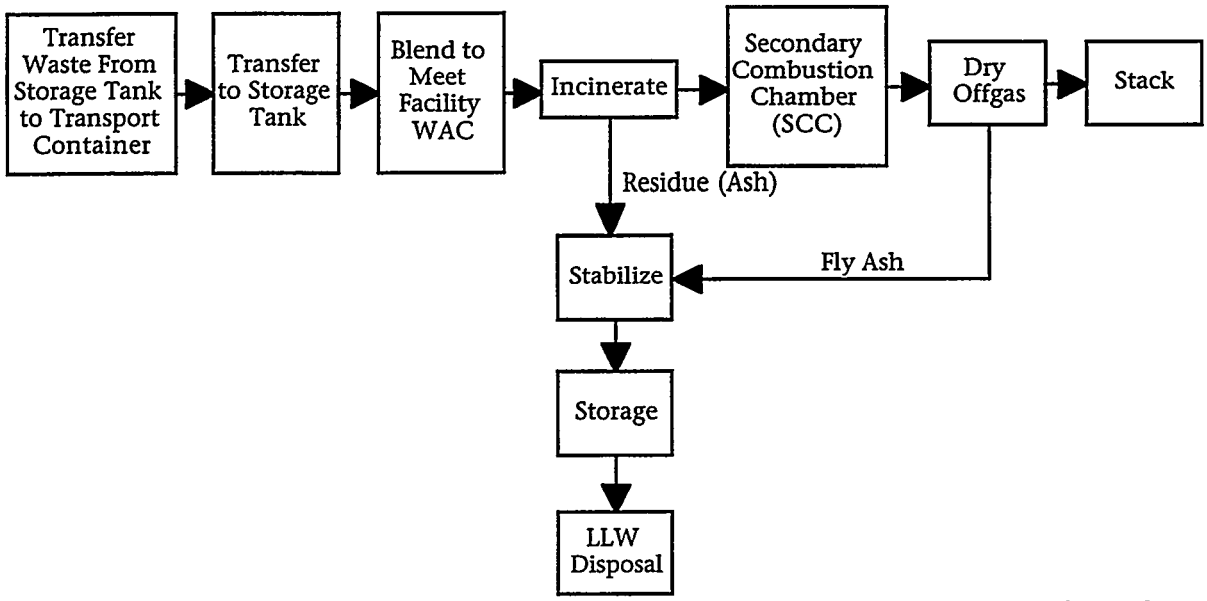
Module Status: [√] Existing [ ] New [ ] Small generator [√] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 0	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 0	
		1.3.2 Safety Assurance Documentation	$ 0	
		1.3.3 Permitting	$ 0	
		1.3.4 Preparation for Operations	$ 0	
		1.3.5 Project Management	$ 0	
		TOTAL PRE-OPERATIONS		$ 0
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 0	
	2.2	Inspection	$ 0	
	2.3	Project Management	$ 0	
	2.4	Building Construction (inc. indirect)	$ 0	
	2.5	Equipment (inc. indirect)	$ 0	
	2.6	Construction Management	$ 0	
	2.7	Contingency	$ 0	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 0
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 45	
	3.2	Annual Utilities	$ 2	
	3.3	Annual Materials	$ 27	
	3.4	Annual Maintenance	$ 16	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 90	
		X NUMBER OF YEARS OF OPERATION	0.25	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 23
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 0	
	4.2	Closure, Post-Closure, Monitoring	$ 3	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 3
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 50
		SUB COST FOR INCINERATOR MODULE		$ 75 .
		ESCALATION		1.23
		TOTAL COST		$ 92

Note: Includes cost of treating SR-W044 which has been combined with SR-W045.
If above numbers do not appear to add correctly, it is the result of computer rounding.

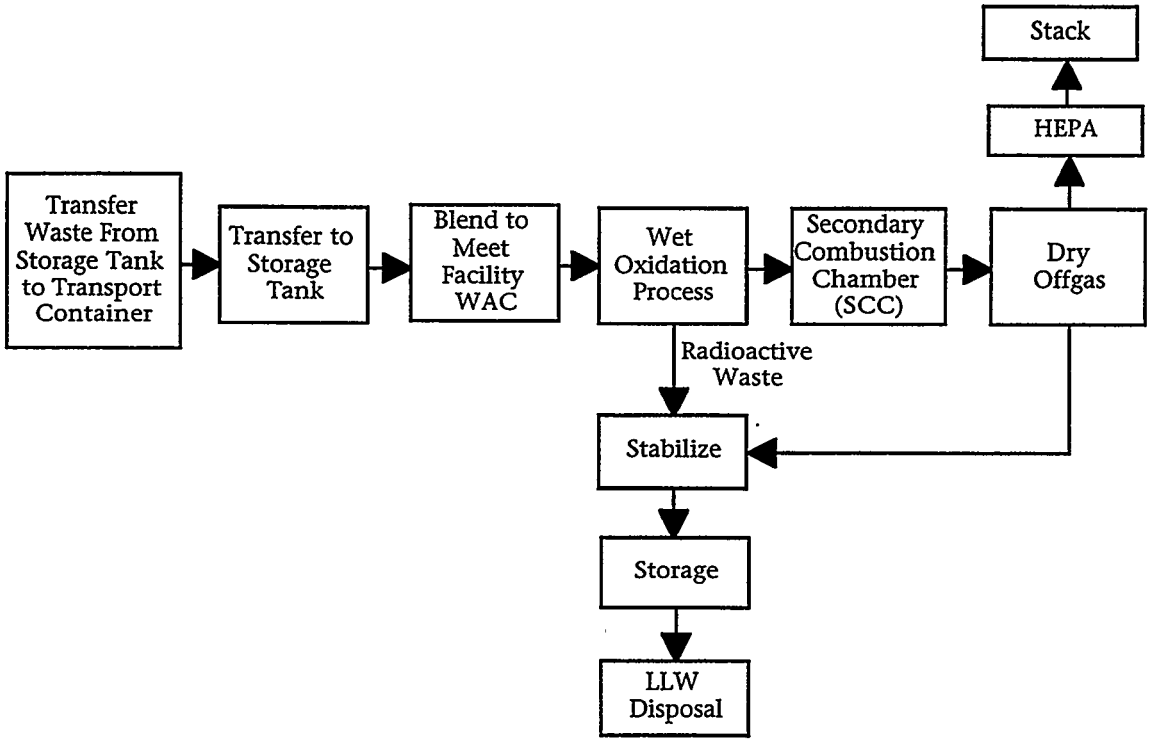
Waste Stream Number & Name: SR-W045 Tri-Butyl-Phosphate and n-Paraffin
Option Number: SR-W045-2
Facility: Vendor

Treatment Technology: Fluidized Bed Combustion



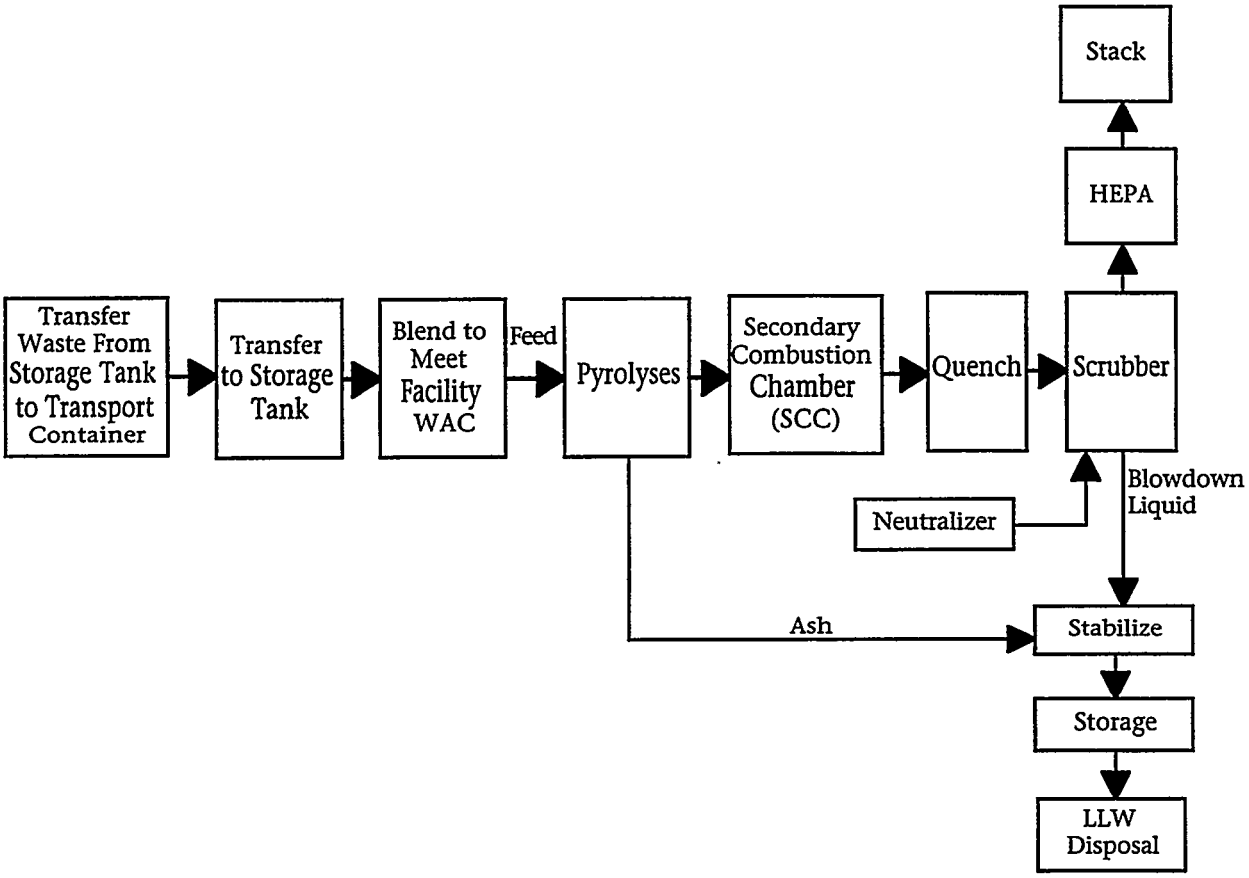
Option rejected during technical success factor evaluation. No further analysis performed.

Waste Stream Number & Name: SR-W045 **Tri-Butyl-Phosphate and n-Paraffin**
Option Number: SR-W045-3
Facility: Vendor **Treatment Technology:** Wet Oxidation



Option rejected during technical success factor evaluation. No further analysis performed.

Waste Stream Number & Name: SR-W045 Tri-Butyl-Phosphate and n-Paraffin
Option Number: SR-W045-4
Facility: Vendor
Treatment Technology: Pyrolysis



Option rejected during technical success factor evaluation. No further analysis performed.

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Summary Page

Waste Stream Number & Name: SR-W046 Consolidated Incinerator (CIF) Ash

Background Information

A future waste stream composed of ash generated from the incineration of mixed waste in the CIF.

Volume
- Expected 1995-1999 volume generation is 124 m^3.

Waste Stream Composition
- Inorganic sludge/particulate

Waste Code
- The waste codes describing the CIF ash waste stream depend on the feed stream into CIF. The ash waste stream will contain all of the listed waste codes that are fed into the CIF. Consult the RCRA Part B Permit Application for a complete listing.

LDR Treatment Standard
- LDR treatment standards are reflected in the waste fed to CIF. Specific information on treatment standards can be acquired by looking at specific wastes (in Section 3.1.1.1) proposed to be treated at CIF.

Waste Characterization
- Process knowledge used to characterize the waste stream.
- Confidence level is medium based on the fact that this is a future waste stream and no analysis is available.

Radiological Characterization
- Radiological hazards are unknown at this time.
- Remote handled by design of the facility
- Mixed low-level waste

Preferred Option

The preferred treatment option for Consolidated Incineration Facility (CIF) Ash is Stabilization using the Consolidated Incineration Facility Ashcrete Process.

Treatment Justification

In-depth options analysis (IDOA) is not required for this waste stream since a Preferred Option has been identified utilizing an existing facility with existing treatment technology.

The CIF is designed to include integrated ash stabilization, the Ashcrete unit, for the treatment of CIF incinerator ash (SR-W046). The Ashcrete unit is directly coupled to the CIF rotary kiln which will allow the ash to be stabilized in an environmentally safe form before it leaves the controlled environment and is transported to a waste storage or disposal facility. Other options for the treatment of CIF ash would entail the shipment of unstabilized ash and would incur the additional cost of providing another treatment facility. Treatment of CIF ash in the unit is the preferred option because it addresses the concerns of shipping unstabilized ash and additional treatment facility costs.

Waste Stream Number & Name: SR-W046 Consolidated Incinerator (CIF) Ash
Facility: CIF Ashcrete Process Treatment Technology: Stabilization
Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [ ] contact handled [√] remote handled (by design)

Module Location: SRS

Module Status: [√] Existing [ ] New [ ] Small generator [√] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 0	
	1.2	Demonstration Costs	$ 0	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 0	
		1.3.2 Safety Assurance Documentation	$ 88	
		1.3.3 Permitting	$ 0	
		1.3.4 Preparation for Operations	$ 2,116	
		1.3.5 Project Management	$ N/A	
		TOTAL PRE-OPERATIONS		$ 2,204
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ N/A	
	2.2	Inspection	$ 87	
	2.3	Project Management	$ 119	
	2.4	Building Construction (inc. indirect)	$ 283	
	2.5	Equipment (inc. indirect)	$ 176	
	2.6	Construction Management	$ 75	
	2.7	Contingency	$ 316	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 1,056
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 0.3	
	3.2	Annual Utilities	$ 0.0	
	3.3	Annual Materials	$ 0.2	
	3.4	Annual Maintenance	$ 0.1	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 0.6	
		X NUMBER OF YEARS OF OPERATION	4.0	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 2.4
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 4,457	
	4.2	Closure, Post-Closure, Monitoring	$ N/A	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 4,457
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$ N/A	
	5.2	Mobile Treatment	$ N/A	
		TOTAL CONTRACTED SERVICES		$ 0
6.0	Offsite Treatment (DOE)			$ 0
7.0	Transportation			$ 0
8.0	Disposal (5 drums of ashcrete)			$ 8
		SUB COST FOR STABILIZATION MODULE		$ 7,727
		ESCALATION		1.060
		TOTAL COST		$ 8,190

This cost represents the share of the SR-W001 costs attributable directly to operation of the ashcrete equipment following incineration of SR-W001, SR-W003, SR-W012, SR-W022, SR-W035. As such, this cost estimate SHOULD NOT be added to the overall cost of treating SRS mixed waste. These costs have already been captured on the cost estimate sheet for SR-W001.

If above numbers do not appear to add correctly, it is the result of computer rounding.

Summary Page – Initial Screening

Waste Stream Number & Name: SR-W047 Consolidated Incineration Facility (CIF) Blowdown

Background Information

This is a future waste stream composed of scrubber blowdown water (wastewater) from the Consolidated Incineration Facility (CIF) offgas emission control system.

Volume
- Expected 1995-1999 volume generation is 800 m^3.

Waste Stream Composition
- Aqueous liquid

Waste Code
- The waste codes describing the CIF blowdown waste stream depend on the feed stream into CIF. Blowdown waste stream will contain all of the listed waste codes that are fed into the CIF. Consult the RCRA Part B Permit Application for a complete listing.

LDR Treatment Standard
- LDR treatment standards are reflected in the waste fed to CIF. Specific information on treatment standards can be acquired by looking at specific wastes in Section 3.1.1.1 proposed to be treated at CIF.

Waste Characterization
- Process knowledge used to characterize the waste stream.
- Confidence level is medium based on the fact this is a future waste stream and no analysis is available.

Radiological Characterization
- Tritium is present.
- Alpha and beta/gamma emitters are present.
- Activity level is <10 nCi/g.
- Waste is contact handled.
- Mixed low-level waste

Preferred Option

The preferred treatment option for Consolidated Incineration Facility (CIF) Blowdown is Stabilization using the Consolidated Incineration Facility Ashcrete Process.

Treatment Justification

In-depth options analysis is not required for this waste stream since a Preferred Option has been identified utilizing an existing facility with existing treatment technology.

The CIF is designed to include integrated ash stabilization, the ashcrete unit, for the treatment of CIF incinerator ash (SR-W046). The ashcrete unit is directly coupled to the CIF rotary kiln which will allow the ash to be stabilized in an environmentally safe form before it leaves the controlled environment and is transported to a waste storage or disposal facility. Consolidated Incineration Facility (CIF) Blowdown (SR-W047) will be transferred to the CIF Ashcrete unit where it will be solidified with portland cement in drums.

Waste Stream Number & Name: SR-W047 Consolidated Incineration Facility (CIF) Blowdown

Option Number: SR-W047
Facility: CIF

Treatment Technology: Ashcrete Stabilization

Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled

Module Location: SRS

Module Status: [√] Existing [ ] New [ ] Small generator [√] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 5	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 18	
		1.3.2 Safety Assurance Documentation	$ 5	
		1.3.3 Permitting	$ 22	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 0	
		TOTAL PRE-OPERATIONS		$ 200
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 91	
	2.2	Inspection	$ 4	
	2.3	Project Management	$ 12	
	2.4	Building Construction (inc. indirect)	$ 64	
	2.5	Equipment (inc. indirect)	$ 16	
	2.6	Construction Management	$ 4	
	2.7	Contingency	$ 47	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 238
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 0.9	
	3.2	Annual Utilities	$ 0.3	
	3.3	Annual Materials	$ 0.6	
	3.4	Annual Maintenance	$ 0.3	
	3.5	Annual Contingency	$	
		TOTAL ANNUAL O & M	$ 2.1	
		X NUMBER OF YEARS OF OPERATION	4.0	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 8.4
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 0	
	4.2	Closure, Post-Closure, Monitoring	$ 250	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 250
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 5,000
		SUB COST FOR ASHCRETE STABILIZATION MODULE		$ 5,696.4
		ESCALATION		1.060
		TOTAL COST		$ 6,038

This cost represents the share of the SR-W001 cost attributable directly to operation of the ashcrete equipment following incineration of SR-W001, SR-W003, SR-W012, SR-W022, and SR-W035. As such, this cost SHOULD NOT be added to the overall cost of treating SRS mixed waste. These costs have already been capture on the cost estimate sheet for SR-W001

If above numbers do not appear to add correctly, it is the result of computer rounding.

Summary Page – Initial Screening

Waste Stream Number & Name: SR-W048 Soils from Spill Remediation

Background Information

This waste consists of soils, sand, and associated debris (rocks, wood, etc.) resulting from cleanup activities of spills and remedial actions around the site due to immediate spills or accidents surrounding operations. This waste stream does not include any coils generated from Environmental Restoration activities.

Volume

- Current volume through 09/30/94 is 16.8 m^3.
- No future waste generation expected; however, if a spill occurs, current volume would increase.

Waste Stream Composition

- Uncategorized soils

Waste Code

- D004 (TCLP As)
- D005 (TCLP Ba)
- D006 (TCLP Cd)
- D007 (TCLP Cr)
- D008 (TCLP Pb)
- D009 (TCLP Hg)
- D010 (TCLP Se)
- D011 (TCLP Ag)
- D012 (Endrin)
- D013 (Lindane)
- D014 (Methoxychlor)
- D015 (Toxaphene)
- D016 (2,4-D)
- D017 (2,4,5-TP (Silvex)
- D018 (Benzene)
- D019 (Carbon Tetrachloride)
- D020 (Chlordane)
- D021 (Chlorobenzene)
- D022 (Chloroform)
- D023 (o-Cresol)
- D024 (m-Cresol)
- D025 (p-Cresol)
- D026 (Cresylic Acid)
- D027 (p-Dichlorobenzene)
- D028 (1, 2-Dichloroethane)
- D029 (1, 1-Dichlorethylene)
- D030 (2, 4-Dinitrotoluene)
- D031 (Heptachlor & Heptachlor Epoxide)
- D032 (Hexachlorobenzene)
- D033 (Hexachlorobutadiene)
- D034 (Hexachloroethane)
- D035 (Methyl Ethyl Ketone)
- D036 (Nitrobenzene)
- D037 (Pentachlorophenol)
- D038 (Pyridine)
- D039 (Pentachloroethylene)
- D040 (Trichloroethylene)
- D041 (2, 4, 5-Trichlorophenol)

- D042 (2, 4, 6-Trichlorophenol)
- D043 (Vinyl Chloride)

LDR Treatment Standard

- D004 = concentration based standard = 5.0 mg/l
- D005 = concentration based standard = 100 mg/l
- D006 = concentration based standard = 1.0 mg/l,
- D007 = concentration based standard = 5.0 mg/l,
- D008 = concentration based standard = 5.0 mg/l
- D009 = concentration based standard = 0.2 mg/l
- D010 = concentration based standard = 5.7 mg/l
- D011 = concentration based standard = 5.0 mg/kg
- D012* = concentration based standard = 0.13 mg/kg
- D013* = concentration based standard = 0.066 mg/kg
- D014* = concentration based standard = 0.18 mg/kg
- D015* = concentration based standard = 2.6 mg/kg
- D016* = concentration based standard = 10.0 mg/kg
- D017* = concentration based standard = 7.9 mg/kg
- D018* = concentration based standard = 10 mg/kg
- D019* = concentration based standard = 6.0 mg/kg
- D020* = concentration based standard = 0.26 mg/kg
- D021* = concentration based standard = 6.0 mg/kg
- D022* = concentration based standard = 6.0 mg/kg
- D023* = concentration based standard = 5.6 mg/kg
- D024* = concentration based standard = 5.6 mg/kg
- D025* = concentration based standard = 5.6 mg/kg
- D026* = concentration based standard = 11.2 mg/kg
- D027* = concentration based standard = 6.0 mg/kg
- D028* = concentration based standard = 6.0 mg/kg
- D029* = concentration based standard = 6.0 mg/kg
- D030* = concentration based standard = 140 mg/kg
- D031* = concentration based standard = 0.066 mg/kg
- D032* = concentration based standard = 10 mg/kg
- D033* = concentration based standard = 5.6 mg/kg
- D034* = concentration based standard = 30 mg/kg
- D035* = concentration based standard = 36 mg/kg
- D036* = concentration based standard = 14 mg/kg
- D037* = concentration based standard = 7.4 mg/kg
- D038* = concentration based standard = 16 mg/kg
- D039* = concentration based standard = 6.0 mg/kg
- D040* = concentration based standard = 6.0 mg/kg
- D041* = concentration based standard = 7.4 mg/kg
- D042* = concentration based standard = 7.4 mg/kg
- D043* = concentration based standard = 6.0 mg/kg

*D012-D043 nonwastewaters must be treated to meet the Universal Treatment Standards (UTS) for any underlying constituents that may be present.

Waste Characterization

- Process knowledge used to characterize the waste stream.
- Confidence level is high based on process knowledge of what was spilled or located at a particular site.

Radiological Characterization

- Beta/gamma and alpha emitters are present.
- Waste is contact handled.
- Mixed low-level waste

Initial Screening

The initial screening identified inappropriate treatment options. These options appear in the Initial Rejections table.

Initial Rejections

Treatment Facility	Treatment Technology	Reasons for Rejection
CIF	Ashcrete Stabilization	Ashcrete process does not have the capacity to treat large amounts of soil.
CIF	Combustion	CIF is not designed to burn large amounts of soil.
ETF	Ion Exchange	ETF has no process to treat this waste.
Lab.	Lab-scale process flowsheet	Volume of waste too great to handle with laboratory-scale equipment.
LETF	Ion Exchange	LETF has no process to treat large amounts of soil.
Z Area	Stabilization	Z Area can treat only those wastes that come by pipeline from Tank 50 and meet strict waste acceptance criteria. The Z-Area process lacks flexibility to treat and dispose of a variety of waste streams.

Summary Page – Technology Success Factor (TSF) & In-Depth Options Analysis (IDOA)

Waste Stream Number & Name: SR-W048 Soils from Spill Remediation

Feasible Options

Option No.	Treatment Facility	Treatment Technology	TSF Score	IDOA Scores Tech.	IDOA Scores Total	COST (x 1,000)	PO
SR-W048-1	M Area	Vitrification	63	56	68	4,338	√
SR-W048-2	Vendor/Onsite	Stabilization	75	56	61	21,406	
SR-W048-3	Vendor/Onsite	Polymer Encapsulation	100	59	68	10,632	
SR-W048-4	Vendor/Onsite	Soil Wash	75	48	55	15,567	
SR-W048-5	HW/MW-TB	Soil Wash	51	47	47	37,017	
SR-W048-6	Vendor/Onsite	Chelation	81	46	55	12,673	
SR-W048-7	INEL/IWPF	Incineration	*	35	49	356	
SR-W048-8	Vendor	Plasma Hearth	1				
SR-W048-9	Cont. Bldg.	Metal Migration	26				
SR-W048-10	Vendor	Vitrification	38				
SR-W048-11	Vendor	Plasma Arc	1				

* No TSF required for proposed or existing non-Savannah River Site-DOE waste processing facilities.

Options Rejected Due To Low Technology Success Factor (TSF)

Plasma Arc Remediation by Vendor

Plasma arc remediation by vendor was rejected because:

- Plasma arc incineration is currently still in the laboratory.
- While prototypes may exist, they have no record of continuous reliable operation in industrial settings, hence, Pm=0.9.
- Control of the process requires sophisticated computerized instrumentation, hence, Pc=0.9.
- It is not expected that this technology will reach a level of reliability suitable for industrial application for 5-10 years.

Plasma Hearth Process by Vendor

Plasma Hearth Process by vendor was rejected because:

- Plasma hearth incineration is currently still in the laboratory. While prototypes may exist, they have no record of continuous reliable operation in industrial settings. Hence, Pm=0.9.
- Control of the process requires sophisticated computerized instrumentation, hence, Pc=0.9.
- It is not expected that this technology will reach a level of reliability suitable for industrial application for 5-10 years.

Metal Migration in Containment Building

Metal migration in containment building was rejected because:

- This process has shown promise only for *in situ* remediation of soil. The process for decontaminating excavated soils is laboratory scale, hence Pm=0.9.
- Control of this process to ensure appropriate levels of decontamination will be difficult and complex, hence, Pc=0.5.

Vitrification by Vendor

Vitrification by vendor was rejected because:

- This unit currently exists as a pilot scale process that can handle only non-hazardous simulated waste, hence, Pm=0.7.
- This is a vitrification process for which solid feed systems and sophisticated controls are expected to be needed, hence, Pc=0.5.

Engineering Assessment

Preferred Option Justification

The preferred treatment option for the Waste Sites/Spill Site Soil waste stream is preparation for treatment in M Area by pulverization and slurrying followed by Stabilization by Vitrification in the M-Area Vendor Treatment Process.

This option treats the constituents of concern, TCLP metals and characteristic organics, by stabilizing it in non-leaching glass matrix.

This option is preferred because:

- Volume reduction will be greater than a factor of 5.
- Treatment meets LDR.
- This small volume waste stream can be easily processed along with the wastes for which the vendor vitrification unit was originally contracted.
- The final wasteform is very stable and long-lived.
- It is cost-effective.

Treatability Study Requirements

Waste must first be characterized:

- Percent of sand, silt, and clay
- Percent of silicon, sodium, calcium, magnesium, and aluminum

If the characteristics fall within the standard glass-forming matrix, no additional studies will be necessary. If the characteristics fall outside the standard glass-forming matrix, crucible studies will be needed to determine whether satisfactory glass can be made by using additives or other techniques.

Options Rejected During IDOA

Stabilization by Vendors

Stabilization (either by polymer or cement grout) by vendors was rejected because:

- Waste volume more than doubles.
- Final wasteform not as long-lived as preferred option.
- Rejected options not as cost-effective as preferred option.

Soil Washing (either by a Vendor or in HW/MW-TB)

Soil washing (either by a vendor or in HW/MW-TB) was rejected because:

- Final waste still required handling as mixed waste.
- Volume of waste increased due to need to treat secondary wastewater.

Incineration at INEL/IWPF

Incineration at INEL/IWPF was rejected because:

- INEL/IWPF is a planned, but not an approved facility. DOE guidance forbids consideration of such facilities.
- Apparent cost advantage over the preferred option is a consequence of the accounting methods stipulated, which do not consider overhead and capital costs of offsite facilities.

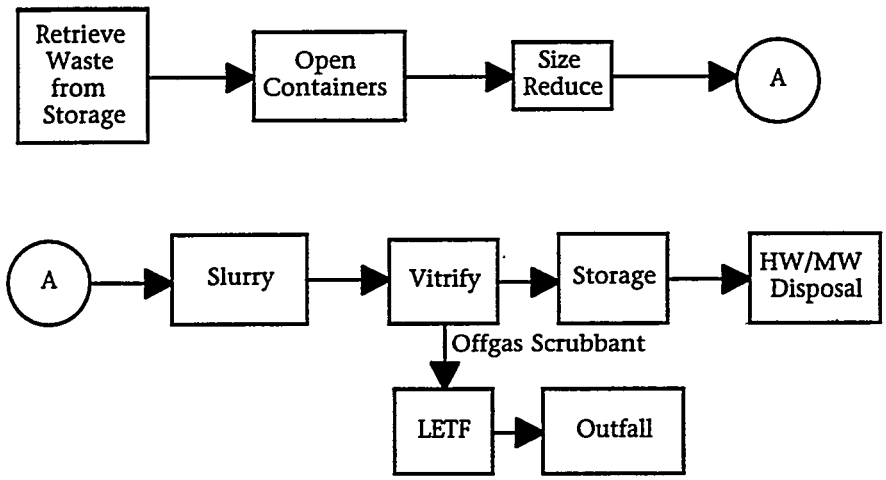
Chelation by a Vendor

Chelation by a vendor was rejected because:

- Final wasteform still required handling as mixed waste.
- Volume of waste increased due to need to treat secondary wastewater.

Waste Stream Number & Name: SR-W048 Soils from Spill Remediation
Option Number: SR-W048-1
Facility: M-Area Vendor Treatment Process **Treatment Technology:** Vitrification

Treatment Cycle Flow Diagram:



Pros

- Volume reduction between 5:1 and 1:1.
- No additional treatment is required to meet LDR.
- Final glass form will meet all shipping requirements.
- Glass will meet final disposal WAC. No additional treatment is required. Wasteform is disposable in form which exits the process.
- Process demonstrated for vitrification.
- Failed wasteform can be easily recycled through melter with little or not additional rework.
- Any potential releases will be within permit limits.
- No increase in non operational workers is required to treat the waste but increase in non-routine maintenance will be required.
- Process will be in full compliance with applicable regulations without requiring a variance.

Cons.

- Not a budgeted item.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	70	Subtract 10 points from the median score of 80 because volume reduction between 5:1 and 1:1, reduction is <5:1.
• secondary waste generation	80	Little secondary waste.
• destruction removal and demobilization efficiency	80	No additional treatment is required to meet LDR standards.

Waste Stream Number & Name: SR-W048 Soils from Spill Remediation
Option Number: SR-W048-1
Facility: M-Area Vendor Treatment Process Treatment Technology: Vitrification
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• flexibility	50	Off design specification feed will reduce efficiency. Sieve required.
• ability to be shipped	80	Final glass form will meet all DOT shipping requirements.
• final wasteform	100	Glass will meet final disposal WAC. Add 20 points to the median score of 80 because glass is considered prime wasteform. Wasteform is disposable in form which exits the process.
Engineering Parameters		
• system implementability	80	Process demonstrated for vitrification.
• availability	50	Normal maintenance requirements apply. This waste stream may require a "clean-out" earlier than anticipated based on curie load.
• scalability	50	Fixed quantity of waste. Throughput is set by design and not easily expanded except by adding more shifts of operation.
• remedial measures	80	Recoverable. Failed wasteform can be easily recycled through melter with little or no additional rework.
• schedule for treatment of waste	80	Fixed quantity easily scheduled.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Potential releases expected to be within permit limits.
• non operational worker potential exposure	50	No increase in non operational workers is required to treat the waste. Additional non-routine maintenance will be required.
• operational worker potential exposure	40	Subtract 10 points from the median score of 50 because potential safety issue with added processes.
• transportation potential exposure	60	Site has experience with transporting soils. Add 10 points to the median score of 50 because no additional characterization needed.
Regulatory Parameters		
• need for variance	80	Process will be in full compliance with all applicable regulations without requiring a variance.
• ability to obtain a permit	50	Similar process permitted elsewhere, but will require a permit modification to the existing wastewater permit. SCDHEC and/or EPA could require a RCRA Part B Permit Application with change in waste stream.
• waste disposal	50	Waste may require disposal in a HW/MW facility due to coprocessing with listed (F006) waste.
Public Acceptance		
• public acceptance	50	Public has supported treatment that results in a glass wasteform.

Waste Stream Number & Name: SR-W048 Soils from Spill Remediation
Option Number: SR-W048-1
Facility: M-Area Vendor Treatment Process Treatment Technology: Vitrification
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Cost Considerations		
• life-cycle cost	88	
• funding availability	20	Not a budgeted item.
Industry Involvement		
• market for technology	20	Existing vendor process.
• private sector involvement	80	Technology is available at an existing vendor process.

IDOA Score: Technical 56 **Total** 68

Waste Stream Number & Name: SR-W048 Soils from Spill Remediation
Option Number: SR-W048-1
Facility: M-Area Vendor Treatment Process Treatment Technology: Vitrification
Cost Estimate Sheet

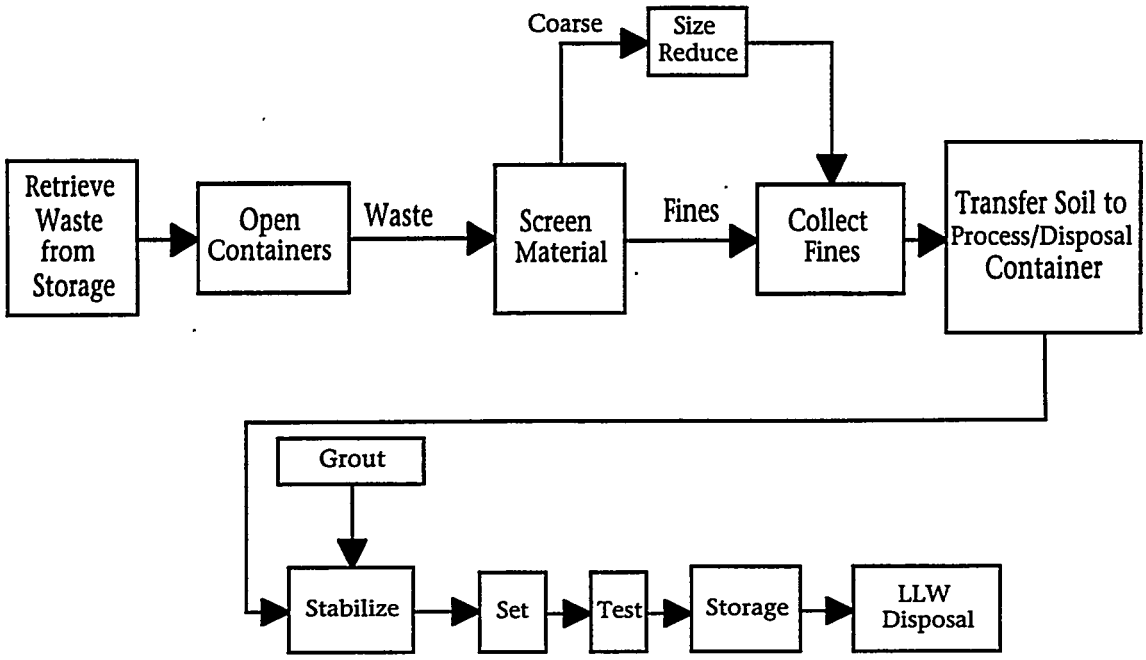
Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled
Module Location: SRS
Module Status: [√] Existing [ ] New [ ] Small generator [√] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 14	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 56	
		1.3.2 Safety Assurance Documentation	$ 14	
		1.3.3 Permitting	$ 125	
		1.3.4 Preparation for Operations	$ 1,150	
		1.3.5 Project Management	$ 5	
		TOTAL PRE-OPERATIONS		$ 1,363
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 66	
	2.2	Inspection	$ 8	
	2.3	Project Management	$ 13	
	2.4	Building Construction (inc. indirect)	$ 100	
	2.5	Equipment (inc. indirect)	$ 0	
	2.6	Construction Management	$ 21	
	2.7	Contingency	$ 144	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 352
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 263	
	3.2	Annual Utilities	$ 11	
	3.3	Annual Materials	$ 158	
	3.4	Annual Maintenance	$ 95	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 525	
		X NUMBER OF YEARS OF OPERATION	1.00	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 525
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 240	
	4.2	Closure, Post-Closure, Monitoring	$ 5	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 245
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$ 200	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$ 200
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 100
		SUB COST FOR VITRIFICATION MODULE		$ 2,785
		ESCALATION		1.558
		TOTAL COST		$ 4,338

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W048 Soils from Spill Remediation
Option Number: SR-W048-2
Facility: Vendor/Onsite
Treatment Technology: Stabilization

Treatment Cycle Flow Diagram:



Pros

- No additional treatment is required to meet LDR standards.
- Can accommodate a wide range of similar wastes and radiation levels. Widely used in the commercial world.
- Wasteform can be easily shipped as-is.
- The wasteform meets the expected WAC for waste disposal. No additional treatment is required. Wasteform is disposable in the form in which it exits the process.
- This is a proven process, used both in DOE Complex and the commercial world.
- Similar systems in the commercial nuclear industry experience availability of 80%.
- Requires fewer non operational workers than comparably-sized facilities. Experience in similar facilities indicates that little non-routine maintenance is needed
- Well accepted wasteform. No variance required.
- All wastes disposed as LLW because waste meets LDR treatment standards.

Cons

- Waste volume will more than double.
- Wasteform is not as permanent as other forms of stabilization.
- Not a budgeted item and will require line item funding.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	10	Subtract 10 points from the median score of 20 because waste volume will more than double.
• secondary waste generation	80	Little secondary waste.
• destruction removal and demobilization efficiency	80	No additional treatment is required to meet LDR standards.

Waste Stream Number & Name: SR-W048 Soils from Spill Remediation
Option Number: SR-W048-2
Facility: Vendor/Onsite Treatment Technology: Stabilization
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• flexibility	80	Can accommodate a wide range of similar wastes and radiation levels. Widely used in the commercial world.
• ability to be shipped	80	Final glass form will meet all DOT shipping requirements.
• final wasteform	80	The wasteform meets the expected WAC for waste disposal. Wasteform is disposable in the form in which it exits the process.
Engineering Parameters		
• system implementability	80	This is a proven process. Used both in DOE Complex and the commercial world.
• availability	80	Similar systems in the commercial nuclear industry experience availability of 80%.
• scalability	50	Throughput is set by design, and not easily expanded except by adding more shifts of operation.
• remedial measures	50	Failed wasteform can be overpacked or ground up and reprocessed.
• schedule for treatment of waste	70	This is a mature technology. Subtract 10 points from the median score of 80 because the process is neither skid-mounted nor currently available in the U. S.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Process can be installed in a containment building with adequate emission controls.
• non operational worker potential exposure	80	Requires fewer non operational workers than comparably sized facilities. Experience in similar facilities indicates that little non-routine maintenance is needed.
• operational worker potential exposure	50	Facility requires about the same number of operational workers as comparably-sized facilities.
• transportation potential exposure	60	No additional testing needed. Add 10 points to the median score of 50 because waste can be handled readily.
Regulatory Parameters		
• need for variance	80	Well-accepted wasteform. No variance required.
• ability to obtain a permit	80	Must demonstrate that waste meets treatment LDR standard.
• waste disposal	80	All wastes disposed of as LLW because meets waste treatment standards.
Public Acceptance		
• public acceptance	20	Mature and proven technology, however wasteform is not as permanent as other forms of stabilization (i.e., vitrification).
Cost Considerations		
• life-cycle cost	39	
• funding availability	20	Not a budgeted item and will require line item funding.

Waste Stream Number & Name: SR-W048 Soils from Spill Remediation
Option Number: SR-W048-2
Facility: Vendor/Onsite **Treatment Technology:** Stabilization
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Industry Involvement		
• market for technology	20	This is an existing vendor process.
• private sector involvement	50	Technology could be provided by an existing vendor process.

IDOA Score: **Technical** 56 **Total** 61

Waste Stream Number & Name: SR-W048 Soils from Spill Remediation
Option Number: SR-W048-2
Facility: Vendor/Onsite **Treatment Technology: Stabilization**
Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled
Module Location: SRS
Module Status: [ ] Existing [√] New [ ] Small generator [√] Large generator
[√] Onsite [ ] Offsite [√] Commercial [ ] Portable [ ] R&D

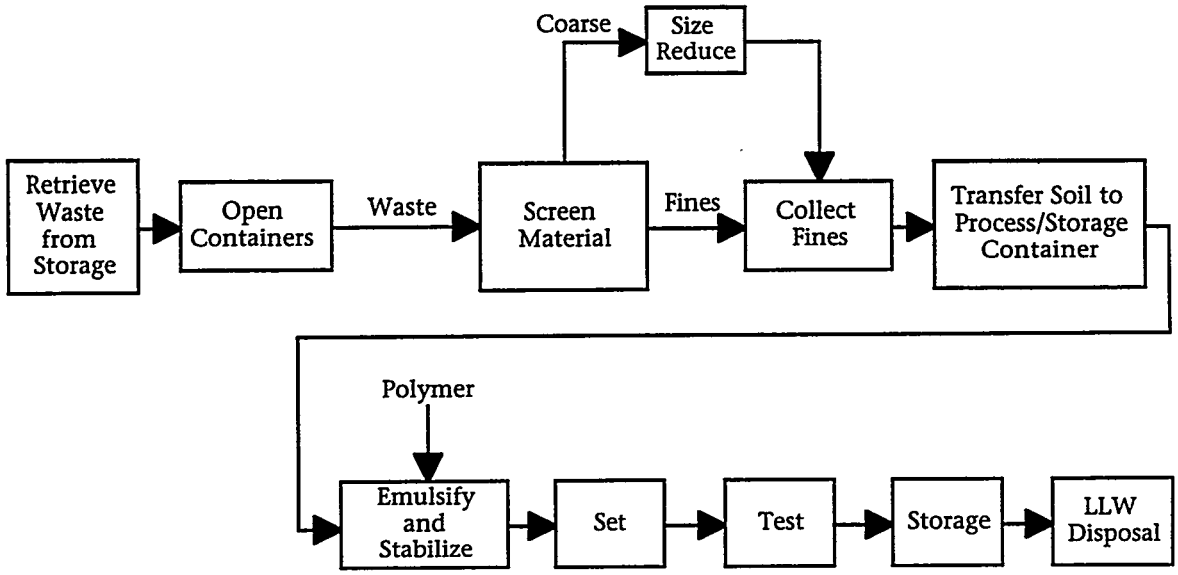
WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
1.1	Studies and Bench Scale Tests		$ 256	
1.2	Demonstration Costs		$ N/A	
1.3	Operations Budget Funded Activities			
1.3.1		Conceptual Design	$ 1,023	
1.3.2		Safety Assurance Documentation	$ 256	
1.3.3		Permitting	$ 125	
1.3.4		Preparation for Operations	$ 150	
1.3.5		Project Management	$ 180	
		TOTAL PRE-OPERATIONS		$ 1,990
2.0	Facility Construction Cost			
2.1	Design (Title I and II)		$ 880	
2.2	Inspection		$ 280	
2.3	Project Management		$ 460	
2.4	Building Construction (inc. indirect)		$ 4,000	
2.5	Equipment (inc. indirect)		$ 0	
2.6	Construction Management		$ 280	
2.7	Contingency		$ 2,653	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 8,553
3.0	Operation and Maintenance			
3.1	Annual Operating Labor		$ 375	
3.2	Annual Utilities		$ 15	
3.3	Annual Materials		$ 225	
3.4	Annual Maintenance		$ 135	
3.5	Annual Contingency		$ 0	
		TOTAL ANNUAL O & M	$ 750	
		X NUMBER OF YEARS OF OPERATION	1.00	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 750
4.0	Decontamination & Decommissioning			
4.1	Facility D&D		$ 4,400	
4.2	Closure, Post-Closure, Monitoring		$ 10	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 4,410
5.0	Contracted Services			
5.1	Commercial Treatment/Disposal		$ 1,500	
5.2	Mobile Treatment		$	
		TOTAL CONTRACTED SERVICES		$ 1,500
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 200
		SUB COST FOR CEMENT STABILIZATION MODULE		$ 17,403
		ESCALATION		1.23
		TOTAL COST		$ 21,406

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W048 Soils from Spill Remediation
Option Number: SR-W048-3
Facility: Vendor/Onsite

Treatment Technology: Polymer Encapsulation

Treatment Cycle Flow Diagram:



Pros

- No additional treatment is required to meet LDR standards.
- Can accommodate a wide range of similar wastes and radiation levels. Widely used in the commercial world.
- Wasteform meets DOT shipping requirements in the form it exits the treatment process.
- The wasteform meets the expected WAC for waste disposal. No additional treatment is required. Wasteform is disposable in the form in which it exits the process.
- This is a proven process, used both in DOE Complex and the commercial world.
- Mature technology. Vendor will bring onsite and set up with a minimum delay.
- Process can be installed in a containment building with adequate emission controls.
- Skid mounted, no D&D, vendor removes upon completion of work. Facility requires more non operational workers than comparably-sized, skid-mounted facilities.
- Well accepted wasteform. No variance required.
- All wastes disposed of as LLW because waste meets treatment standards.

Cons

- The waste volume will more than double.
- Wasteform is not as permanent as other forms of stabilization.
- Not a budgeted item and will require line item funding.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	10	Subtract 10 points from the median score of 20 because the waste volume will far more than double.
• secondary waste generation	80	Little secondary waste.
• destruction removal and demobilization efficiency	80	No additional treatment is required to meet LDR.

Waste Stream Number & Name: SR-W048 Soils from Spill Remediation
Option Number: SR-W048-3
Facility: Vendor/Onsite
Treatment Technology: Polymer Encapsulation

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• flexibility	80	Can accommodate a wide range of similar wastes and radiation levels. Widely used in the commercial world.
• ability to be shipped	80	Wasteform meets DOT shipping requirements in the form it exits the treatment process.
• final wasteform	100	The wasteform meets the expected WAC for waste disposal. Add 20 points to the median score of 80 because no additional treatment is required. Wasteform is disposable in the form in which it exits the process.
Engineering Parameters		
• system implementability	100	This is a proven process. Add 20 points to the median score of 80 because this process is used both in DOE Complex and the commercial world.
• availability	60	Operator error can cause downtime. Add 10 points to the median score of 50 because system is normally available 50% of the time.
• scalability	50	Throughput is set by design, and not easily expanded except by adding more shifts of operation.
• remedial measures	50	Failed wasteform can be ground up and reprocessed.
• schedule for treatment of waste	80	Mature technology. Vendor will bring onsite and set up with a minimum delay.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Process can be installed in a containment building with adequate emission controls.
• non operational worker potential exposure	80	Requires the same number of non operational workers as comparable skid-mounted units. Most or all initial construction can be done in a vendor shop. Experience in similar facilities indicates that little non-routine maintenance is required.
• operational worker potential exposure	40	Subtract 10 points from the median score of 50 because the facility requires more operational workers than comparably-sized, skid-mounted facilities.
• transportation potential exposure	60	No additional characterization needed. Add 10 points to the median score of 50 because waste can be handled readily.
Regulatory Parameters		
• need for variance	80	Well accepted wasteform. No variance required.
• ability to obtain a permit	80	Must demonstrate that waste meets LDR treatment standard.
• waste disposal	80	Waste can be disposed as LLW.
Public Acceptance		
• public acceptance	20	Mature and proven technology, however wasteform is not as permanent as other forms of stabilization (i.e., vitrification).

Waste Stream Number & Name: SR-W048 Soils from Spill Remediation
Option Number: SR-W048-3
Facility: Vendor/Onsite
Treatment Technology: Polymer Encapsulation

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Cost Considerations		
• life-cycle cost	70	
• funding availability	20	Not a budgeted item and will require line item funding.
Industry Involvement		
• market for technology	20	This is an existing vendor process.
• private sector involvement	50	Technology could be provided by an existing vendor process.

IDOA Score: **Technical** 59 **Total** 68

Waste Stream Number & Name: SR-W048 Soils from Spill Remediation
Option Number: SR-W048-3
Facility: Vendor/Onsite **Treatment Technology: Polymer Encapsulation**

Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled

Module Location: SRS

Module Status: [ ] Existing [√] New [ ] Small generator [√] Large generator
[√] Onsite [ ] Offsite [√] Commercial [ ] Portable [ ] R&D

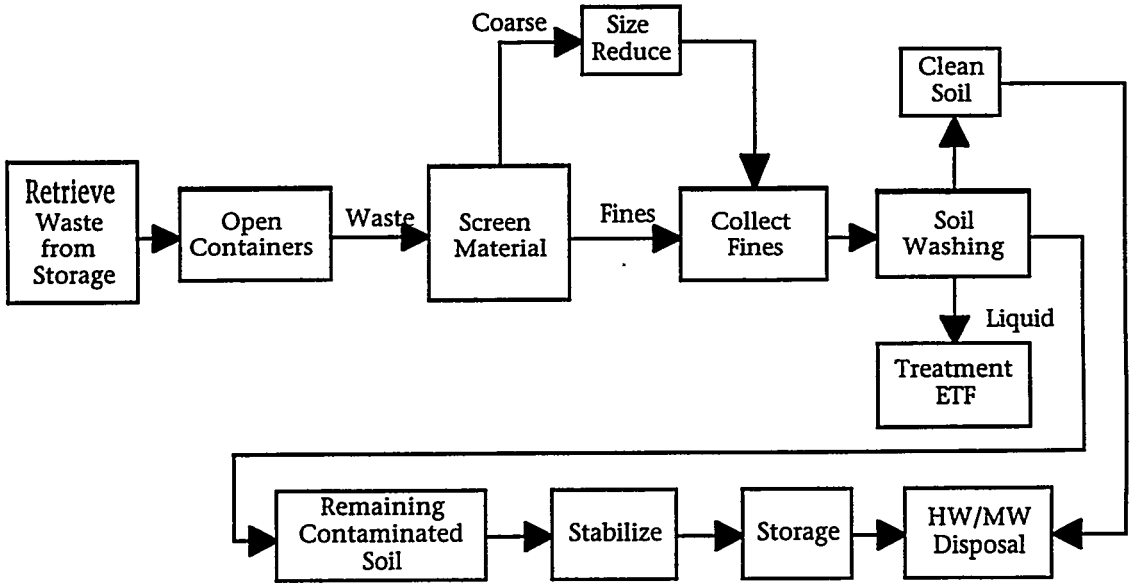
WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 128	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 512	
		1.3.2 Safety Assurance Documentation	$ 128	
		1.3.3 Permitting	$ 125	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 90	
		TOTAL PRE-OPERATIONS		$ 1,132
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 440	
	2.2	Inspection	$ 140	
	2.3	Project Management	$ 230	
	2.4	Building Construction (inc. indirect)	$ 2,000	
	2.5	Equipment (inc. indirect)	$ 0	
	2.6	Construction Management	$ 140	
	2.7	Contingency	$ 1,327	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 4,277
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 38	
	3.2	Annual Utilities	$ 2	
	3.3	Annual Materials	$ 23	
	3.4	Annual Maintenance	$ 14	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 75	
		X NUMBER OF YEARS OF OPERATION	1.00	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 75
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 2,200	
	4.2	Closure, Post-Closure, Monitoring	$ 10	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 2,210
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$ 750	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$ 750
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 200
		SUB COST FOR POLYMER ENCAPSULATION MODULE		$ 8,644
		ESCALATION		1.23
		TOTAL COST		$ 10,632

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W048 Soils from Spill Remediation
Option Number: SR-W048-4
Facility: Vendor/Onsite

Treatment Technology: Soil Wash

Treatment Cycle Flow Diagram:



Pros

- No additional treatment is required to meet LDR standards.
- Capable of handling wide variations in the composition of the design waste stream.
- Meets the expected WAC for waste disposal. Additional secondary waste treatment is required. Waste is disposable in the form in which it exits the process.
- Most elements have been demonstrated.
- Process will be designed to comply with applicable regulations without seeking a variance.

Cons

- Constituent of concern is not permanently and irreversibly isolated from the environment Although the soil is clean, constituents of concern must be stabilized by some other technology.
- Not a budgeted item. Will require line funding.
- Wastes will require disposal in HW/MW facilities.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	50	Little or no reduction in waste volume.
• secondary waste generation	50	Wash water is a secondary waste that must be treated and stabilized with routine technology. Volume of stabilized secondary waste may equal volume of original waste.
• destruction removal and demobilization efficiency	80	No additional treatment is required to meet LDR standards.

Waste Stream Number & Name: SR-W048 Soils from Spill Remediation
Option Number: SR-W048-4
Facility: Vendor/Onsite **Treatment Technology: Soil Wash**
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• flexibility	80	Designed to decontaminate soil, but other wastes may possibly be decontaminated with the same process with few additional process steps (e.g., shredding). Capable of handling wide variations in the composition of the design waste stream.
• ability to be shipped	50	Treatment residuals require further treatment to meet shipping requirements.
• final wasteform	80	Meets the expected WAC for waste disposal. Additional secondary waste treatment is required. Waste is disposable in the form in which it exits the process.
Engineering Parameters		
• system implementability	70	Most elements have been demonstrated, but not as an integrated system. Subtract 10 points from the median score of 80 because no plant-scale facilities exist in the U. S.
• availability	50	Based on projections from European facilities, it seems likely that the availability will be around 50%.
• scalability	50	Throughput is set by design, and not easily expanded except by adding more shifts of operation.
• remedial measures	50	If washed soil fails to meet release specifications, it can be recycled or stabilized by other routine technology.
• schedule for treatment of waste	50	Because process has not been unequivocally demonstrated to treat the waste, uncertainties remain about the accuracy of a schedule.
Personnel Parameters		
◦ consequence of unmitigated accident scenarios	80	Process can be installed in a containment building with adequate emission controls.
◦ non operational worker potential exposure	50	Facility is expected to require the same number of non operational workers as comparably sized cement mix plants, in which material handling (not cement mixing) is somewhat analogous to this treatment process.
◦ operational worker potential exposure	40	Subtract 10 points from the median score of 50 because the facility is expected to require more operational workers per shift than wastewater treatment facilities owing to an expected number of manual laborers needed to handle the waste, which is in boxes.
• transportation potential exposure	50	Some additional characterization needed. Waste can be handled readily.
Regulatory Parameters		
• need for variance	80	Process will be designed to comply with applicable regulations without seeking a variance.
• ability to obtain a permit	60	Must demonstrate that waste meets treatment standard. New process in the U. S., unfamiliar to regulators. Add 10 points to the median score of 50 because operating background from European facilities should help allay concerns.
• waste disposal	20	Wastes will require disposal in HW/MW facilities.

Waste Stream Number & Name: SR-W048 Soils from Spill Remediation
Option Number: SR-W048-4
Facility: Vendor/Onsite **Treatment Technology: Soil Wash**
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Public Acceptance		
• public acceptance	20	Constituent of concern is not permanently and irreversibly isolated from the environment Although the soil is clean, constituents of concern must be stabilized by some other technology.
Cost Considerations		
• life-cycle cost	56	
• funding availability	20	Not a budgeted item and will require line funding.
Industry Involvement		
• market for technology	20	This is an existing vendor process.
• private sector involvement	50	Vendor process evaluated.

IDOA Score: Technical 48 **Total** 55

Waste Stream Number & Name: SR-W048 Soils from Spill Remediation
Option Number: SR-W048-4
Facility: Vendor/Onsite **Treatment Technology: Soil Wash**
Cost Estimate Sheet

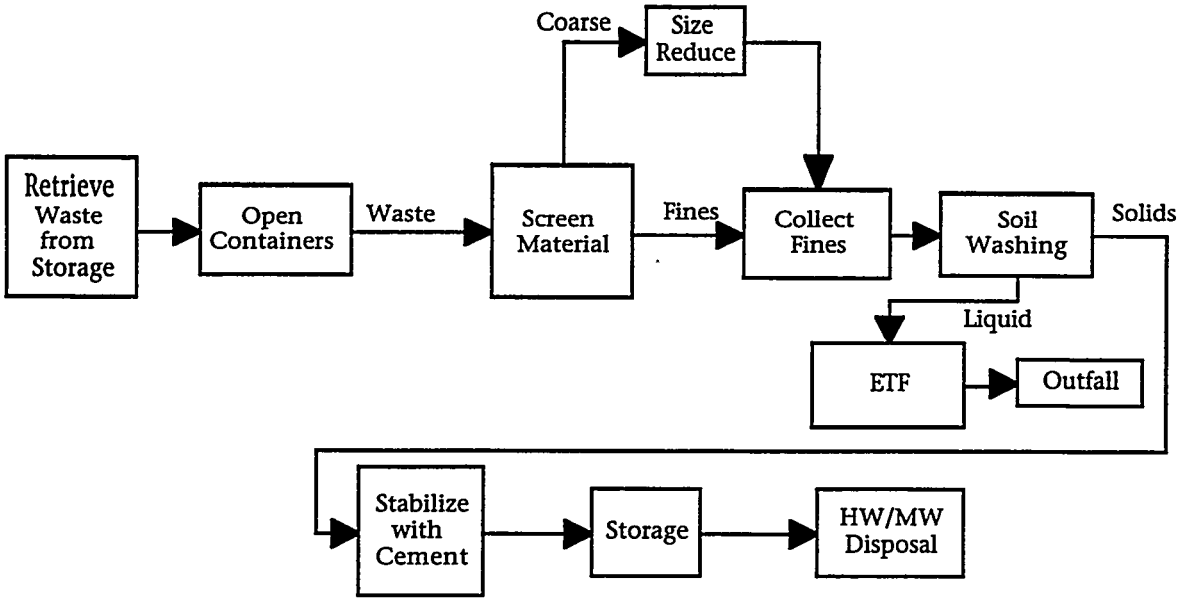
Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled
Module Location: SRS
Module Status: [ ] Existing [√] New [ ] Small generator [√] Large generator
[√] Onsite [ ] Offsite [√] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
1.1	Studies and Bench Scale Tests		$ 187	
1.2	Demonstration Costs		$ N/A	
1.3	Operations Budget Funded Activities			
1.3.1		Conceptual Design	$ 748	
1.3.2		Safety Assurance Documentation	$ 187	
1.3.3		Permitting	$ 125	
1.3.4		Preparation for Operations	$ 150	
1.3.5		Project Management	$ 90	
		TOTAL PRE-OPERATIONS		$ 1,487
2.0	Facility Construction Cost			
2.1	Design (Title I and II)		$ 440	
2.2	Inspection		$ 140	
2.3	Project Management		$ 230	
2.4	Building Construction (inc. indirect)		$ 2,000	
2.5	Equipment (inc. indirect)		$ 0	
2.6	Construction Management		$ 140	
2.7	Contingency		$ 1,939	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 4,889
3.0	Operation and Maintenance			
3.1	Annual Operating Labor		$ 38	
3.2	Annual Utilities		$ 2	
3.3	Annual Materials		$ 23	
3.4	Annual Maintenance		$ 14	
3.5	Annual Contingency		$ 0	
		TOTAL ANNUAL O & M	$ 75	
		X NUMBER OF YEARS OF OPERATION	1.00	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 75
4.0	Decontamination & Decommissioning			
4.1	Facility D&D		$ 3,600	
4.2	Closure, Post-Closure, Monitoring		$ 5.00	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 3,605
5.0	Contracted Services			
5.1	Commercial Treatment/Disposal		$ 2,500	
5.2	Mobile Treatment		$	
		TOTAL CONTRACTED SERVICES		$ 2,500
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 100
		SUB COST FOR SOIL WASH MODULE		$ 12,656
		ESCALATION		1.23
		TOTAL COST		$ 15,567

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W048 Soils from Spill Remediation
Option Number: SR-W048-5
Facility: HW/MW-TB
Treatment Technology: Soil Washing

Treatment Cycle Flow Diagram:



Pros

- No additional treatment is required to meet LDR standards.
- Capable of handling wide variations in the composition of the design waste stream.
- Meets the expected WAC for waste disposal. Wasteform is disposable in the form in which it exits the process.
- Most elements have been demonstrated.
- Process will be designed to comply with applicable regulations without seeking a variance.

Cons

- Although the soil is clean, constituents of concern must be stabilized by some other technology.
- Not a budgeted item and will require line item funding.
- Wastes will require HW/MW disposal **in HW/MW facilities.**

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	50	No volume reduction.
• secondary waste generation	50	Wash water is a secondary waste that must be treated and stabilized with routine technology. Volume of stabilized secondary waste may equal volume of original waste.
• destruction removal and demobilization efficiency	80	No additional treatment is required to meet LDR standards.

Waste Stream Number & Name: SR-W048 Soils from Spill Remediation
Option Number: SR-W048-5
Facility: HW/MW-TB **Treatment Technology: Soil Washing**
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• flexibility	80	Designed to decontaminate soil, but other wastes may possibly be decontaminated with the same process with few additional process steps (e.g., shredding). Capable of handling wide variations in the composition of the design waste stream.
• ability to be shipped	50	Treatment residuals require further treatment to meet shipping requirements.
• final wasteform	80	Meets the expected WAC for waste disposal. Additional secondary waste treatment is required. Wasteform is disposable in the form in which it exits the process.
Engineering Parameters		
• system implementability	70	Most elements have been demonstrated, but not as an integrated system. Subtract 10 points from the median score of 80 because no plant-scale facilities exist in the U. S.
• availability	40	Subtract 10 points from the median score of 50 because based on projections from European facilities, availability will be around 50%. Availability will be affected by wear on moving parts caused by handling an abrasive slurry, and time required to maintain process equipment contaminated by radionuclides.
• scalability	50	Throughput is set by design and not easily expanded except by adding more shifts of operation.
• remedial measures	50	If washed soil fails to meet release specifications, it can be recycled or stabilized by other routine technology.
• schedule for treatment of waste	40	Subtract 10 points from the median score of 50 because process has not been unequivocally demonstrated to treat the waste, uncertainties remain about the accuracy of a schedule.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Process can be installed in a building with adequate emission controls.
• non operational worker potential exposure	50	Facility is expected to require the same number of non operational workers as comparably-sized cement mix facilities in which material handling (not cement mixing) is somewhat analogous to this treatment process.
• operational worker potential exposure	40	Subtract 10 points from the median score of 50 because facility is expected to require more operational workers per shift than wastewater treatment facilities owing to an expected number of manual laborers needed to handle waste, which is in boxes.
• transportation potential exposure	50	Some additional characterization needed. Waste can be handled readily.

Waste Stream Number & Name: SR-W048 Soils from Spill Remediation

Option Number: SR-W048-5
Facility: HW/MW-TB **Treatment Technology: Soil Washing**
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Regulatory Parameters		
• need for variance	80	Process will be designed to comply with applicable regulations without seeking a variance.
• ability to obtain a permit	60	Must demonstrate that waste meets treatment standard. Add 10 points to the median score of 50 because new process in the U.S., unfamiliar to regulators. Operating background from European facilities should allay concerns.
• waste disposal	20	Wastes will require disposal in HW/MW facilities.
Public Acceptance		
• public acceptance	20	Although the soil is clean, constituents of concern must be stabilized by some other technology.
Cost Considerations		
• life-cycle cost	0	
• funding availability	20	Not a budgeted item and will require line item funding.
Industry Involvement		
• market for technology	20	Existing technology.
• private sector involvement	20	SRS facility evaluated.

IDOA Score: **Technical** 47 **Total** 47

Waste Stream Number & Name: SR-W048 Soils from Spill Remediation
Option Number: SR-W048-5
Facility: HW/MW-TB **Treatment Technology: Soil Washing**
Cost Estimate Sheet

INCLUDES COST FOR OPTION SR-W049-2

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled

Module Location: SRS

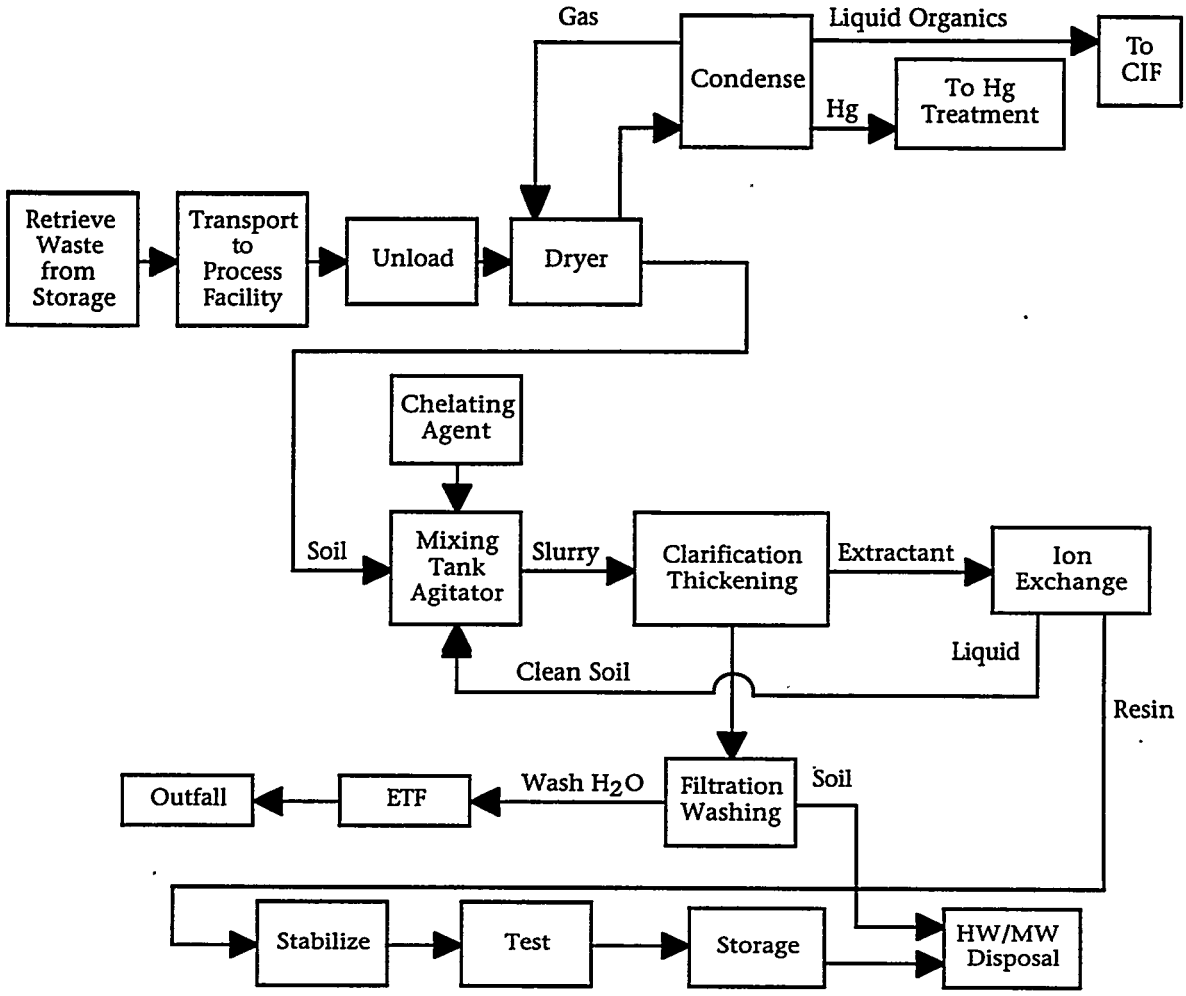
Module Status: [ ] Existing [√] New [ ] Small generator [√] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 424	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 1,695	
		1.3.2 Safety Assurance Documentation	$ 424	
		1.3.3 Permitting	$ 125	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 315	
		TOTAL PRE-OPERATIONS		$ 3,133
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 1,848	
	2.2	Inspection	$ 546	
	2.3	Project Management	$ 861	
	2.4	Building Construction (inc. indirect)	$ 7,000	
	2.5	Equipment (inc. indirect)	$ 1,400	
	2.6	Construction Management	$ 588	
	2.7	Contingency	$ 4,395	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 16,638
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 75	
	3.2	Annual Utilities	$ 3	
	3.3	Annual Materials	$ 45	
	3.4	Annual Maintenance	$ 27	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 150	
		X NUMBER OF YEARS OF OPERATION	1.00	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 150
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 6,720	
	4.2	Closure, Post-Closure, Monitoring	$ 5	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 6,725
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 100
		SUB COST FOR SOIL WASHING MODULE		$ 26,746
		ESCALATION		1.384
		TOTAL COST		$ 37,017

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W048 Soils from Spill Remediation
Option Number: SR-W048-6
Facility: Vendor/Onsite **Treatment Technology:** Chelation

Treatment Cycle Flow Diagram:



Pros

- Extractants are reused, resulting in the generation of little secondary waste.
- No additional treatment is required to meet LDR standards.
- Capable of handling wide variations in the composition of the design waste stream.
- Wasteform meets DOT shipping requirements in the form it exits the treatment process.
- Meets the expected WAC for waste disposal. Waste is disposable in the form in which it exits the process.
- Process will be designed to comply with applicable regulations without seeking a variance.

Cons

- Failed wasteform would require additional stabilization. The large volume of waste that might require remediation.
- New technology. Scale-up problems could cause uncertainties in the schedule.

Waste Stream Number & Name: SR-W048 Soils from Spill Remediation
Option Number: SR-W048-6
Facility: Vendor/Onsite **Treatment Technology: Chelation**

Cons (contd)

- Process without directly applicable operating history to demonstrate environmental acceptability will concern the public.
- Not a budgeted item and will require line item funding.
- Wastes will require disposal in HW/MW facilities.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	50	No volume reduction.
• secondary waste generation	80	Extractants are reused, resulting in the generation of little secondary waste.
• destruction removal and demobilization efficiency	80	No additional treatment is required to meet LDR standards.
• flexibility	80	Designed to decontaminate soil, but other wastes may possibly be decontaminated with the same process with few additional process steps (e.g., shredding). Capable of handling wide variations in the composition of the design waste stream.
• ability to be shipped	80	Wasteform meets shipping requirements in the form it exits the treatment process.
• final wasteform	80	Meets the expected WAC for waste disposal. Additional secondary waste treatment is required. Waste is disposable in the form in which it exits the process.
Engineering Parameters		
• system implementability	50	Demonstrated on pilot scale, but there are no operational facilities elsewhere.
• availability	50	Process combines a rotary kiln dryer with contaminant removal process. Availability expected to be about 50%.
• scalability	50	Throughput is set by design and not easily expanded except by adding more shifts of operation.
• remedial measures	30	Failed wasteform would require additional stabilization. Subtract 20 points from the median score of 50 because the large volume of waste that might require remediation.
• schedule for treatment of waste	20	New technology. Scale-up problems could cause uncertainties in the schedule.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Process can be installed in a containment building with adequate emission controls.
• non operational worker potential exposure	50	Expect process would require a number of non operational workers similar to a wastewater treatment plant.

Waste Stream Number & Name: SR-W048 Soils from Spill Remediation
Option Number: SR-W048-6
Facility: Vendor/Onsite **Treatment Technology: Chelation**
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• operational worker potential exposure	50	Expect process would require a number of operational workers similar to a wastewater treatment plant.
• transportation potential exposure	50	Some additional characterization needed.
Regulatory Parameters		
• need for variance	80	Process will be designed to comply with applicable regulations without seeking a variance.
• ability to obtain a permit	50	Must demonstrate that waste meets treatment standard. Lack of operating background from other facilities may engender concerns.
• waste disposal	20	Wastes will require disposal in HW/MW facilities.
Public Acceptance		
• public acceptance	20	Process without directly applicable operating history to demonstrate environmental acceptability will concern the public.
Cost Considerations		
• life-cycle cost	64	
• funding availability	20	Not a budgeted item and will require line item funding.
Industry Involvement		
• market for technology	20	This is a vendor process.
• private sector involvement	50	Vendor process evaluated.

IDOA Score: Technical 46 **Total** 55

Waste Stream Number & Name: SR-W048 Soils from Spill Remediation
Option Number: SR-W048-6
Facility: Vendor/Onsite **Treatment Technology: Chelation**
Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled

Module Location: SRS

Module Status: [ ] Existing [√] New [ ] Small generator [√] Large generator
[√] Onsite [ ] Offsite [√] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 153	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
	1.3.1	Conceptual Design	$ 613	
	1.3.2	Safety Assurance Documentation	$ 153	
	1.3.3	Permitting	$ 125	
	1.3.4	Preparation for Operations	$ 150	
	1.3.5	Project Management	$ 90	
		TOTAL PRE-OPERATIONS		$ 1,284
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 440	
	2.2	Inspection	$ 140	
	2.3	Project Management	$ 230	
	2.4	Building Construction (inc. indirect)	$ 2,000	
	2.5	Equipment (inc. indirect)	$ 0	
	2.6	Construction Management	$ 140	
	2.7	Contingency	$ 1,589	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 4,539
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 38	
	3.2	Annual Utilities	$ 2	
	3.3	Annual Materials	$ 23	
	3.4	Annual Maintenance	$ 14	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 75	
		X NUMBER OF YEARS OF OPERATION	1.00	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 75
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 2,800	
	4.2	Closure, Post-Closure, Monitoring	$ 5	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 2,805
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$ 1,500	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$ 1,500
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 100
		SUB COST FOR CHELATION MODULE		$ 10,303
		ESCALATION		1
		TOTAL COST		$ 12,673

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W048 Soils from Spill Remediation
Option Number: SR-W048-7
Facility: INEL/IWPF
Treatment Technology: Incineration/ Stabilization

Treatment Technology

Idaho National Engineering Laboratory (INEL) Idaho Waste Processing Facility (IWPF) incinerator is in the preliminary design phase. The type of kiln and offgas system have not yet been determined.

Pros

- Incineration will reduce the waste volume by more than 100 to 1.
- The facility will treat waste streams similar in composition to those assumed in the design basis without modification.
- Any ash waste generated, after stabilization, is anticipated to meet the SRS disposal WAC.
- Process failure is not anticipated to result in the creation of a waste that cannot be treated.

Cons

- The facility is in preliminary design phase, uncertain of facility design and secondary waste streams. An ash waste stream and some blowdown type wastes are anticipated.
- Uncertainties surrounding the design prevent an accurate estimation of availability.
- A schedule for waste treatment can be provided; however, acceptance of SRS waste will be contingent upon state-approved permit modifications. In addition, facility operation is contingent upon the receipt of DOE funding.
- Waste characterization will be required for any waste streams returned to SRS for disposal.
- The process will require RCRA Part B Permit application approval from the state. State approval for treatment of offsite waste may be difficult.
- The majority of the treated waste will be classified as mixed waste which will require disposal in a HW/MW facility.
- Currently stakeholder acceptance of incineration is perceived as low. Public approval of incineration is anticipated to drop will the additional treatment of offsite wastes.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	80	Incineration will reduce the waste volume by more than 100 to 1.
• secondary waste generation	20	The facility is in preliminary design phase, uncertain of facility design and secondary waste streams. An ash waste stream and some blowdown type wastes are anticipated.
• destruction removal and demobilization efficiency	50	Additional LDR treatment will be required for waste streams contaminated with nonorganic contaminated (heavy metals) materials.
• flexibility	80	The facility will treat waste streams similar in composition to those assumed in the design basis without modification.
• ability to be shipped	50	The ash waste, when generated, must be stabilized in a grout matrix prior to shipment.
• final wasteform	80	Any ash waste generated, after stabilization, is anticipated to meet the SRS waste disposal WAC.
Engineering Parameters		
• system implementability	20	The process is currently in the preliminary design phase, final incinerator type has been selected.

Waste Stream Number & Name: SR-W048 Soils from Spill Remediation
Option Number: SR-W048-7
Facility: INEL/IWPF
Treatment Technology: Incineration/ Stabilization

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• availability	20	Uncertainties surrounding the design prevent an accurate estimation of availability.
• scalability	50	The facility is currently in the preliminary design phase. Any modification required for unique waste streams could be incorporated in to the facility design.
• remedial measures	80	Process failure is not anticipated to result in the creation of a waste that cannot be treated.
• schedule for treatment of waste	20	A schedule for waste treatment cannot be provided. Additionally, acceptance of SRS waste will be contingent upon state-approved permit modifications. In addition facility operation is contingent upon the receipt of DOE funding.
Personnel Parameters		
• consequence of unmitigated accident scenarios	50	Emissions from the planned facility could result during potential accident scenarios.
• non operational worker potential exposure	50	The facility is in the early design phase, so construction of the facility will be required.
• operational worker potential exposure	50	Personnel exposure is anticipated to be average for operations of this type.
• transportation potential exposure	20	Waste characterization will be required for any waste streams returned to SRS for waste disposal.
Regulatory Parameters		
• need for variance	20	The process will require RCRA Part B Permit Application approval from the State of Idaho. State approval for treatment of offsite waste may be difficult.
• ability to obtain a permit	50	Permitting process is well-defined, however, the State of Idaho acceptance of offsite waste treatment is unknown. Approval may be difficult.
• waste disposal	20	The majority of the treated waste will be classified as mixed waste which with require disposal in a HW/MW facility.
Public Acceptance		
• public acceptance	20	Currently stakeholder acceptance of incineration is perceived as low. Public approval of incineration is anticipated to drop will the additional treatment of offsite wastes.
Cost Considerations		
• life-cycle cost	99	
• funding availability	50	Funding for treatment cost can be provide using the operating budget, however the additional costs may result in an increase in the budget in excess of 10%. (Line item funding is being pursued by the facility contractor.)
Industry Involvement		
• market for technology	20	This is an existing commercial technology.
• private sector involvement	20	Facility is GOCO.

IDOA Score: **Technical** 35 **Total** 49

Waste Stream Number & Name: SR-W048 Soils from Spill Remediation

Option Number: SR-W048-7
Facility: INEL/IWPF
Treatment Technology: Incineration/ Stabilization

Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled

Module Location: INEL

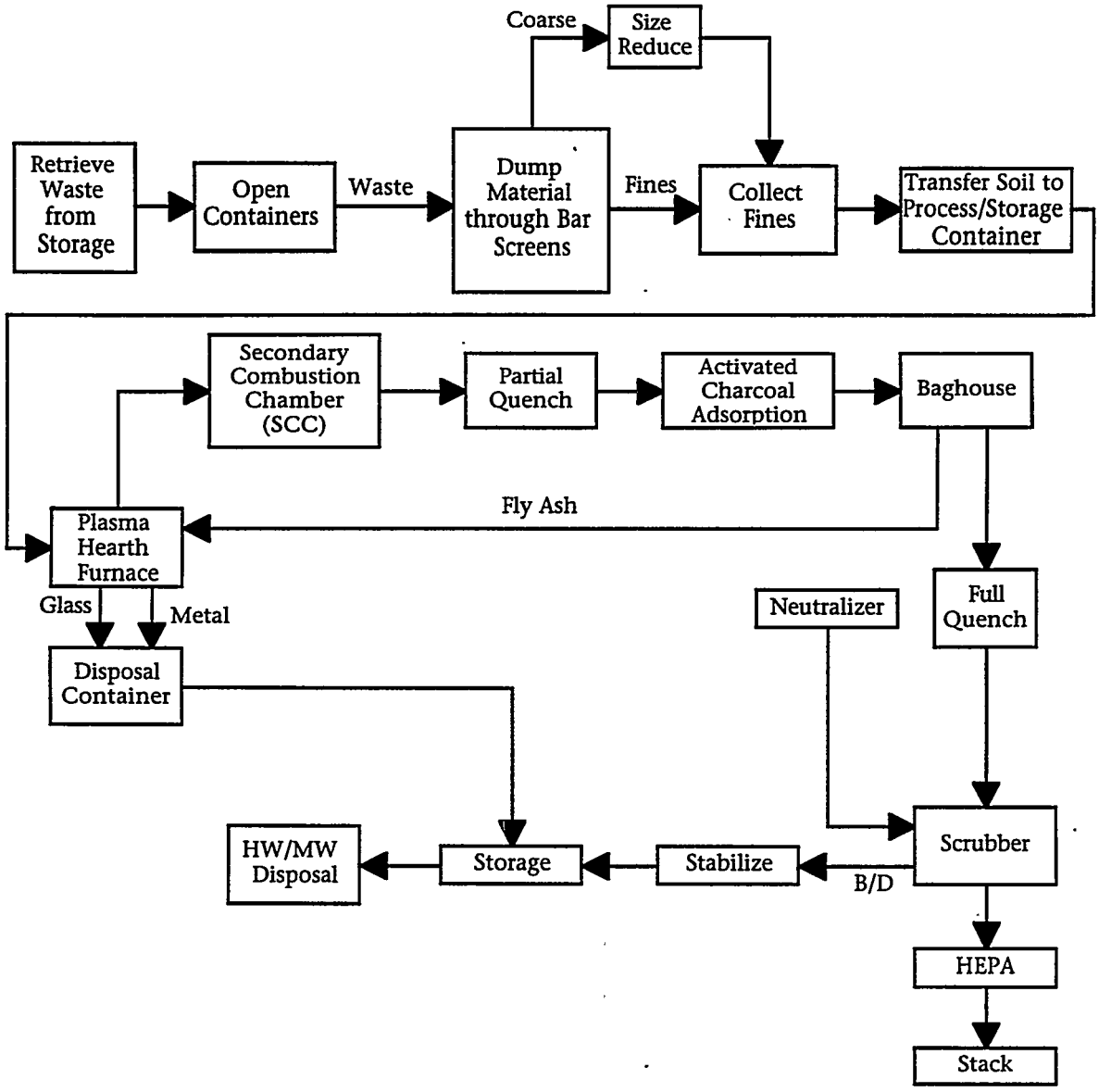
Module Status: [ ] Existing [√] New [ ] Small generator [√] Large generator
[ ] Onsite [√] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ N/A	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ N/A	
		1.3.2 Safety Assurance Documentation	$ N/A	
		1.3.3 Permitting	$ N/A	
		1.3.4 Preparation for Operations	$ N/A	
		1.3.5 Project Management	$ N/A	
		TOTAL PRE-OPERATIONS		$ N/A
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ N/A	
	2.2	Inspection	$ N/A	
	2.3	Project Management	$ N/A	
	2.4	Building Construction (inc. indirect)	$ N/A	
	2.5	Equipment (inc. indirect)	$ N/A	
	2.6	Construction Management	$ N/A	
	2.7	Contingency	$ N/A	
		TOTAL FACILITY CONSTRUCTION COSTS		$ N/A
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ N/A	
	3.2	Annual Utilities	$ N/A	
	3.3	Annual Materials	$ N/A	
	3.4	Annual Maintenance	$ N/A	
	3.5	Annual Contingency	$ N/A	
		TOTAL ANNUAL O & M	$ N/A	
		X NUMBER OF YEARS OF OPERATION		
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ N/A
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ N/A	
	4.2	Closure, Post-Closure, Monitoring	$ N/A	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ N/A
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$ N/A	
	5.2	Mobile Treatment	$ N/A	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$ 210
7.0	Transportation			$ 26
8.0	Disposal			$ 100
		SUB COST FOR INCINERATOR MODULE		$ 336
		ESCALATION		1.06
		TOTAL COST		$ 356

Note: Per DOE directions, this cost estimate is the incremental cost for treatment at an offsite DOE facility; therefore, it carries no overhead burden or capital costs.

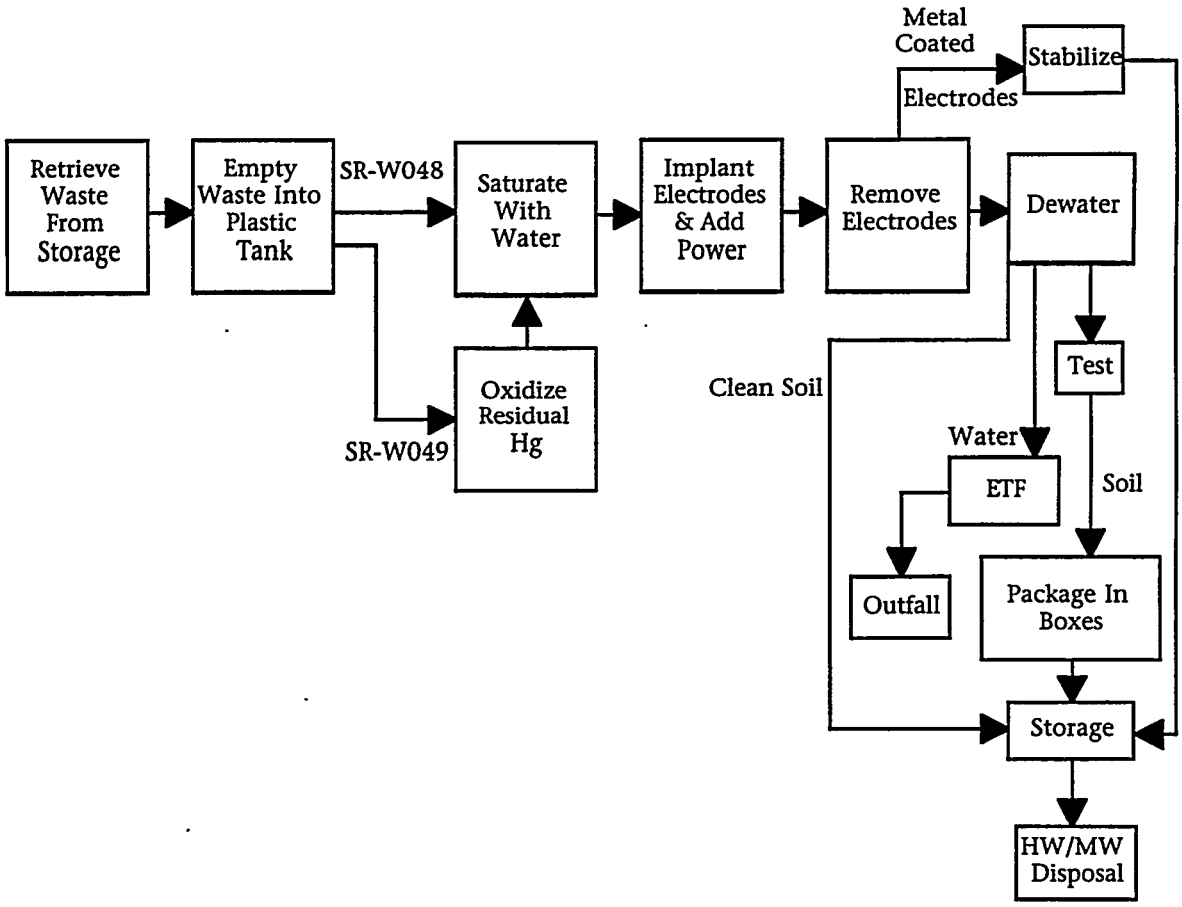
If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W048 Soils from Spill Remediation
Option Number: SR-W048-8
Facility: Vendor
Treatment Technology: Plasma Hearth



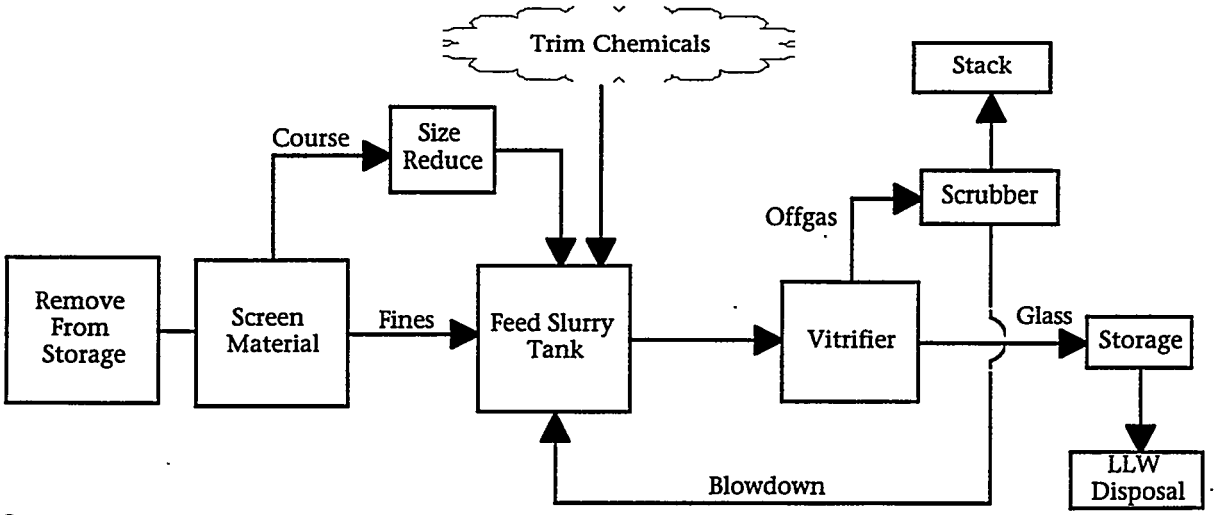
Option rejected during technical success factor evaluation. No further analysis performed.

Waste Stream Number & Name: SR-W048 Soils from Spill Remediation
Option Number: SR-W048-9
Facility: Containment Building **Treatment Technology:** Metal Migration



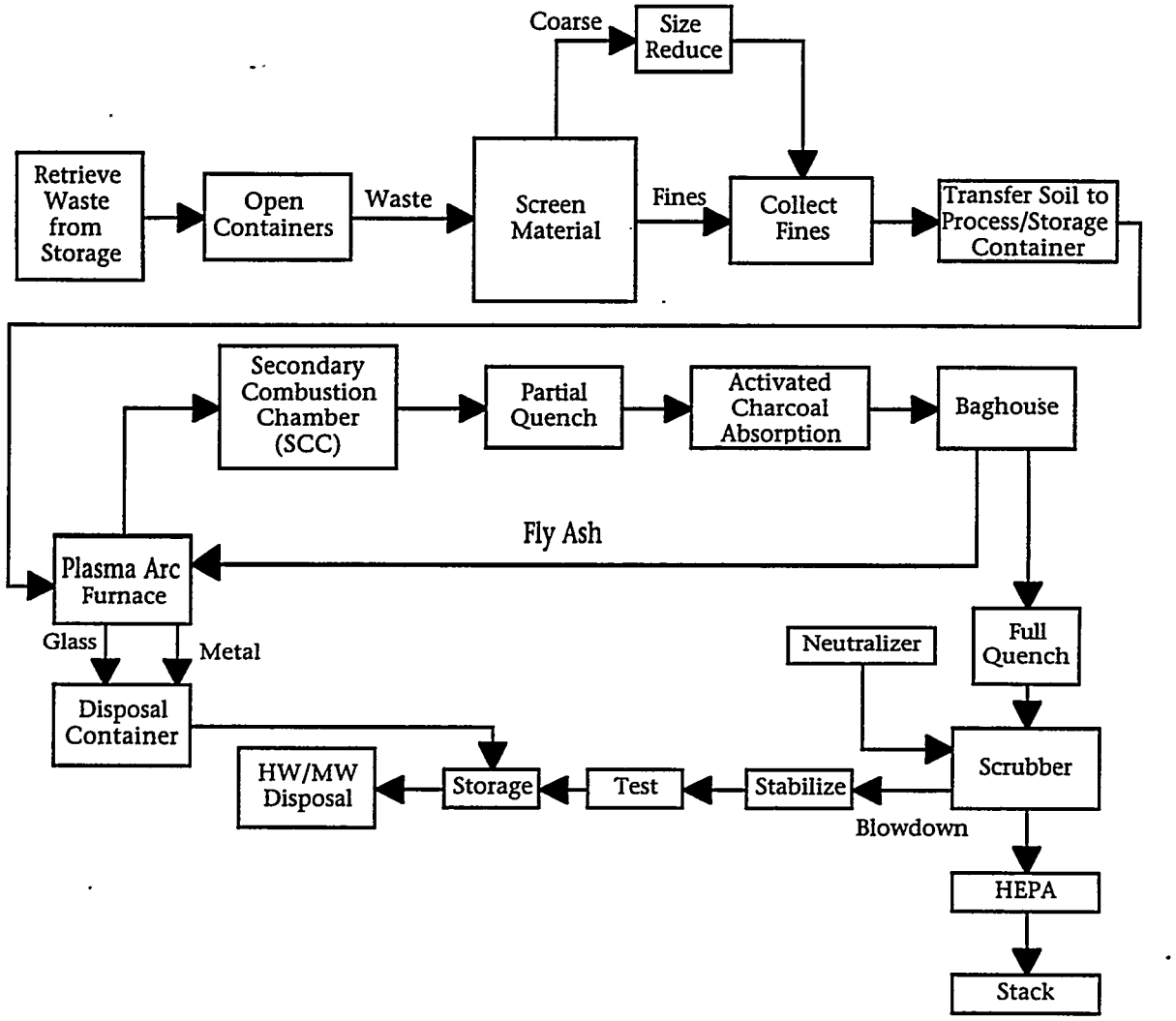
Option rejected during technical success factor evaluation. No further analysis performed.

Waste Stream Number & Name: SR-W048 Soils from Spill Remediation
Option Number: SR-W048-10
Facility: Vendor
Treatment Technology: Vitrification



Option rejected during technical success factor evaluation. No further analysis performed.

Waste Stream Number & Name: SR-W048 Soils from Spill Remediation
Option Number: SR-W048-11
Facility: Vendor
Treatment Technology: Plasma Arc



Option rejected during technical success factor evaluation. No further analysis performed.

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Summary Page – Initial Screening

Waste Stream Number & Name: SR-W049 Tank E-3-1 Clean Out Material

Background Information

The waste stream consists of mercury contaminated rocks, dirt, sand, concrete, and glass cleaned out of the bottom of Tank E-3-1, a sump receipt tank in H Area. Volume reduced to 1.2 m^3 from 1.4 m^3 when one 55-gallon drum of rinse material from this clean up was moved into waste stream SR-W041, due to waste matrix similarity.

Volume
- Current volume through 09/30/94 is 1.2 m^3.
- No future waste generation is expected as this was a one-time generation.

Waste Stream Composition
- Inorganic sludges

Waste Code
- D009A (TCLP Hg) nonwastewater

LDR Treatment Standard
- D009A = concentration based standard = 0.2 mg/l

Waste Characterization
- Sampling and analysis used to characterize the waste stream.
- Confidence level is high based upon analytical results.
- TCLP indicates typical mercury concentration is 14 mg/l.

Radiological Characterization
- Activity level is <80 d/m/ml.
- Beta/gamma emitters are present.
- Waste is contact handled.
- Mixed low-level waste

Initial Screening

The initial screening identified inappropriate treatment options. These options appear in the Initial Rejections table.

Initial Rejections

Treatment Facility	Treatment Technology	Reasons for Rejection
CIF	Incineration	CIF is not designed to burn rocks.
ETF	Ion Exchange	ETF has no process to treat this waste.
Lab.	Lab scale process flowsheet	Volume of waste too great to handle with laboratory-scale equipment.
M Area	Vitrification	Vitrifier has no provision to control volatized Hg.
Z Area	Stabilization	Z Area can treat only those wastes that come by pipeline from Tank 50 and meet strict waste acceptance criteria. The Z-Area process lacks flexibility to treat and dispose of a variety of waste streams.

Summary Page – Technology Success Factor (TSF) & In-Depth Options Analysis (IDOA)

Waste Stream Number & Name: SR-W049 Tank E-3-1 Clean Out Material

Feasible Options

Option No.	Treatment Facility	Treatment Technology	TSF Score	IDOA Scores Tech.	IDOA Scores Total	COST (x 1,000)	PO
SR-W049-1	INEL/WEDF	Stabilization	*	55	69	96	√
SR-W049-2	CIF	Ashcrete Stabilization	75	54	65	6,830	
SR-W049-3	HW/MW-TB	Soil Washing	51	47	61	SR-W048-5	
SR-W049-4	Cont. Bldg.	Metal Migration	26				

* No TSF required for proposed or existing non-Savannah River Site-DOE waste processing facilities.

Options Rejected Due To Low Technology Success Factor (TSF)

Metal Migration in Containment Building

Metal migration in containment building was rejected because:
- This process has shown promise for in situ remediation of soil. The process for decontaminating excavated soils is laboratory scale, hence Pm=0.9.
- Control of this process to ensure appropriate levels of decontamination will be difficult and complex, hence, Pc=0.5.

Engineering Assessment

Preferred Option Justification

The preferred treatment option for the Tank E-3-1 Clean Out Material is Stabilization with grout at an offsite DOE facility; the Idaho National Engineering Laboratory/Waste Engineering Development Facility (INEL/WEDF) Stabilization Unit.

This option treats the constituent of concern, mercury, by stabilizing it with grout.

This option is preferred because:
- Final wasteform should meet LDR standards.
- Throughput is fixed by design. Facility is currently being designed.
- It is cost-effective.

Options Rejected During IDOA

Stabilization in CIF Ashcrete

Stabilization in CIF ashcrete was process rejected because:
- The unit would require special handling and a deviation from normal operations, to process waste by only stabilization, rather than incineration followed by stabilization.
- Cost is significantly higher than the INEL option.

Soil Washing in HW/MW-TB

Soil washing in HW/MW-TB was rejected because:
- Final waste still required handling as mixed waste.
- Volume of waste increased due to need to treat secondary waste water.

Waste Stream Number & Name: SR-W049 Tank E-3-1 Clean Out Material
Option Number: SR-W049-1
Facility: INEL/WEDF **Treatment Technology: Stabilization**

Treatment Technology

The Idaho National Engineering Laboratory (INEL) Waste Engineering Development Facility (WEDF) stabilization process provides treatments for aqueous and organic liquids and debris. The process will stabilize waste in a grout matrix to reduce leachability.

Pros

- No secondary waste streams are expected to be generated.
- Waste stream is expected to meet all applicable LDR standards through this treatment.
- The facility should be able to treat waste streams similar in composition to those assumed in the design basis without modification.
- The stabilized waste could be shipped without additional treatment.
- Final wasteform is anticipated to meet the SRS waste disposal WAC.
- Stabilization has been demonstrated.
- The facility is anticipated to have minimal down time.
- Process failure is not anticipated to create a waste stream that cannot be treated.
- Few emissions for the facility are anticipated during normal operation and most accident scenarios.
- The facility could potentially be used to treat numerous waste streams throughout the DOE Complex.

Cons

- Stabilization will increase the overall waste volume by a factor of 2 or more after processing.
- Throughput fixed by design. Facility is currently being designed.
- Waste characterization will be required for any waste streams returned to SRS for disposal.
- The majority of the treated waste will be classified as mixed waste which will require disposal in a HW/MW facility.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	10	Subtract 10 points from the median score of 20 because stabilization will increase the overall waste volume by a factor of 2 or more after processing.
• secondary waste generation	100	Add 20 points to median score of 80 because no secondary waste streams are generated.
• destruction removal and demobilization efficiency	80	Final wasteform expected to meet LDR standards.
• flexibility	80	The facility should be able to treat waste streams similar in composition to those assumed in the design basis without modification.
• ability to be shipped	80	The stabilized waste could be shipped without additional treatment.
• final wasteform	80	Final wasteform is anticipated to meet the SRS waste disposal WAC.
Engineering Parameters		
• system implementability	80	Stabilization has been demonstrated .
• availability	80	The facility is anticipated to have minimal down time.
• scalability	20	Throughput fixed by design. Facility is currently being designed.

Waste Stream Number & Name: SR-W049 Tank E-3-1 Clean Out Material
Option Number: SR-W049-1
Facility: INEL/WEDF **Treatment Technology: Stabilization**
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• remedial measures	80	Process failure is not anticipated to create a waste stream that cannot be treated.
• schedule for treatment of waste	50	A schedule for waste treatment cannot be provided. Additionally, acceptance of SRS waste will be contingent upon state-approved permit modifications.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Few emissions for the facility are anticipated during normal operation and most accident scenarios.
• non operational worker potential exposure	50	Processing this material will not increase the exposure to non operational personnel.
• operational worker potential exposure	50	Personnel exposure is average for operations of this type. Processing this material will not increase the exposure to operational personnel.
• transportation potential exposure	20	Waste characterization will be required for any waste streams returned to SRS for disposal.
Regulatory Parameters		
• need for variance	80	Process will be in full compliance without needing a variance.
• ability to obtain a permit	50	Permitting process is well-defined, however, the State of Idaho acceptance of offsite waste treatment is unknown. Approval may be difficult.
• waste disposal	80	The majority of the treated waste will require disposal in a LLW facility.
Public Acceptance		
• public acceptance	50	Public acceptance for stabilization is positive; however, the treatment of offsite waste is anticipated to reduce the overall public acceptance of this process.
Cost Considerations		
• life-cycle cost	99	
• funding availability	50	Not a budgeted item, though line item funding may be required.
Industry Involvement		
• market for technology	80	The facility could potentially be used to treat numerous waste streams throughout the DOE Complex.
• private sector involvement	20	Technology is available at an existing facility.

IDOA Score: **Technical** 55 **Total** 69

Waste Stream Number & Name: SR-W049 Tank E-3-1 Clean Out Material
Option Number: SR-W049-1
Facility: INEL/WEDF **Treatment Technology: Stabilization**
Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[ ] alpha [√] non-alpha [√] contact handled [ ] remote handled

Module Location: INEL

Module Status: [√] Existing [ ] New [ ] Small generator [√] Large generator
[ ] Onsite [√] Offsite [ ] Commercial [ ] Portable [ ] R&D

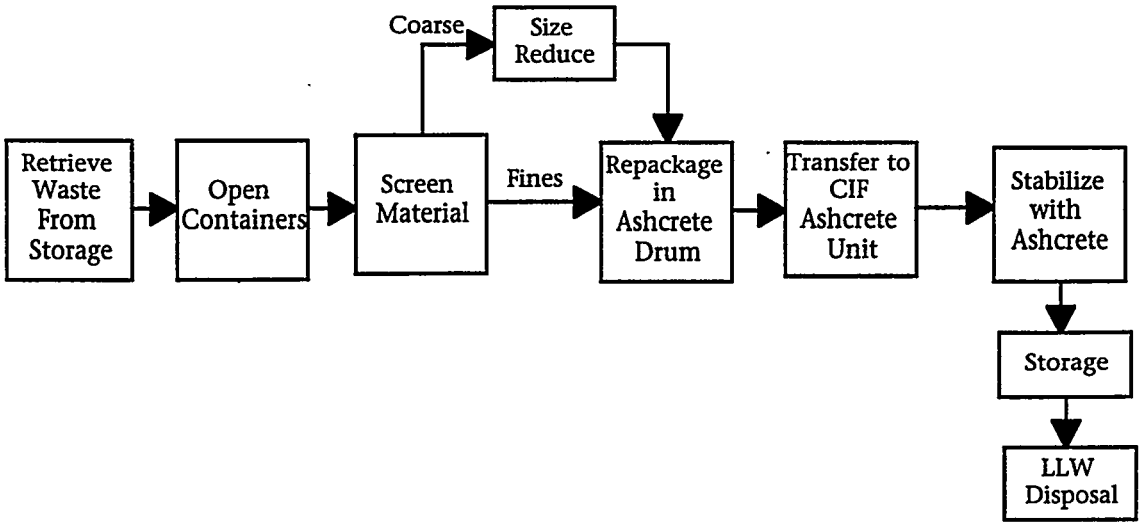
WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ N/A	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ N/A	
		1.3.2 Safety Assurance Documentation	$ N/A	
		1.3.3 Permitting	$ N/A	
		1.3.4 Preparation for Operations	$ N/A	
		1.3.5 Project Management	$ N/A	
		TOTAL PRE-OPERATIONS		$ N/A
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ N/A	
	2.2	Inspection	$ N/A	
	2.3	Project Management	$ N/A	
	2.4	Building Construction (inc. indirect)	$ N/A	
	2.5	Equipment (inc. indirect)	$ N/A	
	2.6	Construction Management	$ N/A	
	2.7	Contingency	$ N/A	
		TOTAL FACILITY CONSTRUCTION COSTS		$ N/A
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ N/A	
	3.2	Annual Utilities	$ N/A	
	3.3	Annual Materials	$ N/A	
	3.4	Annual Maintenance	$ N/A	
	3.5	Annual Contingency	$ N/A	
		TOTAL ANNUAL O & M	$ N/A	
		X NUMBER OF YEARS OF OPERATION		
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ N/A
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ N/A	
	4.2	Closure, Post-Closure, Monitoring	$ N/A	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ N/A
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$ N/A	
	5.2	Mobile Treatment	$ N/A	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$ 23
7.0	Transportation			$ 18
8.0	Disposal			$ 50
		SUB COST FOR STABILIZATION MODULE		$ 91
		ESCALATION		1.06
		TOTAL COST		$ 96

Note: Per DOE directions, this cost estimate is the incremental cost for treatment at an offsite DOE; facility; therefore, it carries no overhead burden or capital costs.

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W049 Tank E-3-1 Clean Out Material
Option Number: SR-W049-2
Facility: CIF
Treatment Technology: Ashcrete Stabilization

Treatment Cycle Flow Diagram:



Pros

- No secondary waste is produced by the ashcrete process.
- Waste stream is expected to meet all applicable LDR standards through this treatment.
- Wasteform meets DOT shipping requirements without additional treatment.
- Meets the expected waste disposal WAC. Wasteform suitable for disposal in the form it exits the process.
- Ashcrete is a current demonstrated and proven technology.
- Failed wasteform can be reprocessed with existing technology.
- Scheduling this small volume of waste will present few, if any, difficulties.
- The metals in this waste stream will be captured in the ashcrete. Very little emissions results in little or no emissions even during an accident.
- No additional maintenance work or non operational workers expected.
- Well-accepted final wasteform. No variance required.
- Line item is funded.

Cons

- Expected to increase volume by factor of three.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	10	Subtract 10 points from the median score of 20 because expected to increase volume by factor of three.
• secondary waste generation	100	Add 20 points to the median score of 80 because no secondary waste produced by the ashcrete process.
• destruction removal and demobilization efficiency	80	Waste stream is expected to meet all applicable LDR standards through this treatment.
• flexibility	50	Waste handling of waste streams directly in ashcrete process is an off-normal process, which lowers efficiency.

Waste Stream Number & Name: SR-W049 Tank E-3-1 Clean Out Material
Option Number: SR-W049-2
Facility: CIF
Treatment Technology: Ashcrete Stabilization

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• ability to be shipped	80	Wasteform meets DOT shipping requirements without additional treatment.
• final wasteform	80	Meets the expected waste disposal WAC. Wasteform suitable for disposal in the form it exits the process.
Engineering Parameters		
• system implementability	80	Ashcrete is a current demonstrated and proven technology.
• availability	50	Normal maintenance requirements apply. During incinerator operation, availability of ashcrete unit for treatment of other waste is very limited.
• scalability	50	Limited excess capacity exists because it is set by design.
• remedial measures	80	Failed wasteform can be reprocessed with existing technology.
• schedule for treatment of waste	80	Scheduling this small volume of waste will present few, if any, difficulties.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	The metals in this waste stream will be captured in the ashcrete. Very little emissions or no emissions even during an accident.
• non operational worker potential exposure	80	No additional maintenance work or non operational workers expected.
• operational worker potential exposure	50	Increased operator handling due to this waste stream so the potential for exposure is increased.
• transportation potential exposure	50	Does not require additional characterization to support transportation and limited number of waste transports required.
Regulatory Parameters		
• need for variance	80	Well-accepted final wasteform. No variance required.
• ability to obtain a permit	50	Modification required to facility's existing permit, but must demonstrate that wasteform meets LDR treatment standards.
• waste disposal	80	100% of the final wasteform will go to LLW Disposal. Waste not in contact with other CIF waste streams.
Public Acceptance		
• public acceptance	20	Mature and proven technology, however wasteform is not as permanent as other forms of stabilization (i.e., vitrification).
Cost Considerations		
• life-cycle cost	80	
• funding availability	80	Line item is funded.
Industry Involvement		
• market for technology	20	This is an existing technology.
• private sector involvement	20	Technology is available at an existing DOE facility.

IDOA Score: **Technical** 54 **Total** 65

Waste Stream Number & Name: SR-W049 Tank E-3-1 Clean Out Material
Option Number: SR-W049-2
Facility: CIF
Treatment Technology: Ashcrete Stabilization

Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[ ] alpha [√] non-alpha [√] contact handled [ ] remote handled

Module Location: SRS

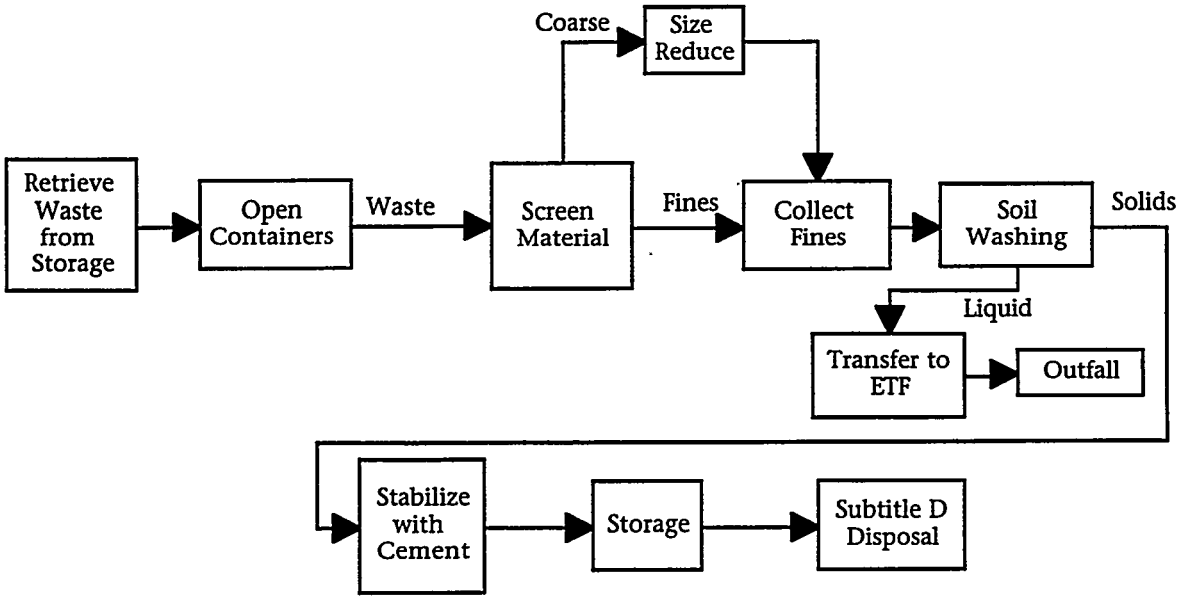
Module Status: [√] Existing [ ] New [ ] Small generator [√] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 61	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 242	
		1.3.2 Safety Assurance Documentation	$ 61	
		1.3.3 Permitting	$ 1,500	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 45	
		TOTAL PRE-OPERATIONS		$ 2,058
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 264	
	2.2	Inspection	$ 78	
	2.3	Project Management	$ 123	
	2.4	Building Construction (inc. indirect)	$ 1,000	
	2.5	Equipment (inc. indirect)	$ 200	
	2.6	Construction Management	$ 84	
	2.7	Contingency	$ 628	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 2,377
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 210	
	3.2	Annual Utilities	$ 8	
	3.3	Annual Materials	$ 126	
	3.4	Annual Maintenance	$ 76	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 420	
		X NUMBER OF YEARS OF OPERATION	0.25	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 105
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 960	
	4.2	Closure, Post-Closure, Monitoring	$ 3	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 963
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 50
		SUB COST FOR ASHCRETE STABILIZATION MODULE		$ 5,553
		ESCALATION		1.23
		TOTAL COST		$ 6,830

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W049 Tank E-3-1 Clean Out Material
Option Number: SR-W049-3
Facility: HW/MW-TB **Treatment Technology:** Soil Washing

Treatment Cycle Flow Diagram:



Pros

- No additional treatment is required to meet LDR standards.
- Capable of handling wide variations in the composition of the design waste stream.
- Meets the expected WAC for waste disposal. Waste is disposable in the form in which it exits the process.
- Most elements have been demonstrated.
- Process will be designed to comply with applicable regulations without seeking a variance.

Cons

- Although the soil is clean, after treatment removed constituents of concern must be stabilized by some other technology.
- Not a budgeted item and will require line funding.
- Wastes may require disposal in HW/MW facilities.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	50	No reduction in volume.
• secondary waste generation	50	Wash water is a secondary waste that must be treated and stabilized with routine technology. Volume of stabilized secondary waste may equal volume of original waste.
• destruction removal and demobilization efficiency	80	No additional treatment is required to meet LDR standards.

Waste Stream Number & Name: SR-W049 Tank E-3-1 Clean Out Material
Option Number: SR-W049-3
Facility: HW/MW-TB **Treatment Technology: Soil Washing**
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• flexibility	80	Designed to decontaminate soil, but other wastes may possibly be decontaminated with the same process with few additional process steps (e.g., shredding). Capable of handling wide variations in the composition of the design waste stream.
• ability to be shipped	50	Treatment residuals require further treatment to meet DOT shipping requirements.
• final wasteform	80	Meets the expected WAC for waste disposal. Additional secondary waste treatment is required. Waste is disposable in the form in which it exits the process.
Engineering Parameters		
• system implementability	70	Most elements have been demonstrated, but not as an integrated system. Subtract 10 points from the median score of 80 because no plant-scale facilities exist in the U. S.
• availability	40	Subtract 10 points from the median score of 50 because based on projections from European facilities, availability will be around 50%. Availability will be affected by wear on moving parts caused by handling an abrasive slurry, and time required to maintain process equipment contaminated by radionuclides.
• scalability	50	Throughput is set by design, and not easily expanded except by adding more shifts of operation.
• remedial measures	50	If washed soil fails to meet release specifications, it can be recycled or stabilized by other routine technology.
• schedule for treatment of waste	40	Subtract 10 points from the median score of 50 because process has not been unequivocally demonstrated to treat the waste, uncertainties remain about the accuracy of a schedule.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Process can be installed in a containment building with adequate emission controls.
• non operational worker potential exposure	50	Facility is expected to require the same number of non operational workers as comparably sized cement mix plants, in which material handling (not cement mixing) is somewhat analogous to this treatment process.
• operational worker potential exposure	40	Subtract 10 points from the median score of 50 because the facility is expected to require more operational workers per shift than wastewater treatment facilities owing to an expected number of manual laborers needed to handle the waste, which is in boxes.
• transportation potential exposure	50	Some additional characterization needed. Waste can be handled readily.
Regulatory Parameters		
• need for variance	80	Process will be designed to comply with applicable regulations without seeking a variance.

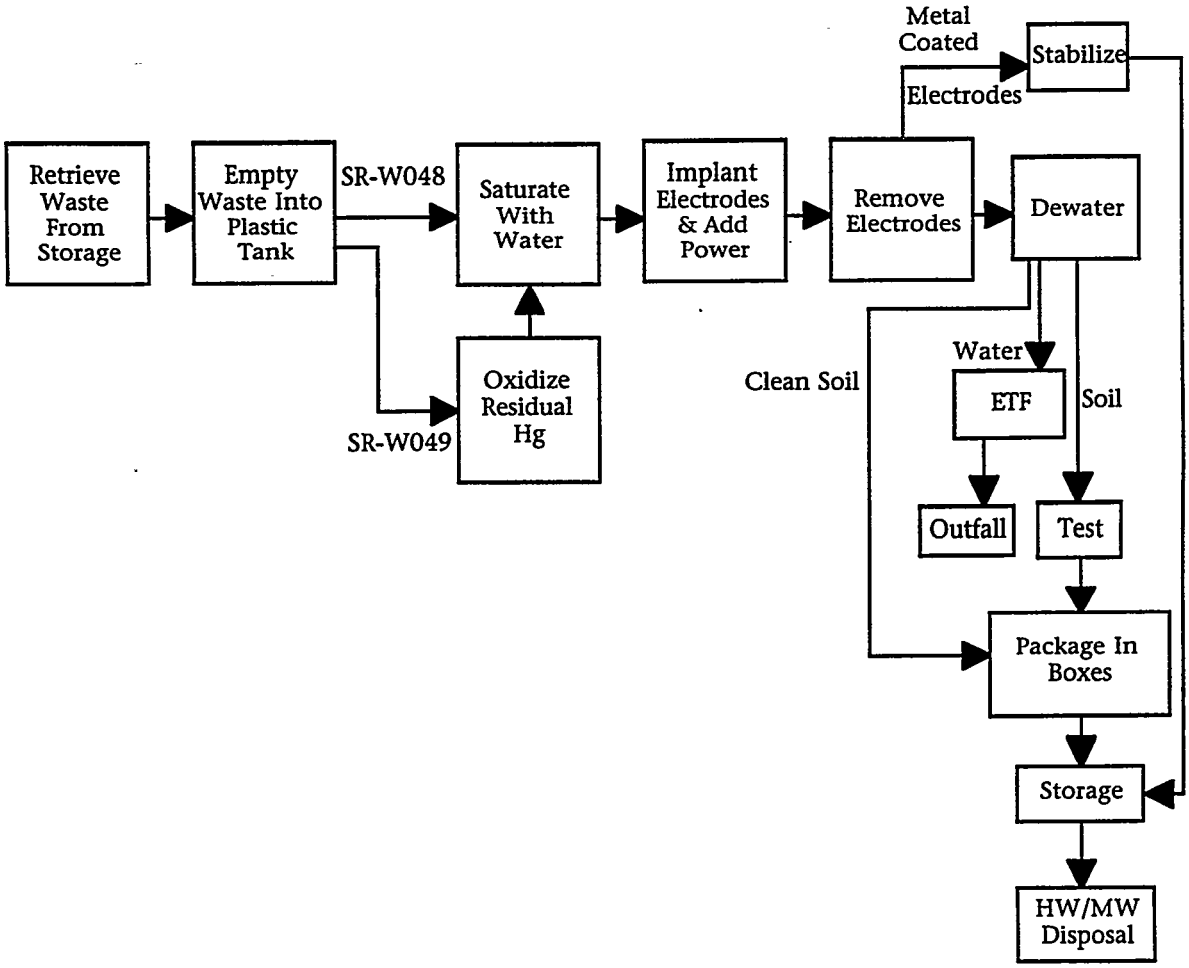
Waste Stream Number & Name: SR-W049 Tank E-3-1 Clean Out Material
Option Number: SR-W049-3
Facility: HW/MW-TB **Treatment Technology:** Soil Washing
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Public Acceptance		
• ability to obtain a permit	60	Must demonstrate that waste meets treatment standard. New process in the U. S., unfamiliar to regulators. Add 10 points to the median score of 50 because operating background from European facilities will should help allay concerns.
• waste disposal	20	Wastes will require HW/MW disposal.
• public acceptance	20	Although the soil is clean, after treatment constituents of concern removed must be stabilized by some other technology.
Cost Considerations		
• life-cycle cost	100	
• funding availability	20	Not a budgeted item and will require line funding.
Industry Involvement		
• market for technology	20	Similar vendor processes exist.
• private sector involvement	20	SRS facility evaluated.

IDOA Score: **Technical** 47 **Total** 61

Cost Estimate: INCLUDED WITH COST OF OPTION SR-W048-5

Waste Stream Number & Name: SR-W049 Tank E-3-1 Clean Out Material
Option Number: SR-W049-4
Facility: Containment Building
Treatment Technology: Metal Migration



Option rejected during technical success factor evaluation. No further analysis performed.

Summary Page

Waste Stream Number & Name: SR-W050 Mixed Waste to Support High-Level Waste (HLW) Processing Demonstrations

Background Information

This waste is generated by laboratory research, development and analytical programs at the SRTC to support the DWPF operations. Waste comes from demonstrations of the DWPF and ITP process samples to support DWPF operations.

Volume
- Current volume through 09/30/94 is 0.1 m^3.
- Expected 1995-1999 volume will be 0.4 m^3.

Waste Stream Composition
- Organic sludge/particulate

Waste Code
- D007B (high-level waste Cr)
- D009F (high-level waste Hg)
- D018 (benzene) nonwastewater

LDR Treatment Standard
- D007B, D009F = specified technology = Vitrification of high-level mixed radioactive wastes
- D018 = concentration based standard = 10 mg/kg

Waste Characterization
- Sampling and analysis used to characterize the waste stream.
- Confidence level is high because analysis was performed on simulants to indicate waste characterization.

Radiological Characterization
- Total activity is <1000 uCi/g.
- Beta/gamma emitters (Cs^{137} and Sr^{90}) are present.
- Waste is remote handled.
- High-level waste.

Preferred Option

The preferred treatment option for the Mixed Waste to Support High-Level Waste (HLW) Processing Demonstrations is treatment in the SRTC 90-day Containment Building by Vitrification in the SRTC small-scale vitrification unit.

Treatment Justification

In-depth options analysis (IDOA) is not required for this waste stream since a Preferred Option has been identified utilizing an existing facility with existing treatment technology.

Treatment of these samples in the Savannah River Technology Center (SRTC) containment building laboratory meets the requirements for treatment in a 90 day containment building found in Part 262.34 and Subpart DD in Parts 264 or 265 of the RCRA regulations.

Waste Stream Number & Name: SR-W050 Mixed Waste to Support High-Level Waste (HLW) Processing Demonstrations

Facility: Savannah River Technology Ctr Treatment Technology: Chem. Oxidation

Cost Estimate Sheet

Waste Type: ☐ MLLW ☑ HLW ☐ M-TRU
☐ alpha ☑ non-alpha ☐ contact handled ☑ remote handled

Module Location: SRS

Module Status: ☑ Existing ☐ New ☑ Small generator ☐ Large generator
☑ Onsite ☐ Offsite ☐ Commercial ☐ Portable ☐ R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ N/A	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ N/A	
		1.3.2 Safety Assurance Documentation	$ N/A	
		1.3.3 Permitting	$ N/A	
		1.3.4 Preparation for Operations	$ N/A	
		1.3.5 Project Management	$ N/A	
		TOTAL PRE-OPERATIONS		$ 0
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ N/A	
	2.2	Inspection	$ N/A	
	2.3	Project Management	$ N/A	
	2.4	Building Construction (inc. indirect)	$ N/A	
	2.5	Equipment (inc. indirect)	$ N/A	
	2.6	Construction Management	$ N/A	
	2.7	Contingency	$ N/A	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 0
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 23.04	
	3.2	Annual Utilities	$ N/A	
	3.3	Annual Materials	$ .24	
	3.4	Annual Maintenance	$ N/A	
	3.5	Annual Contingency	$ N/A	
		TOTAL ANNUAL O & M	$ 23.28	
		X NUMBER OF YEARS OF OPERATION	3.0	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 70
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ N/A	
	4.2	Closure, Post-Closure, Monitoring	$ N/A	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 0
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$ N/A	
	5.2	Mobile Treatment	$ N/A	
		TOTAL CONTRACTED SERVICES		$ 0
6.0	Offsite Treatment (DOE)			$ 0
7.0	Transportation			$ 0
8.0	Disposal			$ 0
		SUB COST FOR CHEMICAL OXIDATION TREATMENT		$ 70
		ESCALATION		$ 1.06
		TOTAL COST		$ 74

If above numbers do not appear to add correctly, it is the result of computer rounding.

Summary Page – Initial Screening

Waste Stream Number & Name: SR-W051 **Spent Filter Cartridges and Carbon Filter Media**

Background Information

The waste stream consists of incinerable filters and filter media. One, in particular, is a waste that consists of a fibrous media filter in a plastic frame used in Naval Fuels to remove particulates in the process flow stream. Mercury salt and particles of depleted uranium are the expected impurities.

Volume
- Current volume through 09/30/94 is 0.8 m^3.
- Expected 1995-1999 volume generation is 3.0 m^3.

Waste Stream Composition
- Heterogeneous debris

Waste Code
- D009A (low TCLP mercury)

LDR Treatment Standard
- D009 = concentration based standard = 0.2 mg/l
- Alternative debris technology may be applied

Waste Characterization
- Process knowledge used to characterize the waste stream.
- Confidence level is high based upon knowledge that mercury is present. No direct analytical data is available; concentration of mercury is unknown.

Radiological Characterization
- Total activity is 6.6×10^{-4} Ci/kg.
- Alpha emitters (U^{235} and U^{238}) are present.
- Waste is contact handled.
- Mixed low-level waste

Initial Screening

The initial screening identified inappropriate treatment options. These options appear in the Initial Rejections table.

Initial Rejections

Treatment Facility	Treatment Technology	Reasons for Rejection
ETF	Ion Exchange	ETF has no process to treat this waste.
Tritium	Macroencapsulation	Tritium has no facilities to treat solvents.
Z Area	Stabilization	Z Area can treat only those wastes that come by pipeline from Tank 50 and meet strict waste acceptance criteria. The Z-Area process lacks flexibility to treat and dispose of a variety of waste streams.
M Area	Vitrification	The presence of mercury in this waste eliminates vendor vitrification as an option because the facility has no means to control mercury vapors.

Summary Page – Technology Success Factor (TSF) & In-Depth Options Analysis (IDOA)

Waste Stream Number & Name: **SR-W051** **Spent Filter Cartridges and Carbon Filter Media**

Feasible Options

Option No.	Treatment Facility	Treatment Technology	TSF	IDOA Scores		COST	PO
			Score	Tech.	Total	(x 1,000)	
SR-W051-1	CIF	Incineration/ Stabilization	94	59	73	346	√
SR-W051-2	Vendor/Onsite	Polymer Encapsulation	100	57	71	SR-W011-4	
SR-W051-3	HW/MW-TB	Macro-encapsulation	100	58	72	SR-W018-4	
SR-W051-4	Cont. Bldg.	Macro-encapsulation	94	58	72	SR-W018-3	
SR-W051-5	INEL/WERF	Incineration/ Stabilization	*	52	66	74	
SR-W051-6	Cont. Bldg.	Acid Leach	32				
SR-W051-7	Vendor	Plasma Hearth	1				

* No TSF required for proposed or existing non-Savannah River Site-DOE waste processing facilities.

Options Rejected Due To Low Technology Success Factor (TSF)

Plasma Hearth Process by Vendor

Plasma hearth process by vendor was rejected because:

- Plasma hearth incineration is currently still in the laboratory. While prototypes may exist, they have no record of continuous reliable operation in industrial settings. Hence, Pm=0.9.
- Control of the process requires sophisticated computerized instrumentation, hence, Pc=0.9.
- It is not expected for this technology to reach a level of reliability suitable for industrial application for five to ten years.

Acid Leach in Containment Building

Acid leach in containment building was rejected because:

- Although acid leaching is a common chemical processing technique, its use on this waste stream has been demonstrated only at laboratory scale, hence, Pm=0.6.
- Scale-up to a full-size processing unit contributes to the overall complexity, hence, Pc=0.7.

Engineering Assessment

Preferred Option Justification

The preferred treatment option for the Spent Filter Cartridges and Carbon Filter Media waste stream is Incineration followed by Stabilization in the CIF.

This option treats the constituents of concern, heavy metals and radionuclides, by converting the combustible fraction to carbon dioxide and water and stabilizing residuals with cement.

This option is preferred because:

- Waste volume will be reduced by a factor of at least two.
- Final wasteform will meet LDR standards.

- Incineration and ash stabilization are demonstrated technologies.
- CIF is currently under construction.
- Residual solids are stabilized with cement.

Options Rejected During IDOA

Macroencapsulation in Stainless Steel Boxes (either in a Containment Building or in HW/MW-TB)

Macroencapsulation in stainless steel boxes (either in a containment building or in HW/MW-TB) was rejected because:

- Waste volume more than doubles.
- Final wasteform requires disposal in a HW/MW facility.

Incineration at INEL/WERF

Incineration at INEL/WERF was rejected because:

- Waste contains chlorides, which upon incineration will produce acids causing grave damage to WERF's offgas system.

Polymer Encapsulation by a Vendor

Polymer encapsulation by a vendor was rejected because:

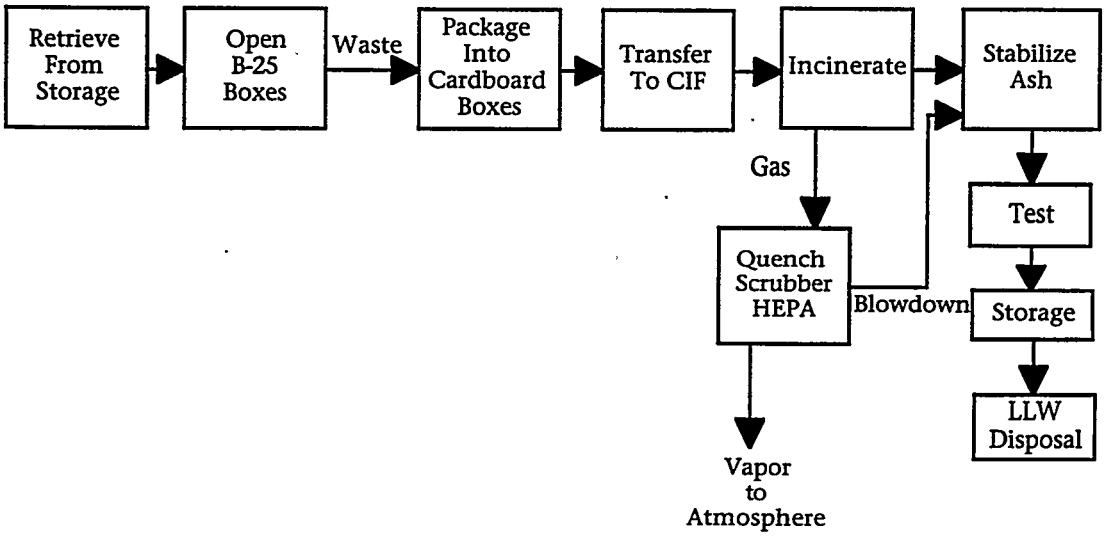
- Limited public acceptance
- Waste volume requiring disposal more than doubles

Waste Stream Number & Name: SR-W051 **Spent Filter Cartridges and Carbon Filter Media**

Option Number: SR-W051-1
Facility: CIF

Treatment Technology: **Incineration/ Stabilization**

Treatment Cycle Flow Diagram:



Pros

- Expect at least 2:1 volume reduction.
- Waste stream is expected to meet all applicable LDR standards after treatment by this facility.
- Incinerator designed for a wide range of wastes with some operational limitations.
- Waste requires no additional treatment to meet DOT shipping requirements.
- Final wasteform meets the expected waste disposal WAC upon exit from the process.
- Incineration is a current demonstrated technology, and all elements and processes have been previously demonstrated.
- Process failure should not create a waste that cannot be treated by existing technologies.
- Reasonably easy to schedule this waste stream assuming current startup schedule.
- Little increase to the environment or public health risk impact is expected from this waste stream because there will be little or no emissions from the facility even in an accident.
- No impact due to this waste stream. No increase in exposure potential and no additional workers are required.
- Processes are in full compliance with all applicable regulations and no variance is needed.
- Line item is funded.
- 100% of the final wasteform will go to the LLW disposal.

Cons

- The public has limited acceptance of treatment involving incineration.
- Additional non-routine maintenance required.

Waste Stream Number & Name: SR-W051 Spent Filter Cartridges and Carbon Filter Media

Option Number: SR-W051-1
Facility: CIF

Treatment Technology: Incineration/ Stabilization

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	70	Subtract 10 points from the median score of 80 because expect at least 2:1 volume reduction.
• secondary waste generation	40	Subtract 10 points from the median score of 50 because the sodium chloride (NaCl) in the blowdown increases secondary waste treatment problems.
• destruction removal and demobilization efficiency	80	Waste stream is expected to meet all applicable LDR standards after treatment by this process.
• flexibility	80	Incinerator designed for a wide range of wastes with some operational limitations.
• ability to be shipped	80	Waste requires no additional treatment to meet DOT shipping requirements.
• final wasteform	80	Final wasteform meets the expected waste disposal WAC upon exit from the process.
Engineering Parameters		
• system implementability	100	Incineration is a current demonstrated technology. Add 20 points to the median score of 80 because all elements and processes have been previously demonstrated.
• availability	50	Incinerator availability for solids is 50%. Normal maintenance requirements apply. This waste stream may require a "clean-out" earlier than anticipated based on curie load.
• scalability	50	Process can accept a range of inputs but capacity is set by design. Excess capacity does exist at this point.
• remedial measures	70	Subtract 10 points from the median score of 80 because presence of metals in the secondary wastes might require rework. Process failure should not create a waste that cannot be treated by existing technologies.
• schedule for treatment of waste	80	Reasonably easy to schedule this waste stream assuming current startup schedule.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Little increase in impact to the environment or public health is expected from this waste stream because there will be little or no emissions from the facility even in an accident.
• non operational worker potential exposure	50	Processing this material will not increase exposure to non operational personnel.
• operational worker potential exposure	50	Personnel exposure is average for operations of this type. Processing this material will not increase the exposure to operational personnel.
• transportation potential exposure	50	Requires transportation – but limited additional characterization required to support transportation.
Regulatory Parameters		
• need for variance	80	Processes are in full compliance with all applicable regulations and no variance is needed.

Waste Stream Number & Name: SR-W051 **Spent Filter Cartridges and Carbon Filter Media**

Option Number: SR-W051-1
Facility: CIF

Treatment Technology: **Incineration/ Stabilization**

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• ability to obtain a permit	100	Add 20 points to the median score of 80 because this waste is part of the basis for permitting.
• waste disposal	80	100% of the final wasteform will go to the LLW disposal.
Public Acceptance		
• public acceptance	20	The public has limited acceptance of treatment involving incineration.
Cost Considerations		
• life-cycle cost	99	
• funding availability	80	Line item is funded.
Industry Involvement		
• market for technology	20	Technology is being purchased.
• private sector involvement	20	Technology is available at an existing DOE facility.

IDOA Score: **Technical** 59 **Total** 73

Waste Stream Number & Name: SR-W051 Spent Filter Cartridges and Carbon Filter Media

Option Number: SR-W051-1
Facility: CIF

Treatment Technology: Incineration/ Stabilization

Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled

Module Location: SRS

Module Status: [√] Existing [ ] New [√] Small generator [ ] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

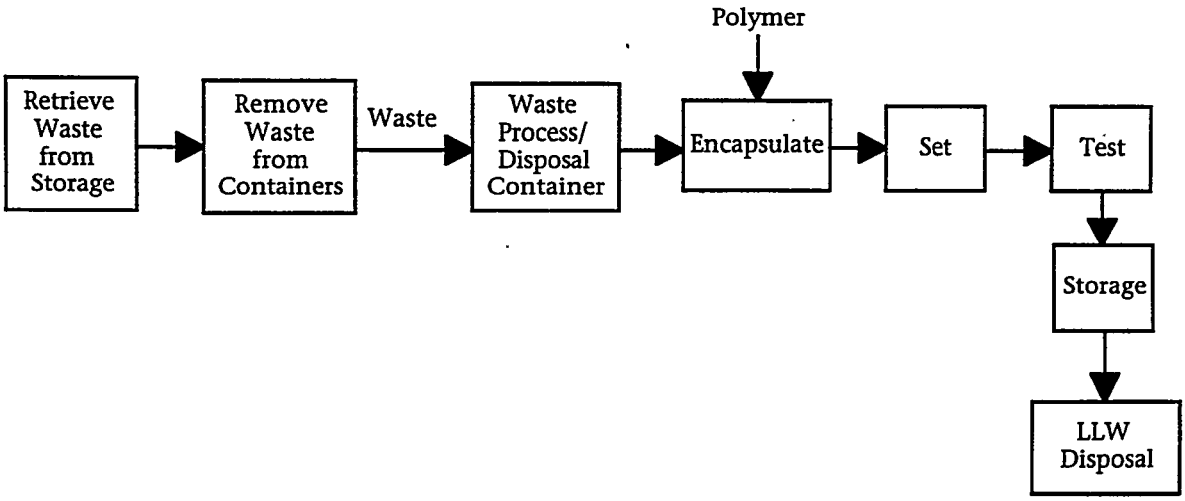
WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 0	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 0	
		1.3.2 Safety Assurance Documentation	$ 0	
		1.3.3 Permitting	$ 0	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 0	
		TOTAL PRE-OPERATIONS		$ 150
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 0	
	2.2	Inspection	$ 0	
	2.3	Project Management	$ 0	
	2.4	Building Construction (inc. indirect)	$ 0	
	2.5	Equipment (inc. indirect)	$ 0	
	2.6	Construction Management	$ 0	
	2.7	Contingency	$ 0	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 0
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 210	
	3.2	Annual Utilities	$ 8	
	3.3	Annual Materials	$ 126	
	3.4	Annual Maintenance	$ 76	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 420	
		X NUMBER OF YEARS OF OPERATION	.25	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 105
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 0	
	4.2	Closure, Post-Closure, Monitoring	$ 3	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 3
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 50
		SUB COST FOR INCINERATOR MODULE		$ 308
		ESCALATION		1.128
		TOTAL COST		$ 346

Waste Stream Number & Name: SR-W051 **Spent Filter Cartridges and Carbon Filter Media**

Option Number: SR-W051-2
Facility: Vendor/Onsite

Treatment Technology: Polymer Encapsulation

Treatment Cycle Flow Diagram:



Pros

- Can accommodate a wide range of similar wastes and radiation levels. Widely used in the commercial world.
- Wasteform meets DOT shipping requirements in the form it exits the treatment process.
- The wasteform meets the expected WAC for waste disposal. No additional treatment is required. Wasteform is disposable in the form in which it exits the process.
- This is a proven process, used both in DOE Complex and the commercial world.
- Mature technology. Vendor will bring onsite and set up with a minimum delay.
- Skid-mounted. Vendor removes equipment upon completion of work. Facility requires more non operational workers than comparably-sized, skid-mounted facilities.
- Well accepted wasteform. No variance required.
- Treated waste will meet treatment standards and can be disposed of as LLW.
- Little secondary waste.

Cons

- The waste volume will more than double.
- Wasteform is not as permanent as other forms of stabilization.
- Not currently budgeted. Will require line item.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	10	Subtract 10 points from the median score of 20 because the waste volume will more than double.
• secondary waste generation	80	Little secondary waste.
• destruction removal and demobilization efficiency	80	No additional treatment is required to meet LDR standards.
• flexibility	80	Can accommodate a wide range of similar wastes and radiation levels. Widely used in the commercial world.

Waste Stream Number & Name: SR-W051 Spent Filter Cartridges and Carbon Filter Media

Option Number: SR-W051-2
Facility: Vendor/Onsite

Treatment Technology: Polymer Encapsulation

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• ability to be shipped	80	Wasteform meets DOT shipping requirements in the form it exits the treatment process.
• final wasteform	80	The wasteform meets the expected WAC for waste disposal.
Engineering Parameters		
• system implementability	100	Add 20 points to the median score of 80 because this is a proven process, used both in DOE Complex and the commercial world.
• availability	60	Add 10 points to the median score of 50 because system is normally available 50% of the time.
• scalability	50	Throughput is set by design, and not easily expanded except by adding more shifts of operation.
• remedial measures	50	Failed wasteform can be ground up and reprocessed by existing technology.
• schedule for treatment of waste	80	Mature technology. Vendor will bring onsite and set up with a minimum delay.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Process can be installed in a building with adequate emission controls.
• non operational worker potential exposure	80	Requires the same number of non operational workers as comparable skid-mounted units. Most or all initial construction can be done in a vendor shop. Experience in similar facilities indicates that little non-routine maintenance is required.
• operational worker potential exposure	40	Subtract 10 points from the median score of 50 because the facility requires more operational workers than comparably-sized, skid-mounted facilities.
• transportation potential exposure	60	No additional characterization needed. Add 10 points to the median score of 50 because waste can be handled readily.
Regulatory Parameters		
• need for variance	80	No variance required.
• ability to obtain a permit	80	Must demonstrate that waste meets treatment standard.
• waste disposal	80	Treated waste will meet treatment standards and can be disposed of as LLW.
Public Acceptance		
• public acceptance	20	Mature and proven technology. Public acceptance limited because wasteform is not unalterably inert.
Cost Considerations		
• life-cycle cost	100	
• funding availability	20	Not currently budgeted. Will require line item.

Waste Stream Number & Name: SR-W051 Spent Filter Cartridges and Carbon Filter Media

Option Number: SR-W051-2
Facility: Vendor/Onsite

Treatment Technology: Polymer Encapsulation

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Industry Involvement		
• market for technology	20	This is an existing vendor process.
• private sector involvement	50	Technology is available at an existing vendor process.

IDOA Score: **Technical** 57 **Total** 71

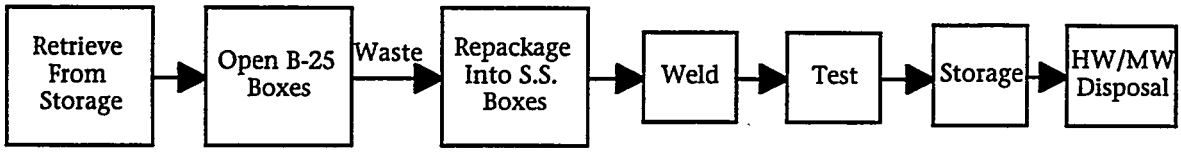
Cost Estimate: INCLUDED WITH COST OF OPTION SR-W011-4

Waste Stream Number & Name: SR-W051 Spent Filter Cartridges and Carbon Filter Media

Option Number: SR-W051-3
Facility: HW/MW-TB

Treatment Technology: Macroencapsulation in a S. S. Box

Treatment Cycle Flow Diagram:



Pros

- Process satisfies requirements of the "debris rule" and all applicable LDR standards are met.
- Can process a wide range of materials without loss of efficiency due to off design feed input.
- S. S. containers will meet current DOT shipping requirements.
- Final wasteform will meet waste disposal WAC.
- All processes involved are existing technology.
- Similar systems have demonstrated availability of greater than 80%.
- Process failure does not produce altered wasteform. A failed container is easily fixed.
- Due to process simplicity, a schedule can be developed easily.
- Process does not create emissions related to the waste stream. Process simply involves container welding.
- Simple welding process requiring minimal maintenance. Minimum personnel required for decommissioning.
- Exposure controlled by design and less than average number of workers. Low potential for exposure.
- Little secondary waste.

Cons

- All waste will require disposal in HW/MW facilities.
- Not a budgeted item and will require line item funding.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	40	Subtract 10 points from the median score of 50 because volume of material increases slightly due to packaging in S. S. container.
• secondary waste generation	80	Little secondary waste.
• destruction removal and demobilization efficiency	80	All applicable LDR standards are met.
• flexibility	80	Can process a wide range of materials without loss of efficiency due to off design feed input.
• ability to be shipped	80	S. S. containers will meet current DOT shipping requirements.
• final wasteform	80	Final wasteform will meet waste disposal WAC.
Engineering Parameters		
• system implementability	90	Add 10 points to the median score of 80 because all processes involved are existing technology.
• availability	80	Similar systems have demonstrated availability of greater than 80%.

Waste Stream Number & Name: SR-W051 Spent Filter Cartridges and Carbon Filter Media

Option Number: SR-W051-3
Facility: HW/MW-TB

Treatment Technology: Macroencapsulation in a S. S. Box

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• scalability	50	Throughput is set by design and not easily expanded except by adding additional shifts of operation.
• remedial measures	90	Process failure does not produce altered wasteform. Add 10 points to the median score of 80 because a failed container is easily fixed.
• schedule for treatment of waste	80	Due to process simplicity, a schedule can be developed easily.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Process does not create emissions related to the waste stream. Process simply involves container welding.
• non operational worker potential exposure	80	Simple welding process requiring minimal maintenance. Minimum personnel required for decommissioning.
• operational worker potential exposure	80	Exposure controlled by design and less than average number of workers. Low potential for exposure.
• transportation potential exposure	60	No additional characterization needed. Add 10 points to the median score of 50 because waste can be handled readily.
Regulatory Parameters		
• need for variance	80	Process satisfies requirements of the "debris rule."
• ability to obtain a permit	40	Subtract 10 points from the median score of 50 because uncertainties surround attaining a permit related to the "debris rule" and the "containment rule."
• waste disposal	20	All waste will require disposal in HW/MW facilities.
Public Acceptance		
• public acceptance	40	Public concern should be limited due to the simplicity of the process. Subtract 10 points from the median score of 50 because the wasteform is not unalterably inert.
Cost Considerations		
• life-cycle cost	100	
• funding availability	20	Not a budgeted item and will require line item funding.
Industry Involvement		
• market for technology	20	This is an existing technology.
• private sector involvement	20	Technology would be provided at a DOE facility.

IDOA Score: Technical 58 Total 72

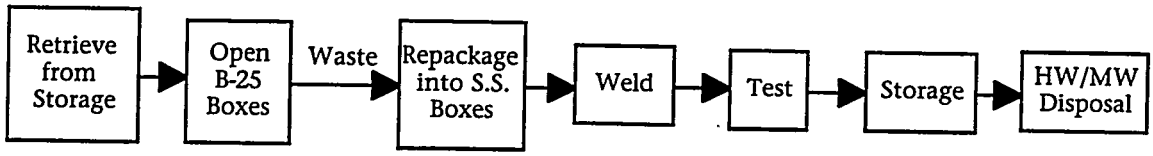
Cost Estimate: INCLUDED WITH COST OF OPTION SR-W018-4

Waste Stream Number & Name: SR-W051 Spent Filter Cartridges and Carbon Filter Media

Option Number: SR-W051-4
Facility: Containment Building

Treatment Technology: Macroencapsulation in a S. S. Box

Treatment Cycle Flow Diagram:



Pros

- Process satisfies requirements of the "debris rule" and all applicable LDR standards are met.
- Can process a wide range of materials without loss of efficiency due to off-design feed input.
- S. S. containers will meet current DOT shipping requirements.
- Final wasteform will meet waste disposal WAC.
- All processes involved are existing technology.
- Similar systems have demonstrated availability of greater than 80%.
- Process failure does not produce altered wasteform. A failed container is easily fixed.
- Due to process simplicity, a schedule can be developed easily.
- Process does not create emissions related to the waste stream. Process simply involves container welding.
- Simple welding process requiring minimal maintenance. Minimal personnel required for decommissioning.
- Exposure controlled by design and less than average number of workers. Low potential for exposure.
- Little secondary waste.

Cons

- All waste will require disposal in HW/MW facilities.
- Not a budget item and will require line item funding.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	40	Subtract 10 points from the median score of 50 because volume of material increases slightly due to packaging in S. S. container.
• secondary waste generation	80	Little secondary waste.
• destruction removal and demobilization efficiency	80	All applicable LDR standards are met.
• flexibility	80	Can process a wide range of materials without loss of efficiency due to off design feed input.
• ability to be shipped	80	S. S. containers will meet current shipping requirements.
• final wasteform	80	Final wasteform will meet waste disposal WAC.
Engineering Parameters		
• system implementability	90	Add 10 points to the median score of 80 because all processes involved are existing technology.
• availability	80	Similar systems have demonstrated availability of greater than 80%.

Waste Stream Number & Name: SR-W051 Spent Filter Cartridges and Carbon Filter Media

Option Number: SR-W051-4
Facility: Containment Building

Treatment Technology: Macroencapsulation in a S. S. Box

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
◦ scalability	50	Throughput is set by design and not easily expandable except by adding shifts.
◦ remedial measures	90	Process failure does not produce altered wasteform. Add 10 points to the median score of 80 because a failed container is easily fixed.
◦ schedule for treatment of waste	80	Due to process simplicity, a schedule can be developed easily.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Process does not create emissions related to the waste stream. Process simply involves container welding.
• non operational worker potential exposure	80	Simple welding process requiring minimal maintenance. Minimal personnel required for decommissioning.
• operational worker potential exposure	80	Exposure controlled by design and less than average number of workers. Low potential for exposure.
• transportation potential exposure	60	No additional characterization needed. Add 10 points to the median score of 50 because waste can be handled readily following treatment.
Regulatory Parameters		
• need for variance	80	Process satisfies requirements of the "debris rule."
• ability to obtain a permit	40	Subtract 10 points from the median score of 50 because uncertainties surround attaining a permit related to the "debris rule" and the "containment rule."
• waste disposal	20	All waste will require disposal in HW/MW facilities.
Public Acceptance		
• public acceptance	40	Public concern should be limited due to the simplicity of the process. Subtract 10 points from the median score of 50 because the wasteform is not unalterably inert.
Cost Considerations		
• life-cycle cost	100	
• funding availability	20	Not a budget item and will require line item funding.
Industry Involvement		
• market for technology	20	This is an existing technology.
• private sector involvement	20	Technology could be provided by either DOE or vendor.

IDOA Score: **Technical** 58 **Total** 72

Cost Estimate: INCLUDED WITH COST OF OPTION SR-W018-3

Waste Stream Number & Name: SR-W051 Spent Filter Cartridges and Carbon Filter Media

Option Number: SR-W051-5
Facility: INEL/WERF

Treatment Technology: Incineration/ Stabilization

Treatment Technology

Idaho National Engineering Laboratory (INEL) Waste Experimental Reduction Facility (WERF) Incinerator is a ram feed, stationary kiln incinerator. The facility is used to treat both solid and liquid waste. The system offgas is passes through a dry quench tower to remove particulates before release of the gas effluent. The facility cannot be used to treat wastes contaminated with chlorides. Chlorides react to create acids, which over time will disintegrate the dry offgas system. The ash solids are removed and stabilized for disposal.

Pros

- According to INEL engineers, incineration will reduce the waste volume by a factor of 100 to 1.
- The facility can treat waste streams similar in composition to those assumed in the design basis without modification.
- The process has been demonstrated on similar waste types.
- 20% or less down time is anticipated when using this process.
- Process failure is not anticipated to result in the creation of a waste that cannot be treated.
- Greater than 80% of the treated waste will require disposal in LLW facility.

Cons

- The process currently exists, so any expansion would require process modifications.
- Waste characterization will be required for any waste streams returned to SRS for disposal.
- Currently stakeholder acceptance of incineration is perceived as low. Public approval of incineration at INEL is anticipated to drop will the additional treatment of offsite wastes.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	100	Add 20 points to the median score of 80 because incineration will reduce the waste volume by a factor of 100 to 1.
• secondary waste generation	50	An additional amount of ash waste, in the range of 10%, is generated that can be handled by existing technologies.
• destruction removal and demobilization efficiency	50	Additional LDR treatments required for waste streams contaminated with non-organic contaminants (heavy metals).
• flexibility	80	The facility can treat waste streams similar in composition to those assumed in the design basis without modification.
• ability to be shipped	50	The ash waste must be stabilized in a grout matrix prior to shipment.
• final wasteform	80	The ash waste after stabilization is anticipated to meet the SRS waste disposal WAC.
Engineering Parameters		
• system implementability	80	The process has been demonstrated on similar waste types.
• availability	80	20% or less down time is anticipated when using this process.

Waste Stream Number & Name: SR-W051 Spent Filter Cartridges and Carbon Filter Media

Option Number: SR-W051-5
Facility: INEL/WERF

Treatment Technology: Incineration/ Stabilization

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• scalability	20	The process currently exists, so any expansion would require process modifications.
• remedial measures	80	Process failure is not anticipated to result in the creation of a waste that cannot be treated by existing technology.
• schedule for treatment of waste	50	A schedule for waste treatment cannot be provided. Additionally, acceptance of SRS waste will be contingent upon state-approved permit modifications.
Personnel Parameters		
• consequence of unmitigated accident scenarios	50	Emissions from the facility could result during potential accident scenarios.
• non operational worker potential exposure	50	Processing this material will not increase the exposure to non operational personnel.
• operational worker potential exposure	50	Personnel exposure is average for operations of this type. Processing this material will not increase the exposure to operational personnel.
• transportation potential exposure	20	Waste characterization will be required for any waste streams returned to SRS for disposal.
Regulatory Parameters		
• need for variance	80	Process is in full compliance with all applicable regulations and no variance is needed.
• ability to obtain a permit	50	Permitting process is well defined, however, the States acceptance of offsite waste treatment is unknown. Approval may be difficult.
• waste disposal	80	Greater than 80% of the treated waste will require disposal in LLW facility.
Public Acceptance		
• public acceptance	20	Currently stakeholder acceptance of incineration is perceived as low. Public approval of incineration at INEL is anticipated to drop with the additional treatment of offsite wastes.
Cost Considerations		
• life-cycle cost	99	
• funding availability	50	Funding for treatment cost can be provide using the operating budget, however the additional costs may result in an increase in the budget in excess of 10%.
Industry Involvement		
• market for technology	20	This is an existing commercial technology.
• private sector involvement	20	Technology is available at an existing DOE facility.

IDOA Score: **Technical** 52 **Total** 66

Waste Stream Number & Name: SR-W051 Spent Filter Cartridges and Carbon Filter Media

Option Number: SR-W051-5
Facility: INEL/WERF

Treatment Technology: Incineration/ Stabilization

Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled

Module Location: INEL

Module Status: [√] Existing [ ] New [√] Small generator [ ] Large generator
[ ] Onsite [√] Offsite [ ] Commercial [ ] Portable [ ] R&D

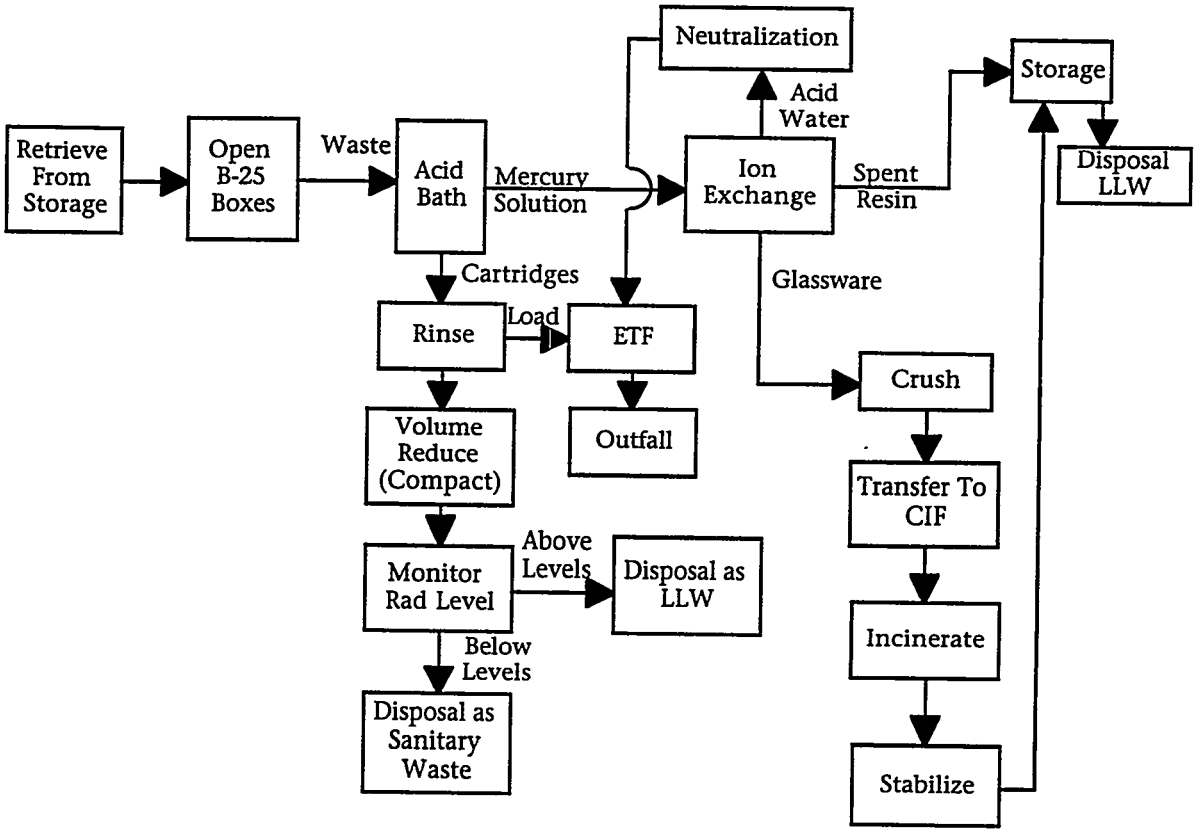
WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ N/A	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ N/A	
		1.3.2 Safety Assurance Documentation	$ N/A	
		1.3.3 Permitting	$ N/A	
		1.3.4 Preparation for Operations	$ N/A	
		1.3.5 Project Management	$ N/A	
		TOTAL PRE-OPERATIONS		$ N/A
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ N/A	
	2.2	Inspection	$ N/A	
	2.3	Project Management	$ N/A	
	2.4	Building Construction (inc. indirect)	$ N/A	
	2.5	Equipment (inc. indirect)	$ N/A	
	2.6	Construction Management	$ N/A	
	2.7	Contingency	$ N/A	
		TOTAL FACILITY CONSTRUCTION COSTS		$ N/A
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ N/A	
	3.2	Annual Utilities	$ N/A	
	3.3	Annual Materials	$ N/A	
	3.4	Annual Maintenance	$ N/A	
	3.5	Annual Contingency	$ N/A	
		TOTAL ANNUAL O & M	$ N/A	
		X NUMBER OF YEARS OF OPERATION		
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ N/A
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ N/A	
	4.2	Closure, Post-Closure, Monitoring	$ N/A	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ N/A
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$ N/A	
	5.2	Mobile Treatment	$ N/A	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$ 2
7.0	Transportation			$ 18
8.0	Disposal			$ 50
		SUB COST FOR INCINERATOR MODULE		$ 70
		ESCALATION		1.06
		TOTAL COST		$ 74

Note: Per DOE directions, this cost estimate is the incremental cost for treatment at an offsite DOE facility; therefore, it carries no overhead burden or capital costs.
If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W051 Spent Filter Cartridges and Carbon Filter Media

Option Number: SR-W051-6
Facility: Containment Building

Treatment Technology: Acid Leach

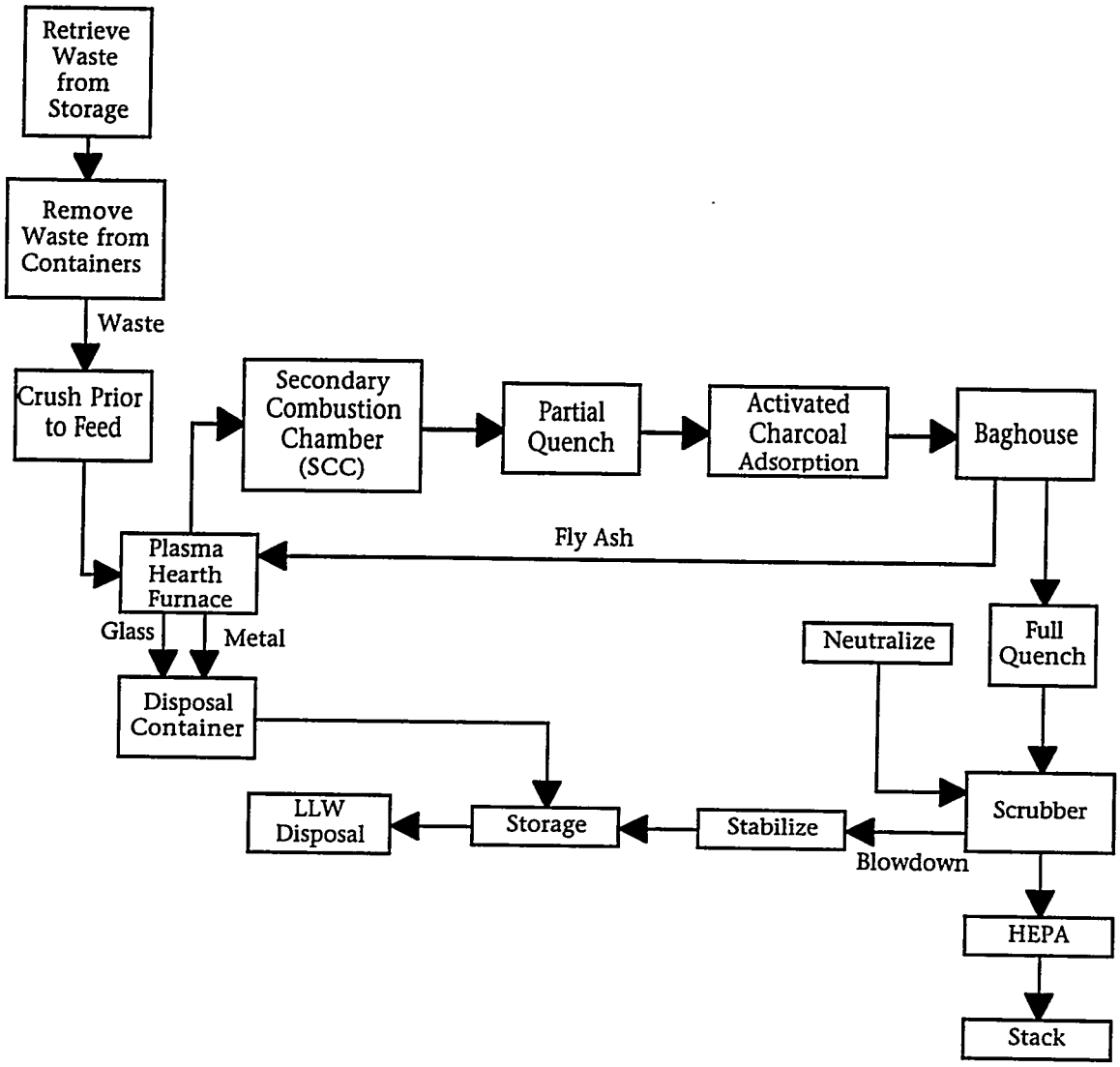


Option rejected during technical success factor evaluation. No further analysis performed.

Waste Stream Number & Name: SR-W051 Spent Filter Cartridges and Carbon Filter Media

Option Number: SR-W051-7
Facility: Vendor

Treatment Technology: Plasma Hearth



Option rejected during technical success factor evaluation. No further analysis performed.

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Summary Page

Waste Stream Number & Name: SR-W052 Cadmium Contaminated Glovebox Section

Background Information

This waste stream was thought to contain a portion of a glovebox section that had been contaminated by the spill of a cadmium containing solution. Subsequent investigation disclosed that the waste stream did not contain a glovebox section. TCLP analysis of the remaining waste in the container, protective laboratory clothing, disclosed no cadmium or other metal contamination exceeding regulatory limits.

This waste stream will be deleted from the Mixed Waste Inventory Report (MWIR) and the Site Treatment Plan (STP).

Waste stream was eliminated.

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Summary Page – Initial Screening

Waste Stream Number & Name: SR-W053 Rocky Flats Incinerator Ash

Background Information

This waste consists of a small volume of ash sent from Rocky Flats to SRS for research into plutonium recovery. Courts in the State of Colorado declared Rocky Flats' ash hazardous based on chemical analysis of F-listed solvent waste processed in the Rocky Flats incinerator. SRS concurred with the declaration and placed the ash in a satellite accumulation area. Rocky Flats is managing this waste under conditions of a separate compliance order. It is not include in their STP.

Volume

- Current volume through 09/30/93 = 0.1 m^3.
- No future waste generation is expected because this waste originally came to SRS as sample material to run plutonium extraction studies. Once the Rocky Flats ash was declared a hazardous waste, plutonium studies were canceled.

Waste Stream Matrix

- Inorganic sludge/particulate

Waste Codes

- D004A (TCLP As)
- D005A (TCLP Ba)
- D006A (TCLP Cd)
- D007A (TCLP Cr)
- D008A (TCLP Pb)
- D009A (TCLP Hg)
- D010A (TCLP Se)
- D011A (TCLP Ag)
- F001
- F002
- F005A (halogenated and nonhalogenated spent solvents)

LDR Treatment Standard

- Rocky Flats will perform technical analysis to determine disposition of the ash. Eventual management could be at WIPP through a No-Migration Determination or another alternative, including methods for reprocesses, per the requirements of the compliance order.

Waste Characterization

- Process knowledge used to characterize the waste stream.
- Confidence level is low. No analytical data is available, and the material is from another DOE site.
- This ash was declared mixed waste after SRS had the material in a vault and was handling the waste as a Special Nuclear Material (SNM).

Radiological Characterization

- Transuranic – alpha emitters
- Waste is contact handled.
- Mixed transuranic waste (MTRU)

Initial Screening

The initial screening identified inappropriate treatment options. These options appear in the Initial Rejections table.

Initial Rejections

Treatment Facility	Treatment Technology	Reasons for Rejection
CIF	Incineration	Material has already been incinerated.
ETF	Ion Exchange	ETF has no process to treat this waste.
M Area	Vitrification	This waste contains TRU which is not allowed in M Area.
Z Area	Stabilization	Z Area can treat only those wastes that come by pipeline from Tank 50 and meet strict waste acceptance criteria. The Z-Area process lacks flexibility to treat and dispose of a variety of waste streams.

Summary Page – Technology Success Factor (TSF) & In-Depth Options Analysis (IDOA)

Waste Stream Number & Name: SR-W053 Rocky Flats Incinerator Ash

Feasible Options

Option No.	Treatment Facility	Treatment Technology	TSF	IDOA Scores		COST (x 1,000)	PO
			Score	Tech.	Total		
SR-W053-1	Other DOE Site	Return to Rocky Flats	100	76	90	167	√
SR-W053-2	CIF	Ashcrete Stabilization	88	54	67	2,048	

Options Rejected Due To Low Technology Success Factor (TSF)

- No options were rejected.

Engineering Assessment

Preferred Option Justification

The preferred treatment option for the Rocky Flats Incinerator Ash waste stream is to return the waste to Rocky Flats for consolidation and treatment with similar wastes and treatment.

This option permits this minuscule volume of waste to be combined at Rocky Flats with hundreds of drums of this material, for which Rocky Flats will determine the preferred treatment.

This option is preferred because:
- It allows consistent treatment of all the MTRU ash waste generated at Rocky Flats.
- It eliminates duplication of research to determine treatment technology.
- It is cost-effective.

Treatability Study Requirements

This waste will not be treated at SRS; therefore, treatability studies will not be done here. Rocky Flats personnel will perform any treatability studies, if needed, to determine the disposal not only of the small quantity of waste returned by SRS, but also the larger amount currently in storage at Rocky Flats. No further studies involving this material are anticipated through FY 2000.

Options Rejected During IDOA

Stabilization in Ashcrete at CIF

Stabilization in ashcrete at CIF was rejected because:
- Waste volume more than doubles.
- Handling this small volume waste at SRS will result in significant cost.

Waste Stream Number & Name: SR-W053 Rocky Flats Incinerator Ash
Option Number: SR-W053-1
Facility: Other DOE Site
Treatment Technology: Return to Rocky Flats

Treatment Cycle Flow Diagram:

Returning the waste to the generator (Rocky Flats) does not require a flow diagram.

Pros

- Treatment (if any) is at the discretion of Rocky Flats. This waste will be treated along with the existing large volume of incineration ash.
- Procedures exist that specify the requirements to return this material to the generator.
- Return of the ash to Rocky Flats and subsequent treatment (if any) will not increase the non operational worker exposure.
- Return of the ash to Rocky Flats and subsequent treatment (if any) will not increase the operational worker exposure.
- Waste will not require further characterization for shipment.
- Does not require additional characterization to support transportation and limited number of waste transports required.
- No variance is required.
- No permits are required.
- No waste disposal will occur at SRS.
- Public will endorse a solution that eliminates a waste at SRS and does not materially increase waste amounts anywhere else.

Cons

- This approach will only work for wastes belonging to others currently held at SRS, of which this is the sole example.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	100	Add 20 points to the median score of 80 because SRS has no waste volume to dispose of.
• secondary waste generation	100	Treatment (if any) is at the discretion of Rocky Flats. Add 20 points to the median score of 80 because this waste will be treated along with the existing large volume of incineration ash, and, *per se* generate no secondary waste.
• destruction removal and demobilization efficiency	100	Treatment (if any) is at the discretion of Rocky Flats. Add 20 points to the median score of 80 because this waste will be treated along with the existing large volume of incinerator ash. The destruction removal and demobilization efficiency will have to satisfy LDR treatment standards.
• flexibility	0	Subtract 20 points from the median score of 20 because this approach will only work for wastes belonging to others currently held at SRS, of which this is the sole example.
• ability to be shipped	80	Waste must meet shipping requirements to be returned to Rocky Flats.
• final wasteform	100	This waste will be treated along with the existing large volume of Rocky Flats incinerator ash. Add 20 points to the median score of 80 because the final wasteform will not be an SRS concern.

Waste Stream Number & Name: SR-W053 Rocky Flats Incinerator Ash
Option Number: SR-W053-1
Facility: Other DOE Site **Treatment Technology:** Return to Rocky Flats
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Engineering Parameters		
• system implementability	80	Procedures exist that specify the requirements to return this material to the generator.
• availability	100	Add 20 points to the median score of 80 because availability is not a consideration for this option.
• scalability	100	Add 20 points to the median score of 80 because scalability is not a consideration for this option.
• remedial measures	80	Failure of Rocky Flats to accept the ash will necessitate stabilization by established technology.
• schedule for treatment of waste	50	Uncertainties exist regarding the schedule by which the ash can be returned.
Personnel Parameters		
• consequence of unmitigated accident scenarios	100	Ash is controlled at Rocky Flats to ensure that accident scenarios cause little or no release. Add 20 points to the median score of 80 because the volume of waste is minuscule.
• non operational worker potential exposure	100	Add 20 points to the median score of 80 because return of the ash to Rocky Flats and subsequent treatment (if any) will not increase the operational worker exposure.
• operational worker potential exposure	100	Add 20 points to the median score of 80 because waste will not require further characterization for shipment.
• transportation potential exposure	100	Does not require additional characterization to support transportation. Add 20 points to the median score of 80 because limited number of waste transports required.
Regulatory Parameters		
• need for variance	100	Add 20 points to the median score of 80 because no variance is required.
• ability to obtain a permit	100	Add 20 points to the median score of 80 because no permits are required.
• waste disposal	100	Add 20 points to the median score of 80 because no waste disposal will occur at SRS.
Public Acceptance		
• public acceptance	80	Public will endorse a solution that eliminates a waste at SRS and does not materially increase waste amounts anywhere else.
Cost Considerations		
• life-cycle cost	100	Less than $250,000
• funding availability	50	Cost can be covered with operating budget with a slight one-time increase in allocation.
Industry Involvement		
• market for technology	0	Subtract 20 points from the median score of 20 because does not apply to this option.
• private sector involvement	0	Subtract 20 points from the median score of 20 because does not apply to this option.

IDOA Score: **Technical** 76 **Total** 90

Waste Stream Number & Name: SR-W053 Rocky Flats Incinerator Ash
Option Number: SR-W053-1
Facility: Other DOE Site **Treatment Technology: Return to Rocky Flats**
Cost Estimate Sheet

Waste Type: ☐ MLLW ☐ HLW ☑ M-TRU
☑ alpha ☐ non-alpha ☑ contact handled ☐ remote handled
Module Location: Rocky Flats
Module Status: ☑ Existing ☐ New ☑ Small generator ☐ Large generator
☐ Onsite ☑ Offsite ☐ Commercial ☐ Portable ☐ R&D

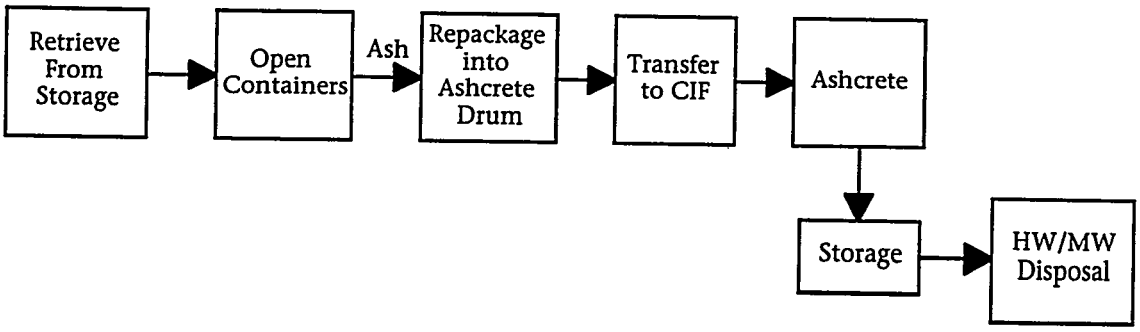
WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 0	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 0	
		1.3.2 Safety Assurance Documentation	$ 0	
		1.3.3 Permitting	$ 0	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 0	
		TOTAL PRE-OPERATIONS		$ 150
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 0	
	2.2	Inspection	$ 0	
	2.3	Project Management	$ 0	
	2.4	Building Construction (inc. indirect)	$ 0	
	2.5	Equipment (inc. indirect)	$ 0	
	2.6	Construction Management	$ 0	
	2.7	Contingency	$ 0	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 0
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 15	
	3.2	Annual Utilities	$ 1	
	3.3	Annual Materials	$ 9	
	3.4	Annual Maintenance	$ 5	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 30	
		X NUMBER OF YEARS OF OPERATION	0.25	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 8
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 0	
	4.2	Closure, Post-Closure, Monitoring	$ 0	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 0
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 0
		SUB COST FOR THE RETURN TO ROCKY FLATS MODULE		$ 158
		ESCALATION		1.06
		TOTAL COST		$ 167

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W053 Rocky Flats Incinerator Ash
Option Number: SR-W053-2
Facility: CIF

Treatment Technology: Ashcrete Stabilization

Treatment Cycle Flow Diagram:



Pros

- No secondary waste produced by ashcrete process.
- The waste stream is expected to meet all applicable LDR standards after this treatment.
- Wasteforms meets DOT shipping requirements without additional treatment.
- The wasteform meets the expected waste disposal WAC. Wasteform suitable for disposal in the form it exits the process.
- Ashcrete is a current demonstrated technology and a proven technology.
- Process failure should not create a wasteform that cannot be treated by existing technologies.
- Reasonably easy to schedule this waste steam assuming current startup schedule.
- The metals in this waste stream will be captured in the ashcrete. Very little emissions resulting in little or no emissions even during an accident.
- Well accepted wasteform. No variance required.
- Line item is funded.

Cons

- Expected to increase volume by factor of three.
- 100% of the final wasteform will go to the HW/MW vaults.
- Wasteform is not as permanent as other forms of stabilization.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	10	Subtract 10 points from the median score of 20 because expected to increase volume by factor of three.
• secondary waste generation	100	Add 20 points to the median score of 80 because no secondary waste produced by ashcrete process.
• destruction removal and demobilization efficiency	80	The waste stream is expected to meet all applicable LDR standards after this treatment.
• flexibility	50	Waste handling of waste streams directly in ashcrete is an off-normal process, which lowers efficiency.
• ability to be shipped	80	Wasteforms meets shipping requirements without additional treatment.
• final wasteform	80	The wasteform meets the expected waste disposal WAC.

Waste Stream Number & Name: SR-W053 Rocky Flats Incinerator Ash
Option Number: SR-W053-2
Facility: CIF
Treatment Technology: Ashcrete Stabilization

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Engineering Parameters		
• system implementability	100	Ashcrete process is a current demonstrated technology. Add 20 points to the median score of 80 because this is a proven technology.
• availability	50	Normal maintenance requirements apply. This waste stream may require a "clean-out" earlier than anticipated based on curie load.
• scalability	50	Limited excess capacity exists because it is set by design.
• remedial measures	70	Presence of metals in the final wasteform might require rework. Subtract 10 points from the median score of 80 because a process failure could create a wasteform that can not be treated by existing technologies.
• schedule for treatment of waste	80	Reasonably easy to schedule this waste steam assuming current startup schedule.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	The metals in this waste stream will be captured in the ashcrete. Very little emissions resulting in little or no emissions even during an accident.
◦ non operational worker potential exposure	70	Subtract 10 points from the median score of 80 because additional non-routine maintenance required.
◦ operational worker potential exposure	50	Increased operator handling due to this waste stream so the potential for exposure is increased.
◦ transportation potential exposure	50	Does not require additional characterization to support transportation and limited number of waste transports required.
Regulatory Parameters		
• need for variance	80	Well-accepted wasteform. No variance required.
• ability to obtain a permit	50	Modification required to facilities existing permit, but must demonstrate that it meets treatment standard.
• waste disposal	20	100% of the final wasteform will go to the HW/MW vaults. This may require disposal as TRU waste.
Public Acceptance		
• public acceptance	20	Mature and proven technology, however wasteform is not as permanent as other forms of stabilization (i.e., vitrification).
Cost Considerations		
• life-cycle cost	94	
• funding availability	80	Line item is funded.
Industry Involvement		
• market for technology	20	Technology is being purchased.
• private sector involvement	20	Technology is available at an existing DOE facility.

IDOA Score: **Technical** 54 **Total** 67

Waste Stream Number & Name: SR-W053 Rocky Flats Incinerator Ash
Option Number: SR-W053-2
Facility: CIF
Treatment Technology: Ashcrete Stabilization

Cost Estimate Sheet

Waste Type: ☐ MLLW ☐ HLW ☑ M-TRU
☑ alpha ☐ non-alpha ☑ contact handled ☐ remote handled

Module Location: SRS

Module Status: ☑ Existing ☐ New ☑ Small generator ☐ Large generator
☑ Onsite ☐ Offsite ☐ Commercial ☐ Portable ☐ R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 0	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 0	
		1.3.2 Safety Assurance Documentation	$ 0	
		1.3.3 Permitting	$ 1,500	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 0	
		TOTAL PRE-OPERATIONS		$ 1,650
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 0	
	2.2	Inspection	$ 0	
	2.3	Project Management	$ 0	
	2.4	Building Construction (inc. indirect)	$ 0	
	2.5	Equipment (inc. indirect)	$ 0	
	2.6	Construction Management	$ 0	
	2.7	Contingency	$ 0	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 0
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 30	
	3.2	Annual Utilities	$ 1	
	3.3	Annual Materials	$ 18	
	3.4	Annual Maintenance	$ 11	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 60	
		X NUMBER OF YEARS OF OPERATION	0.25	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 15
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 0	
	4.2	Closure, Post-Closure, Monitoring	$ 0	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 0
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 0
		SUB COST FOR ASHCRETE MODULE		$ 1,665
		ESCALATION		1.23
		TOTAL COST		$ 2,048

If above numbers do not appear to add correctly, it is the result of computer rounding.

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Summary Page

Waste Stream Number & Name: SR-W054 Enriched Uranium Contaminated with Lead

Background Information

An acidified analytical solution generated by, was located in the 320-M Laboratory Satellite Accumulation Area, was moved and consolidated on June 28, 1994, with waste stream SR-W037, M-Area Nickel Plating Line Sludge. This consolidation was prompted by the DOE commitment to de-inventory fissile material in the 320-M Laboratory by June 30, 1994. SR-W054 no longer exists as a separate waste stream.

This waste stream will be deleted from the Mixed Waste Inventory Report (MWIR) and the Site Treatment Plan (STP).

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Summary Page – Initial Screening

Waste Stream Number & Name: SR-W055 Job Control Waste Containing Solvent Contaminated Wipes

Background Information

This waste is sitewide operations generated job waste, including radiologically contaminated plastic huts, protective clothing, contaminated metal tools, glass, paper and cardboard which is suspected to have been mixed with solvent contaminated wipes. Job control waste has been declared mixed waste according to the Mixture Rule. SRS has modified procedures and practices regarding solvent contaminated wipes generation and management to eliminate or substantially reduce this type of waste.

Volume
- Current volume through 09/30/94 is 951 m^3.
- No future waste generation is expected due to the solvent rag minimization program.

Waste Stream Matrix
- Organic debris

Waste Code
- F001-F003, F005A (halogenated and nonhalogenated spent solvents)

LDR Treatment Standard
- F001 = concentration based standards = 6-30 mg/kg
- F002 = concentration based standards = 6-30 mg/kg
- F003 = concentration based standards = 2.6-180 mg/kg
- F005 = concentration based standards = 10-170 mg/kg, except for 2-Ethoxyethanol, and 2-Nitropropane = Incineration
- Alternate debris technology may be applied

Waste Characterization
- Process knowledge used to characterize the waste stream.
- Confidence level is medium based on the use of process knowledge to characterize waste. Also, other waste in the waste stream may not actually be contaminated with solvents but are characterized as such, according to the Mixture Rule.

Radiological Characterization
- Beta/gamma emitters are present.
- Waste is contact handled.
- Mixed low-level waste

Initial Screening

The initial screening identified inappropriate treatment options. These options appear in the Initial Rejections table.

Initial Rejections

Treatment Facility	Treatment Technology	Reasons for Rejection
ETF	Ion Exchange	ETF has no process to treat this waste.
Lab.	Lab-scale process flowsheet	Volume of waste too great to handle with laboratory-scale equipment.
LETF	Ion Exchange	LETF has no process to treat this waste.
M Area	Vitrification	This waste has too large a volume than M Area can handle effectively.
Tritium	Macro-encapsulation	Cannot have fission products in the Tritium Facility.
Z Area	Stabilization	Z Area can treat only those wastes that come by pipeline from Tank 50 and meet strict waste acceptance criteria. The Z-Area process lacks flexibility to treat and dispose of a variety of waste streams.

Summary Page – Technology Success Factor (TSF) & In-Depth Options Analysis (IDOA)

Waste Stream Number & Name: SR-W055 Job Control Waste Containing Solvent Contaminated Wipes

Feasible Options

Option No.	Treatment Facility	Treatment Technology	TSF	IDOA Scores		COST (x 1,000)	PO
			Score	Tech.	Total		
SR-W055-1	CIF	Incineration/ Stabilization	94	57	67	7,037	√
SR-W055-2	INEL/WEDF	Stabilization	*	52	54	29,000	
SR-W055-3	INEL/WERF	Incineration/ Stabilization	*	49	52	29,000	
SR-W055-4	INEL/IWPF	Incineration/ Stabilization	*	36	39	29,000	

* No TSF required for proposed or existing non-Savannah River Site-DOE facilities.

Options Rejected Due To Low Technology Success Factor (TSF)

- No options were rejected.

Engineering Assessment

Preferred Option Justification

The preferred treatment option for the Job Control Waste Containing Solvent Contaminated Wipes waste stream is Incineration followed by Stabilization in the Consolidated Incineration Facility (CIF).

This option treats the constituents of concern, listed organics, by converting the combustible fraction to carbon dioxide, water, and salt, and stabilizing residuals with cement.

This option is preferred because:
- Waste volume will be reduced by a factor of at least two.
- Final wasteform will meet LDR standards.
- Incineration and ash stabilization are demonstrated technologies.
- CIF is currently under construction.
- Residual solids are stabilized with cement.
- It is cost-effective.

Options Rejected During IDOA

Stabilization at INEL/WEDF

Stabilization at INEL/WEDF (encapsulating the waste with a grout matrix) was rejected because:
- Large volume waste streams are designated to be treated onsite.
- Rejected option is less cost-effective than the preferred option.
- Waste volume will more than doubles.
- Existing process will have to be expanded to handle this waste.
- Combustible material will have to be shipped to the treatment facility.
- INEL/WEDF is a planned, but unapproved, facility.

Incineration at INEL/WERF

Incineration at INEL/WERF was rejected because:
- Large volume waste streams are designated to be treated onsite.

- Cost of preparation for treatment (shredding and packaging) will not be avoided.
- Rejected option is less cost-effective than the preferred option.
- Offsite incineration offers neither technological nor environmental advantage over the preferred option.

Incineration at INEL/IWPF

Incineration at INEL/IWPF was rejected because:

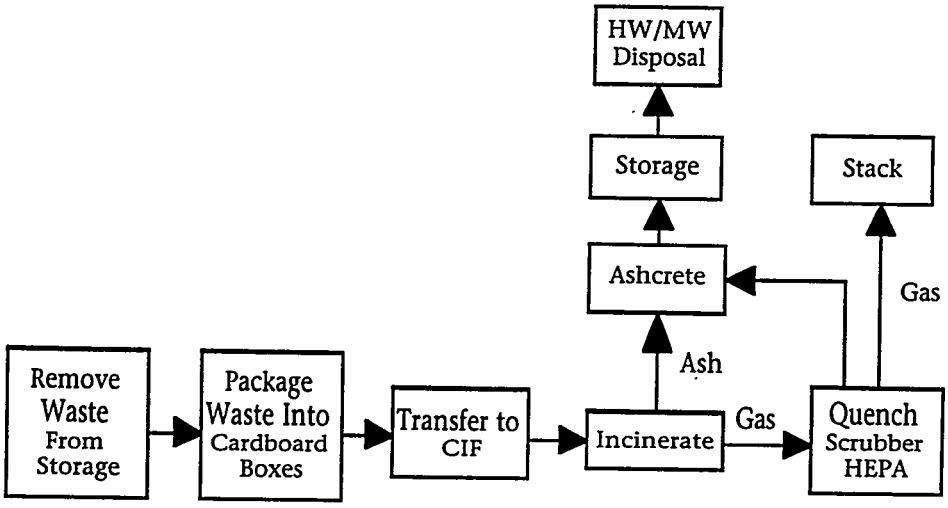
- INEL/IWPF is a planned, but not approved facility.
- Large volume waste streams are designated to be treated onsite.
- Rejected option is less cost-effective than the preferred option.

Waste Stream Number & Name: SR-W055 Job Control Waste Containing Solvent Contaminated Wipes

Option Number: SR-W055-1
Facility: CIF

Treatment Technology: Incineration/ Stabilization

Treatment Cycle Flow Diagram:



Pros

- Expect at least 2:1 reduction.
- The waste stream is expected to meet all applicable LDR standards.
- Incinerator designed for a wide range of wastes with some operational limitations.
- Waste does not require additional treatment to meet DOT shipping requirements.
- The wasteforms expected to meet the waste disposal WAC in the form it exits the facility.
- Incineration is a current demonstrated technology.
- Process failures will not result in a wasteform that cannot be treated by existing technologies.
- Reasonably easy to schedule this waste steam assuming current startup schedule.
- Most of the additional metals in this waste stream will be captured in the ashcrete resulting in little or no emissions from the facility even during most accidents.
- No additional non operational workers are required.
- No additional operational workers will be required.
- All processes are in full compliance with existing regulations and no variances are required.
- Line item is funded.

Cons

- 100% of the final wasteform will go to HW/MW facilities for disposal.
- The public has significant concerns about incineration and publicly expressed concerns about the safety of incinerators.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	70	Subtract 10 points from the median score of 80 because expect at least 2:1 reduction.
• secondary waste generation	50	Significant volume of secondary waste due to non-combustible sludge and it can be handled by an existing technology.

Waste Stream Number & Name: SR-W055 Job Control Waste Containing Solvent Contaminated Wipes

Option Number: SR-W055-1
Facility: CIF

Treatment Technology: Incineration/ Stabilization

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• destruction removal and demobilization efficiency	80	The waste stream is expected to meet all applicable LDR standards.
• flexibility	80	Incinerator designed for a wide range of wastes with some operational limitations.
• ability to be shipped	80	Waste does not require additional treatment to meet shipping requirements.
• final wasteform	80	Wasteforms expected to meet the waste disposal WAC.
Engineering Parameters		
• system implementability	100	Add 20 points to the median score of 80 because incineration is a current demonstrated technology.
• availability	50	Incinerator availability for solids is 50%. Normal maintenance requirements apply.
• scalability	50	Capacity is set by design but the facility can accept a wide range of inputs.
• remedial measures	70	Subtract 10 points from the median score of 80 because the presence of metals in the secondary wastes might require rework. Process failures should not result in a wasteform that cannot be treated by existing technologies.
• schedule for treatment of waste	80	Reasonably easy to schedule this waste steam assuming current startup schedule.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Most of the additional metals in this waste stream will be captured in the ashcrete resulting in little or no emissions from the facility even during most accidents.
• non operational worker potential exposure	50	Processing this material will not increase the exposure to non operational personnel.
• operational worker potential exposure	50	Personnel exposure is average for operations of this type. Processing this material will not increase the exposure to operational personnel.
• transportation potential exposure	60	Limited transportation will be required. Add 10 points to the median score of 50 because no additional characterization will be required.
Regulatory Parameters		
• need for variance	80	All processes are in full compliance with existing regulations and no variances are required.
• ability to obtain a permit	100	Add 20 points to the median score of 80 because this waste is part of the basis for permitting.
• waste disposal	20	100% of the final wasteform will go to HW/MW disposal in HW/MW facilities.
Publi · Acceptance		
• pu ic acceptance	20	Incineration has limited acceptance. Public has expressed concerns about the safety of incinerators.
Cost · nsiderations		
• life-cycle cost	78	

Waste Stream Number & Name: SR-W055 Job Waste Containing Solvent Contaminated Wipes
Option Number: SR-W055-1
Facility: CIF
Treatment Technology: Incineration/ Stabilization

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• funding availability	80	Line item is funded.
Industry Involvement		
• market for technology	20	Technology is being purchased.
• private sector involvement	20	Technology is available at an existing DOE facility.

IDOA Score: **Technical** 57 **Total** 67

Waste Stream Number & Name: SR-W055 Job Control Waste Containing Solvent Contaminated Wipes

Option Number: SR-W055-1
Facility: CIF

Treatment Technology: Incineration/ Stabilization

Cost Estimate Sheet INCLUDES COST OF OPTION SR-W056-1

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[ ] alpha [√] non-alpha [√] contact handled [ ] remote handled

Module Location: SRS

Module Status: [√] Existing [ ] New [ ] Small generator [√] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 14	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 55	
		1.3.2 Safety Assurance Documentation	$ 14	
		1.3.3 Permitting	$ 0	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 0	
		TOTAL PRE-OPERATIONS		$ 233
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 22	
	2.2	Inspection	$ 4	
	2.3	Project Management	$ 4	
	2.4	Building Construction (inc. indirect)	$ 0	
	2.5	Equipment (inc. indirect)	$ 100	
	2.6	Construction Management	$ 7	
	2.7	Contingency	$ 48	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 185
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 713	
	3.2	Annual Utilities	$ 29	
	3.3	Annual Materials	$ 428	
	3.4	Annual Maintenance	$ 257	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 1,425	
		X NUMBER OF YEARS OF OPERATION	2.00	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 2,850
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 80	
	4.2	Closure, Post-Closure, Monitoring	$ 100	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 180
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
	Transportation			$
	Disposal			$ 2,000
		SUB COST FOR INCINERATOR MODULE		$ 5,393
		ESCALATION		1.305
		TOTAL COST		$ 7,037

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W055 Job Control Waste Containing Solvent Contaminated Wipes

Option Number: SR-W055-2
Facility: INEL/WEDF

Treatment Technology: Stabilization

Treatment Technology

The Idaho National Engineering Laboratory (INEL) Waste Engineering Development Facility (WEDF) stabilization process will provide treatments for aqueous and organic liquids and debris. The process will stabilize waste in a grout matrix to reduce leachability.

Pros

- Little secondary waste streams are expected to be generated.
- The facility can treat waste streams similar in composition to those assumed in the design basis without modification.
- The stabilized waste could be shipped without additional treatment.
- Final wasteform is anticipated to meet the SRS waste disposal WAC.
- Stabilization has been demonstrated at the facility.
- The facility is anticipated to have minimal down time.
- Process failure is not anticipated to create a waste stream that cannot be treated.
- Few emissions for the facility are anticipated during normal operation and most accident scenarios.
- The facility could potentially be used to treat numerous waste streams throughout the DOE Complex.

Cons

- Stabilization will increase the overall waste volume by a factor of two or more after processing.
- The facility is a planned but not approved facility.
- Waste characterization will be required for any waste streams returned to SRS for disposal.
- The majority of the treated waste will be classified as mixed waste which will require disposal in a HW/MW facility.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	10	Subtract 10 points from the median score of 20 because stabilization will increase the overall waste volume by a factor of 2 or more after processing.
• secondary waste generation	80	Secondary waste streams are generated and can be handled by existing technology.
• destruction removal and demobilization efficiency	50	Additional treatment for some waste streams may be required prior to stabilization to ensure LDR standards are met.
• flexibility	80	The facility can treat waste streams similar in composition to those assumed in the design basis without modification.
• ability to be shipped	80	The stabilized waste could be shipped without additional treatment.
• final wasteform	80	Final wasteform is anticipated to meet the SRS disposal WAC.
Engineering Parameters		
• system implementability	80	Stabilization has been demonstrated at the facility.
• availability	80	The facility is anticipated to have minimal down time.
• scalability	20	The facility is a planned but not approved facility.

Waste Stream Number & Name: SR-W055 Job Control Waste Containing Solvent Contaminated Wipes

Option Number: SR-W055-2
Facility: INEL/WEDF
Treatment Technology: Stabilization
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• remedial measures	80	Process failure is not anticipated to create a waste stream that cannot be treated.
• schedule for treatment of waste	50	A schedule for waste treatment cannot be provided. Additionally, acceptance of SRS waste will be contingent upon state-approved permit modifications.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Few emissions for the facility are anticipated during normal operation and most accident scenarios.
• non operational worker potential exposure	50	Processing this material will not increase the exposure to non operational personnel.
• operational worker potential exposure	50	Personnel exposure is average for operations of this type. Processing this material will not increase the exposure to operational personnel.
• transportation potential exposure	20	Waste characterization will be required for any waste streams returned to SRS for disposal.
Regulatory Parameters		
• need for variance	80	Process will be in full compliance with applicable regulations without needing a variance.
• ability to obtain a permit	50	Permitting process is well-defined, however, the States acceptance of offsite waste treatment is unknown. Approval may be difficult.
• waste disposal	20	The majority of the treated waste will be classified as mixed waste which will require disposal in a HW/MW facility.
Public Acceptance		
• public acceptance	50	Public acceptance for stabilization is positive; however, the treatment of offsite waste is anticipated to reduce the overall public acceptance of this process.
Cost Considerations		
• life-cycle cost	17	
• funding availability	50	Not a budgeted item though line item funding may be required.
Industry Involvement		
• market for technology	80	The facility could potentially be used to treat numerous waste streams throughout the DOE Complex.
• private sector involvement	20	Technology is available at an existing DOE facility.

IDOA Score: Technical 52 Total 54

Waste Stream Number & Name: SR-W055 Job Control Waste Containing Solvent Contaminated Wipes

Option Number: SR-W055-2
Facility: INEL/WEDF
Treatment Technology: Stabilization
Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[ ] alpha [√] non-alpha [√] contact handled [ ] remote handled

Module Location: INEL

Module Status: [√] Existing [ ] New [ ] Small generator [√] Large generator
[ ] Onsite [√] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ N/A	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ N/A	
		1.3.2 Safety Assurance Documentation	$ N/A	
		1.3.3 Permitting	$ N/A	
		1.3.4 Preparation for Operations	$ N/A	
		1.3.5 Project Management	$ N/A	
		TOTAL PRE-OPERATIONS		$ N/A
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ N/A	
	2.2	Inspection	$ N/A	
	2.3	Project Management	$ N/A	
	2.4	Building Construction (inc. indirect)	$ N/A	
	2.5	Equipment (inc. indirect)	$ N/A	
	2.6	Construction Management	$ N/A	
	2.7	Contingency	$ N/A	
		TOTAL FACILITY CONSTRUCTION COSTS		$ N/A
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ N/A	
	3.2	Annual Utilities	$ N/A	
	3.3	Annual Materials	$ N/A	
	3.4	Annual Maintenance	$ N/A	
	3.5	Annual Contingency	$ N/A	
		TOTAL ANNUAL O & M	$ N/A	
		X NUMBER OF YEARS OF OPERATION		
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ N/A
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ N/A	
	4.2	Closure, Post-Closure, Monitoring	$ N/A	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ N/A
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$ N/A	
	5.2	Mobile Treatment	$ N/A	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$ 26,000
7.0	Transportation			$ 352
8.0	Disposal			$ 1,000
		SUB COST FOR STABILIZATION MODULE		$ 27,352
		ESCALATION		1.06
		TOTAL COST		$ 29,000

Note: Per DOE directions, this cost estimate is the incremental cost for treatment at an offsite DOE facility; therefore, it carries no overhead burden or capital costs.

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W055 Job Control Waste Containing Solvent Contaminated Wipes

Option Number: SR-W055-3
Facility: INEL/WERF

Treatment Technology: Incineration/ Stabilization

Treatment Technology

Idaho National Engineering Laboratory (INEL) Waste Experimental Reduction Facility (WERF) Incinerator is a ram feed, stationary kiln incinerator. The facility is used to treat both solid and liquid waste. The system offgas passes through a dry quench tower to remove contaminated prior to the release of the gas effluents. The facility cannot be used to treat wastes contaminated with chlorides. Chlorides react to create acids, which over time will disintegrate the dry offgas system. The ash solids are removed and stabilized for disposal.

Pros

- Incineration will reduce the waste volume by a factor of 100 to 1.
- The facility can treat waste streams similar in composition to those assumed in the design basis without modification.
- The process has been demonstrated on similar waste types.
- 20% or less down time is anticipated when using this process.
- Process failure is not anticipated to result in the creation of a waste that cannot be treated.

Cons

- The process currently exists, so any expansion would require process modifications.
- Waste characterization will be required for any waste streams returned to SRS for disposal.
- 80% of the treated waste will be classified as mixed waste which will require disposal in a HW/MW facility.
- Currently stakeholder acceptance of incineration is perceived as low. Public approval of incineration at INEL is anticipated to drop will the additional treatment of offsite wastes.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
◦ volume alteration	100	Add 20 points to the median score of 80 because incineration will reduce the waste volume by a factor of 100 to 1.
◦ secondary waste generation	50	An additional amount of ash waste, in the range of 10%, is generated, which can be handled by existing technologies.
◦ destruction removal and demobilization efficiency	50	Additional LDR treatments may be required for waste streams contaminated with non-organic materials.
• flexibility	80	The facility can treat waste streams similar in composition to those assumed in the design basis without modification.
• ability to be shipped	50	The ash waste must be stabilized in a grout matrix prior to shipment.
• final wasteform	80	The ash waste after stabilization is anticipated to meet the SRS waste disposal WAC.
Engineering Parameters		
• system implementability	80	The process has been demonstrated on similar waste types.
• availability	80	20% or less down time is anticipated when using this process.
• scalability	20	The process currently exists, so any expansion would require process modifications.

Waste Stream Number & Name: SR-W055 Job Waste Containing Solvent Contaminated Wipes
Option Number: SR-W055-3
Facility: INEL/WERF
Treatment Technology: Incineration/ Stabilization

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• remedial measures	80	Process failure is not anticipated to result in the creation of a waste that cannot be treated by existing technology.
• schedule for treatment of waste	50	A schedule for waste treatment cannot be provided. Additionally, acceptance of SRS waste will be contingent upon state-approved permit modifications.
Personnel Parameters		
• consequence of unmitigated accident scenarios	50	Emissions from the facility could result during potential accident scenarios.
• non operational worker potential exposure	50	Processing this material will not increase the exposure to non operational personnel.
• operational worker potential exposure	50	Personnel exposure is average for operations of this type. Processing this material will not increase the exposure to operational personnel.
• transportation potential exposure	20	Waste characterization will be required for any waste streams returned to SRS for disposal.
Regulatory Parameters		
• need for variance	80	Process is in compliance with all applicable regulations and no variance is needed.
• ability to obtain a permit	50	Permitting process is well defined, however, the state's acceptance of offsite waste treatment is unknown. Approval may be difficult.
• waste disposal	20	The majority of the treated waste will be classified as mixed waste which will require disposal in a HW/MW facility.
Public Acceptance		
• public acceptance	20	Currently stakeholder acceptance of incineration is perceived as low. Public approval of incineration at INEL is anticipated to drop with the additional treatment of offsite wastes.
Cost Considerations		
• life-cycle cost	17	
• funding availability	50	Funding for treatment cost can be provide using the operating budget, however the additional costs may result in an increase in the budget in excess of 10%.
Industry Involvement		
• market for technology	20	This is an existing commercial technology.
• private sector involvement	20	Technology is available at an existing DOE facility.

IDOA Score: **Technical** 49 **Total** 52

Waste Stream Number & Name: SR-W055 Job Control Waste Containing Solvent Contaminated Wipes

Option Number: SR-W055-3
Facility: INEL/WERF

Treatment Technology: Incineration/ Stabilization

Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[ ] alpha [√] non-alpha [√] contact handled [ ] remote handled

Module Location: INEL

Module Status: [√] Existing [ ] New [ ] Small generator [√] Large generator
[ ] Onsite [√] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ N/A	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ N/A	
		1.3.2 Safety Assurance Documentation	$ N/A	
		1.3.3 Permitting	$ N/A	
		1.3.4 Preparation for Operations	$ N/A	
		1.3.5 Project Management	$ N/A	
		TOTAL PRE-OPERATIONS		$ N/A
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ N/A	
	2.2	Inspection	$ N/A	
	2.3	Project Management	$ N/A	
	2.4	Building Construction (inc. indirect)	$ N/A	
	2.5	Equipment (inc. indirect)	$ N/A	
	2.6	Construction Management	$ N/A	
	2.7	Contingency	$ N/A	
		TOTAL FACILITY CONSTRUCTION COSTS		$ N/A
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ N/A	
	3.2	Annual Utilities	$ N/A	
	3.3	Annual Materials	$ N/A	
	3.4	Annual Maintenance	$ N/A	
	3.5	Annual Contingency	$ N/A	
		TOTAL ANNUAL O & M	$ N/A	
		X NUMBER OF YEARS OF OPERATION		
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ N/A
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ N/A	
	4.2	Closure, Post-Closure, Monitoring	$ N/A	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ N/A
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$ N/A	
	5.2	Mobile Treatment	$ N/A	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$ 26,000
7.0	Transportation			$ 352
8.0	Disposal			$ 1,000
		SUB COST FOR INCINERATION MODULE		$ 27,352
		ESCALATION		1.06
		TOTAL COST		$ 29,000

Note: Per DOE directions, this cost estimate is the incremental cost for treatment at an offsite DOE facility; therefore, it carries no overhead burden or capital costs.

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W055 Job Control Waste Containing Solvent Contaminated Wipes

Option Number: SR-W055-4
Facility: INEL/IWPF

Treatment Technology: Incineration/ Stabilization

Treatment Technology

INEL IWPF incinerator is in the preliminary design phase. The type of kiln and offgas system have not yet been determined.

Pros

- Incineration will reduce the waste volume by more than 100 to 1.
- The facility will treat waste streams similar in composition to those assumed in the design basis without modification.
- Any ash waste generated, after stabilization, is anticipated to meet the SRS disposal WAC.
- Process failure is not anticipated to result in the creation of a waste that cannot be treated.

Cons

- The facility is in preliminary design phase, uncertain of facility design and secondary waste streams. An ash waste stream and some blowdown type wastes are anticipated.
- The process is currently in the preliminary design phase. Final incinerator type has been selected.
- Uncertainties surrounding the design prevent an accurate estimation of availability.
- A schedule for waste treatment cannot be provided. Additionally, acceptance of SRS waste will be contingent upon state-approved permit modifications. In addition, facility operation is contingent upon the receipt of DOE funding.
- Waste characterization will be required for any waste streams returned to SRS for disposal.
- The process will require RCRA Part B Permit Application approval from the state. State approval for treatment of offsite waste may be difficult.
- The majority of the treated waste will be classified as mixed waste which will require disposal in a HW/MW facility.
- Currently stakeholder acceptance of incineration is perceived as low. Public approval of incineration is anticipated to drop will the additional treatment of offsite wastes.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	100	Add 20 points to the median score of 80 because incineration will reduce the waste volume by more than 100 to 1.
• secondary waste generation	20	The facility is in preliminary design phase, uncertain of facility design and secondary waste streams. An ash waste stream and some blowdown type wastes are anticipated.
• destruction removal and demobilization efficiency	50	Additional LDR treatment may be required for waste streams contaminated with non-organic materials.
• flexibility	80	The facility will treat waste streams similar in composition to those assumed in the design basis without modification.
• ability to be shipped	50	The ash waste, when generated, must be stabilized in a group matrix prior to shipment.
• final wasteform	80	Any ash waste generated, after stabilization, is anticipated to meet the SRS waste disposal WAC.

Waste Stream Number & Name: SR-W055 Job Control Waste Containing Solvent Contaminated Wipes

Option Number: SR-W055-4
Facility: INEL/WERF

Treatment Technology: Incineration/ Stabilization

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Engineering Parameters		
• system implementability	20	The process is currently in the preliminary design phase. Final incinerator type has been selected.
• availability	20	Uncertainties surrounding the design prevent an accurate estimation of availability.
• scalability	50	The facility is currently in the preliminary design phase. Any modification required for unique waste streams could be incorporated in to the facility design.
• remedial measures	80	Process failure is not anticipated to result in the creation of a waste that cannot be treated.
• schedule for treatment of waste	20	A schedule for waste treatment cannot be provided. Additionally, acceptance of SRS waste will be contingent upon state-approved permit modifications. In addition facility operation is contingent upon the receipt of DOE funding.
Personnel Parameters		
• consequence of unmitigated accident scenarios	50	Emissions form the planned facility could result during potential accident scenarios.
• non operational worker potential exposure	50	Personnel exposure is expected to be average for operations of this type.
• operational worker potential exposure	50	Personnel exposure is anticipated to be average for operations of this type.
• transportation potential exposure	20	Waste characterization will be required for any waste streams returned to SRS for disposal.
Regulatory Parameters		
• need for variance	20	The process will require RCRA Part B Permit application approval from the state. State approval for treatment of offsite waste may be difficult.
• ability to obtain a permit	50	Permitting process is well defined, however, the state's acceptance of offsite waste treatment is unknown. Approval may be difficult.
• waste disposal	20	The majority of the treated waste will be classified as mixed waste which will require disposal in a HW/MW facility.
Public Acceptance		
• public acceptance	20	Currently stakeholder acceptance of incineration is perceived as low. Public approval of incineration is anticipated to drop will the additional treatment of offsite wastes.
Cost Considerations		
• life-cycle cost	17	
• funding availability	50	Funding for treatment cost can be provide using the operating budget, however the additional costs may result in an increase in the budget in excess of 10%. (Line item funding is being pursued by the facility contractor).

Waste Stream Number & Name: SR-W055 Job Control Waste Containing Solvent Contaminated Wipes

Option Number: SR-W055-4
Facility: INEL/WERF

Treatment Technology: Incineration/ Stabilization

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Industry Involvement		
• market for technology	20	This is an existing commercial technology.
• private sector involvement	20	Technology is being developed at an existing DOE facility.

IDOA Score: **Technical** 36 **Total** 39

Waste Stream Number & Name: SR-W055 Job Control Waste Containing Solvent Contaminated Wipes

Option Number: SR-W055-4
Facility: INEL/WERF

Treatment Technology: Incineration/ Stabilization

Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[ ] alpha [√] non-alpha [√] contact handled [ ] remote handled

Module Location: INEL

Module Status: [ ] Existing [√] New [ ] Small generator [√] Large generator
[ ] Onsite [√] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element		($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations		
1.1	Studies and Bench Scale Tests	$ N/A	
1.2	Demonstration Costs	$ N/A	
1.3	Operations Budget Funded Activities		
1.3.1	Conceptual Design	$ N/A	
1.3.2	Safety Assurance Documentation	$ N/A	
1.3.3	Permitting	$ N/A	
1.3.4	Preparation for Operations	$ N/A	
1.3.5	Project Management	$ N/A	
	TOTAL PRE-OPERATIONS		$ N/A
2.0	Facility Construction Cost		
2.1	Design (Title I and II)	$ N/A	
2.2	Inspection	$ N/A	
2.3	Project Management	$ N/A	
2.4	Building Construction (inc. indirect)	$ N/A	
2.5	Equipment (inc. indirect)	$ N/A	
2.6	Construction Management	$ N/A	
2.7	Contingency	$ N/A	
	TOTAL FACILITY CONSTRUCTION COSTS		$ N/A
3.0	Operation and Maintenance		
3.1	Annual Operating Labor	$ N/A	
3.2	Annual Utilities	$ N/A	
3.3	Annual Materials	$ N/A	
3.4	Annual Maintenance	$ N/A	
3.5	Annual Contingency	$ N/A	
	TOTAL ANNUAL O & M	$ N/A	
	X NUMBER OF YEARS OF OPERATION		
	TOTAL OPERATIONS AND MAINTENANCE COSTS		$ N/A
4.0	Decontamination & Decommissioning		
4.1	Facility D&D	$ N/A	
4.2	Closure, Post-Closure, Monitoring	$ N/A	
	TOTAL DECONTAMINATION & DECOMMISSIONING		$ N/A
5.0	Contracted Services		
5.1	Commercial Treatment/Disposal	$ N/A	
5.2	Mobile Treatment	$ N/A	
	TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)		$ 26,000
7.0	Transportation		$ 352
8.0	Disposal		$ 1,000
	SUB COST FOR INCINERATION MODULE		$ 27,352
	ESCALATION		1.06
	TOTAL COST		$ 29,000

Note: Per DOE directions this cost estimate is the incremental cost for treatment at an offsite DOE facility; therefore, it carries no overhead burden or capital costs.

If above numbers do not appear to add correctly, it is the result of computer rounding.

Summary Page – Initial Screening

Waste Stream Number & Name: SR-W056 **Job Control Waste with Enriched Uranium and Solvent Applicators**

Background Information

This waste stream is job wastes such as plastic huts, protective clothing, contaminated metal tools, glass bottles, paper, etc., that were declared hazardous due to the likelihood of being mixed with solvent contaminated rags. The waste is contaminated with enriched uranium from the Naval Fuels (NF) Facility, which is no longer operational. The amount of enriched uranium is sufficient to cause concerns about criticality, should treatment concentrate the uranium.

Volume
- Current volume through 09/30/94 is 260 m^3.
- No future waste generation is expected because the Naval Fuels manufacturing process which generated this waste, is no longer operational.

Waste Stream Composition
- Organic debris

Waste Code
- F001
- F002
- F003
- F005A (halogenated and nonhalogenated spent solvents)

LDR Treatment Standard
- F001 = concentration based standards = 6-30 mg/kg
- F002 = concentration based standards = 6-30 mg/kg
- F003 = concentration based standards = 2.6-180 mg/kg
- F005 = concentration based standards = 10-170 mg/kg, except for 2-Ethoxyethanol, and 2-Nitropropane = Incineration
- Alternative debris technology may be applied

Waste Characterization
- Process knowledge used to characterize the waste stream.
- Confidence level is medium based on the use of process knowledge to characterize waste and the use of the mixture rule, declaring low-level job control waste mixed if it was suspected that solvent wipes could have been placed in the box or drum.

Radiological Characterization
- The 90-cubic foot boxes contain 146-246 grams of U^{235}.
- The 55-gallon drums contain 0-115 grams U^{235}.
- This waste is contact handled.
- Mixed low-level waste

Initial Screening

Although CIF will have spare capacity to treat this volume of waste in addition to the design basis waste streams, the possibility of critical amounts of U^{235} accumulating in the ashcrete system disqualifies CIF as a treatment option. Other treatment and administrative alternatives must be pursued until they can be realistically evaluated to determine a preferred option.

Three possible methods for treatment of this waste exist:

1. Reprocess at a vendor to recover and reuse significant amounts of U^{235}
2. Recharacterize the waste so that it can be handled as low-level waste
3. Macroencapsulate in stainless steel overpack containers

Unlike treatments for other mixed waste streams, SRS is not currently in possession of sufficient information about the above options to make a realistic evaluation. Thus, a research program must thoroughly investigate these options before IDOAs can be done and a preferred option selected.

Summary Page

Waste Stream Number & Name: **SR-W057** **D-Tested Neutron Generators**

Background Information

Material shipped to SRS from the Pantex site. D-tested (destructively-tested) neutron generators were mixed with non-destructively tested generators in error. Destructively-tested material has been returned to Pantex.

This waste stream has been returned to the site where it was generated.

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Summary Page – Initial Screening

Waste Stream Number & Name: **SR-W058** **Mixed Sludge Waste with Mercury from DWPF Treatability Studies**

Background Information

This waste stream consists of high-level waste supernate, sludge, and salt samples from the tank farm and mercury contamination generated during DWPF treatability studies. The waste mercury sludge has dried and caked onto eight centrifuge tubes and a glass bottle. The waste is stored in a satellite accumulation area metal can in shielded cell at SRTC. The waste stream was reported incorrectly as mixed low-level waste n the final Mixed Waste Inventory Report; it is actually high-level waste. Analysis has shown that mercury contamination is sufficiently low enough to allow acid dissolution followed by mercury separation with aqueous waste going to High-Level Waste Tank Farm for processing in the DWPF. If high-level vitrification is not the preferred process for this small quantity of waste, SRS will need will need to request SCDHEC to approved an alternative treatment.

Volume
- Current volume through 09/30/94 is 0.1 m^3.
- No future waste generation is expected (one time generation).

Waste Stream Composition
- Organic debris – glass

Waste Code
- D009F – (high-level waste Hg) nonwastewater

LDR Treatment Standard
- D009F = specified technology = Vitrification of high-level mixed radioactive wastes

Waste Characterization
- Process knowledge used to characterize the waste stream.
- Confidence level is high.

Radiological Characterization
- Beta/gamma emitters (Cs^{137}, Eu^{154} and Sr^{90}) are present.
- Activity level > 10,000 nCi/g
- Waste is remote handled.
- High-level waste

Preferred Option Justification

The preferred option for the Mixed Sludge Waste with Mercury from DWPF Treatability Studies waste stream is treatment as 90-day generator at SRTC followed by vitrification of the residuals.

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Summary Page – Initial Screening – THIS WASTE STREAM HAS BEEN CONSOLIDATED WITH WASTE STREAM SR-W001

Waste Stream Number & Name: SR-W059 Tetrabutyl Titanate (TBT)

Background Information

This waste stream's data has been consolidated and reported under SR-W001, Rad-Contaminated Solvents. This decision to classify this was SR-W001 was made during the MWIR inventory update as of 9/30/94. The consolidation of solvent streams SR-W001, SR-W002, SR-010, SR-W030, and SR-W059, in the mixed waste data reporting, grouped solvents with the same treatment.

SR-W059 was formerly described as an organic liquid used as a catalyst in the Beta/Gamma Incinerator in H Area. When the incinerator was shut down, excess material could not be used elsewhere onsite or returned to the vendor. It was declared a hazardous waste due to TBT degrading to ignitable butanol. Prior to shipping the waste for offsite treatment, all of the drums underwent radiological screening in which four drums showed detectable levels of tritium (H^3) in their analysis. These four drums were withheld from the rest and declared mixed waste.

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Summary Page

Waste Stream Number & Name: SR-W060 Tritiated Water with Mercury

Background Information

Waste is highly tritiated heavy water with a small amount of mercury that has been absorbed on silica gel. Waste resulted from a single incident of a weld failure in a retired thermal diffusion column. Waste is contained in a welded stainless steel container, known colloquially as a "fat boy" and is characterized as 17 liters of highly tritiated water, 3 or 4 ml of elemental mercury, and 50 kg of silicon gel. However, there are no free liquids in this container.

Volume
- Current volume through 09/30/94 is 0.2 m^3
- No future waste generation expected; this waste resulted from a spill incident.

Waste Stream Composition
- Inorganic particulate

Waste Code
- D009A (TCLP Hg)

LDR Treatment Standard
- D009 = concentration based standard = 0.2 mg/l

Waste Characterization
- Process knowledge used to characterize the waste stream.
- Confidence level is medium.

Radiological Characterization
- 13,200 Ci of tritium

Initial Screening

The initial screening identified inappropriate treatment options. These options appear in the Initial Rejections table.

Initial Rejections

Treatment Facility	Treatment Technology	Reasons for Rejection
CIF	Incineration	Incineration is not an appropriate treatment for elemental mercury. Constituent of concern is volatilized and escapes to atmosphere. Tritium concentration exceeds CIF WAC.
CIF	Ashcrete Stabilization	Concrete stabilization is not an appropriate treatment for elemental mercury. Constituent of concern is not immobilized
ETF	Ion Exchange	ETF has no process to treat this waste.
INEL	Amalgamation	INEL reports that they do not have the capability to handle the amount of tritium in this waste.
LETF	Ion Exchange	LETF has no equipment to treat this waste.
M Area	Vitrification	Vitrification is not an appropriate treatment for elemental mercury. Constituent of concern is volatilized and escapes to atmosphere.
Z Area	Stabilization	Concrete stabilization is not an appropriate treatment for elemental mercury. Constituent of concern is not immobilized

Summary Page – Technology Success Factor (TSF) & In-Depth Options Analysis (IDOA)

Waste Stream Number & Name: SR-W060 Tritiated Water with Mercury

Feasible Options

Option No.	Treatment Facility	Treatment Technology	TSF	IDOA Scores		COST (x 1,000)	PO
			Score	Tech.	Total		
SR-W060-1	None	Macro-encapsulation	100	57	71	541	√
SR-W060-2	Containment building (tritium)	In situ roast and retort	51	47	56	11900	
SR-W060-3	Containment building (tritium)	Repackage, roast, and retort	51	46	54	13201	

Options Rejected Due To Low Technology Success Factor (TSF)

- No options were rejected.

Engineering Assessment

Preferred Option Justification

The preferred treatment option for the tritiated water with mercury is macroencapsulation of the existing container ("fat boy") in a stainless steel box. Because this waste stream is a one-time generation and a small volume (i.e., a single custom made container) welding the box shut and verifying the integrity of the welds can take place in a maintenance facility. A treatability variance will need to be granted for this alternative treatment

This option treats the constituent of concern mercury by encapsulating the contaminated waste in a corrosion-resistant box.

This option is preferred because:

- Few or no secondary wastes are generated.
- Treatment is cost-effective.
- In situ macroencapsulation minimizes exposure to non operational workers.
- In situ macroencapsulation minimizes exposure to operational workers.

Options Rejected During IDOA

Roasting in the waste container (in situ roasting) and retorting. Mercury is then amalgamated for disposal. Tritium released by the process will be captured by the existing tritium system.

Roasting in the waste container (in situ roasting) and retorting. Mercury is then amalgamated for disposal. Tritium released by the process will be captured by the existing tritium system was rejected because:

- This treatment facility would be specially designed to treat this waste stream on a one-time-only basis.
- No integrated testing of this system has occurred. No laboratory tests have been made.
- Uncertainties surrounding laboratory tests and process design make a schedule difficult to project.
- This treatment is less cost-effective than the preferred option.
- The ca[illegible]ing of released tritium by the existing tritium system would require applicable permit[illegible]om state regulations.

Roasting the silica gel in an oven after removal from the waste container.

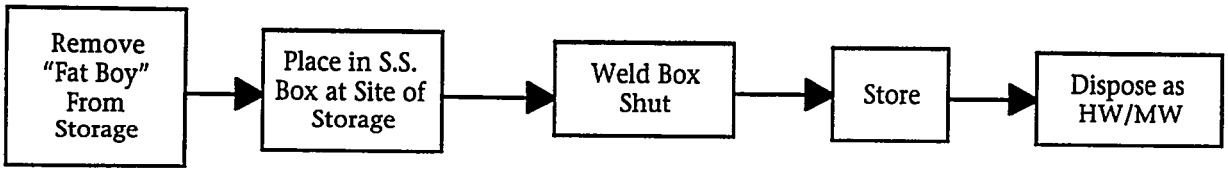
Roasting the silica gel in an oven after removal from the waste container was rejected because:

- The waste requires more handling than the selected option.
- This option is less cost-effective than the selected option.

Waste Stream Number & Name: SR-W060 **Tritiated Water with Mercury**
Option Number: SR-W060-1
Facility: None

Treatment Technology: In Situ Macroencapsulation

Treatment Cycle Flow Diagram



Pros

- Few or no secondary wastes generated
- Process will comply with regulations without requiring a variance.
- In situ macroencapsulation minimizes exposure to non operational workers.
- In situ macroencapsulation minimizes exposure to operational workers.

Cons

- Final wasteform will require disposal in HW/MW facility.
- Public may express concern that mercury remains in an untreated (i.e., leachable) form.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	50	Gross volume of waste will increase remain essentially the same.
• secondary waste generation	80	Few or no secondary wastes are generated.
• destruction removal and demobilization efficiency	80	Macroencapsulation, permitted by a variance immobilizes the constituent of concern.
• flexibility	80	Process is very flexible and can handle a wide variety of wasteforms. Stainless steel containers can be custom fabricated to meet almost any need.
• ability to be shipped	80	Stainless steel containers meet DOT shipping requirements.
• final wasteform	80	Final wasteform will meet WAC.
Engineering Parameters		
• system implementability	80	Process is very simple and mature. Stainless steel welding techniques are well known.
• availability	80	Availability will be of little concern. One-time process.
• scalability	80	Process can be adapted to any waste requirement by designing custom containers.
• remedial measures	80	Failed welds are easily detected and repaired.
• schedule for treatment of waste	80	Placing waste in stainless steel boxes lends itself to accurate scheduling.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	In situ macroencapsulation is a one-time operation which will not result in emissions. Most accident scenarios will not result in emissions.
• non operational worker potential exposure	80	In situ macroencapsulation minimizes exposure to non operational workers.

Waste Stream Number & Name: SR-W060 Tritiated Water with Mercury
Option Number: SR-W060-1
Facility: None
Treatment Technology: In Situ Macroencapsulation

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• operational worker potential exposure	80	In situ macroencapsulation minimizes exposure to operational workers.
• transportation potential exposure	80	No transportation until waste is macroencapsulated.
Regulatory Parameters		
• need for variance	50	Process will require a variance.
• ability to obtain a permit	80	The process is well-defined.
• waste disposal	20	Final wasteform will require disposal in HW/MW facility.
Public Acceptance		
• public acceptance	20	Public may express concern that mercury remains in an untreated (i.e., leachable) form.
Cost Considerations		
• life-cycle cost	98	
• funding availability	50	Life-cycle cost can be supported with 10% increase in funding levels.
Industry Involvement		
• market for technology	20	Adaptation of existing technology.
• private sector involvement	20	No vendors have exhibited an interest in this technology.

IDOA Score: **Technical** 57 **Total** 71

Waste Stream Number & Name: SR-W060 Tritiated Water with Mercury
Option Number: SR-W060-1
Facility: None
Treatment Technology: In Situ Macroencapsulation

Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [ ] contact handled [ ] remote handled
Module Location: INEL
Module Status: [ ] Existing [√] New [√] Small generator [ ] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 2	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 9	
		1.3.2 Safety Assurance Documentation	$ 2	
		1.3.3 Permitting	$ 125	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$	
		TOTAL PRE-OPERATIONS		289
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 11	
	2.2	Inspection	$ 2	
	2.3	Project Management	$ 2	
	2.4	Building Construction (inc. indirect)	$	
	2.5	Equipment (inc. indirect)	$ 50	
	2.6	Construction Management	$ 4	
	2.7	Contingency	$ 24	
		TOTAL FACILITY CONSTRUCTION COSTS		92
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 15	
	3.2	Annual Utilities	$ 1	
	3.3	Annual Materials	$ 9	
	3.4	Annual Maintenance	$ 5	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 30	
		X NUMBER OF YEARS OF OPERATION	1.00	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		30
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 40	
	4.2	Closure, Post-Closure, Monitoring	$	
		TOTAL DECONTAMINATION & DECOMMISSIONING		40
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		
6.0	Offsite Treatment (DOE)			
7.0	Transportation			
8.0	Disposal			
		SUB COST FOR IN SITU MACROENCAPSULATION MODULE		2
		ESCALATION		453
		TOTAL COST		1.194
				541

Note: Per DOE directions this cost estimate is the incremental cost for treatment at an offsite DOE facility; therefore, it carries no overhead burden or capital costs.

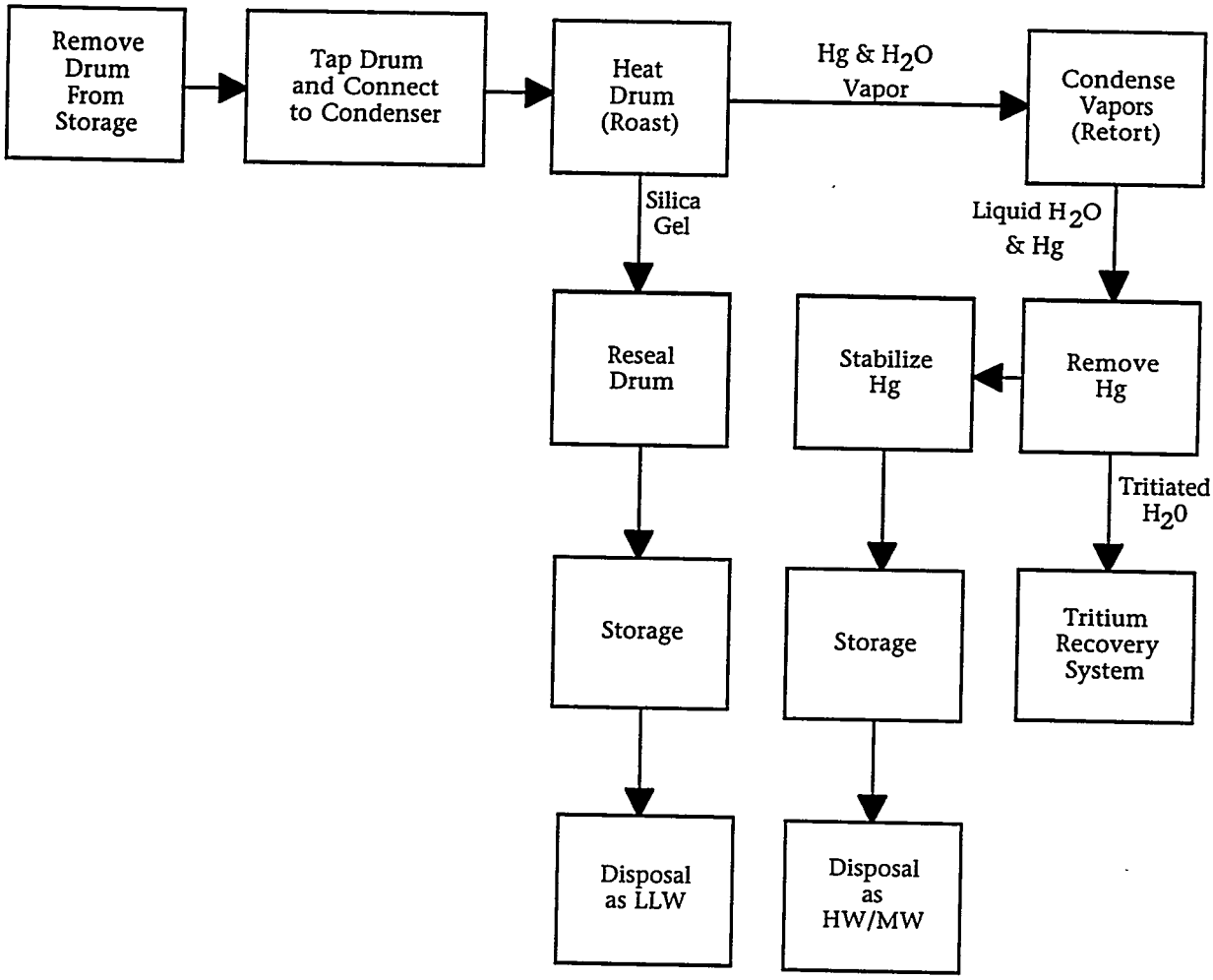
If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W060 Tritiated Water with Mercury
Option Number: SR-W060-2
Facility: Containment Building (Tritium) **Treatment Technology:** In Situ Roast and Retort

Treatment Technology

This process opens the drum containing the waste and the interior is piped to a condenser. An electrical heating jacket, attached to the outside of the waste container, heats the silica gel, desorbing the tritiated water, and vaporizing the mercury. The water and mercury are condensed (retorted) and the mercury removed. The mercury-free, tritiated water is fed to the existing tritium recovery system (which would have to be permitted by the state regulators).

Treatment Cycle Flow Diagram:



Waste Stream Number & Name: SR-W060 Tritiated Water with Mercury
Option Number: SR-W060-2
Facility: Containment Building (Tritium) **Treatment Technology:** In Situ Roast and Retort

Pros

- No secondary waste streams are generated. Instead the original waste is separated into its component parts.
- No additional treatment would be required before amalgamation to ensure LDR standards are met.
- The stabilized waste could be shipped without additional treatment.
- Final wasteform is anticipated to meet the SRS waste disposal WAC.
- The facility is anticipated to have minimal down time.
- Few emissions for the facility are anticipated during normal operation and most accident scenarios
- Residual silica gel can be disposed of as low-level waste.

Cons

- This treatment facility would be specially designed to treat this waste stream on a one-time-only basis.
- No integrated testing of this system has occurred. No laboratory tests have been made.
- Uncertainties surrounding laboratory tests and process design make a schedule difficult to project.
- Project is unbudgeted. It will require line item funding.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	50	Roasting and retorting will not change the gross volume of waste going to disposal.
• secondary waste generation	80	No secondary waste streams are generated. Instead the original waste is separated into its component parts.
• destruction removal and demobilization efficiency	80	No additional treatment would be required after amalgamation to ensure LDR standards are met.
• flexibility	20	This treatment facility would be specially designed to treat this waste stream on a one-time-only basis.
• ability to be shipped	80	The stabilized waste could be shipped without additional treatment.
• final wasteform	80	Final wasteform is anticipated to meet the SRS waste disposal WAC.
Engineering Parameters		
• system implementability	20	No integrated testing of this system has occurred. No laboratory tests have been made.
• availability	80	The facility is anticipated to have minimal down time.
• scalability	20	This treatment facility would be specially designed to treat this waste stream on a one-time-only basis.
• remedial measures	50	Process failure may result in costly and time-consuming remedial measures.
• schedule for treatment of waste	20	Uncertainties surrounding laboratory tests and process design make a schedule difficult to project.

Waste Stream Number & Name: SR-W060 Tritiated Water with Mercury
Option Number: SR-W060-2
Facility: Containment Building (Tritium) **Treatment Technology:** In Situ Roast and Retort

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Few emissions for the facility are anticipated during normal operation and most accident scenarios.
• non operational worker potential exposure	50	Processing this material will not increase the exposure to non operational personnel.
• operational worker potential exposure	50	Personnel exposure is average for operations of this type. Processing this material will not increase the exposure to operational personnel.
• transportation potential exposure	80	Few or no transportation requirements minimize the potential for exposure during transportation.
Regulatory Parameters		
• need for variance	80	Process will comply with regulations without requiring a variance.
• ability to obtain a permit	50	Permitting process is well-defined, however, the undefined nature of the process may make approval difficult.
• waste disposal	80	Residual silica gel can be disposed of as low-level waste.
Public Acceptance		
• public acceptance	50	Public acceptance for roasting and retorting is mixed.
Cost Considerations		
• life-cycle cost	66	
• funding availability	20	Project is unbudgeted. It will require line item funding.
Industry Involvement		
• market for technology	20	This process is waste and site-specific.
• private sector involvement	20	No private vendor has expressed an interest in treating this waste stream.

IDOA Score: **Technical** 47 **Total** 56

Waste Stream Number & Name: SR-W060 Tritiated Water with Mercury
Option Number: SR-W060-2
Facility: Containment Building (Tritium) Treatment Technology: In Situ Roast and Retort

Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[ ] alpha [√] non-alpha [√] contact handled [ ] remote handled
Module Location: INEL
Module Status: [ ] Existing [√] New [√] Small generator [ ] Large generator
[ ] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 141	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 565	
		1.3.2 Safety Assurance Documentation	$ 141	
		1.3.3 Permitting	$ 125	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 90	
		TOTAL PRE-OPERATIONS		1212
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 624	
	2.2	Inspection	$ 173	
	2.3	Project Management	$ 263	
	2.4	Building Construction (inc. indirect)	$ 2000	
	2.5	Equipment (inc. indirect)	$ 835	
	2.6	Construction Management	$ 198	
	2.7	Contingency	$ 1464	
		TOTAL FACILITY CONSTRUCTION COSTS		5558
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 38	
	3.2	Annual Utilities	$ 2	
	3.3	Annual Materials	$ 23	
	3.4	Annual Maintenance	$ 14	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 75	
		X NUMBER OF YEARS OF OPERATION	1	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		75
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 2268	
	4.2	Closure, Post-Closure, Monitoring	$ 0	
		TOTAL DECONTAMINATION & DECOMMISSIONING		2268
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		
6.0	Offsite Treatment (DOE)			
7.0	Transportation			
8.0	Disposal			5
		SUB COST FOR IN SITU ROAST AND RETORT MODULE		9119
		ESCALATION		1.305
		TOTAL COST		11900

Note: Per DOE directions this cost estimate is the incremental cost for treatment at an offsite DOE facility; therefore, it carries no overhead burden or capital cost.

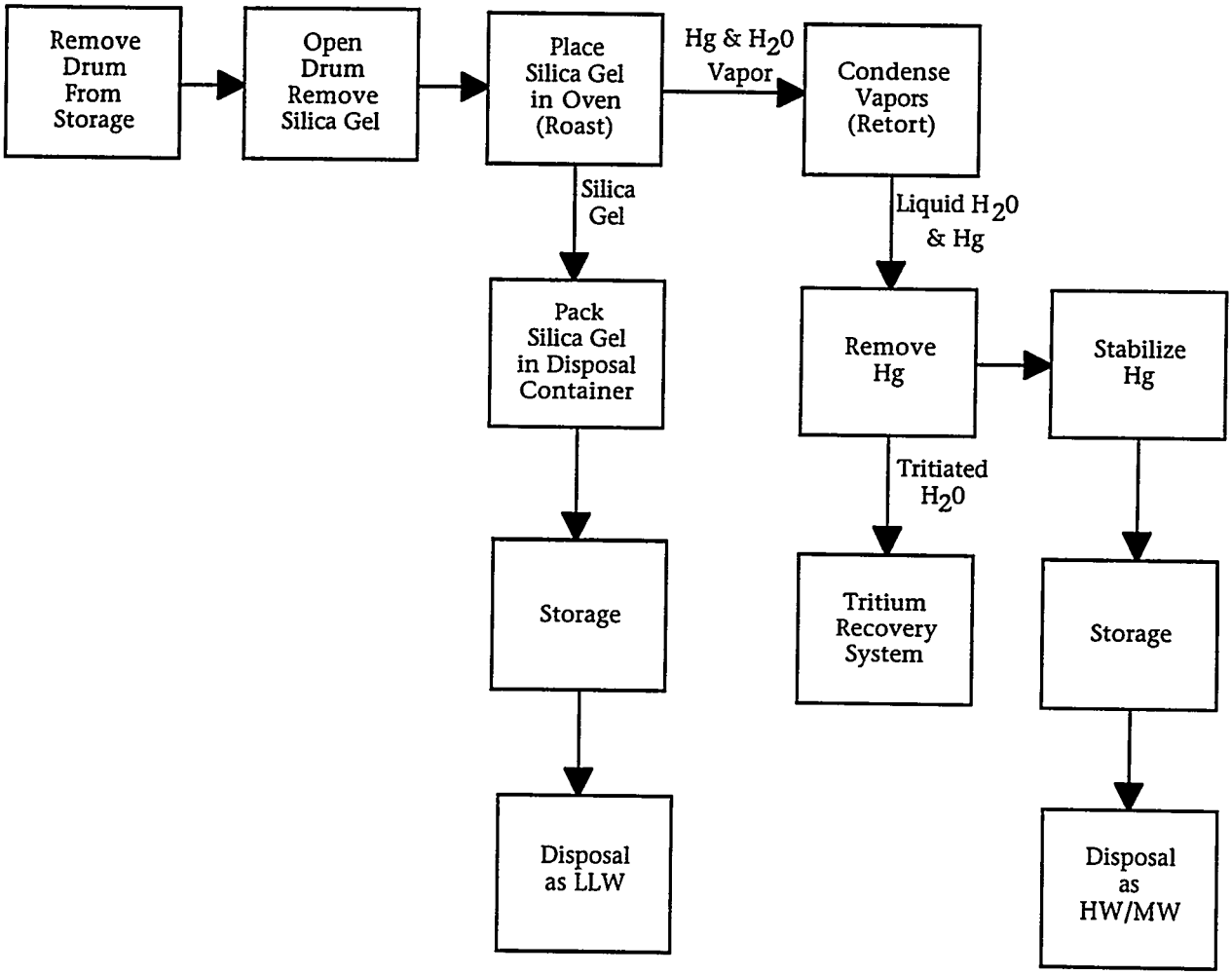
If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W060 Tritiated Water with Mercury
Option Number: SR-W060-3
Facility: Containment Building (Tritium) **Treatment Technology:** Repackage, Roast, and Retort

Treatment Technology

This process opens the drum containing the waste and removes the contents to a roasting furnace, which heats the silica gel, desorbing the tritiated water and vaporizing the mercury. The water and mercury are condensed (retorted) and the mercury removed. The mercury-free, tritiated water is fed to the existing tritium recovery system (which will have to be permitted by state regulators).

Treatment Cycle Flow Diagram:



Waste Stream Number & Name: SR-W060 Tritiated Water with Mercury
Option Number: SR-W060-3
Facility: Containment Building (Tritium) Treatment Technology: Repackage, Roast, and Retort

Pros

- No secondary waste streams are generated. Instead the original waste is separated into its component parts.
- No additional treatment would be required after amalgamation to ensure LDR standards are met.
- The amalgamated waste could be shipped without additional treatment.
- Final wasteform is anticipated to meet the SRS waste disposal WAC.
- The facility is anticipated to have minimal down time.
- Few emissions for the facility are anticipated during normal operation and most accident scenarios
- Few or no transportation requirements minimize the potential for exposure during transportation.
- Residual silica gel can be disposed of as low-level waste.

Cons

- This treatment facility would be specially designed to treat this waste stream on a one-time-only basis.
- No integrated testing of this system has occurred. No laboratory tests have been made.
- Uncertainties surrounding laboratory tests and process design make a schedule difficult to project.
- Project is unbudgeted. It will require line item funding.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	50	Roasting and retorting will not change the gross volume of waste going to disposal.
• secondary waste generation	80	No secondary waste streams are generated. Instead the original waste is separated into its component parts.
• destruction removal and demobilization efficiency	80	No additional treatment would be required before stabilize to ensure LDR standards are met.
• flexibility	20	This treatment facility would be specially designed to treat this waste stream on a one-time-only basis.
• ability to be shipped	60	The stabilized waste could be shipped without additional treatment. Subtract 20 point for high median of 80 because dewatered silica gel would require repackaging before shipment to disposal.
• final wasteform	80	Final wasteform is anticipated to meet the SRS waste disposal WAC.
Engineering Parameters		
• system implementability	20	No integrated testing of this system has occurred. No laboratory tests have been made.
• availability	50	The facility is anticipated to have 50% down time. Availability is of little concern with this process.
• scalability	20	This treatment facility would be specially designed to treat this waste stream on a one-time-only basis.

Waste Stream Number & Name: SR-W060 Tritiated Water with Mercury
Option Number: SR-W060-3
Facility: Containment Building (Tritium) **Treatment Technology:** Repackage, Roast, and Retort

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• remedial measures	50	Process failure may result in costly and time-consuming remedial measures.
• schedule for treatment of waste	20	Uncertainties surrounding laboratory tests and process design make a schedule difficult to project.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Few emissions for the facility are anticipated during normal operation and most accident scenarios.
• non operational worker potential exposure	50	Processing this material will not increase the exposure to non operational personnel.
• operational worker potential exposure	50	Personnel exposure is average for operations of this type. Processing this material will not increase the exposure to operational personnel.
• transportation potential exposure	80	Few or no transportation requirements minimize the potential for exposure during transportation.
Regulatory Parameters		
• need for variance	80	Process will comply with regulations without requiring a variance.
• ability to obtain a permit	50	Permitting process is well-defined; however, the undefined nature of the process may make approval difficult.
• waste disposal	80	Residual silica gel can be disposed of as low-level waste.
Public Acceptance		
• public acceptance	50	Public acceptance for roasting and retorting is mixed.
Cost Considerations		
• life-cycle cost	62	
• funding availability	20	Project is unbudgeted. It will require line item funding.
Industry Involvement		
• market for technology	20	This process is waste and site specific.
• private sector involvement	20	No private vendor has expressed an interest in treating this waste stream.

IDOA Score: **Technical** 46 **Total** 54

Waste Stream Number & Name: SR-W060 Tritiated Water with Mercury
Option Number: SR-W060-3
Facility: Containment Building (Tritium) **Treatment Technology:** Repackage, Roast, and Retort

Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [√] non-alpha [√] contact handled [ ] remote handled

Module Location: SRS

Module Status: [ ] Existing [√] New [√] Small generator [ ] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 156	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 623	
		1.3.2 Safety Assurance Documentation	$ 156	
		1.3.3 Permitting	$ 125	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 90	
		TOTAL PRE-OPERATIONS		1300
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 693	
	2.2	Inspection	$ 186	
	2.3	Project Management	$ 276	
	2.4	Building Construction (inc. indirect)	$ 2000	
	2.5	Equipment (inc. indirect)	$ 1150	
	2.6	Construction Management	$ 221	
	2.7	Contingency	$ 1615	
		TOTAL FACILITY CONSTRUCTION COSTS		6141
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 75	
	3.2	Annual Utilities	$ 3	
	3.3	Annual Materials	$ 45	
	3.4	Annual Maintenance	$ 27	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 150	
		X NUMBER OF YEARS OF OPERATION	1	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		150
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 2520	
	4.2	Closure, Post-Closure, Monitoring	$ 0	
		TOTAL DECONTAMINATION & DECOMMISSIONING		2520
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		
6.0	Offsite Treatment (DOE)			
7.0	Transportation			
8.0	Disposal			
		SUB COST FOR ROAST AND RETORT MODULE		5
		ESCALATION		10116
		TOTAL COST		1.305
				13201

If above numbers do not appear to add correctly, it is the result of computer rounding.

Summary Page – Initial Screening

Waste Stream Number & Name: SR-W061 DWPF Mercury

Background Information

This is a future waste stream. This waste will be produced by the recovery of mercury from the DWPF vitrification of high-level waste process. Mercury is introduced into the separations process as a catalyst in metal dissolution and eventually collects in the high-level liquid waste (reference streams SR-W016 and SR-W017).

Volume
- Current volume through 09/30/94 is 0.00 m^3.
- Expected 1995-1999 generation volume will be 0.9 m^3.

Waste Stream Composition
- Elemental mercury

Waste Code
- D009D (elemental Hg)

LDR Treatment Standard
- D009 = specified technology = Amalgamation

Waste Characterization
- Process knowledge used to characterize the waste stream.
- Confidence level is high based on the waste composition being mercury.

Radiological Characterization
- Unknown, future waste

Initial Screening

The initial screening identified inappropriate treatment options. These options appear in the Initial Rejections table.

Initial Rejections

Treatment Facility	Treatment Technology	Reasons for Rejection
CIF	Incineration	Incineration is not an appropriate treatment for elemental mercury. Constituent of concern is volatilized and escapes to atmosphere.
CIF	Ashcrete Stabilization	Concrete stabilization is not an appropriate treatment for elemental mercury. Constituent of concern is not immobilized
ETF	Ion Exchange	ETF has no process to treat this waste.
LETF	Ion Exchange	LETF has no equipment to treat this waste.
M Area	Vitrification	Vitrification is not an appropriate treatment for elemental mercury. Constituent of concern is volatilized and escapes to atmosphere.
Z Area	Stabilization	Concrete stabilization is not an appropriate treatment for elemental mercury. Constituent of concern is not immobilized

Summary Page – Technology Success Factor (TSF) & In-Depth Options Analysis (IDOA)

Waste Stream Number & Name: SR-W061 DWPF Mercury

Feasible Options

Option No.	Treatment Facility	Treatment Technology	TSF Score	IDOA Scores		COST (x 1,000)	PO
				Tech.	Total		
SR-W061-1	INEL/WEDF	Amalgamation	*	51	65	126	–
SR-W061-2	Cont. Bldg.	Distill/Reuse	51	43	57	2163	
SR-W061-3	Cont. Bldg.	Amalgamation	51	50	63	2905	
SR-W061-4	HW/MW-TB	Amalgamation	51	50	62	3173	

* No TSF required for proposed or existing non-Savannah River Site-DOE facilities.

Options Rejected Due To Low Technology Success Factor (TSF)

- No options were rejected.

Engineering Assessment

Preferred Option Justification

The preferred treatment option for the DWPF mercury is Amalgamation at an offsite DOE facility; the Idaho National Engineering Laboratory/Waste Engineering Development Facility (INEL/WEDF) – Amalgamation Unit.

This option treats mercury, the constituent of concern, by binding it with another metal into a non-leachable form (amalgam).

This option is preferred because:
- No secondary waste streams are generated.
- This waste stream is compatible with the design basis for the facility.
- Treatment is specified technology.
- Offsite treatment is cost-effective.

Options Rejected During IDOA

Distillation Followed by Reuse or Amalgamation in a Containment Building or HW/MW-TB

Distillation followed by reuse or amalgamation in a containment building or HW/MW-TB was rejected because:
- Rejected options are far less cost-effective than the preferred option.
- Rejected options require design and construction of new facilities.
- New facilities will be decommissioned, and relegated to waste after only a short operating period.
- Waste mercury would have already been distilled in the DWPF process. Further distillation would be of dubious value.
- If material could be recovered by distillation and reused, it would not have been declared waste.

Waste Stream Number & Name: SR-W061 DWPF Mercury
Option Number: SR-W061-1
Facility: INEL/WEDF
Treatment Technology: Amalgamation

Treatment Technology

This process is amalgamation, where mercury and the amalgamating material combine to form a material (amalgam) in which the mercury is easily managed and immobile.

Pros

- Treatment is specified technology. No secondary waste streams are generated.
- The stabilized waste could be shipped without additional treatment.
- Final wasteform is anticipated to meet the SRS disposal WAC.
- Amalgamation has been demonstrated at the facility.
- The facility is anticipated to have minimal down time.
- Process failure is not anticipated to create a waste stream that cannot be treated.
- Few emissions for the facility are anticipated during normal operation and most accident scenarios
- The facility could potentially be used to treat numerous waste streams throughout the DOE Complex.

Cons

- Amalgamation will increase the overall waste volume by a factor of two or more after processing.
- Waste characterization will be required for any waste streams returned to SRS for disposal.
- The majority of the treated waste will be classified as mixed waste which will require disposal in a RCRA Subtitle C HW/MW facility.
- Need to transport waste offsite
- This is a planned but not funded facility.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	20	Amalgamation will increase the overall waste volume by a factor of two or more after processing.
• secondary waste generation	80	No secondary waste streams are generated.
• destruction removal and demobilization efficiency	80	No additional treatment would be required before amalgamation to ensure LDR standards are met.
• flexibility	80	The facility can treat waste streams similar in composition to those assumed in the design basis without modification.
• ability to be shipped	80	The stabilized waste could be shipped without additional treatment.
• final wasteform	80	Final wasteform is anticipated to meet the SRS waste disposal WAC.
Engineering Parameters		
• system implementability	80	Amalgamation has been demonstrated at the facility.
• availability	80	The facility is anticipated to have minimal down time.
• scalability	80	Although throughput is fixed by design, the volumes of additional waste from this stream are so small that no modification would be required.

Waste Stream Number & Name: SR-W061 DWPF Mercury
Option Number: SR-W061-1
Facility: INEL/WEDF
Treatment Technology: Amalgamation

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• remedial measures	80	Process failure is not anticipated to create a waste stream that cannot be treated.
• schedule for treatment of waste	20	The schedule for waste treatment that can be provided is preconceptual. Moreover, acceptance of SRS waste will be contingent upon State of Idaho-approved permit modifications.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Few emissions for the facility are anticipated during normal operation and most accident scenarios.
• non operational worker potential exposure	50	Processing this material will require an average number of non operational personnel.
• operational worker potential exposure	50	Personnel exposure is average for operations of this type. Processing this material will not increase the exposure to operational personnel.
• transportation potential exposure	20	Waste characterization will be required for any waste streams returned to SRS for disposal.
Regulatory Parameters		
• need for variance	80	Process is currently permitted under interim status.
• ability to obtain a permit	50	Permitting process is well defined, however, the State of Idaho acceptance of offsite waste treatment is unknown. Approval may be difficult. It is anticipated that the State of Idaho will call for a full RCRA Part B Permit Application before construction of the amalgamation unit.
• waste disposal	20	All treated waste will be classified as mixed waste which will require disposal in a HW/MW facility.
Public Acceptance		
• public acceptance	50	Public acceptance for amalgamation is neutral; however, the treatment of offsite waste is anticipated to reduce the overall public acceptance of this process.
Cost Considerations		
• life-cycle cost	99	
• funding availability	20	Funding for treatment cost can be provided using the operating budget, however the additional costs may result in an increase in the budget more than 10%.
Industry Involvement		
• market for technology	80	The facility could potentially be used to treat numerous waste streams throughout the DOE Complex.
• private sector involvement	20	Facility is a GOCO. No private involvement is foreseen.

IDOA Score: **Technical** 51 **Total** 65

Waste Stream Number & Name: SR-W061 DWPF Mercury
Option Number: SR-W061-1
Facility: INEL/WEDF
Treatment Technology: Amalgamation
Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[ ] alpha [√] non-alpha [√] contact handled [ ] remote handled

Module Location: INEL

Module Status: [ ] Existing [√] New [√] Small generator [ ] Large generator
[ ] Onsite [√] Offsite [ ] Commercial [ ] Portable [ ] R&D

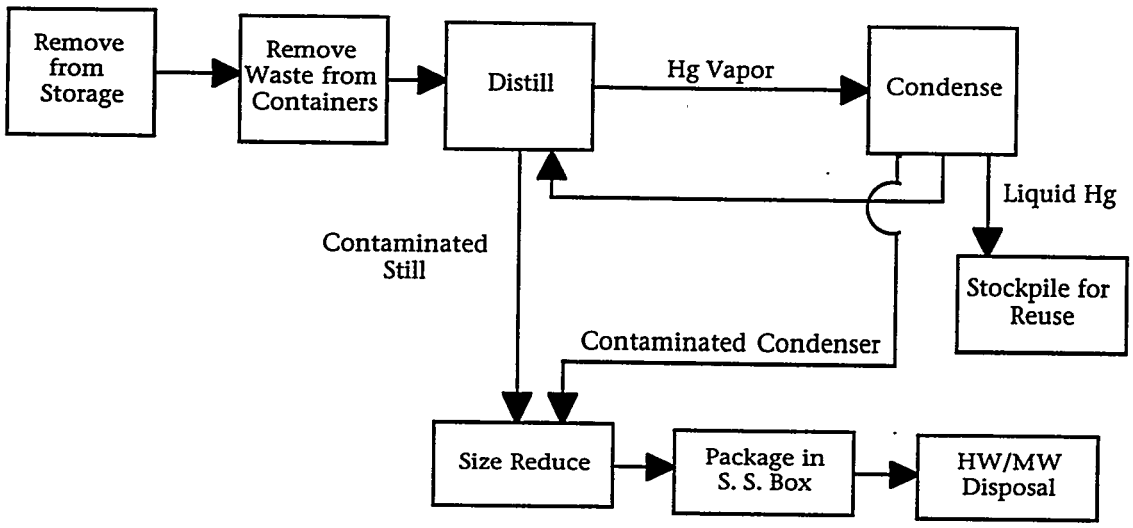
WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ N/A	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ N/A	
		1.3.2 Safety Assurance Documentation	$ N/A	
		1.3.3 Permitting	$ N/A	
		1.3.4 Preparation for Operations	$ N/A	
		1.3.5 Project Management	$ N/A	
		TOTAL PRE-OPERATIONS		$ N/A
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ N/A	
	2.2	Inspection	$ N/A	
	2.3	Project Management	$ N/A	
	2.4	Building Construction (inc. indirect)	$ N/A	
	2.5	Equipment (inc. indirect)	$ N/A	
	2.6	Construction Management	$ N/A	
	2.7	Contingency	$ N/A	
		TOTAL FACILITY CONSTRUCTION COSTS		$ N/A
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ N/A	
	3.2	Annual Utilities	$ N/A	
	3.3	Annual Materials	$ N/A	
	3.4	Annual Maintenance	$ N/A	
	3.5	Annual Contingency	$ N/A	
		TOTAL ANNUAL O & M	$ N/A	
		X NUMBER OF YEARS OF OPERATION		
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ N/A
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ N/A	
	4.2	Closure, Post-Closure, Monitoring	$ N/A	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ N/A
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$ N/A	
	5.2	Mobile Treatment	$ N/A	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$ 1
7.0	Transportation			$ 17.6
8.0	Disposal			$ 100
		SUB COST FOR AMALGAMATION MODULE		$ 118.6
		ESCALATION		1.06
		TOTAL COST		$ 126

Note: Per DOE directions this cost estimate is the incremental cost for treatment at an offsite DOE facility; therefore, it carries no overhead burden or capital costs.

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W061 DWPF Mercury
Option Number: SR-W061-2
Facility: Containment Building **Treatment Technology:** Distill/Reuse

Treatment Cycle Flow Diagram:



Pros

- Small scale equipment.
- Final wasteform will meet waste disposal WAC.
- Small scale process. Availability will be of little concern.
- Process will comply with regulations without requiring a variance.

Cons

- Traps and used equipment will require disposal in HW/MW facilities.
- Not a budgeted item and will require line item funding.
- Large cost for a small, hypothetical volume waste.
- Waste has already been distilled once, further distillations unlikely to improve composition.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
◦ volume alteration	80	Significant reduction in waste volume if mercury is recovered for reuse.
◦ secondary waste generation	50	A variety of secondary wastes, but small scale equipment.
◦ destruction removal and demobilization efficiency	50	Probable that distillation will not yield materials fit for reuse.
◦ flexibility	50	Process may require additional steps or equipment to handle off-design input streams.
• ability to be shipped	80	There are no treatment residuals because material will be for reuse. Contaminated processing equipment will require simple treatment prior to shipment.
• final wasteform	80	Final wasteform will meet waste disposal WAC.

Waste Stream Number & Name: SR-W061 DWPF Mercury
Option Number: SR-W061-2
Facility: Containment Building **Treatment Technology:** Distill/Reuse
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Engineering Parameters		
• system implementability	20	The process is commercially available. But, the waste has already been distilled. Additional distillations are envisioned to result in no improvement of the mercury.
• availability	80	Small-scale process. Availability will be of little concern.
• scalability	50	Fixed by design. Very small volume of waste projected.
• remedial measures	50	Rupture or breakage of glass equipment will require a significant cleanup effort.
• schedule for treatment of waste	80	Laboratory-scale process can be clearly defined using off-the-shelf equipment. Thus, it is expected to be accurately scheduled.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Process will take place in a controlled area. Source is small.
• non operational worker potential exposure	40	Subtract 10 points from the median score of 50 because of the labor required for decommissioning the facility.
• operational worker potential exposure	50	An average number of operational workers will be required to tend this process.
• transportation potential exposure	50	Waste will require some additional characterization before transportation to storage.
Regulatory Parameters		
• need for variance	80	Process will comply with regulations without requiring a variance.
• ability to obtain a permit	80	The process is well-defined.
• waste disposal	20	Traps and used equipment will require disposal in HW/MW facilities.
Public Acceptance		
• public acceptance	20	Public concern may surface over the effectiveness of the technology (i.e. if distillation worked this material would not be generated).
Cost Considerations		
• life-cycle cost	94	
• funding availability	20	Not a budgeted item and will require line item funding.
Industry Involvement		
• market for technology	20	Adaptation of existing technology.
• private sector involvement	50	Other vendors have expressed an interest in treating this waste stream.

IDOA Score: **Technical** 43 **Total** 57

Waste Stream Number & Name: SR-W061 DWPF Mercury
Option Number: SR-W061-2
Facility: Containment Building **Treatment Technology: Distill/Reuse**
Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[ ] alpha [√] non-alpha [√] contact handled [ ] remote handled

Module Location: SRS

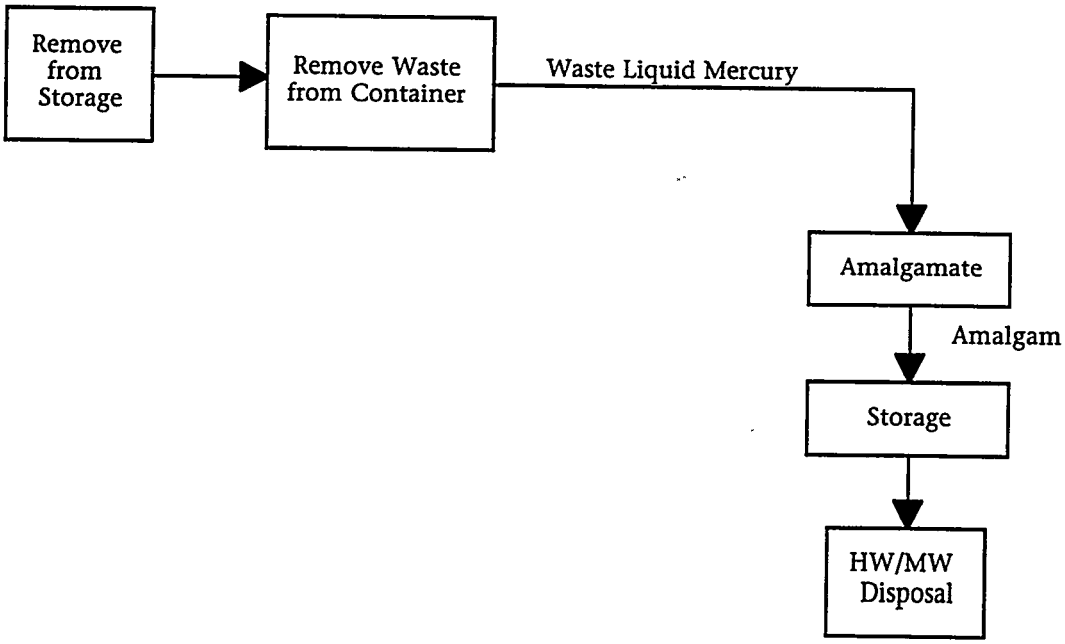
Module Status: [ ] Existing [√] New [√] Small generator [ ] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 22	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 86	
		1.3.2 Safety Assurance Documentation	$ 22	
		1.3.3 Permitting	$ 0	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 7	
		TOTAL PRE-OPERATIONS		$ 411
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 99	
	2.2	Inspection	$ 23	
	2.3	Project Management	$ 29	
	2.4	Building Construction (inc. indirect)	$ 150	
	2.5	Equipment (inc. indirect)	$ 300	
	2.6	Construction Management	$ 32	
	2.7	Contingency	$ 224	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 856
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 8	
	3.2	Annual Utilities	$ 0	
	3.3	Annual Materials	$ 5	
	3.4	Annual Maintenance	$ 3	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 15	
		X NUMBER OF YEARS OF OPERATION	5.00	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 75
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 360	
	4.2	Closure, Post-Closure, Monitoring	$ 5	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 365
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 5
		SUB COST FOR DISTILL AND REUSE MODULE		$ 5,794
		ESCALATION		1.267
		TOTAL COST		$ 2163

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W061 DWPF Mercury
Option Number: SR-W061-3
Facility: Containment Building **Treatment Technology:** Amalgamation

Treatment Cycle Flow Diagram:



Pros

- LDR requirements will be met without further treatment.
- All treatment residuals will be able to be shipped without further treatment.
- Final wasteform will meet the waste disposal WAC.
- Small scale process. Availability will be of little concern.
- Process will take place in a controlled laboratory area. Source is small.
- Process will comply with regulations without requiring a variance.
- The process is well-defined, and has been permitted in other locations.

Cons

- Waste volume increases by a factor of two because of the amalgam.
- Process flexibility is limited because throughput is fixed by design. Increased throughput possible by adding operating shifts.
- Owing to the small batch size, it is expected that this will be a labor-intensive process.
- All waste will require disposal in HW/MW facilities.
- Not a budgeted item, cost will be high for the small volume of waste treated

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	20	Amalgamation will increase the overall waste volume by a factor of 2 or more after processing.
• secondary waste generation	40	Subtract 10 points from the median score of 50 because contaminated process equipment created.
• destruction removal and demobilization efficiency	80	LDR requirements will be met without further treatment.

Waste Stream Number & Name: SR-W061 DWPF Mercury
Option Number: SR-W061-3
Facility: Containment Building **Treatment Technology:** Amalgamation

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• flexibility	50	Process may require additional steps or equipment to handle off-design input.
• ability to be shipped	80	All treatment residuals will be able to be shipped without further treatment.
• final wasteform	80	Final wasteform will meet waste disposal WAC.
Engineering Parameters		
• system implementability	80	The process is commercially available.
• availability	80	Small-scale process. Availability will be of little concern.
• scalability	80	Fixed by design. But, volumes are so small that no modification would be required to handle 2 or 3 times as much as predicted.
• remedial measures	80	Failure to amalgamate can easily be addressed by reprocessing with more reagents.
• schedule for treatment of waste	50	Concerns about the effectiveness of commercial technology may result in uncertainty in the schedule.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Process will take place in a controlled laboratory area. Source is small.
• non operational worker potential exposure	40	The process equipment is small. Subtract 10 points from the median score of 50 because decommissioning may be labor intensive.
• operational worker potential exposure	20	Owing to the small batch size, it is expected that this will be a labor-intensive process.
• transportation potential exposure	50	Waste will require some additional characterization before transportation to storage.
Regulatory Parameters		
• need for variance	80	Process will comply with regulations without requiring a variance.
• ability to obtain a permit	80	The process is well defined.
• waste disposal	20	All waste will require disposal in HW/MW facilities.
Public Acceptance		
• public acceptance	50	Public acceptance to amalgamation is neutral. Process does not create a wasteform that is as permanent as others.
Cost Considerations		
• life-cycle cost	92	
• funding availability	20	Not a budgeted item and will require line item funding.
Industry Involvement		
• market for technology	20	Adaptation of existing technology.
• private sector involvement	50	Other vendors have expressed an interest in treating this waste stream.

IDOA Score: **Technical** 50 **Total** 63

Waste Stream Number & Name: SR-W061 DWPF Mercury
Option Number: SR-W061-3
Facility: Containment Building **Treatment Technology: Amalgamation**
Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[ ] alpha [√] non-alpha [√] contact handled [ ] remote handled

Module Location: SRS

Module Status: [ ] Existing [√] New [√] Small generator [ ] Large generator
[ ] Onsite [√] Offsite [ ] Commercial [ ] Portable [ ] R&D

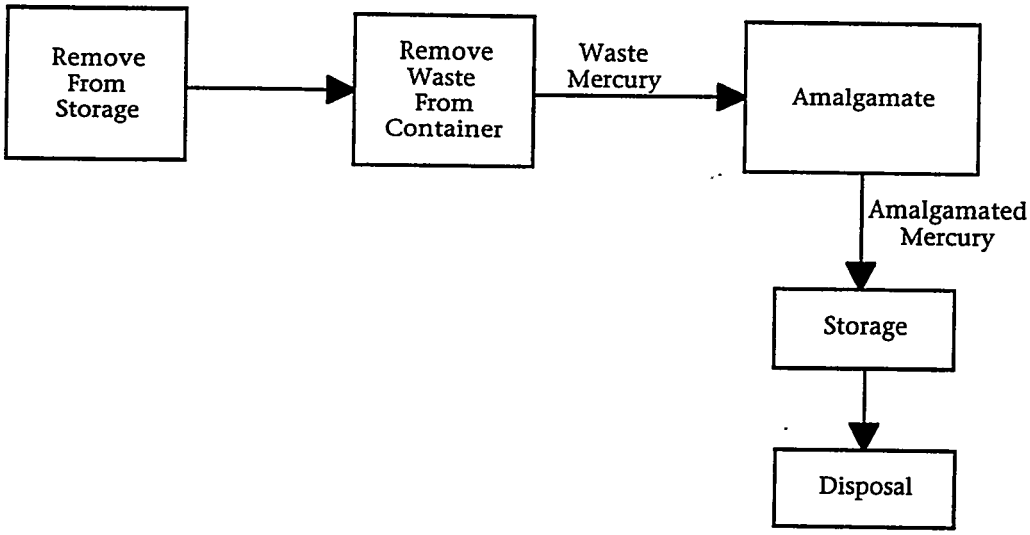
WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 31	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 123	
		1.3.2 Safety Assurance Documentation	$ 31	
		1.3.3 Permitting	$ 125	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 7	
		TOTAL PRE-OPERATIONS		$ 467
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 143	
	2.2	Inspection	$ 31	
	2.3	Project Management	$ 37	
	2.4	Building Construction (inc. indirect)	$ 150	
	2.5	Equipment (inc. indirect)	$ 500	
	2.6	Construction Management	$ 46	
	2.7	Contingency	$ 320	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 1226
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 8	
	3.2	Annual Utilities	$ 0	
	3.3	Annual Materials	$ 5	
	3.4	Annual Maintenance	$ 3	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 15	
		X NUMBER OF YEARS OF OPERATION	5.00	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 75
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 520	
	4.2	Closure, Post-Closure, Monitoring	$ 0	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 520
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 10
		SUB COST FOR AMALGAMATION MODULE		$ 2293
		ESCALATION		1.267
		TOTAL COST		$ 2905

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W061 DWPF Mercury
Option Number: SR-W061-4
Facility: HW/MW-TB

Treatment Technology: Amalgamation

Treatment Cycle Flow Diagram:



Pros

- LDR requirements will be met without further treatment.
- All treatment residuals will be able to be shipped without further treatment.
- Final wasteform will meet waste disposal WAC.
- Small-scale process. Availability will be of little concern.
- Process will take place in a controlled laboratory area. Source is small.
- Process will comply with regulations without requiring a variance.
- The process is well-defined, and has been permitted in other locations.

Cons

- Waste volume increases by a factor of two because of the amalgam.
- Process flexibility is limited because throughput is fixed by design. Increased throughput possible by adding operating shifts.
- Owing to the small batch size, it is expected that this will be a labor intensive process.
- All waste will require disposal in HW/MW facilities.
- Not a budgeted item and cost will be high for the small volume of waste treated

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	20	Amalgamation will increase the overall waste volume by a factor of two or more after processing.
• secondary waste generation	40	Subtract 10 points from the median score of 50 because contaminated process equipment created.
• destruction removal and demobilization efficiency	80	LDR requirements will be met without further treatment.
• flexibility	50	Process may require additional steps or equipment to handle off-design input.
• ability to be shipped	80	All treatment residuals will be able to be shipped without further treatment.
• final wasteform	80	Final wasteform will meet waste disposal WAC.

Waste Stream Number & Name: SR-W061 DWPF Mercury
Option Number: SR-W061-4
Facility: HW/MW-TB **Treatment Technology:** Amalgamation
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Engineering Parameters		
• system implementability	80	The process is commercially available.
• availability	80	Small scale process. Availability will be of little concern.
• scalability	80	Fixed by design. But, volumes are so small that no modification would be required to handle 2 or 3 times as much as predicted.
• remedial measures	80	Failure to amalgamate can easily be addressed by reprocessing with more reagents.
• schedule for treatment of waste	50	Some technology concerns.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Process will take place in a controlled laboratory area. Source is small.
• non operational worker potential exposure	40	The process equipment is small. Subtract 10 points from the median score of 50 because decommissioning may be labor intensive.
• operational worker potential exposure	20	Owing to the small batch size, it is expected that this will be a labor-intensive process.
• transportation potential exposure	50	Waste will require some additional characterization before transportation to storage.
Regulatory Parameters		
• need for variance	80	Process will comply with regulations without requiring a variance.
• ability to obtain a permit	80	The process is well defined.
• waste disposal	20	All waste will require disposal in HW/MW facilities.
Public Acceptance		
• public acceptance	50	Public acceptance to amalgamation is neutral. Process does not create a wasteform that is as permanent as others.
Cost Considerations		
• life-cycle cost	91	
• funding availability	20	Not a budgeted item and will require line item funding.
Industry Involvement		
• market for technology	20	Adaptation of existing technology.
• private sector involvement	50	Other vendors have expressed an interest in treating this waste stream.

IDOA Score: **Technical** 50 **Total** 62

Waste Stream Number & Name: SR-W061 DWPF Mercury
Option Number: SR-W061-4
Facility: HW/MW-TB
Treatment Technology: Amalgamation
Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[ ] alpha [√] non-alpha [√] contact handled [ ] remote handled

Module Location: SRS

Module Status: [ ] Existing [√] New [√] Small generator [ ] Large generator
[ ] Onsite [√] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 31	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 123	
		1.3.2 Safety Assurance Documentation	$ 31	
		1.3.3 Permitting	$ 125	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 7	
		TOTAL PRE-OPERATIONS		$ 467
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 143	
	2.2	Inspection	$ 31	
	2.3	Project Management	$ 37	
	2.4	Building Construction (inc. indirect)	$ 150	
	2.5	Equipment (inc. indirect)	$ 500	
	2.6	Construction Management	$ 46	
	2.7	Contingency	$ 320	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 1226
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 8	
	3.2	Annual Utilities	$ 0	
	3.3	Annual Materials	$ 5	
	3.4	Annual Maintenance	$ 3	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 15	
		X NUMBER OF YEARS OF OPERATION	5.00	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 75
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 520	
	4.2	Closure, Post-Closure, Monitoring	$ 0	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 520
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 5
		SUB COST FOR AMALGAMATION MODULE		$ 2293
		ESCALATION		1.384
		TOTAL COST		$ 3173

If above numbers do not appear to add correctly, it is the result of computer rounding.

Summary Page – Initial Screening

Waste Stream Number & Name: SR-W062 Toxic Characteristic (TC) Contaminated Debris

Background Information

This waste stream consists of non-combustible debris (metal, floor tiles, fluorescent light bulbs, broken thermometers, instruments, and other equipment) contaminated with mercury and radionuclides. Note this is a different stream from SR-W015 (Mercury/Tritium Contaminated Equipment). Future waste includes debris generated during decommissioning and decontamination (D&D) activities, in which the debris would be treated within 90 days.

Volume
- Current volume through 09/30/94 is 6.2 m^3.
- Expected 1995-1999 generation volume will be 5 m^3.

Waste Stream Composition
- Inorganic debris

Waste Code
- D006A (TCLP Cd)
- D007A (TCLP Cr)
- D008A (TCLP Pb)
- D009A (TCLP Hg) Nonwastewater

LDR Treatment Standard
- D006 = concentration based standard = 1.0 mg/l
- D007 = concentration based standard = 5.0 mg/l
- D008 = concentration based standard = 5.0 mg/l
- D009 = concentration based standard = 0.2 mg/l
- Alternative debris technology may be applied.

Waste Characterization
- Process knowledge used to characterize the waste stream.
- Confidence level is high based on knowing process history of the recorder.

Radiological Characterization
- Radioactivity will vary depending on the generation source and location.
- 232-F Facility waste contains tritium.
- Waste is contact handled.
- Mixed low-level waste

Initial Screening

The initial screening identified inappropriate treatment options. These options appear in the Initial Rejections table.

Initial Rejections

Treatment Facility	Treatment Technology	Reasons for Rejection
CIF	Incineration	Incineration is not an appropriate treatment for mercury. Constituent of concern is volatilized and escapes to atmosphere. Moreover, the waste in not combustible.
CIF	Ashcrete Stabilization	Concrete stabilization is not an appropriate treatment for elemental mercury. Constituent of concern is not immobilized. Moreover, waste would require size reduction to fit in an ashcrete drum.
ETF	Ion Exchange	ETF has no process to treat this waste.

Initial Rejections (contd)

Treatment Facility	Treatment Technology	Reasons for Rejection
LETF	Ion Exchange	LETF has no equipment to treat this waste.
M Area	Vitrification	Vitrification is not an appropriate treatment for elemental mercury. Constituent of concern is volatilized and escapes to atmosphere.
Z Area	Stabilization	Concrete stabilization is not an appropriate treatment for mercury. Constituent of concern is not immobilized

Summary Page – Technology Success Factor (TSF) & In-Depth Options Analysis (IDOA)

Waste Stream Number & Name: SR-W062 Toxic Characteristic (TC) Contaminated Debris

Feasible Options

Option No.	Treatment Facility	Treatment Technology	TSF Score	IDOA Scores Tech.	IDOA Scores Total	COST (x 1,000)	PO
SR-W062-1	Cont. Bldg.	Vendor Macroencapsulation in Polymer	100	55	68	2596	X
SR-W062-2	Cont. Bldg.	Macroencapsulation	94	47	58	9347	
SR-W062-3	INEL/WEDF	Stabilization	94	40	53	654	

Options Rejected Due To Low Technology Success Factor (TSF)

- No options were rejected.

Engineering Assessment

Preferred Option Justification

The preferred treatment option for the toxic characteristic contaminated debris is macroencapsulation in polymer by a vendor. This option will share facilities with the preferred option for SR-W069.

This option treats the constituent of concern mercury by encapsulating the contaminated waste in a corrosion-resistant polymer.

This option is preferred because:

- Few or no secondary wastes are generated.
- Macroencapsulation, permitted by the debris rule, immobilizes the constituent of concern.
- Process is very flexible and can handle a wide variety of wasteforms. Stainless steel containers can be custom fabricated to meet almost any need.
- Process will comply with regulations without requiring a variance.
- Process can be adapted to any waste requirement by designing custom containers.
- Treatment is cost-effective.

Options Rejected During IDOA

Macroencapsulation in a containment building or HW/MW-TB in which mercury contaminated waste would be packaged for transportation to a containment building in which the temporary container would be emptied into or overpacked with a stainless steel box that would be welded shut and the integrity of the welds verified.

Macroencapsulation in a containment building or HW/MW-TB was rejected because:

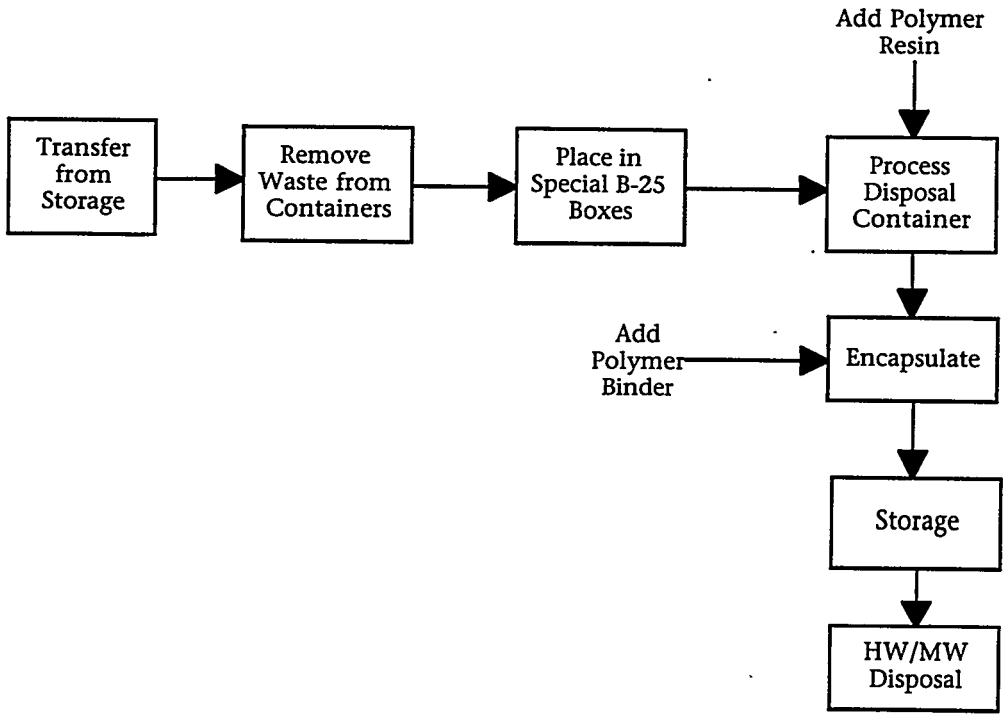
- Rejected options require design and construction of new facilities.
- Process requires waste to be double handled.
- These options are less cost-efficient than the selected option (the construction cost of the HW/MW-TB is incremental for this waste stream and assumes a significant initial construction cost borne by other waste streams, which understates the real cost of the HW/MW-TB option).

Waste Stream Number & Name: SR-W062 Toxic Characteristic (TC) Contaminated Debris

Option Number: SR-W062-1
Facility: Containment Building

Treatment Technology: Macroencapsulation in Polymer by Vendor

Treatment Cycle Flow Diagram:



Pros

- Few or no secondary wastes are generated.
- Macroencapsulation, permitted by the debris rule, immobilizes the constituent of concern.
- Process is very flexible and can handle a wide variety of wasteforms.
- Process will comply with regulations without requiring a variance.
- Mature technology. Vendor can bring process onsite in an easily scheduled evolution.

Cons

- Gross volume of waste will increase by a factor of 2 or more.
- Final wasteform will require disposal in HW/MW facility

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
volume alteration	10	Subtract 10 points from low medium score because gross volume of waste will increase by a factor of 2 or more.
• secondary waste generation	80	Few or no secondary wastes generated.
• destruction removal and demobilization efficiency	80	No additional treatment is required to meet LDR.

Waste Stream Number & Name: SR-W062 Toxic Characteristic (TC) Contaminated Debris

Option Number: SR-W062-1
Facility: Containment Building

Treatment Technology: Macroencapsulation in Polymer by Vendor

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• flexibility	80	Process is very flexible and can handle a wide variety of wasteforms. Widely used in the commercial world.
Engineering Parameters		
• ability to be shipped	80	Containers meet DOT shipping requirements.
• final wasteform	80	Final wasteform will meet waste disposal WAC.
• system implementability	100	Encapsulation with plastic is a proven process. Add 20 points to the high median score because its use is wide-spread through the DOE Complex and the commercial world.
• availability	60	Add 10 points to the median score of 50 because availability is expected to be more than 50%.
• scalability	50	Throughput set by design.
• remedial measures	50	Failed wasteforms can be reprocessed without great difficulty.
• schedule for treatment of waste	80	Mature technology. Vendor can bring process onsite in an easily scheduled evolution.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Process can be installed in a containment building that will limit the potential for releases.
• non operational worker potential exposure	80	Requires average number of non operational workers for this type process. Construction will be in vendor's shop.
• operational worker potential exposure	40	Subtract 10 points from median score of 50 because this facility is expected to require a greater than average number of operational workers. An average number of operational workers will be required to tend this process.
• transportation potential exposure	60	Waste will not require additional characterization before transportation to storage. Add 10 points to median score of 50 because the final wasteform is easily handled.
Regulatory Parameters		
• need for variance	80	Process will comply with regulations without requiring a variance.
• ability to obtain a permit	80	The process is well defined.
• waste disposal	20	Final wasteform will require disposal in HW/MW facility.

Waste Stream Number & Name: SR-W062 Toxic Characteristic (TC) Contaminated Debris

Option Number: SR-W062-1

Facility: Containment Building

Treatment Technology: Macroencapsulation in Polymer by Vendor

In-Depth Options Analysis (IDOA) Score Sheet

Public Acceptance		
• public acceptance	20	Public may express concern that wasteform is not totally unalterable.
Cost Considerations		
• life-cycle cost	93	
• funding availability	50	Life-cycle cost can be supported with 10 % increase in funding levels if facility is shared with treatment of waste stream SR-W069.
Industry Involvement		
• market for technology	20	Existing vendor process
• private sector involvement	50	Existing vendor process

IDOA Score: **Technical** 55 **Total** 68

Waste Stream Number & Name: SR-W062 Toxic Characteristic (TC) Contaminated Debris

Option Number: SR-W062-1

Facility: Containment Building

Treatment Technology: Macroencapsulation in Polymer by Vendor

Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled

Module Location: SRS

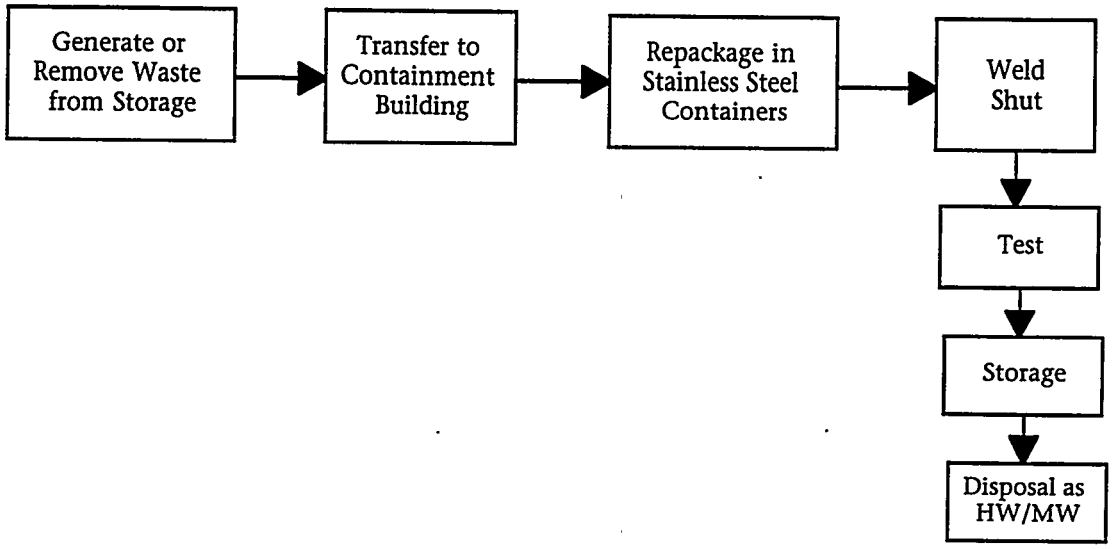
Module Status: [ ] Existing [√] New [ ] Small generator [√] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 7	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 28	
		1.3.2 Safety Assurance Documentation	$ 7	
		1.3.3 Permitting	$ 10	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 0	
		TOTAL PRE-OPERATIONS		$ 202
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 33	
	2.2	Inspection	$ 6	
	2.3	Project Management	$ 6	
	2.4	Building Construction (inc. indirect)	$ 0	
	2.5	Equipment (inc. indirect)	$ 150	
	2.6	Construction Management	$ 11	
	2.7	Contingency	$ 72	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 277
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 30	
	3.2	Annual Utilities	$ 1	
	3.3	Annual Materials	$ 18	
	3.4	Annual Maintenance	$ 11	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 60	
		X NUMBER OF YEARS OF OPERATION	5.00	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 300
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 0	
	4.2	Closure, Post-Closure, Monitoring	$ 10	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 10
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$ 1000	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$ 1000
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 200
	SUB COST FOR MACROENCAPSULATION IN POLYMER MODULE			$ 1989
		ESCALATION		1.305
		TOTAL COST		$ 2596

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W062 **Toxic Characteristic (TC) Contaminated Debris**

Option Number: SR-W062-2
Facility: Containment Building
Treatment Technology: Macroencapsulation
Treatment Cycle Flow Diagram:



Pros

- Few or no secondary wastes are generated.
- Macroencapsulation, permitted by the debris rule, immobilizes the constituent of concern.
- Process is very flexible and can handle a wide variety of wasteforms. Stainless steel containers can be custom fabricated to meet almost any need.
- Process will comply with regulations without requiring a variance.
- Process can be adapted to any waste requirement by designing custom containers.
- Failed welds are easily detected and repaired.

Cons

- Gross volume of waste will increase by a factor of 2 or more.
- Final wasteform will require disposal in HW/MW facility.
- Public may express concern that mercury remains in an untreated (i.e., leachable) form.
- Process requires waste to be double handled.

Waste Stream Number & Name: SR-W062 Toxic Characteristic (TC) Metal Contaminated Debris

Option Number: SR-W062-2
Facility: Containment Building

Treatment Technology: Macroencapsulation

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	20	Gross volume of waste will increase by a factor of 2 or more.
• secondary waste generation	80	Few or no secondary wastes are generated.
• destruction removal and demobilization efficiency	80	Macroencapsulation permitted by the debris rule immobilizes the constituent of concern.
• flexibility	80	Process is very flexible and can handle a wide variety of wasteforms. Stainless steel containers can be custom fabricated to meet almost any need.
• ability to be shipped	80	Stainless steel containers meet DOT shipping requirements.
• final wasteform	80	Final wasteform will meet waste disposal WAC.
Engineering Parameters		
• system implementability	60	Process is very simple and mature. Stainless steel welding techniques are well known. Subtract 20 points from high median of 80 because of the double handling of the waste.
• availability	80	Availability will be of little concern; process will proceed as wastes are scheduled for treatment.
• scalability	80	Process can be adapted to any waste requirement by designing custom containers.
• remedial measures	80	Failed welds are easily detected and repaired.
• schedule for treatment of waste	80	Placing waste in boxes lends itself to accurate scheduling.
Personnel Parameters		
• consequence of unmitigated accident scenarios	50	Few or no emissions from routine operations. Most accident scenarios could result in a significant release of mercury, which would be difficult to remediate.
• non operational worker potential exposure	40	An average number of operational workers will be required to tend this process. Subtract 10 points form medium median of 50 because of additional potential for exposure due to double handling the waste.
• operational worker potential exposure	40	An average number of operational workers will be required to tend this process. Subtract 10 points form medium median of 50 because of additional potential for exposure due to double handling the waste.
• transportation potential exposure	50	Waste will require some additional characterization before transportation to storage.
Regulatory Parameters		
• need for variance	80	Process will comply with regulations without requiring a variance.
• ability to obtain a permit	80	The process is well-defined.
• waste disposal	20	Final wasteform will require disposal in HW/MW facility.

Waste Stream Number & Name: SR-W062 Toxic Characteristic (TC) Metal Contaminated Debris

Option Number: SR-W062-2
Facility: Containment Building

Treatment Technology: Macroencapsulation

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Public Acceptance		
◦ public acceptance	20	Public may express concern that mercury remains in an untreated (i.e., leachable) form.
Cost Considerations		
◦ life-cycle cost	73	
◦ funding availability	50	Life-cycle cost can be supported with 10 % increase in funding levels.
Industry Involvement		
◦ market for technology	20	Adaptation of existing technology.
• private sector involvement	20	No vendors have exhibited an interest in this technology.

IDOA Score: **Technical** 47 **Total** 58

Waste Stream Number & Name: SR-W062 Toxic Characteristic (TC) Contaminated Debris

Option Number: SR-W062-2
Facility: Containment Building

Treatment Technology: Macroencapsulation

Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled

Module Location: SRS

Module Status: [ ] Existing [√] New [ ] Small generator [√] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 73	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 292	
		1.3.2 Safety Assurance Documentation	$ 73	
		1.3.3 Permitting	$ 2,000	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 54	
		TOTAL PRE-OPERATIONS		$ 2643
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 319	
	2.2	Inspection	$ 94	
	2.3	Project Management	$ 148	
	2.4	Building Construction (inc. indirect)	$ 1,200	
	2.5	Equipment (inc. indirect)	$ 250	
	2.6	Construction Management	$ 102	
	2.7	Contingency	$ 758	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 2871
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 30	
	3.2	Annual Utilities	$ 1	
	3.3	Annual Materials	$ 18	
	3.4	Annual Maintenance	$ 11	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 60	
		X NUMBER OF YEARS OF OPERATION	5.00	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 300
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 1,160	
	4.2	Closure, Post-Closure, Monitoring	$ 10	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 1,170
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 200
		SUB COST FOR MACROENCAPSULATION MODULE		$ 7,183
		ESCALATION		1.305
		TOTAL COST		$ 9,374

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W062 Toxic Characteristic (TC) Contaminated Debris

Option Number: SR-W062-3
Facility: INEL/WEDF

Treatment Technology: Stabilization

Treatment Technology

The Idaho National Engineering Laboratory (INEL) Waste Engineering Development Facility (WEDF) stabilization process provides treatments aqueous and organic liquids and debris. The process stabilizes waste in a grout matrix to reduce leachability.

Pros

- Minimal secondary wastes are generated.
- Final wasteform is expected to meet SRS WAC.
- Few emissions are expected during normal operations and most accident scenarios.

Cons

- Volume of processed waste will increase by much more than a factor of 2.
- Waste Engineering Development Facility (WEDF) is a planned facility. Process has not been demonstrated at greater than laboratory scale.
- Process failure is not expected to produce an untreatable waste, but remedial processing would be costly and time-consuming.
- Planned facility, but availability of funding makes scheduling difficult.
- Waste must be characterized before return to SRS for disposal. Transportation of untreated waste material thousands of miles to the treatment facility poses added risks.
- Treated waste will require disposal in HW/MW vaults.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	10	Subtract 10 points from the median score of 20 because volume of processed waste will increase by much more than a factor of 2.
• secondary waste generation	80	Minimal secondary wastes are generated.
• destruction removal and demobilization efficiency	50	Additional treatment for some waste streams may be needed before stabilization to ensure LDR requirements are met.
• flexibility	80	The facility can treat waste streams similar in composition to those assumed in the design basis without modification.
• ability to be shipped	50	Final wasteform can be shipped without additional treatment, however, the untreated waste will also have to be shipped thousands of miles in it unstabilized state.
• final wasteform	80	Final wasteform is expected to meet SRS WAC.
Engineering Parameters		
• system implementability	20	WEDF is planned facility. Process has not been demonstrated at greater than laboratory scale.
• availability	20	Availability is difficult to predict at this stage of design.
• scalability	20	Process currently exists, so any expansion would require process modification.

Waste Stream Number & Name: SR-W062 Toxic Characteristic (TC) Contaminated Debris

Option Number: SR-W062-3
Facility: INEL/WEDF

Treatment Technology: Stabilization

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• remedial measures	20	Process failure is not expected to produce an untreatable waste, but remedial processing would be costly and time-consuming.
• schedule for treatment of waste	20	Planned facility, but availability of funding makes scheduling difficult.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Few emissions are expected during normal operations and most accident scenarios.
• non operational worker potential exposure	50	Processing this waste will not increase exposure to non operating personnel.
• operational worker potential exposure	50	Processing this waste will not increase exposure to operating personnel.
• transportation potential exposure	20	Waste must be characterized before return to SRS for disposal. Transportation of untreated waste material thousands of miles to the treatment facility poses added risks.
Regulatory Parameters		
• need for variance	80	Process is expected to be in full compliance without needing a variance.
• ability to obtain a permit	50	Permitting process is well defined, however, the State of Idaho may prove reluctant to permit treatment of offsite wastes.
• waste disposal	20	Treated waste will require disposal in HW/MW vaults.
Public Acceptance		
• public acceptance	40	Public acceptance of stabilization is positive. Subtract 10 points from median score of 50 because of anticipated reluctance on the part of the citizenry of the waste-receiving state.
Cost Considerations		
• life-cycle cost	98	
• funding availability	50	Costs expected to be borne but operating budget with 10% or less increase.
Industry Involvement		
• market for technology	80	Facility could treat waste from other DOE sites.
• private sector involvement	20	Technology is planned for an existing facility.

IDOA Score: **Technical** 40 **Total** 53

Waste Stream Number & Name: SR-W062 Toxic Characteristic (TC) Contaminated Debris

Option Number: SR-W062-3
Facility: INEL/WEDF

Treatment Technology: Macroencapsulation

Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled

Module Location: INEL

Module Status: [ ] Existing [√] New [ ] Small generator [√] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$	
	1.2	Demonstration Costs	$	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$	
		1.3.2 Safety Assurance Documentation	$	
		1.3.3 Permitting	$	
		1.3.4 Preparation for Operations	$	
		1.3.5 Project Management	$	
		TOTAL PRE-OPERATIONS		$
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$	
	2.2	Inspection	$	
	2.3	Project Management	$	
	2.4	Building Construction (inc. indirect)	$	
	2.5	Equipment (inc. indirect)	$	
	2.6	Construction Management	$	
	2.7	Contingency	$	
		TOTAL FACILITY CONSTRUCTION COSTS		$
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$	
	3.2	Annual Utilities	$	
	3.3	Annual Materials	$	
	3.4	Annual Maintenance	$	
	3.5	Annual Contingency	$	
		TOTAL ANNUAL O & M	$	
		X NUMBER OF YEARS OF OPERATION		
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 0	
	4.2	Closure, Post-Closure, Monitoring	$ 3	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 3
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$ 400
7.0	Transportation			$ 20
8.0	Disposal			$ 50
		SUB COST FOR STABILIZATION MODULE		$ 473
		ESCALATION		1.384
		TOTAL COST		$ 654

If above numbers do not appear to add correctly, it is the result of computer rounding.

Summary Page

Waste Stream Number & Name: SR-W063 **Macroencapsulated Toxic Characteristic (TC) Waste**

Background Information

This future waste stream consists of a wide variety of miscellaneous macroencapsulated toxic characteristic metal items (lead, cadmium, etc.) contaminated with radioactive materials. The majority of the lead is encapsulated in stainless steel. The lead items include lead counterweighted jumpers (lead welded in pipe for balancing jumpers), cesium removal columns (CRC) (lead sandwiched between stainless steel for shielding purposes), draw-off valves, flush valves and discarded equipment (same description as CRC configuration). These wastes are used as shields from radioactivity (e.g., around pipes in the tank farms), as counterweights, or serve as parts of other devices. The majority of the radioactive contamination should be surface contamination. The waste is generated in reactor areas, fuel and target areas, separations areas, waste management areas, and laboratories. Future generation rates are dependent on site transition and decommissioning activities.

Volume
- Current volume through 09/30/94 is 0 m^3.
- Expected 1995-1999 volume will be 42 m^3.

Waste Stream Composition
- Metal debris

Waste Code
- D004A (TCLP As)
- D005A (TCLP Ba)
- D006A (TCLP Cd)
- D007A (TCLP Cr)
- D008A (TCLP Pb)
- D008C (radioactive Pb solids)
- D009A (TCLP Hg)
- D010A (TCLP Se)
- D011A (TCLP Ag)

LDR Treatment Standard
- D004 = concentration based standard = 5.0 mg/l
- D005 = concentration based standard = 100 mg/l
- D006 = concentration based standard = 1.0 mg/l
- D007 = concentration based standard = 5.0 mg/l
- D008 = concentration based standard = 5.0 mg/l or macroencapsulation
- D009 = concentration based standard = 0.2 mg/l
- D010 = concentration based standard = 5.7 mg/l
- D011 = concentration based standard = 5.0 mg/l
- Alternative debris technology

Waste Characterization
- Process knowledge was used to characterize the waste stream.
- Confidence level is high based on knowledge of the materials of construction.

Radiological Characterization
- Total activity unknown – future waste
- Waste is contact handled.
- Mixed low-level waste

Preferred Option

The preferred treatment option for SR-W063 is alternative debris technology of Macroencapsulation. This waste stream already meets the treatment standard

Treatment Justification

No IDOA required for waste stream SR-W063 since this waste stream will meet the treatment standards.

This is a waste that will be generated in the future. The future generation rate is dependent on the site's D&D activities.

The majority of this waste stream is lead integrated in equipment for shielding purposes. The waste stream also consists of discarded equipment that has become contaminated with radioactive materials over time. The remainder of the waste is rad-contaminated counter weight or other devices parts (lead encapsulated in some form).

There will be no treatment requirements since the lead in waste stream SR-W063 meets the LDR treatment standards.

This waste stream meets the lead treatment standard of macroencapsulation for radioactive lead solids and requires no further treatment prior to disposal in a RCRA Subtitle C disposal unit.

Summary Page

Waste Stream Number & Name: SR-W064 IDW Soils/Sludges/Slurries

Background Information

Investigative derived waste (IDW) will not be reported on characterization until samples are run. IDW will be generated during Environmental Restoration (ER) site characterization and has a potential for all or none (the extremes) of the waste volume generated for the year to be characterized as mixed. However, waste generated from these investigations may be tested and found to be nonhazardous, with a decrease in projected volume.

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Summary Page

Waste Stream Number & Name: **SR-W065** **IDW Monitoring Well Purge/Development Water**

Background Information

Investigative derived waste (IDW) will not be reported on characterization until samples are run. IDW will be generated during Environmental Restoration (ER) site characterization and has a potential for all or none (the extreme) of the waste volume generated for the year to be characterized as mixed. However, waste generated from these investigations may be tested and found to be nonhazardous, with a decrease in projected volume.

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Summary Page

Waste Stream Number & Name: SR-W066 IDW Steel and Metal Debris

Background Information

Investigative derived waste (IDW) is waste generated during Environmental Restoration (ER) site characterization and has a potential to be characterized as mixed waste. This waste will be generated at various waste sites that will contain various hazardous waste and radiological constituents. Yearly projections indicate the volume of IDW waste anticipated to be generated, with the total volume having the potential to be all mixed waste. However, waste generated from these investigations may be tested and found to be nonhazardous, with a decrease in projected volume.

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Summary Page

Waste Stream Number & Name: SR-W067 IDW Personnel Protective Equipment (PPE) Waste

Background Information

Investigative derived waste (IDW) is waste generated during Environmental Restoration (ER) site characterization and has a potential to be characterized as mixed waste. This waste will be generated at various waste sites that will contain various hazardous waste and radiological constituents. Yearly projections indicate the volume of IDW waste anticipated to be generated, with the total volume having the potential to be all mixed waste. However, waste generated from these investigations may be tested and found to be nonhazardous, with a decrease in projected volume.

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Summary Page – Initial Screening

Waste Stream Number & Name: SR-W068 Elemental (Liquid) Mercury

Background Information

This waste stream is waste elemental mercury generated at different SRS facilities during their transition or decommissioning stages. Current inventory is two 0.5 liter bottles from the closing of a small laboratory in the Savannah River Technology Center (SRTC) to support Naval Fuels developmental studies. This was previously listed as SR-W041B in the Draft Site Treatment Plan. Future generation will be from transition activities at Separations and High-Level Waste facilities (mercury is used as a catalyst in metal dissolution).

Volume
- Current volume through 09/30/94 is 0.1 m^3. .
- Expected 1995-1999 generation volume will be 0.2 m^3.

Waste Stream Composition
- Elemental mercury

Waste Code
- D009D (elemental Hg)

LDR Treatment Standard
- D009D = specified technology = Amalgamation

Waste Characterization
- Process knowledge used to characterize the waste stream.
- Confidence level is high based on the waste composition.

Radiological Characterization
- Radioactivity will vary depending on the generation source and location.
- Waste is contact handled.
- Mixed low-level waste

Initial Screening

The initial screening identified inappropriate treatment options. These options appear in the Initial Rejections table.

Initial Rejections

Treatment Facility	Treatment Technology	Reasons for Rejection
CIF	Incineration	Incineration is not an appropriate treatment for elemental mercury.
CIF	Ashcrete Stabilization	Concrete stabilization is not an appropriate treatment for elemental mercury.
ETF	Ion Exchange	ETF has no process to treat this waste.
LETF	Ion Exchange	LETF has no equipment to treat this waste.
M Area	Vitrification	Vitrification is not an appropriate treatment for elemental mercury.
Z Area	Stabilization	Concrete stabilization is not an appropriate treatment for elemental mercury.

Summary Page – Technology Success Factor (TSF) & In-Depth Options Analysis (IDOA)

Waste Stream Number & Name: SR-W068 Elemental (Liquid) Mercury

Feasible Options

Option No.	Treatment Facility	Treatment Technology	TSF Score	IDOA Scores Tech.	IDOA Scores Total	COST (x 1,000)	PO
SR-W068-1	INEL/WEDF	Amalgamation	*	51	64	228	√
SR-W068-2	Cont. Bldg.	Distill/Reuse	51	51	62	7,341	
SR-W068-3	Cont. Bldg.	Distill/Amalg	51	46	56	8,139	
SR-W068-4	HW/MW-TB	Distill/Amalg	51	42	49	17,810	

* No TSF required for proposed or existing non-Savannah River Site-DOE facilities.

Options Rejected Due To Low Technology Success Factor

- No options were rejected.

Engineering Assessment

Preferred Option Justification

The preferred treatment option for the Elemental (Liquid) Mercury waste stream is Amalgamation at an offsite DOE facility; the Idaho National Engineering Laboratory/Waste Engineering Development Facility (INEL/WEDF) – Amalgamation Unit.

This option treats the constituent of concern mercury by binding it with another metal into a non-leachable form (amalgam).

This option is preferred because:
- No secondary waste streams are generated.
- This waste stream is similar to the design basis for the facility.
- Treatment is BDAT.
- Offsite treatment is cost-effective.

Options Rejected During IDOA

Distillation Followed by Reuse or Amalgamation in a Containment Building or HW/MW-TB

Distillation followed by reuse or amalgamation in a containment building or HW/MW-TB was rejected because:
- Preferred option is BDAT.
- Rejected options are far less cost-effective than the preferred option.
- Rejected options require design and construction of new facilities.
- New facilities will be decommissioned and relegated to waste after only a short operating period.

Waste Stream Number & Name: SR-W068 Elemental (Liquid) Mercury

Option Number: SR-W068-1
Facility: INEL/WEDF
Treatment Technology: Amalgamation

Treatment Technology

This process is amalgamation can be used for radioactive wastes containing mercury and particularly for wastes containing radioactive mercury isotopes. Mercury and the amalgamating material combine to form a material (amalgam) in which the mercury is easily managed and immobilized.

Pros

- No secondary waste streams are generated.
- The facility can treat waste streams similar in composition to those assumed in the design basis without modification.
- The stabilized waste could be shipped without additional treatment.
- Final wasteform is anticipated to meet the SRS disposal WAC.
- Stabilization has been demonstrated at the facility.
- The facility is anticipated to have minimal down time.
- Process failure is not anticipated to create a waste stream that cannot be treated.
- Few emissions for the facility are anticipated during normal operation and most accident scenarios
- The facility could potentially be used to treat numerous waste streams throughout the DOE Complex.

Cons

- Stabilization will increase the overall waste volume by a factor of 2 or more after processing.
- This is a planned, but not budgeted, facility.
- Waste characterization will be required for any waste streams returned to SRS for disposal.
- The majority of the treated waste will be classified as mixed waste which will require disposal in a HW/MW facility.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	20	Stabilization will increase the overall waste volume by a factor of 2 or more after processing.
• secondary waste generation	80	No secondary waste streams are generated.
• destruction removal and demobilization efficiency	50	Additional treatment for some waste streams may be required prior to amalgamation to ensure LDR standards are met.
• flexibility	80	The facility can treat waste streams similar in composition to those assumed in the design basis without modification.
• ability to be shipped	80	The stabilized waste could be shipped without additional treatment.
• final wasteform	80	Final wasteform is anticipated to meet the SRS waste disposal WAC.
Engineering Parameters		
• system implementability	80	Stabilization has been demonstrated at the facility.
• availability	80	The facility is anticipated to have minimal down time.

Waste Stream Number & Name: SR-W068 Elemental (Liquid) Mercury
Option Number: SR-W068-1
Facility: INEL/WEDF **Treatment Technology: Amalgamation**
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• scalability	20	This is a planned, but not budgeted, facility.
• remedial measures	80	Process failure is not anticipated to create a waste stream that cannot be treated.
• schedule for treatment of waste	50	A schedule for waste treatment cannot be provided. Additionally, acceptance of SRS waste will be contingent upon state-approved permit modifications.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Few emissions for the facility are anticipated during normal operation and most accident scenarios.
• non operational worker potential exposure	50	Processing this material will not increase the exposure to non operational personnel.
• operational worker potential exposure	50	Personnel exposure is average for operations of this type. Processing this material will not increase the exposure to operational personnel.
• transportation potential exposure	20	Waste characterization will be required for any waste streams returned to SRS for disposal.
Regulatory Parameters		
• need for variance	50	Process is currently permitted under interim status. Acceptance of offsite waste will require submission of a permit modification. It is anticipated that the state will call for a full RCRA Part B Permit Application prior to acceptance of offsite wastes.
• ability to obtain a permit	50	Permitting process is well defined; however, the state's acceptance of offsite waste treatment is unknown. Approval may be difficult.
• waste disposal	20	The majority of the treated waste will be classified as mixed waste which will require disposal in a HW/MW facility.
Public Acceptance		
• public acceptance	50	Public acceptance for stabilization is positive; however, the treatment of offsite waste is anticipated to reduce the overall public acceptance of this process.
Cost Considerations		
• life-cycle cost	99	
• funding availability	20	Funding for treatment cost can be provided using the operating budget, however the additional costs may result in an increase in the budget more than 10%.
Industry Involvement		
• market for technology	80	The facility could potentially be used to treat numerous waste streams throughout the DOE Complex.
• private sector involvement	20	Technology is available at an existing DOE facility.

IDOA Score: **Technical** 51 **Total** 64

Waste Stream Number & Name: SR-W068 Elemental (Liquid) Mercury
Option Number: SR-W068-1
Facility: INEL/WEDF **Treatment Technology: Amalgamation**
Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[ ] alpha [√] non-alpha [√] contact handled [ ] remote handled
Module Location: INEL
Module Status: [ ] Existing [√] New [√] Small generator [ ] Large generator
[ ] Onsite [√] Offsite [ ] Commercial [ ] Portable [ ] R&D

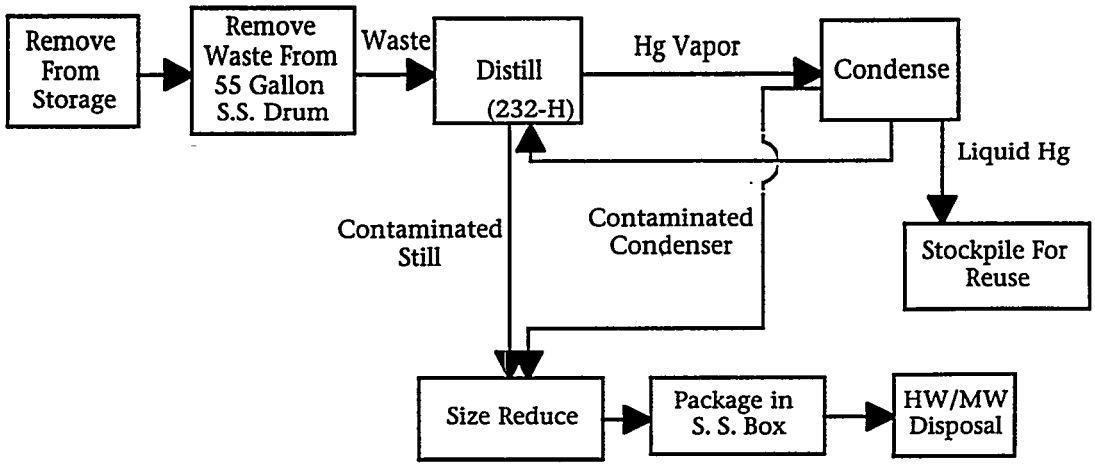
WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ N/A	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ N/A	
		1.3.2 Safety Assurance Documentation	$ N/A	
		1.3.3 Permitting	$ N/A	
		1.3.4 Preparation for Operations	$ N/A	
		1.3.5 Project Management	$ N/A	
		TOTAL PRE-OPERATIONS		$ N/A
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ N/A	
	2.2	Inspection	$ N/A	
	2.3	Project Management	$ N/A	
	2.4	Building Construction (inc. indirect)	$ N/A	
	2.5	Equipment (inc. indirect)	$ N/A	
	2.6	Construction Management	$ N/A	
	2.7	Contingency	$ N/A	
		TOTAL FACILITY CONSTRUCTION COSTS		$ N/A
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ N/A	
	3.2	Annual Utilities	$ N/A	
	3.3	Annual Materials	$ N/A	
	3.4	Annual Maintenance	$ N/A	
	3.5	Annual Contingency	$ N/A	
		TOTAL ANNUAL O & M	$ N/A	
		X NUMBER OF YEARS OF OPERATION		
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ N/A
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ N/A	
	4.2	Closure, Post-Closure, Monitoring	$ N/A	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ N/A
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$ N/A	
	5.2	Mobile Treatment	$ N/A	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$ 98
7.0	Transportation			$ 17.6
8.0	Disposal			$ 100
		SUB COST FOR AMALGAMATION MODULE		$ 215
		ESCALATION		1.06
		TOTAL COST		$ 228

Note: Per DOE directions this cost estimate is the incremental cost for treatment at an offsite DOE facility; therefore, it carries not overhead burden or capital costs.

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W068 Elemental (Liquid) Mercury
Option Number: SR-W068-2
Facility: Containment Building **Treatment Technology:** Distill/Reuse

Treatment Cycle Flow Diagram:



Pros

- Significant reduction in waste volume as mercury is recovered for reuse.
- A variety of secondary wastes, but small-scale equipment.
- Materials will be reused.
- Final wasteform will meet waste disposal WAC.
- Small-scale process. Availability will be of little concern.
- Potential for tritium release is small. Process will take place in a controlled area. Source is small.
- Process will comply with regulations without requiring a variance.
- Process is well-defined and has been permitted in other locations tritium may be present in the mercury.

Cons

- Fixed by design. Increased throughput possible by adding operating shifts.
- Traps and used equipment will require disposal in HW/MW facilities.
- Not a budgeted item and will require line item funding.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	80	Significant reduction in waste volume as mercury is recovered for reuse.
• secondary waste generation	80	A variety of secondary wastes, but small-scale equipment.
• destruction removal and demobilization efficiency	100	Add 20 points to the median score of 80 because materials will be reused.
• flexibility	50	Process may require additional steps or equipment to handle off-design input streams.
• ability to be shipped	50	There are no treatment residuals because material will be for reuse. Contaminated processing equipment will require simple treatment prior to shipment.
• final wasteform	80	Final wasteform will meet waste disposal WAC.

Waste Stream Number & Name: SR-W068 Elemental (Liquid) Mercury
Option Number: SR-W068-2
Facility: Containment Building Treatment Technology: Distill/Reuse
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Engineering Parameters		
• system implementability	70	The process is commercially available. Subtract 10 points from the median score of 80 because there are uncertainties arising from operation in a tritium environment.
• availability	80	Small-scale process.. Availability will be of little concern.
• scalability	20	Fixed by design. Increased throughput possible by adding operating shifts.
• remedial measures	50	Rupture or breakage of glass equipment will require a significant cleanup effort.
• schedule for treatment of waste	50	Some technology concerns about operating in a tritium environment.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Potential for tritium release is small. Process will take place in a controlled area. Source is small.
• non operational worker potential exposure	40	Subtract 10 points from the median score of 50 because the process equipment is small but decommissioning costs would be high for a waste stream of such small volume of waste.
• operational worker potential exposure	50	An average number of operational workers will be required to tend this process.
• transportation potential exposure	50	Waste will require some additional characterization before transportation to storage.
Regulatory Parameters		
• need for variance	80	Process will comply with regulations without requiring a variance.
• ability to obtain a permit	70	The process is well-defined. Subtract 10 points from the median score of 80 because the process has been permitted in other locations tritium may be present in the mercury.
• waste disposal	20	Traps and used equipment will require disposal in HW/MW facilities.
Public Acceptance		
• public acceptance	20	Public concern may be allayed because Hg is recycled for reuse.
Cost Considerations		
• life-cycle cost	79	
• funding availability	20	Not a budgeted item and will require line item funding.
Industry Involvement		
• market for technology	20	Adaptation of existing technology.
• private sector involvement	50	Other vendors have expressed an interest in treating this waste stream.

IDOA Score: Technical 51 Total 62

Waste Stream Number & Name: SR-W068 Elemental (Liquid) Mercury
Option Number: SR-W068-2
Facility: Containment Building **Treatment Technology: Distill/Reuse**
Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[ ] alpha [√] non-alpha [√] contact handled [ ] remote handled

Module Location: SRS

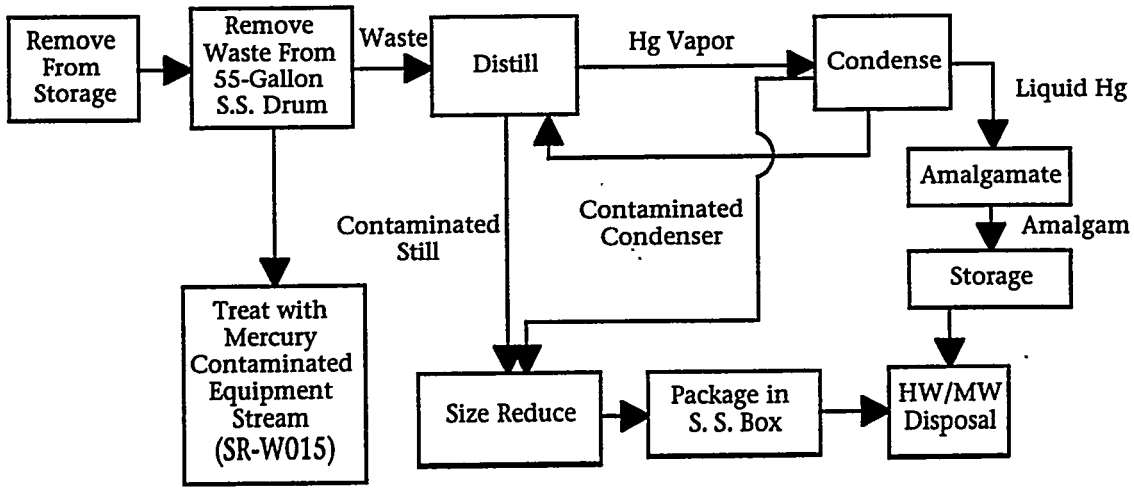
Module Status: [ ] Existing [√] New [√] Small generator [ ] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 84	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 335	
		1.3.2 Safety Assurance Documentation	$ 84	
		1.3.3 Permitting	$ 125	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 45	
		TOTAL PRE-OPERATIONS		$ 822
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 374	
	2.2	Inspection	$ 98	
	2.3	Project Management	$ 143	
	2.4	Building Construction (inc. indirect)	$ 1,000	
	2.5	Equipment (inc. indirect)	$ 700	
	2.6	Construction Management	$ 119	
	2.7	Contingency	$ 868	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 3,302
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 75	
	3.2	Annual Utilities	$ 3	
	3.3	Annual Materials	$ 45	
	3.4	Annual Maintenance	$ 27	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 150	
		X NUMBER OF YEARS OF OPERATION	2.00	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 300
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 1,360	
	4.2	Closure, Post-Closure, Monitoring	$ 1	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 1,361
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 10
		SUB COST FOR DISTILL AND REUSE MODULE		$ 5,794
		ESCALATION		1.267
		TOTAL COST		$ 7,341

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W068 Elemental (Liquid) Mercury
Option Number: SR-W068-3
Facility: Containment Building **Treatment Technology: Distill/Amalg**

Treatment Cycle Flow Diagram:



Pros

- LDR requirements will be met without further treatment.
- All treatment residuals will be able to be shipped without further treatment.
- Final wasteform will meet waste disposal WAC.
- Small scale process. Availability will be of little concern.
- Process will take place in a controlled laboratory area. Source is small.
- Process will comply with regulations without requiring a variance.
- The process is well-defined and has been permitted in other locations.

Cons

- Waste volume increases by a factor of two because of the amalgam.
- Fixed by design.. Increased throughput possible by adding operating shifts.
- Owing to the small batch size, it is expected that this will be a labor-intensive process.
- All waste will require disposal in HW/MW facilities.
- Process does not create a wasteform that is as permanent as others.
- Not a budgeted item and will require line item funding.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	10	Subtract 10 points from the median score of 20 because waste volume increases by a factor of two because of the amalgam.
• secondary waste generation	40	Subtract 10 points from the median score of 50 because contaminated process equipment created.
• destruction removal and demobilization efficiency	80	LDR standards will be met without further treatment.
• flexibility	50	Process may require additional steps or equipment to handle off-design input.
• ability to be shipped	80	All treatment residuals will be able to be shipped without further treatment.
• final wasteform	80	Final wasteform will meet waste disposal WAC.

Waste Stream Number & Name: SR-W068 Elemental (Liquid) Mercury
Option Number: SR-W068-3
Facility: Containment Building Treatment Technology: Distill/Amalg
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Engineering Parameters		
• system implementability	80	The process is commercially available.
• availability	80	Small-scale process. Availability will be of little concern.
• scalability	20	Fixed by design. Increased throughput possible by adding operating shifts.
• remedial measures	50	Failure to amalgamate can be addressed by reprocessing with more reagents.
• schedule for treatment of waste	50	Some technology concerns.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Process will take place in a controlled laboratory area. Source is small.
• non operational worker potential exposure	40	The process equipment is small. Subtract 10 points from the median score of 50 because decommissioning may be labor intensive.
• operational worker potential exposure	20	Owing to the small batch size, it is expected that this will be a labor-intensive process.
• transportation potential exposure	50	Waste will require some additional characterization before transportation to storage.
Regulatory Parameters		
• need for variance	80	Process will comply with regulations without requiring a variance.
• ability to obtain a permit	70	The process is well-defined. Subtract 10 points from the median score of 80 because the process has been permitted in other locations.
• waste disposal	20	All waste will require disposal in HW/MW facilities.
Public Acceptance		
• public acceptance	20	Process does not create a wasteform that is as permanent as others.
Cost Considerations		
• life-cycle cost	77	
• funding availability	20	Not a budgeted item and will require line item funding.
Industry Involvement		
• market for technology	20	Adaptation of existing technology.
• private sector involvement	50	Other vendors have expressed an interest in treating this waste stream.

IDOA Score: Technical 46 **Total** 56

Waste Stream Number & Name: SR-W068 Elemental (Liquid) Mercury
Option Number: SR-W068-3
Facility: Containment Building **Treatment Technology: Distill/Amalg**
Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[ ] alpha [√] non-alpha [√] contact handled [ ] remote handled

Module Location: SRS

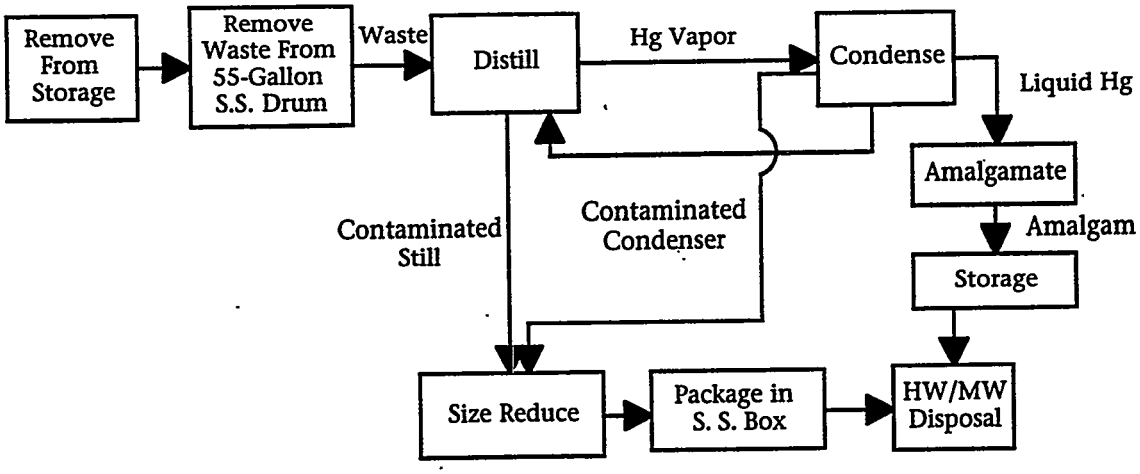
Module Status: [ ] Existing [√] New [√] Small generator [ ] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 93	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 372	
		1.3.2 Safety Assurance Documentation	$ 93	
		1.3.3 Permitting	$ 0	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 45	
		TOTAL PRE-OPERATIONS		$ 752
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 418	
	2.2	Inspection	$ 106	
	2.3	Project Management	$ 151	
	2.4	Building Construction (inc. indirect)	$ 1,000	
	2.5	Equipment (inc. indirect)	$ 900	
	2.6	Construction Management	$ 133	
	2.7	Contingency	$ 964	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 3,672
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 750	
	3.2	Annual Utilities	$ 30	
	3.3	Annual Materials	$ 450	
	3.4	Annual Maintenance	$ 270	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 1,500	
		X NUMBER OF YEARS OF OPERATION	0.25	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 375
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 1,520	
	4.2	Closure, Post-Closure, Monitoring	$ 5	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 1,525
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 100
		SUB COST FOR DISTILL AND AMALGAMATION MODULE		$ 6,424
		ESCALATION		1.267
		TOTAL COST		$ 8,139

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W068 Elemental (Liquid) Mercury
Option Number: SR-W068-4
Facility: HW/MW-TB
Treatment Technology: Distill/Amalg

Treatment Cycle Flow Diagram:



Pros

- LDR standards will be met without further treatment.
- All treatment residuals will be able to be shipped without further treatment.
- Final wasteform will meet waste disposal WAC.
- Small-scale process, availability is of little concern.
- Process will take place in a controlled area. Source is small.
- Process will comply with regulations without requiring a variance.

Cons

- Waste volume increases by a factor of two because of the amalgam.
- Fixed by design. Need for increased throughput in not expected.
- Implementation of HW/MW facility cannot be predicted with any degree of certainty.
- New facility will require a RCRA Part B Permit application.
- All waste will require disposal in a HW/MW facility.
- Process does not create an irreversibly stable wasteform, although it is the BDAT.
- Not a budgeted item and will require line item funding.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	10	Subtract 10 points from the median score of 20 because waste volume increases by a factor of two because of the amalgam.
• secondary waste generation	40	Subtract 10 points from the median score of 50 because contaminated process equipment created.
• destruction removal and demobilization efficiency	80	LDR standards will be met without further treatment.
• flexibility	50	Process may require additional steps to handle off-design input.
• ability to be shipped	80	All treatment residuals will be able to be shipped without further treatment.
• final wasteform	80	Final wasteform will meet waste disposal WAC.

Waste Stream Number & Name: SR-W068 Elemental (Liquid) Mercury
Option Number: SR-W068-4
Facility: HW/MW-TB **Treatment Technology:** Distill/Amalg
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Engineering Parameters		
• system implementability	80	Process is commercially available.
• availability	80	Small-scale process, availability is of little concern.
• scalability	20	Fixed by design. Need for increased throughput is not expected.
• remedial measures	50	Failure to amalgamate can be addressed by reprocessing with other reagents.
• schedule for treatment of waste	30	Subtract 20 points from a median score of 50 because implementation of HW/MW facility cannot be predicted with any degree of certainty.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Process will take place in a controlled area. Source is small.
• non operational worker potential exposure	40	Subtract 10 points from the median score of 50 because despite the small size of the process, decommissioning may be labor-intensive.
• operational worker potential exposure	20	Owing to its small size, the process is expected to be labor-intensive.
• transportation potential exposure	50	Waste will require some additional characterization before transportation to storage.
Regulatory Parameters		
• need for variance	80	Process will comply with regulations without requiring a variance.
• ability to obtain a permit	20	New facility will require a RCRA Part B Permit application.
• waste disposal	20	All waste will require disposal in a HW/MW facility.
Public Acceptance		
• public acceptance	20	Process does not create an irreversibly stable wasteform, although it is the BDAT.
Cost Considerations		
• life-cycle cost	49	
• funding availability	20	Not a budgeted item and will require line item funding.
Industry Involvement		
• market for technology	20	Adaptation of existing technology.
• private sector involvement	20	SRS facility evaluated.

IDOA Score: **Technical** 42 **Total** 49

Waste Stream Number & Name: SR-W068 Elemental (Liquid) Mercury
Option Number: SR-W068-4
Facility: HW/MW-TB
Treatment Technology: Distill/Amalg
Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[ ] alpha [√] non-alpha [√] contact handled [ ] remote handled

Module Location: SRS

Module Status: [ ] Existing [√] New [√] Small generator [ ] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 196	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 782	
		1.3.2 Safety Assurance Documentation	$ 196	
		1.3.3 Permitting	$ 125	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 135	
		TOTAL PRE-OPERATIONS		$ 1,583
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 858	
	2.2	Inspection	$ 246	
	2.3	Project Management	$ 381	
	2.4	Building Construction (inc. indirect)	$ 3,000	
	2.5	Equipment (inc. indirect)	$ 900	
	2.6	Construction Management	$ 273	
	2.7	Contingency	$ 2,028	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 7,686
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 750	
	3.2	Annual Utilities	$ 30	
	3.3	Annual Materials	$ 450	
	3.4	Annual Maintenance	$ 270	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 1,500	
		X NUMBER OF YEARS OF OPERATION	0.25	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 375
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 3,120	
	4.2	Closure, Post-Closure, Monitoring	$ 5	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 3,125
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 100
		SUB COST FOR DISTILL AND AMALGAMATION MODULE		$ 12,869
		ESCALATION		1.384
		TOTAL COST		$ 17,810

If above numbers do not appear to add correctly, it is the result of computer rounding.

Summary Page – Initial Screening

Waste Stream Number & Name: SR-W069 Low-Level Waste (LLW) Lead – to be Macroencapsulated

Background Information

This waste stream consists of low-level waste lead and lead compounds that are inseparably mixed with non-lead components. Examples of this waste stream are lead-lined gloves and aprons and equipment containing lead solder.

Volume
- Current volume through 09/30/94 is 73.5 m^3.
- Expected 1995-1999 volume will be 15 m^3.

Waste Stream Composition
- Elemental lead
- Non-elemental lead
- Lead acid batteries from radiological areas (less than 1% of the waste stream)

Waste Code
- D008A (TCLP Pb)
- D008B – (lead acid batteries)
- D008C – (elemental Pb)

LDR Treatment Standard
- D008 = concentration based technology = 5 mg/l; or specified technology = Thermal recovery of lead in secondary lead smelters for lead acid batteries or macroencapsulation for radioactive elemental lead

Waste Characterization
- Process knowledge used to characterize the waste stream.
- Confidence level is high based on the fact that waste is easily identified as containing lead.

Radiological Characterization
- Beta/gamma emitters (Cs^{137}, Sr^{90}) are present
- Alpha emitters (Pu^{238}, Pu^{239}, and U^{235}) are present.
- Waste is contact handled.
- Mixed low-level waste

Initial Screening

The initial screening identified inappropriate treatment options. These options appear in the Initial Rejections table.

Initial Rejections

Treatment Facility	Treatment Technology	Reasons for Rejection
CIF	Ashcrete Stabilization	Ashcrete encapsulation will not meet BDAT QC requirements.
CIF	Incineration	CIF would melt elemental lead. It has no provision for handling molten metal.
ETF	Ion Exchange	ETF has no equipment to treat elemental lead.

Initial Rejections (contd)

Treatment Facility	Treatment Technology	Reasons for Rejection
Lab.	Lab-scale process flowsheet	Volume of waste too great to handle with laboratory-scale equipment.
LETF	Ion Exchange	LEFT has no equipment to decontaminate elemental lead.
M Area	Vitrification	Lead must be recovered per LDR rules.
Z Area	Stabilization	Z Area can treat only those wastes that come by pipeline from Tank 50 and meet strict waste acceptance criteria. The Z-Area process lacks flexibility to treat and dispose of a variety of waste streams.
Vendor Macro-encapsulation	Macro-encapsulation in polyethylene boxes, which are then "welded" shut	The specified technology for radioactive lead solids is defined as: Macroencapsulation with surface coating materials such as polymeric organics or with a jacket of inert organic materials to substantially reduce surface exposure to potential leaching media. Macroencapsulation in a box either made of polyethylene proposed by a vendor, or some other material, such as stainless steel, does not satisfy the requirements for the specified technology.
DOE Macro-encapsulation Skid	Surface coating	This project is in the preconceptual design stage. This technology is insufficiently developed to select as a preferred option in the STP. When the technology matures and has been proven, it will deserve further consideration.

Summary Page – Technology Success Factor (TSF) & In-Depth Options Analysis (IDOA)

Waste Stream Number & Name: SR-W069 Low-Level Waste (LLW) Lead – to be Macroencapsulated

Feasible Options

Option No.	Treatment Facility	Treatment Technology	TSF Score	IDOA Scores Tech.	IDOA Scores Total	COST (x 1,000)	PO
SR-W069-1	Vendor/Onsite	Polymer Encapsulation	100	57	64	22,069	√
SR-W069-2	Cont. Bldg.	Macro-encapsulation	75	55	56	32,101	
SR-W069-3	HW/MW-TB	Macro-encapsulation	81	53	53	49,065	
SR-W069-4	INEL/WEDF	Stabilization	*	46	54	19,712	
SR-W069-5	INEL/WEDF	Macro-encapsulation	*	46	54	19,712	

* No TSF required for proposed or existing non-Savannah River Site-DOE facilities.

Options Rejected Due To Low Technology Success Factor (TSF)

- No options were rejected.

Engineering Assessment

Preferred Option Justification

The preferred option for the Low-Level Waste (LLW) Lead – to be Macroencapsulated waste stream is Macroencapsulation in polymer encapsulation onsite by vendor treatment.

This option is preferred because:
- The final wasteform meets LDR.
- It is a proven process that has been used both in the DOE Complex and in the commercial world.
- It is a specified treatment technology.
- It is cost-effective.

Treatability Study Requirements

The vendor will demonstrate that polymer encapsulation of low-level waste lead, which is inseparably mixed with non-lead components (e.g., plastic coating) and unsuited for decontamination, is capable of producing a stable monolith.

Options Rejected During IDOA

Macroencapsulation (either by a vendor or in a Containment Building)

Macroencapsulation (either by a vendor or in a Containment Building) for all the contaminated lead was rejected because:
- Rejected options scored 17 or more points less than the preferred option in the model evaluation, which was thought to be significant.
- Waste volume more than doubles.
- Rejected options were less cost-efficient than reuse.

Stabilization at INEL/WEDF

Stabilization at INEL/WEDF (encapsulating the lead waste with a grout matrix) was rejected because:

- Large volume waste streams are designated to be treated onsite.
- It is more costly than equally effective onsite treatment with a vendor process.
- Waste volume more than doubles.
- This is a planned, but not budgeted, facility.

Macroencapsulation at INEL/WEDF

Macroencapsulation at INEL/WEDF (encapsulating waste with polymer) was rejected because:

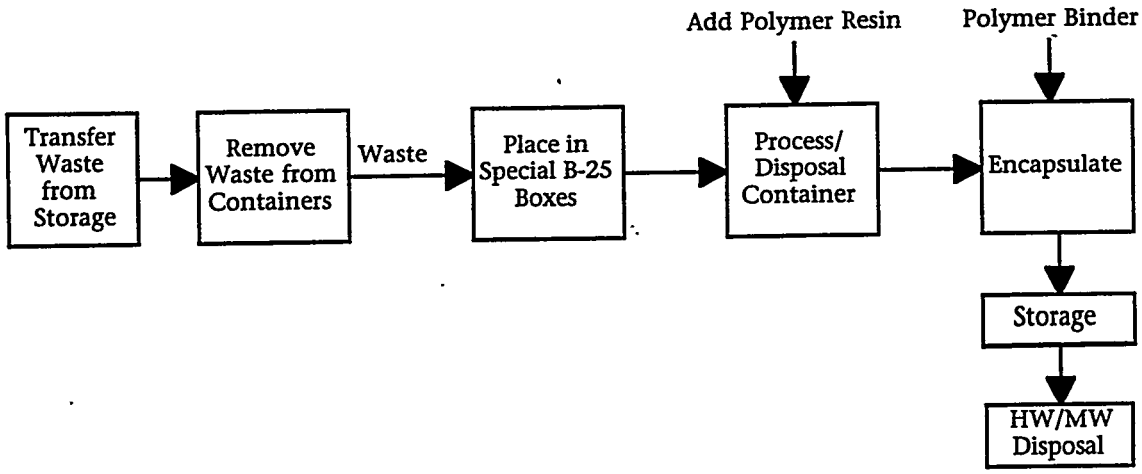
- Large volume waste streams are designated to be treated onsite.
- It is assumed to be less cost-effective than onsite treatment with a vendor process.
- INEL did not recommend WEDF treatment of this waste stream.
- Waste volume more than doubles.
- This is a planned, but not budgeted, facility.

Waste Stream Number & Name: SR-W069 Low-Level Waste (LLW) Lead – to be Macroencapsulated

Option Number: SR-W069-1
Facility: Vendor/Onsite

Treatment Technology: Polymer Encapsulation

Treatment Cycle Flow Diagram



Pros

- No secondary waste is generated.
- No additional treatment is required to meet LDR standards.
- Can accommodate a wide range of similar wastes and radiation levels. Widely used in the commercial world.
- Wasteform meets DOT shipping requirements in the form it exits the treatment process.
- The wasteform meets the expected WAC for disposal. No additional treatment is required. Wasteform is disposable in the form in which it exits the process.
- This is a proven process, used both in DOE Complex and the commercial world.
- Mature technology. Vendor will bring onsite and set up with a minimum delay.
- Process can be installed in a containment building with adequate emission controls.
- Skid mounted, no D&D, vendor removes upon completion of work.
- Process is in full compliance without needing a permit.
- This is the specified treatment technology.

Cons

- The waste volume will more than double.
- Waste requires HW/MW disposal.
- Wasteform is not as permanent as other forms of stabilization.
- Not a budgeted item **and** will require line item funding.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	10	Subtract 10 points from the median score of 20 because the waste volume will more than double.
• secondary waste generation	100	Add 20 points to the median score of 80 because no secondary waste is generated.

Waste Stream Number & Name: SR-W069 Low-Level Waste (LLW) Lead – to be Macroencapsulated

Option Number: SR-W069-1
Facility: Vendor/Onsite

Treatment Technology: Polymer Encapsulation

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• destruction removal and demobilization efficiency	80	No additional treatment is required to meet LDR standards.
• flexibility	80	Can accommodate a wide range of similar wastes and radiation levels. Widely used in the commercial world.
• ability to be shipped	80	Wasteform meets shipping requirements in the form it exits the treatment process.
• final wasteform	100	The wasteform meets the expected waste disposal WAC for disposal. Add 20 points to the median score of 80 because no additional treatment is required. Wasteform is disposable in the form in which it exits the process.
Engineering Parameters		
• system implementability	100	Encapsulation with plastic is a proven process. Add 20 points to the median score of 80 because this is a proven process, used both in DOE Complex and the commercial world.
• availability	60	Add 10 points to the median score of 50 because system is normally available 50+% of the time.
• scalability	50	Throughput is set by design and not easily expanded except by adding more shifts of operation.
• remedial measures	50	Failed wasteform can be ground up and reprocessed.
• schedule for treatment of waste	80	Mature technology. Vendor will bring onsite and set up with a minimum delay.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Process can be installed in a building with adequate emission controls.
• non operational worker potential exposure	80	Requires the same number of non operational workers as comparable skid-mounted units. Most or all initial construction can be done in a vendor shop. Experience in similar facilities indicates that little non-routine maintenance is required.
• operational worker potential exposure	40	Subtract 10 points from the median score of 50 because the facility requires more operational workers than comparably sized, skid mounted facilities.
• transportation potential exposure	60	No additional characterization needed. Add 10 points to the median score of 50 because waste can be handled readily.
Regulatory Parameters		
• need for variance	80	Process is in full compliance. No variance needed.
• ability to obtain a permit	80	This is the specified treatment technology.
• waste disposal	20	Waste requires HW/MW disposal.
Public Acceptance		
• public acceptance	20	Mature and proven technology, however wasteform is not as permanent as other forms of stabilization (i.e., vitrification).

Waste Stream Number & Name: SR-W069 Low-Level Waste (LLW) Lead – to be Macroencapsulated

Option Number: SR-W069-1
Facility: Vendor/Onsite

Treatment Technology: Polymer Encapsulation

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Cost Considerations		
• life-cycle cost	51	
• funding availability	20	Not a budgeted item and will require line item funding.
Industry Involvement		
• market for technology	20	This is an existing vendor process.
• private sector involvement	50	Technology could be provided by an existing vendor process.

IDOA Score: **Technical** 57 **Total** 64

Waste Stream Number & Name: SR-W069 Low-Level Waste (LLW) Lead – to be Macroencapsulated

Option Number: SR-W069-1
Facility: Vendor/Onsite

Treatment Technology: Polymer Encapsulation

Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled

Module Location: SRS

Module Status: [ ] Existing [√] New [ ] Small generator [√] Large generator
[√] Onsite [ ] Offsite [√] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 212	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 848	
		1.3.2 Safety Assurance Documentation	$ 212	
		1.3.3 Permitting	$ 125	
		1.3.4 Preparation for Operations	$ 2,000	
		1.3.5 Project Management	$ 68	
		TOTAL PRE-OPERATIONS		$ 3,489
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 330	
	2.2	Inspection	$ 105	
	2.3	Project Management	$ 173	
	2.4	Building Construction (inc. indirect)	$ 1,500	
	2.5	Equipment (inc. indirect)	$ 0	
	2.6	Construction Management	$ 105	
	2.7	Contingency	$ 2,198	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 4,411
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 94	
	3.2	Annual Utilities	$ 4	
	3.3	Annual Materials	$ 56	
	3.4	Annual Maintenance	$ 34	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 188	
		X NUMBER OF YEARS OF OPERATION	4.00	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 750
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 4,400	
	4.2	Closure, Post-Closure, Monitoring	$ 43	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 4,443
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$ 4,000	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$ 4,000
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 850
		SUB COST FOR POLYMER ENCAPSULATION MODULE		$ 17,942
		ESCALATION		1.06
		TOTAL COST		$ 22,069

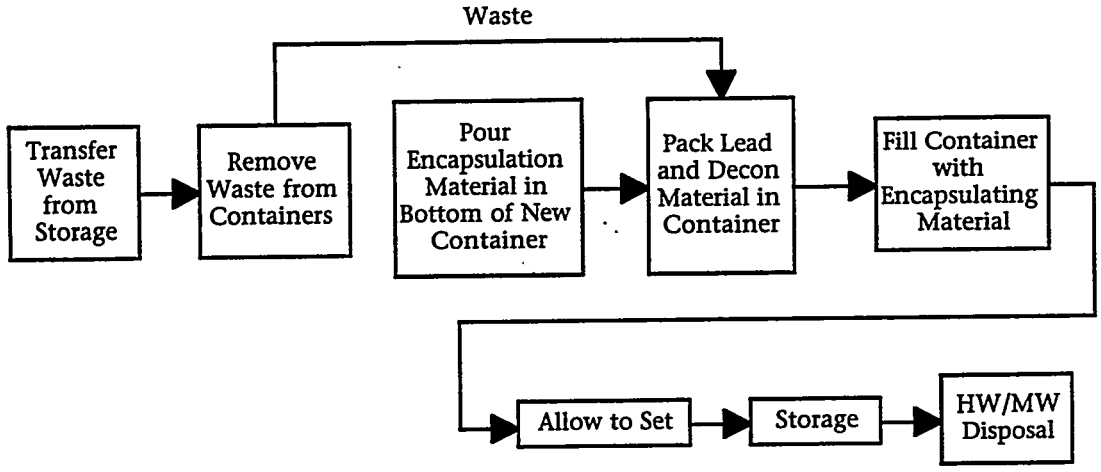
If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W069 **Low-Level Waste (LLW) Lead – to be Macroencapsulated**

Option Number: SR-W069-2
Facility: Containment Building

Treatment Technology: Macroencapsulation

Treatment Cycle Flow Diagram



Pros

- No secondary waste is generated.
- No additional treatment is required to meet LDR standards.
- Can accommodate a wide range of similar wastes and radiation levels. Widely used in the commercial world.
- Wasteform meets DOT shipping requirements in the form it exits the treatment process.
- The wasteform meets the expected WAC for waste disposal. No additional treatment is required. Wasteform is disposable in the form in which it exits the process.
- Encapsulation with plastic is a proven process. Used both in DOE Complex and the commercial world.
- Well-accepted wasteform. No variance needed.

Cons

- Volume of material to disposal will increase owing to the amount of encapsulating material required.
- Waste requires disposal in HW/MW facilities.
- Wasteform is not as permanent as other forms of stabilization.
- Not a budgeted item and will require line item funding.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	20	Volume of material to disposal will increase owing to the amount of encapsulating material required.
• secondary waste generation	100	Add 20 points to the median score of 80 because no secondary waste is generated.
• destruction removal and demobilization efficiency	80	No additional treatment is required to meet LDR standards.
• flexibility	80	Can accommodate a wide range of similar wastes and radiation levels. Widely used in the commercial world.

Waste Stream Number & Name: SR-W069 **Low-Level Waste (LLW) Lead – to be Macroencapsulated**

Option Number: SR-W069-2
Facility: Containment Building **Treatment Technology:** Macroencapsulation
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• ability to be shipped	80	Wasteform meets shipping requirements in the form it exits the treatment process.
• final wasteform	100	The wasteform meets the expected WAC for disposal. Add 20 points to the median score of 80 because no additional treatment is required. Wasteform is disposable in the form in which it exits the process.
Engineering Parameters		
• system implementability	100	Encapsulation with plastic is a proven process. Add 20 points to the median score of 80 because it is used both in DOE Complex and the commercial world.
• availability	50	System is normally available 50% of the time.
• scalability	50	Throughput is set by design, and not easily expanded except by adding more shifts of operation.
• remedial measures	50	Failed wasteforms can be ground up and reprocessed.
• schedule for treatment of waste	40	This is mature technology, but containment building process will have to be designed. Subtract 10 points from the median score of 50 because installation in a containment building will add uncertainties.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Process can be installed in a containment building with adequate emission controls.
• non operational worker potential exposure	50	Maintenance of encapsulating material mixing equipment will require an average crew.
• operational worker potential exposure	40	An average crew is required to operate the equipment. Subtract 10 points from the median score of 50 because manual labor is required to unload boxes and stack lead in the encapsulation containers.
• transportation potential exposure	60	No additional characterization needed. Add 10 points to the median score of 50 because waste can be handled readily.
Regulatory Parameters		
• need for variance	80	Process is in full compliance. No variance needed.
• ability to obtain a permit	80	Encapsulation is the specified treatment technology.
• waste disposal	20	Waste requires disposal in HW/MW facilities.
Public Acceptance		
• public acceptance	20	Mature and proven technology, however wasteform is not as permanent as other forms of stabilization (i.e., vitrification).
Cost Considerations		
• life-cycle cost	8	
• funding availability	20	Not a budgeted item and will require line item funding.

Waste Stream Number & Name: SR-W069 Low-Level Waste (LLW) Lead – to be Macroencapsulated

Option Number: SR-W069-2
Facility: Containment Building **Treatment Technology:** Macroencapsulation
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Industry Involvement		
• market for technology	20	Similar processes are commercially available.
• private sector involvement	20	No vendor evaluation.

IDOA Score: **Technical** 55 **Total** 56

Waste Stream Number & Name: SR-W069 Low-Level Waste (LLW) Lead – to be Macroencapsulated

Option Number: SR-W069-2
Facility: Containment Building
Cost Estimate Sheet

Treatment Technology: Macroencapsulation

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled

Module Location: SRS

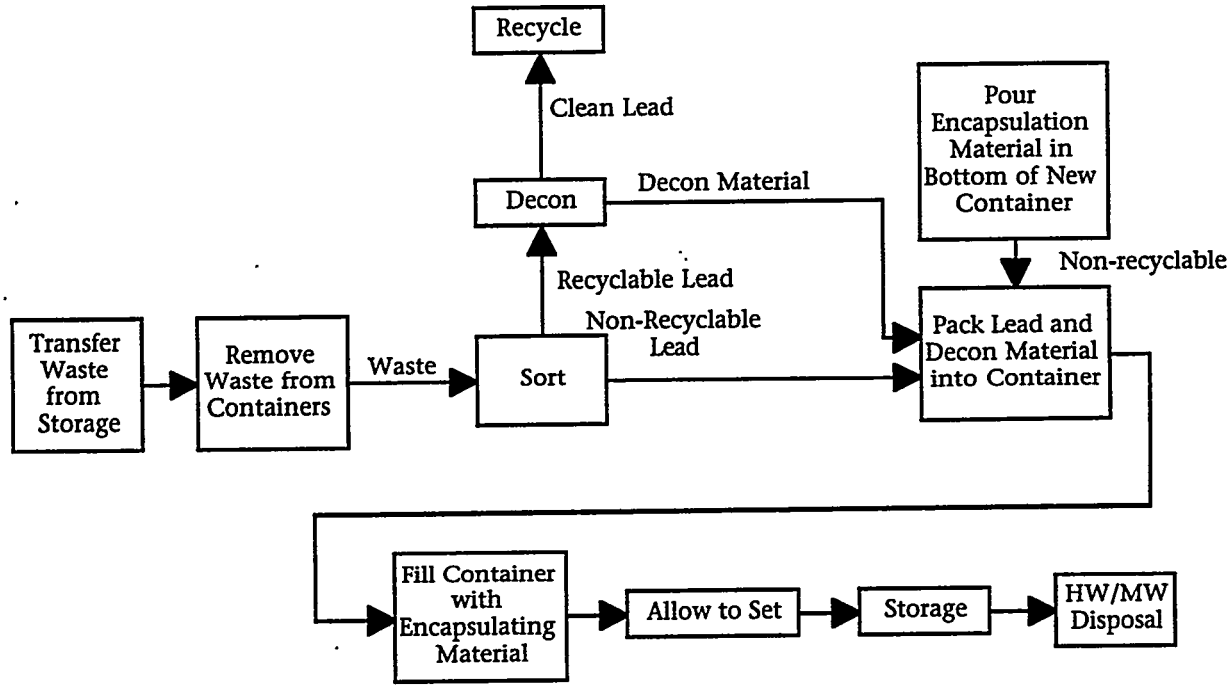
Module Status: [ ] Existing [√] New [ ] Small generator [√] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1000) Sub $	($ x 1000) Element $
1.0	Pre-Operations			
1.1	Studies and Bench Scale Tests		$ 254	
1.2	Demonstration Costs		$ N/A	
1.3	Operations Budget Funded Activities			
1.3.1		Conceptual Design	$ 1,018	
1.3.2		Safety Assurance Documentation	$ 254	
1.3.3		Permitting	$ 125	
1.3.4		Preparation for Operations	$ 150	
1.3.5		Project Management	$ 77	
		TOTAL PRE-OPERATIONS		$ 1,879
2.0	Facility Construction Cost			
2.1	Design (Title I and II)		$ 1,170	
2.2	Inspection		$ 264	
2.3	Project Management		$ 341	
2.4	Building Construction (inc. indirect)		$ 1,716	
2.5	Equipment (inc. indirect)		$ 3,600	
2.6	Construction Management		$ 372	
2.7	Contingency		$ 2,639	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 10,102
3.0	Operation and Maintenance			
3.1	Annual Operating Labor		$ 422	
3.2	Annual Utilities		$ 17	
3.3	Annual Materials		$ 253	
3.4	Annual Maintenance		$ 152	
3.5	Annual Contingency		$ 0	
		TOTAL ANNUAL O & M	$ 844	
		X NUMBER OF YEARS OF OPERATION	8.00	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 6,750
4.0	Decontamination & Decommissioning			
4.1	Facility D&D		$ 4,253	
4.2	Closure, Post-Closure, Monitoring		$ 10	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 4,263
5.0	Contracted Services			
5.1	Commercial Treatment/Disposal		$	
5.2	Mobile Treatment		$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 200
		SUB COST FOR MACROENCAPSULATION MODULE		$ 23,194
		ESCALATION		1.384
		TOTAL COST		$ 32,101

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W069 **Low-Level Waste (LLW) Lead – to be Macroencapsulated**

Option Number: SR-W069-3
Facility: *HW/MW-TB*
Treatment Technology: Macroencapsulation
Treatment Cycle Flow Diagram



Pros

- Decontamination is a simple technology. The material that is not decontaminated or cannot be easily decontaminated will be encapsulated.
- No additional treatment is required to meet LDR standards.
- Can accommodate a wide range of similar wastes and radiation levels. Widely used in the commercial world.
- Wasteform meets DOT shipping requirements in the form it exits the treatment process.
- This wasteform meets the expected WAC for waste disposal. Wasteform is disposable in the form in which it exits the process.
- Encapsulation with plastic is a proven process. Used both in DOE Complex and the commercial world.
- Well-accepted wasteform. No variance needed.

Cons

- Volume of material to disposal will increase owing to the amount of encapsulating material required.
- Waste requires disposal in HW/MW facilities (RCRA Subtitle C facility).
- Wasteform is not as permanent as other forms of stabilization.
- Not a budgeted item and will require line item funding.

Waste Stream Number & Name: SR-W069 Low-Level Waste (LLW) Lead – to be Macroencapsulated

Option Number: SR-W069-3
Facility: HW/MW-TB
Treatment Technology: Macroencapsulation
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	20	Volume of material to disposal will increase owing to the amount of encapsulating material required.
• secondary waste generation	100	Add 20 points to the median score of 80 because no secondary waste is generated.
• destruction removal and demobilization efficiency	80	No additional treatment is required to meet LDR standards.
• flexibility	80	Can accommodate a wide range of similar wastes and radiation levels. Widely used in the commercial world.
• ability to be shipped	80	Wasteform meets shipping requirements in the form it exits the treatment process.
• final wasteform	100	This wasteform meets the expected WAC for waste disposal. Add 20 points to the median score of 80 because wasteform is disposable in the form in which it exits the process.
Engineering Parameters		
• system implementability	100	Encapsulation with plastic is a proven process. Add 20 points to the median score of 80 because the process is used both in DOE Complex and the commercial world.
• availability	50	System is normally available 50% of the time.
• scalability	50	Throughput is set by design, and not easily expanded except by adding more shifts of operation.
• remedial measures	50	Failed wasteform must be ground up and reprocessed.
• schedule for treatment of waste	50	Mature technology, but treatment building process will have to be designed.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Process can be installed in a containment building with adequate emission controls.
• non operational worker potential exposure	50	Maintenance of encapsulating material mixing equipment will require an average crew.
• operational worker potential exposure	40	An average crew is required to operate the equipment. Subtract 10 points from the median score of 50 because manual labor required to unload boxes and stack lead in the encapsulation containers.
• transportation potential exposure	60	No additional characterization needed. Add 10 points to the median score of 50 because waste can be handled readily.
Regulatory Parameters		
• need for variance	80	Well-accepted wasteform. No variance needed.
• ability to obtain a permit	50	Encapsulation is the specified treatment technology.
• waste disposal	20	Waste requires HW/MW disposal.
Public Acceptance		
• public acceptance	20	Mature and proven technology, however wasteform is not as permanent as other forms of stabilization (i.e., vitrification).

Waste Stream Number & Name: SR-W069 **Low-Level Waste (LLW) Lead – to be Macroencapsulated**

Option Number: SR-W069-3
Facility: HW/MW-TB **Treatment Technology:** Macroencapsulation
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Cost Considerations		
• life-cycle cost	0	
• funding availability	20	Will require line item funding.
Industry Involvement		
• market for technology	20	Similar processes are commercially available.
• private sector involvement	20	SRS facility evaluated.

IDOA Score: **Technical** 53 **Total** 53

Waste Stream Number & Name: SR-W069 Low-Level Waste (LLW) Lead – to be Macroencapsulated

Option Number: SR-W069-3
Facility: HW/MW-TB
Cost Estimate Sheet

Treatment Technology: Macroencapsulation

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled

Module Location: SRS

Module Status: [ ] Existing [√] New [ ] Small generator [√] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element		($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations		
1.1	Studies and Bench Scale Tests	$ 526	
1.2	Demonstration Costs	$ N/A	
1.3	Operations Budget Funded Activities		
1.3.1	Conceptual Design	$ 2,102	
1.3.2	Safety Assurance Documentation	$ 526	
1.3.3	Permitting	$ 125	
1.3.4	Preparation for Operations	$ 150	
1.3.5	Project Management	$ 315	
	TOTAL PRE-OPERATIONS		$ 3,743
2.0	Facility Construction Cost		
2.1	Design (Title I and II)	$ 2,332	
2.2	Inspection	$ 634	
2.3	Project Management	$ 949	
2.4	Building Construction (inc. indirect)	$ 7,000	
2.5	Equipment (inc. indirect)	$ 3,600	
2.6	Construction Management	$ 742	
2.7	Contingency	$ 5,450	
	TOTAL FACILITY CONSTRUCTION COSTS		$ 20,707
3.0	Operation and Maintenance		
3.1	Annual Operating Labor	$ 422	
3.2	Annual Utilities	$ 17	
3.3	Annual Materials	$ 253	
3.4	Annual Maintenance	$ 152	
3.5	Annual Contingency	$ 0	
	TOTAL ANNUAL O & M	$ 844	
	X NUMBER OF YEARS OF OPERATION	8.0	
	TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 6,750
4.0	Decontamination & Decommissioning		
4.1	Facility D&D	$ 8,480	
4.2	Closure, Post-Closure, Monitoring	$ 10	
	TOTAL DECONTAMINATION & DECOMMISSIONING		$ 8,490
5.0	Contracted Services		
5.1	Commercial Treatment/Disposal	$	
5.2	Mobile Treatment	$	
	TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)		$
7.0	Transportation		$
8.0	Disposal		$ 200
	SUB COST FOR MACROENCAPSULATION MODULE		$ 39,891
	ESCALATION		1.23
	TOTAL COST		$ 49,065

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W069 Low-Level Waste (LLW) Lead – to be Macroencapsulated

Option Number: SR-W069-4
Facility: INEL/WEDF

Treatment Technology: Stabilization

Treatment Technology

The Idaho National Engineering Laboratory (INEL) Waste Engineering Development Facility (WEDF) Stabilization process will provide treatments for aqueous and organic liquids and debris. The process will stabilize waste in a grout matrix to reduce leachability.

Pros

- No secondary waste streams are expected to be generated.
- The facility can treat waste streams similar in composition to those assumed in the design basis without modification.
- The stabilized waste could be shipped without additional treatment.
- Final wasteform is anticipated to meet the SRS waste disposal WAC.
- Stabilization has been demonstrated at the facility.
- The facility is anticipated to have minimal down time.
- Process failure is not anticipated to create a waste stream that cannot be treated.
- Few emissions for the facility are anticipated during normal operation and most accident scenarios.
- The facility could potentially be used to treat numerous waste streams throughout the DOE Complex.

Cons

- Stabilization will increase the overall waste volume by a factor of 2 or more after processing.
- Throughput fixed by design. The facility is currently being designed.
- Waste characterization will be required for any waste streams returned to SRS for disposal.
- The treated waste will be classified as mixed waste which will require disposal in an HW/MW facility.
- This is a planned, but not funded, facility.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	10	Subtract 10 points from the median score of 20 because stabilization will increase the overall waste volume by a factor of 2 or more after processing.
• secondary waste generation	80	Minimal secondary waste streams are generated.
• destruction removal and demobilization efficiency	50	Additional treatment for some waste streams may be required prior to stabilization to ensure LDR standards are met.
• flexibility	80	The facility can treat waste streams similar in composition to those assumed in the design basis without modification.
• ability to be shipped	80	The stabilized waste could be shipped without additional treatment.
• final wasteform	80	Final wasteform is anticipated to meet the SRS disposal WAC.
Engineering Parameters		
• system implementability	80	Stabilization has been demonstrated at the facility.
• availability	80	The facility is anticipated to have minimal down time.
• scalability	20	Throughput fixed by design. The facility is currently being designed

Waste Stream Number & Name: SR-W069 Low-Level Waste (LLW) Lead – to be Macroencapsulated

Option Number: SR-W069-4
Facility: INEL/WEDF
Treatment Technology: Stabilization
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• remedial measures	80	Process failure is not anticipated to create a waste stream that cannot be treated.
• schedule for treatment of waste	50	A schedule for waste treatment cannot be provided. Additionally, acceptance of SRS waste will be contingent upon state-approved permit modifications.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Few emissions for the facility are anticipated during normal operation and most accident scenarios.
• non operational worker potential exposure	50	Processing this material will not increase the exposure to non operational personnel.
• operational worker potential exposure	50	Personnel exposure is average for operations of this type. Processing this material will not increase the exposure to operational personnel.
• transportation potential exposure	20	Waste characterization will be required for any waste streams returned to SRS for waste disposal.
Regulatory Parameters		
• need for variance	80	Process will be in full compliance without needing a variance.
• ability to obtain a permit	50	Permitting process is well defined, however, the state's acceptance of offsite waste treatment is unknown. Approval may be difficult.
• waste disposal	20	The treated waste will be classified as mixed waste which will require disposal in an HW/MW facility.
Public Acceptance		
• public acceptance	40	Public acceptance for stabilization is positive; however, the treatment of offsite waste is anticipated to reduce the overall public acceptance of this process. Subtract 10 points from median score of 50.
Cost Considerations		
• life-cycle cost	54	
• funding availability	50	Not a budgeted item, though line item funding may not be required.
Industry Involvement		
• market for technology	80	The facility could potentially be used to treat numerous waste streams throughout the DOE Complex.
• private sector involvement	20	Technology is available at an existing DOE facility.

IDOA Score: **Technical** 46 **Total** 54

Waste Stream Number & Name: SR-W069 Low-Level Waste (LLW) Lead – to be Macroencapsulated

Option Number: SR-W069-4
Facility: INEL/WEDF
Treatment Technology: Stabilization
Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled

Module Location: INEL

Module Status: [√] Existing [ ] New [ ] Small generator [√] Large generator
[ ] Onsite [√] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$	
		1.3.2 Safety Assurance Documentation	$	
		1.3.3 Permitting	$	
		1.3.4 Preparation for Operations	$	
		1.3.5 Project Management	$	
		TOTAL PRE-OPERATIONS		$
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$	
	2.2	Inspection	$	
	2.3	Project Management	$	
	2.4	Building Construction (inc. indirect)	$	
	2.5	Equipment (inc. indirect)	$	
	2.6	Construction Management	$	
	2.7	Contingency	$	
		TOTAL FACILITY CONSTRUCTION COSTS		$
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$	
	3.2	Annual Utilities	$	
	3.3	Annual Materials	$	
	3.4	Annual Maintenance	$	
	3.5	Annual Contingency	$	
		TOTAL ANNUAL O & M	$	
		X NUMBER OF YEARS OF OPERATION		
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$	
	4.2	Closure, Post-Closure, Monitoring	$	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$ 17,360
7.0	Transportation			$ 387
8.0	Disposal			$ 850
		SUB COST FOR STABILIZATION MODULE		$ 18,597
		ESCALATION		1.06
		TOTAL COST		$ 19,712

Note: Per DOE directions this cost estimate is the incremental cost for treatment at an offsite DOE facility; therefore, it carries no overhead burden or capital costs.

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W069 **Low-Level Waste (LLW) Lead – to be Macroencapsulated**

Option Number: SR-W069-5
Facility: INEL/WEDF

Treatment Technology: **Macroencapsulation**

Treatment Technology

Idaho National Engineering Laboratory (INEL) Waste Engineering Development Facility (WEDF) will have a grout encapsulation process. Stabilization of the debris will be accomplished with the following reagents (or waste reagents) such that the leachability of the hazardous contaminants is reduced: Portland cement; or lime/pozzolans (e.g., fly ash and cement kiln dust. Reagents (e.g., iron salts, silicates, and clay) may be added to enhance the set/cure time and/or compressive strength, or to reduce the leachability of the hazardous constituents.

Option Justification or Rejection Rationale

INEL did not agree with this as a viable option. INEL recommended the ICPP debris treatment facility for treatment of this waste stream. The facility is also planned and unapproved. An additional reason for rejection is the basic assumption that large volume waste streams will be treated onsite.

Pros

- Few or no secondary waste streams are generated.
- The facility can treat waste streams similar in composition to those assumed in the design basis without modification.
- The macroencapsulated waste could be shipped without additional treatment.
- Final wasteform is anticipated to meet the SRS waste disposal WAC.
- The facility is anticipated to have less than 20% down time.
- Process failure is not anticipated to create a waste stream that cannot be treated.
- Few emissions for the facility are anticipated during normal operation and most accident scenarios.
- The facility could potentially be used to treat numerous waste streams throughout the DOE Complex.

Cons

- Macroencapsulation will increase the overall waste volume by a factor of 5 or more.
- A schedule for waste treatment cannot be provided. Additionally, acceptance of SRS waste will be contingent upon state approved permit modifications. In addition since this is a proposed facility the operating schedule is contingent upon receipt of DOE funding. The early stage of design also adds uncertainties.
- Waste characterization will be required for any waste streams returned to SRS for disposal.
- 80% of the treated waste will be classified as mixed waste which will require disposal in a HW/MW facility.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	20	Macroencapsulation will increase the overall waste volume by a factor of 5 or more.
• secondary waste generation	80	Few or no secondary waste streams are generated.
• destruction removal and demobilization efficiency	50	Additional treatment for some waste streams may be required prior to macroencapsulation to ensure LDR standards are met.

Waste Stream Number & Name: SR-W069 Low-Level Waste (LLW) Lead – to be Macroencapsulated

Option Number: SR-W069-5
Facility: INEL/WEDF **Treatment Technology:** Macroencapsulation
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• flexibility	80	The facility can treat waste streams similar in composition to those assumed in the design basis without modification.
• ability to be shipped	80	The macroencapsulated waste could be shipped without additional treatment.
• final wasteform	80	Final wasteform is anticipated to meet the SRS waste disposal WAC.
Engineering Parameters		
• system implementability	50	The facility is currently being designed. Although individual treatment methods have been proven, an integrated facility has not been demonstrated.
• availability	80	The facility is anticipated to have less than 20% down time.
• scalability	50	The process is currently in the early design phase so additional modification could be incorporated.
• remedial measures	80	Process failure is not anticipated to create a waste stream that cannot be treated.
• schedule for treatment of waste	20	A schedule for waste treatment cannot be provided. Additionally, acceptance of SRS waste will be contingent upon state approved permit modifications. Since this is a proposed facility the operating schedule is contingent upon receipt of DOE funding. The early stage of design also adds uncertainties.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Few emissions for the facility are anticipated during normal operation and most accident scenarios.
• non operational worker potential exposure	50	Average number of non operational workers is anticipated.
• operational worker potential exposure	50	Personnel exposure is expected to be average for operations of this type.
• transportation potential exposure	20	Waste characterization will be required for any waste streams returned to SRS for disposal.
Regulatory Parameters		
• need for variance	50	Process will be permitted under a RCRA Part B Permit Application. Acceptance of offsite waste will require submission of a permit modification.
• ability to obtain a permit	50	Permitting process is well defined, however, the state's acceptance of offsite waste treatment is unknown. Approval may be difficult.
• waste disposal	20	80% of the treated waste will be classified as mixed waste which will require disposal in a HW/MW facility.
Public Acceptance		
• public acceptance	40	Public acceptance for macroencapsulation is reasonably positive; however, the treatment of offsite waste is anticipated to reduce the overall public acceptance of this process at INEL's location. Subtract 10 points from median score of 50.

Waste Stream Number & Name: SR-W069 Low-Level Waste (LLW) Lead – to be Macroencapsulated

Option Number: SR-W069-5
Facility: INEL/WEDF
Treatment Technology: Macroencapsulation
In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Cost Considerations		
• life-cycle cost	54	
• funding availability	50	Funding for treatment cost can be provided using the operating budget, however the additional costs may result in an increase in the budget in excess of 10%.
Industry Involvement		
• market for technology	80	The facility could potentially be used to treat numerous waste streams throughout the DOE Complex.
• private sector involvement	20	Technology is available at an existing DOE facility.

IDOA Score: **Technical** 46 **Total** 54

Waste Stream Number & Name: SR-W069 Low-Level Waste (LLW) Lead – to be Macroencapsulated

Option Number: SR-W069-5
Facility: INEL/WEDF
Treatment Technology: Macroencapsulation
Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled

Module Location: INEL

Module Status: [√] Existing [ ] New [ ] Small generator [√] Large generator
[ ] Onsite [√] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element		($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations		
1.1	Studies and Bench Scale Tests	$	
1.2	Demonstration Costs	$ N/A	
1.3	Operations Budget Funded Activities		
1.3.1	Conceptual Design	$	
1.3.2	Safety Assurance Documentation	$	
1.3.3	Permitting	$	
1.3.4	Preparation for Operations	$	
1.3.5	Project Management	$	
	TOTAL PRE-OPERATIONS		$
2.0	Facility Construction Cost		
2.1	Design (Title I and II)	$	
2.2	Inspection	$	
2.3	Project Management	$	
2.4	Building Construction (inc. indirect)	$	
2.5	Equipment (inc. indirect)	$	
2.6	Construction Management	$	
2.7	Contingency	$	
	TOTAL FACILITY CONSTRUCTION COSTS		$
3.0	Operation and Maintenance		
3.1	Annual Operating Labor	$	
3.2	Annual Utilities	$	
3.3	Annual Materials	$	
3.4	Annual Maintenance	$	
3.5	Annual Contingency	$	
	TOTAL ANNUAL O & M	$	
	X NUMBER OF YEARS OF OPERATION		
	TOTAL OPERATIONS AND MAINTENANCE COSTS		$
4.0	Decontamination & Decommissioning		
4.1	Facility D&D	$	
4.2	Closure, Post-Closure, Monitoring	$	
	TOTAL DECONTAMINATION & DECOMMISSIONING		$
5.0	Contracted Services		
5.1	Commercial Treatment/Disposal	$	
5.2	Mobile Treatment	$	
	TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)		$ 17,360
7.0	Transportation		$ 387
8.0	Disposal		$ 850
	SUB COST FOR MACROENCAPSULATION MODULE		$ 18,597
	ESCALATION		$ 1.06
	TOTAL COST		$ 19,712

Note: Per DOE directions this cost estimate is the incremental cost for treatment at an offsite DOE facility; therefore, it carries no overhead burden or capital costs..

If above numbers do not appear to add correctly, it is the result of computer rounding.

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Summary Page – Initial Screening

Waste Stream Number & Name: SR-W070 Mixed Waste from Laboratory Samples

Background Information

Future waste stream consisting of aqueous lab waste from the analytical testing of ground water samples taken from the site and processed at commercial, offsite laboratories.

Volume
- Future waste generation, 1995 through 1999, is 2.2 m^3.

Waste Stream Composition
- Aqueous liquid

Waste Code
- D004A (TCLP As)
- D005A (TCLP Ba)
- D006A (TCLP Cd)
- D007A (TCLP Cr)
- D008A (TCLP Pb)
- D009A (TCLP Hg)
- D010A (TCLP Se)
- D011A (TCLP Ag)
- F001, F002, and F005 (spent solvents – these waste codes pertain only to samples that may contain a listed waste)

LDR Treatment Standard
- D004 = concentration based standard = 5 mg/l
- D005 = concentration based standard = 100 mg/l
- D006 = concentration based standard = 1.0 mg/l
- D007 = concentration based standard = 5.0 mg/l
- D008 = concentration based standard = 5.0 mg/l
- D009 = concentration based standard = 0.2 mg/l
- D010 = concentration based standard = 5.7 mg/l
- D011 = concentration based standard = 5.0 mg/l
- F001, F002, and F005 = concentration based standards = 6.0-170 mg/kg, except for 2-Ethoxyethanol and 2-Nitropropane = Incineration

Waste Characterization
- Process knowledge used to characterize the waste stream
- Confidence level varies depending on the specific waste, it is generally medium to high. .

Radiological Characterization
- H^3, Am^{-241}, Cs^{-137}, Pu^{238}, Pu^{239}, Pu^{240}, Pu^{241}, Sr^{-90}, U^{234}, U^{235}, U^{236}, U^{237}, U^{238}
- Activity unknown
- Contact handled

Initial Screening

The initial screening identified inappropriate treatment options. These options appear in the Initial Rejections table.

Initial Rejections

Treatment Facility	Treatment Technology	Reasons for Rejection
ETF	Ion Exchange	ETF has insufficient information on the characteristics of this waste in determine if treatment processes exist in the facility. ETF if prohibited from processing F-listed wastes.
M Area	Vitrification	While vitrification may be an appropriate treatment for this waste the projected waste generation exceeds the service life of the M-Area vitrifier.
Z Area	Stabilization	Z Area can treat only those wastes that come by pipeline from Tank 50 and meet strict waste acceptance criteria. The Z-Area process lacks flexibility to treat and dispose of a variety of waste streams.

Summary Page – Technology Success Factor (TSF) & In-Depth Options Analysis (IDOA)

Waste Stream Number & Name: SR-W070 Mixed Waste from Laboratory Samples

Feasible Options

Option No.	Treatment Facility	Treatment Technology	TSF Score	IDOA Scores Tech.	IDOA Scores Total	COST (x 1,000)	PO
SR-W070-1	CIF	Incineration/ Stabilization	100	66	80	240	√
SR-W070-2	CIF	Ashcrete Stabilization	88	64	78	259	√
SR-W070-3	Cont. Bldg.	Vendor stabilization	75	60	73	2476	

Options Rejected Due To Low Technology Success Factor (TSF)

- No options were rejected.

Engineering Assessment

Preferred Option Justification

The preferred treatment option for the Mixed Waste from Laboratory Samples waste stream is Incineration followed by Stabilization at CIF, provided the organic content for one or more hazardous constituents is greater than the F039 level.

This option is preferred because:

- Rotary kiln technology is very mature and well known.
- Volume will decrease by a factor of more than ten.
- Incineration eliminates the constituent of concern. Treatment residuals are immobilized with cement.
- This small waste stream can be scheduled with high confidence.
- Few or no emissions during normal operations. Accident scenarios do not cause an increase in emissions.
- Life-cycle cost can be supported within target budgets.

Options Rejected During IDOA

Stabilization of the waste stream with Portland cement and additives either in the ashcrete process at CIF or with a vendor's process in a containment building.

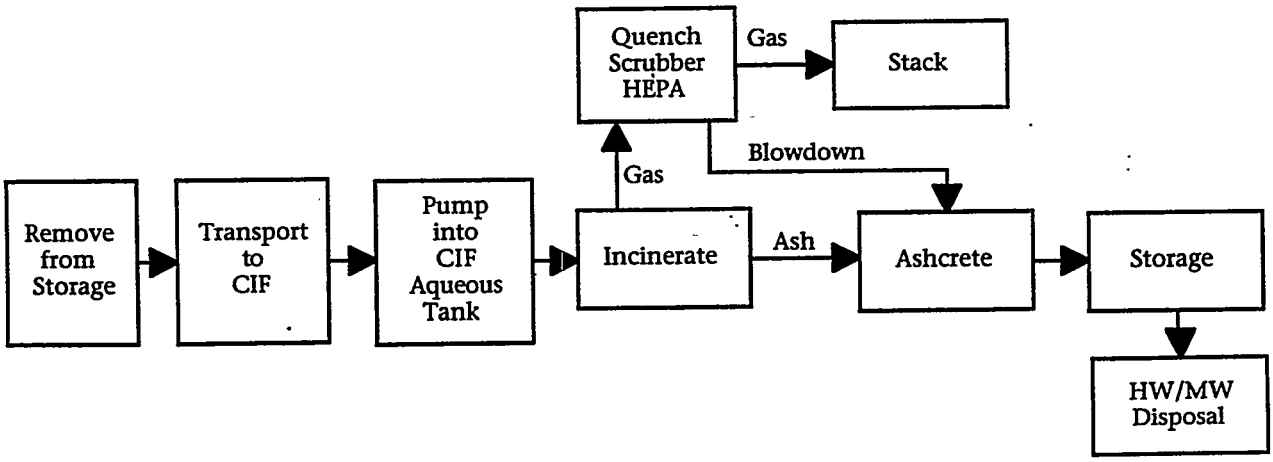
Stabilization with cement was rejected because:

- Gross volume of waste will increase by a factor of 2 or more
- Final wasteform will require disposal in HW/MW facility.

Nevertheless, if metals, for which cement stabilization is an LDR treatment standards are present in the waste stream and the organic content is less than the F039 level, then ashcrete stabilization becomes the preferred option and incineration is rejected because it is forbidden by EPA's policy against the dilution of inorganic metal-bearing wastes by incineration.

Waste Stream Number & Name: SR-W070 Mixed Waste from Laboratory Samples
Option Number: SR-W070-1
Facility: CIF
Treatment Technology: Incineration/ Stabilization

Treatment Cycle Flow Diagram:



Pros

- Rotary kiln technology is very mature and well known.
- Volume will decrease by a factor of more than ten.
- Incineration eliminates the constituent of concern. Treatment residuals are immobilized with cement.
- Shipping requirements are met for treatment residuals.
- Availability of 80% is easily achievable with this technology.
- This small waste stream can be scheduled with high confidence.
- Few or no emissions during normal operations. Accident scenarios do not cause an increase in emissions.
- Fewer than average number of operational workers and non operational workers will be acquired to tend this process.
- Only a small percentage of the final waste will require disposal as mixed waste.
- Life-cycle cost can be supported within target budgets.

Cons

- Public has expressed concern about incineration as a waste treatment process.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	90	Volume will be reduced. Add 10 points to high median of 80 because volume will decrease by a factor of more than ten.
• secondary waste generation	80	Few or no secondary wastes generated. Waste stream will form little ash upon incineration.
• destruction removal and demobilization efficiency	80	All applicable LDR standards are met.

Waste Stream Number & Name: SR-W070 Mixed Waste from Laboratory Samples
Option Number: SR-W070-1
Facility: CIF
Treatment Technology: Incineration/ Stabilization

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• flexibility	100	Incineration eliminates the constituent of concern. Treatment residuals are immobilized with cement. Add 20 points to the high median of 80 because of the wide variety of this waste stream that incineration can accommodate.
• ability to be shipped	80	DOT shipping requirements are met for treatment residuals.
• final wasteform	80	Final wasteform will meet waste disposal WAC.
Engineering Parameters		
• system implementability	100	Commercial process. Add 10 points to high median of 80 because kiln technology is very mature and well known.
• availability	80	Availability of 80% is easily achievable with this technology.
• scalability	50	Total throughout is fixed by design.
• remedial measures	70	Only the solidified treatment residuals can fail. Subtract 10 points from high medial of 80 because of the difficulty in size-reducing the stabilized wasteform.
• schedule for treatment of waste	80	This small waste stream can be scheduled with high confidence.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Few or no emissions during normal operations. Accident scenarios do not cause an increase in emissions.
• non operational worker potential exposure	80	Fewer than average number of operational workers will be required to tend this process.
• operational worker potential exposure	80	Fewer than average number of operational workers will be required to tend this process.
• transportation potential exposure	70	Waste will require characterization before transport to CIF. Subtract 10 points because of the slight increase in transportation risk inherent in transporting drums of liquid waste to the treatment site.
Regulatory Parameters		
• need for variance	80	Process will comply with regulations without requiring a variance.
• ability to obtain a permit	80	The process is well-defined.
• waste disposal	80	Only a small percentage of the final waste will require disposal as mixed waste.
Public Acceptance		
• public acceptance	20	Public has expressed concern about incineration as a waste treatment process.
Cost Considerations		
• life-cycle cost	99	
• funding availability	80	Life-cycle cost can be supported within target budgets.

Waste Stream Number & Name: SR-W070 Mixed Waste from Laboratory Samples
Option Number: SR-W070-1
Facility: CIF
Treatment Technology: Incineration/ Stabilization

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Industry Involvement		
• market for technology	20	Technology is vendor-supplied.
• private sector involvement	20	SRS facility evaluated.

IDOA Score: **Technical** 66 **Total** 80

Waste Stream Number & Name: SR-W070 Mixed Waste from Laboratory Samples
Option Number: SR-W070-1
Facility: CIF
Treatment Technology: Incineration/ Stabilization

Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled

Module Location: SRS

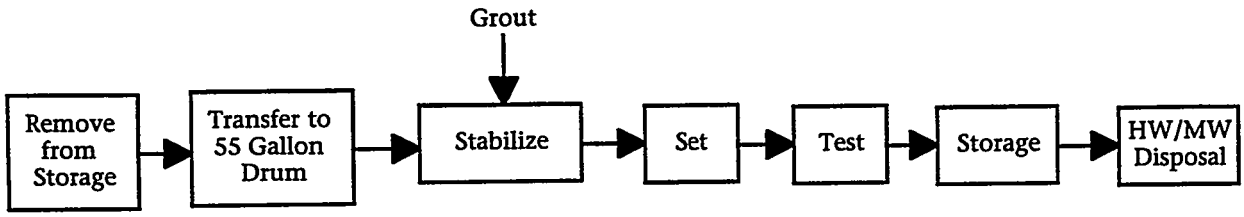
Module Status: [ ] Existing [√] New [ ] Small generator [√] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 1	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$	
		1.3.2 Safety Assurance Documentation	$	
		1.3.3 Permitting	$	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$	
		TOTAL PRE-OPERATIONS		$ 151
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 1	
	2.2	Inspection	$	
	2.3	Project Management	$	
	2.4	Building Construction (inc. indirect)	$	
	2.5	Equipment (inc. indirect)	$ 3	
	2.6	Construction Management	$	
	2.7	Contingency	$ 1	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 6
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 2	
	3.2	Annual Utilities	$	
	3.3	Annual Materials	$ 1	
	3.4	Annual Maintenance	$ 1	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 3	
		X NUMBER OF YEARS OF OPERATION	5.00	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 15
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 2	
	4.2	Closure, Post-Closure, Monitoring	$ 1	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 3
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 10
		SUB COST FOR INCINERATION MODULE		$ 184
		ESCALATION		1.305
		TOTAL COST		$ 240

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W070 Mixed Waste from Laboratory Samples
Option Number: SR-W070-2
Facility: CIF
Treatment Technology: Ashcrete Stabilization

Treatment Cycle Flow Diagram:



Pros

- Ash solidification technology is very mature and well known.
- Availability of 80% is easily achievable with this technology.
- This small waste streams can be scheduled with high confidence.
- Few or no emissions during normal operations. Accident scenarios do not cause an increase in emissions.
- Fewer than average number of operational workers and non operational workers will be required to tend this process.
- Public has indicated acceptance to solidification as a method of treating large volumes of waste.
- Life-cycle cost can be supported within target budgets.

Cons

- Gross volume of waste will increase by a factor of 2 or more.
- Final wasteform will require disposal in HW/MW facility.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	20	Gross volume of waste will increase by a factor of 2 or more.
• secondary waste generation	80	Few or no secondary wastes generated.
• destruction removal and demobilization efficiency	80	All applicable LDR standards are met.
• flexibility	50	Process can treat all expected wasteforms. Some concern revolves around the ability to treat some concentrations or organics in the waste stream.
• ability to be shipped	80	Shipping requirements are met for treatment residuals.
• final wasteform	80	Final wasteform will meet waste disposal WAC.
Engineering Parameters		
• system implementability	100	Commercial process. Add 10 points to high median of 80 because ash solidification technology is very mature and well known.
• availability	80	Availability of 80% is easily achievable with this technology.
• scalability	50	Total throughout is fixed by design.
• remedial measures	50	Reprocessing failed wasteforms would require additional facilities.

Waste Stream Number & Name: SR-W070 Mixed Waste from Laboratory Samples
Option Number: SR-W070-2
Facility: CIF
Treatment Technology: Ashcrete Stabilization

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• schedule for treatment of waste	80	This small waste streams can be scheduled with high confidence.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Few or no emissions during normal operations. Accident scenarios do not cause an increase in emissions.
• non operational worker potential exposure	80	Fewer than average number of operational workers will be required to tend this process.
• operational worker potential exposure	80	Fewer than average number of operational workers will be required to tend this process.
• transportation potential exposure	70	Waste will require characterization before transport to CIF. Subtract 10 points because of the slight increase in transportation risk inherent in transporting drums of liquid waste in the treatment site.
Regulatory Parameters		
• need for variance	80	Process will comply with regulations without requiring a variance.
• ability to obtain a permit	80	The process is well-defined.
• waste disposal	20	Final wasteform will require disposal in HW/MW facility.
Public Acceptance		
• public acceptance	80	Public has indicated acceptance to solidification as a method of treating large volumes of waste (e.g., Z-Area saltstone).
Cost Considerations		
• life-cycle cost	99	
• funding availability	80	Life-cycle cost can be supported within target budgets.
Industry Involvement		
• market for technology	20	Technology exists.
• private sector involvement	20	SRS facility evaluated.

IDOA Score: **Technical** 64 **Total** 78

Waste Stream Number & Name: SR-W070 Mixed Waste from Laboratory Samples
Option Number: SR-W070-2
Facility: CIF
Treatment Technology: Ashcrete Stabilization

Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled

Module Location: SRS

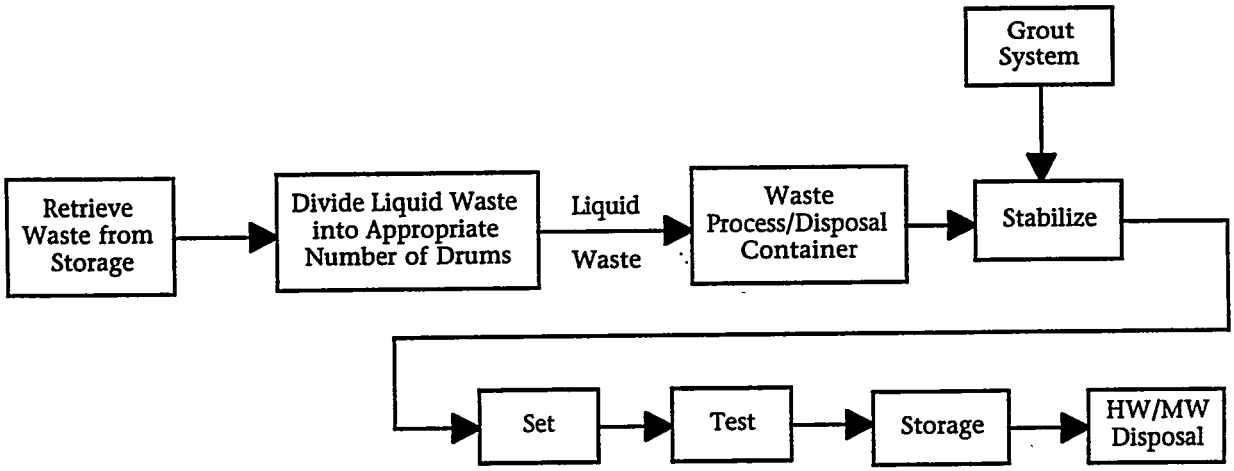
Module Status: [ ] Existing [√] New [ ] Small generator [√] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 1	
		1.3.2 Safety Assurance Documentation	$ 1	
		1.3.3 Permitting	$	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$	
		TOTAL PRE-OPERATIONS		$ 151
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 2	
	2.2	Inspection	$ 0	
	2.3	Project Management	$ 0	
	2.4	Building Construction (inc. indirect)	$	
	2.5	Equipment (inc. indirect)	$ 5	
	2.6	Construction Management	$	
	2.7	Contingency	$ 2	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 9
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 2	
	3.2	Annual Utilities	$	
	3.3	Annual Materials	$ 1	
	3.4	Annual Maintenance	$ 1	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 5	
		X NUMBER OF YEARS OF OPERATION	5.00	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 23
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 4	
	4.2	Closure, Post-Closure, Monitoring	$ 1	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 5
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 10
		SUB COST FOR ASHCRETE STABILIZATION MODULE		$ 198
		ESCALATION		1.305
		TOTAL COST		$ 259

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W070 Mixed Waste from Laboratory Samples
Option Number: SR-W070-3
Facility: Containment Buildings
Treatment Technology: Vendor Stabilization

Treatment Cycle Flow Diagram:



Pros

- Few or no secondary wastes are generated.
- Cement stabilization immobilizes the constituent of concern.
- This is a proven process in use both in the DOE complex and the commercial world.
- Requires fewer non operational workers than comparably sized facilities. Experience in similar facilities indicates little maintenance is required.
- Public has indicated acceptance to solidification as a method of treating large volumes of waste.

Cons

- Waste volume will significantly more than double.
- Final wasteform will require disposal in HW/MW facility.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	10	Gross volume of waste will increase. Subtract 10 points from low median of 20 because waste volume will significantly more than double.
• secondary waste generation	80	Few or no secondary wastes are generated.
• destruction removal and demobilization efficiency	80	All applicable LDR standards are met.
• flexibility	80	Process can handle a variety of waste liquids. Widely used in the commercial world.
• ability to be shipped	80	Waste can be shipped without further treatment.
• final wasteform	80	Final wasteform will meet waste disposal WAC.
Engineering Parameters		
• system implementability	100	Add 20 points to the high median score of 80 because this is a proven process in use both in the DOE complex and the commercial world.
• availability	80	Similar commercial systems have availability of 80%.

Waste Stream Number & Name: SR-W070 Mixed Waste from Laboratory Samples
Option Number: SR-W070-3
Facility: Containment Buildings
Treatment Technology: Vendor Stabilization

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• scalability	50	Throughput fixed by design.
• remedial measures	50	Reprocessing failed wasteforms would require additional facilities.
• schedule for treatment of waste	70	This is a mature technology, but subtract 10 point from the high median of 80 because of uncertainties surrounding procurement and funding.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Containment building will control emissions.
• non operational worker potential exposure	80	Requires fewer non operational workers than comparably sized facilities. Experience in similar facilities indicates little maintenance as required.
• operational worker potential exposure	50	An average number or operational workers will be required to tend this process.
• transportation potential exposure	50	Waste will require some additional characterization before transportation to storage.
Regulatory Parameters		
• need for variance	80	Process will comply with regulations without requiring a variance.
• ability to obtain a permit	50	Must demonstrate that the waste meets LDR treatment standards.
• waste disposal	20	Final wasteform will require disposal in HW/MW facility.
Public Acceptance		
• public acceptance	80	Public has indicated acceptance to solidification as a method of treating large volumes of waste (e.g., Z-area saltstone).
Cost Considerations		
• life-cycle cost	93	
• funding availability	50	Life-cycle cost can be supported with 10% increase in funding levels.
Industry Involvement		
• market for technology	20	Technology is vendor-supplied.
• private sector involvement	50	Vendor may be sought.

IDOA Score: **Technical** 60 **Total** 73

Waste Stream Number & Name: SR-W070 Mixed Waste from Laboratory Samples
Option Number: SR-W070-3
Facility: Containment Building
Treatment Technology: Vendor Stabilization

Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled

Module Location: SRS

Module Status: [ ] Existing [ ] New [ ] Small generator [√] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element		($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations		
1.1	Studies and Bench Scale Tests	$ 25	
1.2	Demonstration Costs	$ N/A	
1.3	Operations Budget Funded Activities		
1.3.1	Conceptual Design	$ 101	
1.3.2	Safety Assurance Documentation	$ 25	
1.3.3	Permitting	$ 125	
1.3.4	Preparation for Operations	$ 150	
1.3.5	Project Management	$ 18	
	TOTAL PRE-OPERATIONS		$ 444
2.0	Facility Construction Cost		
2.1	Design (Title I and II)	$ 110	
2.2	Inspection	$ 32	
2.3	Project Management	$ 50	
2.4	Building Construction (inc. indirect)	$ 400	
2.5	Equipment (inc. indirect)	$	
2.6	Construction Management	$ 35	
2.7	Contingency	$ 261	
	TOTAL FACILITY CONSTRUCTION COSTS		$ 888
3.0	Operation and Maintenance		
3.1	Annual Operating Labor	$ 5	
3.2	Annual Utilities	$	
3.3	Annual Materials	$ 3	
3.4	Annual Maintenance	$ 2	
3.5	Annual Contingency	$	
	TOTAL ANNUAL O & M	$ 9	
	X NUMBER OF YEARS OF OPERATION	5.00	
	TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 45
4.0	Decontamination & Decommissioning		
4.1	Facility D&D	$ 400	
4.2	Closure, Post-Closure, Monitoring	$ 1	
	TOTAL DECONTAMINATION & DECOMMISSIONING		$ 401
5.0	Contracted Services		
5.1	Commercial Treatment/Disposal	$ 100	
5.2	Mobile Treatment	$	
	TOTAL CONTRACTED SERVICES		$ 100
6.0	Offsite Treatment (DOE)		$
7.0	Transportation		$
8.0	Disposal		$ 20
	SUB COST FOR STABILIZATION MODULE		$ 1898
	ESCALATION		1.305
	TOTAL COST		$ 2476

If above numbers do not appear to add correctly, it is the result of computer rounding.

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Summary Page – Initial Screening

Waste Stream Number & Name: SR-W071 Wastewater from TRU Drum Dewatering

Background Information

This waste is generated by the removal of rainwater from the space between the metal TRU waste storage drum and the drum's plastic liner. The TRU waste stored in the drums is assumed to contain solvent contaminated wipes. When analysis of water recovered from the space between the drum and the liner indicates the presence of radionuclides, the water is presumed to have been in contact with the solvent-contaminated wipes. Thus, the water is conservatively assumed to be a mixed waste.

Volume
- Current volume through 09/30/94 is 11.8 m^3.
- Future waste generation, 1995 through 1999, is 4.2 m^3.

Waste Stream Composition
- Aqueous liquid

Waste Codes
- F001
- F002
- F003
- F005A (halogenated and nonhalogenated spent solvents)

LDR Treatment Standard
- F001 = concentration based standards = 6-30 mg/kg
- F002 = concentration based standards = 6-30 mg/kg
- F003 = concentration based standards = 2.6-180 mg/kg
- F005 = concentration based standards = 10-170 mg/kg, except 2-Ethoxyethanol, 2-Nitropropane = Incineration

Waste Characterization
- Analysis of water recovered from the space between the drum and the liner. Water screened and found to have a radionuclide contamination is assumed to have come in contact with the TRU waste (containing solvent rags) and characterized as hazardous under the mixture rule. Confidence level about the radionuclide analyses is high.

Radiological Characterization
- 10 to 100 nCi/g alpha emitters
- Contact handled

Initial Screening

The initial screening identified inappropriate treatment options. These options appear in the Initial Rejections table.

Initial Rejections

Treatment Facility	Treatment Technology	Reasons for Rejection
ETF	Ion Exchange	ETF has insufficient information on the characteristics of this waste to determine if treatment processes exist in the facility. ETF if prohibited from processing F-listed wastes.
M Area	Vitrification	While vitrification may be an appropriate treatment for this waste, the projected waste generation exceeds the service life of the M-Area vitrifier.
Z Area	Stabilization	Z Area can treat only those wastes that come by pipeline from Tank 50 and meet strict waste acceptance criteria. The Z-Area process lacks flexibility to treat and dispose of a variety of waste streams.

Summary Page – Technology Success Factor (TSF) & In-Depth Options Analysis (IDOA)

Waste Stream Number & Name: SR-W071 Wastewater from TRU Drum Dewatering

Feasible Options

Option No.	Treatment Facility	Treatment Technology	TSF Score	IDOA Scores Tech.	IDOA Scores Total	COST (x 1,000)	PO
SR-W071-1	CIF	Incineration/ Stabilization	100	65	79	396	X
SR-W071-2	CIF	Ashcrete Stabilization	88	63	77	694	X
SR-W071-3	Cont. Bldg.	Vendor stabilization	75	59	72	2779	

Options Rejected Due To Low Technology Success Factor (TSF)

- No options were rejected.

Engineering Assessment

Preferred Option Justification

The preferred treatment option for the wastewater from TRU drum dewatering is Incineration followed by Stabilization at CIF, provided the organic content for one or more hazardous constituents is greater than the F039 level.

This option is preferred because:

- Rotary kiln technology is very mature and well known.
- Volume will decrease by a factor of more than ten.
- Incineration eliminates the constituent of concern. Treatment residuals are immobilized with cement.
- This small waste stream can be scheduled with high confidence.
- Few or no emissions during normal operations. Accident scenarios do not cause an increase in emissions.
- Life-cycle cost can be supported within target budgets.

Options Rejected During IDOA

Stabilization of the waste stream with Portland cement and additives either in the ashcrete facility at CIF or with a vendor's process in a containment building.

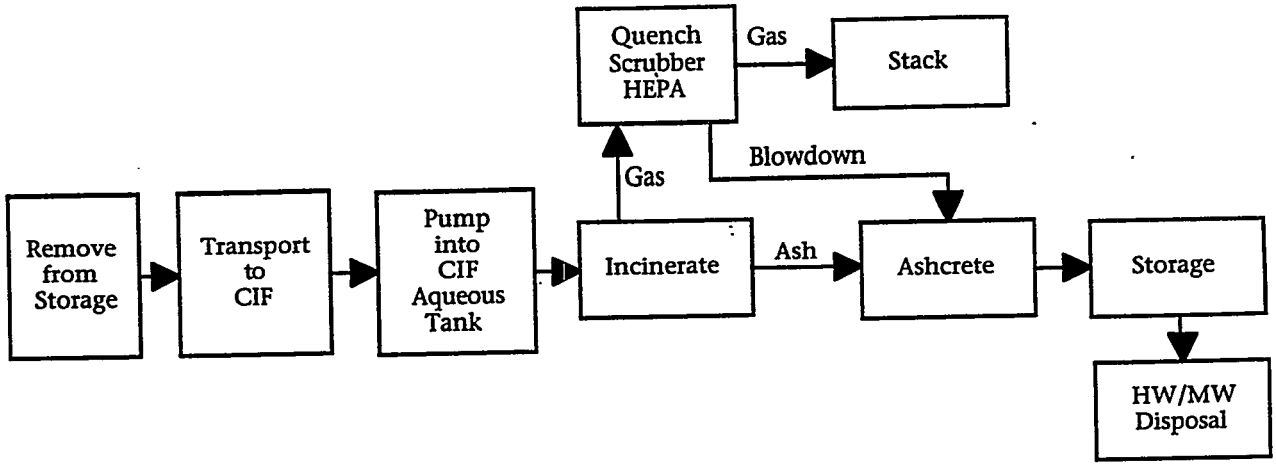
Stabilization with cement was rejected because:

- Gross volume of waste will increase by a factor of 2 or more
- Final wasteform will require disposal in HW/MW facility.

Nevertheless, if metals, for which cement stabilization is an LDR treatment standard, are present in the waste stream and the organic content is less than the F039 level, then ashcrete stabilization becomes the preferred option and incineration is rejected because it is prohibited by EPA's policy against the dilution of inorganic wastes.

Waste Stream Number & Name: SR-W071 Wastewater from TRU Drum Dewatering
Option Number: SR-W071-1
Facility: CIF
Treatment Technology: Incineration/ Stabilization

Treatment Cycle Flow Diagram:



Pros

- Rotary kiln technology is very mature and well known.
- Volume will decrease by a factor of more than ten.
- Incineration eliminates the constituent of concern. Treatment residuals are immobilized with cement.
- Shipping requirements are met for treatment residuals.
- Availability of 80% is easily achievable with this technology.
- This small waste stream can be scheduled with high confidence.
- Few or no emissions during normal operations. Accident scenario do not cause an increase in emissions.
- Fewer than average number of operational workers and non operational workers will be acquired to tend this process.
- Only a small percentage of the final waste will require disposal as mixed waste.
- Life-cycle cost can be supported within target budgets.

Cons

- Public has expressed concern about incineration as a waste treatment process.
- Solid treatment residual requires disposal in an HW/MW facility.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	90	Volume will be reduced. Add 10 points to high median of 80 because volume will decrease by a factor of more than ten.
• secondary waste generation	80	Few or no secondary wastes generated. Waste stream will form little ash upon incineration.
• destruction removal and demobilization efficiency	80	All applicable LDR standards are met.

Waste Stream Number & Name: SR-W071 Wastewater from TRU Drum Dewatering
Option Number: SR-W071-1
Facility: CIF
Treatment Technology: Incineration/ Stabilization

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• flexibility	100	Incineration eliminates the constituent of concern. Treatment residuals are immobilized with cement. Add 20 points to the high median of 80 because of the wide variety of this waste stream that incineration can accommodate.
• ability to be shipped	80	Shipping requirements are met for treatment residuals.
• final wasteform	80	Final wasteform will meet waste disposal WAC.
Engineering Parameters		
• system implementability	100	Commercial process. Add 10 points to high median of 80 because kiln technology is very mature and well known.
• availability	80	Availability of 80% is easily achievable with this technology.
• scalability	50	Total throughout is fixed by design.
• remedial measures	70	Only the solidified treatment residuals can fail. Subtract 10 points from high medial of 80 because of the difficulty in size-reducing the stabilized wasteform.
• schedule for treatment of waste	80	This small waste stream can be scheduled with high confidence.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Few or no emissions during normal operations. Accident scenarios do not cause an increase in emissions.
• non operational worker potential exposure	80	Fewer than average number of operational workers will be required to tend this process.
• operational worker potential exposure	70	Fewer than average number of operational workers will be required to tend this process. Subtract 10 points from the high median of 80 because of concerns surrounding TRU waste handling.
• transportation potential exposure	70	Waste will require characterization before transport to CIF. Subtract 10 points because of the slight increase in transportation risk inherent in transporting drums of liquid waste to the treatment site.
Regulatory Parameters		
• need for variance	80	Process will comply with regulations without requiring a variance.
• ability to obtain a permit	80	The process is well-defined.
• waste disposal	80	Only a small percentage of the final waste will require disposal as mixed waste.
Public Acceptance		
• public acceptance	20	Public has expressed concern about incineration as a waste treatment process.

Waste Stream Number & Name: SR-W071 Wastewater from TRU Drum Dewatering
Option Number: SR-W071-1
Facility: CIF
Treatment Technology: Incineration/ Stabilization

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Cost Considerations		
• life-cycle cost	99	
• funding availability	80	Life-cycle cost can be supported within target budgets.
Industry Involvement		
• market for technology	20	Technology exists.
• private sector involvement	20	SRS facility evaluated.

IDOA Score: **Technical** 65 **Total** 79

Waste Stream Number & Name: SR-W071 Wastewater from TRU Drum Dewatering
Option Number: SR-W071-1
Facility: CIF
Treatment Technology: Incineration/ Stabilization

Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled

Module Location: SRS

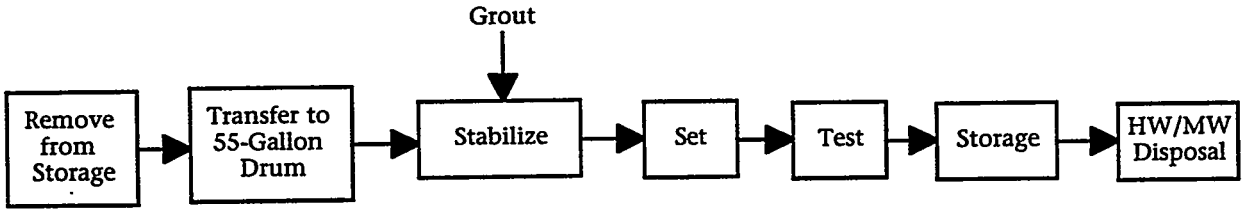
Module Status: [ ] Existing [√] New [ ] Small generator [√] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 1	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 3	
		1.3.2 Safety Assurance Documentation	$ 1	
		1.3.3 Permitting	$	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$	
		TOTAL PRE-OPERATIONS		$ 155
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 4	
	2.2	Inspection	$ 1	
	2.3	Project Management	$ 1	
	2.4	Building Construction (inc. indirect)	$	
	2.5	Equipment (inc. indirect)	$ 17	
	2.6	Construction Management	$ 1	
	2.7	Contingency	$ 8	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 32
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 9	
	3.2	Annual Utilities	$	
	3.3	Annual Materials	$ 6	
	3.4	Annual Maintenance	$ 3	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 18	
		X NUMBER OF YEARS OF OPERATION	5.00	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 92
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 14	
	4.2	Closure, Post-Closure, Monitoring	$ 1	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 15
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 10
		SUB COST FOR INCINERATOR MODULE		$ 303
		ESCALATION		1.305
		TOTAL COST		$ 396

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W071 Wastewater from TRU Drum Dewatering
Option Number: SR-W071-2
Facility: CIF
Treatment Technology: Ashcrete Stabilization

Treatment Cycle Flow Diagram:



Pros

- Ash solidification technology is very mature and well known.
- Availability of 80% is easily achievable with this technology.
- This small waste stream can be scheduled with high confidence.
- Few or no emissions during normal operations. Accident scenarios do not cause an increase in emissions.
- Fewer than average number of operational workers and non operational workers will be required to tend this process.
- Public has indicated acceptance to solidification as a method of treating large volumes of waste.
- Life-cycle cost can be supported within target budgets.

Cons

- Gross volume of waste will increase by a factor of 2 or more.
- Final wasteform will require disposal in HW/MW facility.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	20	Gross volume of waste will increase by a factor of 2 or more.
• secondary waste generation	80	Few or no secondary wastes generated.
• destruction removal and demobilization efficiency	80	All applicable LDR standards are met.
• flexibility	50	Process can treat all expected wasteforms. Some concern revolves around the ability to treat some concentrations or organics in the waste stream.
• ability to be shipped	80	Shipping requirements are met for treatment residuals.
• final wasteform	80	Final wasteform will meet waste disposal WAC.
Engineering Parameters		
• system implementability	100	Commercial process. Add 10 points to high median of 80 because ash solidification technology is very mature and well known.
• availability	80	Availability of 80% is easily achievable with this technology.
• scalability	50	Total throughout is fixed by design.
• remedial measures	50	Reprocessing failed wasteforms would require additional facilities.
• schedule for treatment of waste	80	This small waste stream can be scheduled with high confidence.

Waste Stream Number & Name: SR-W071 Wastewater from TRU Drum Dewatering
Option Number: SR-W071-2
Facility: CIF
Treatment Technology: Ashcrete Stabilization

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Few or no emissions during normal operations. Accident scenarios do not cause an increase in emissions.
• non operational worker potential exposure	80	Fewer than average number of operational workers will be required to tend this process.
• operational worker potential exposure	70	Fewer than average number of operational workers will be required to tend this process. Subcontract 10 points because of concerns surrounding TRU waste handling.
• transportation potential exposure	70	Waste will require characterization before transport to CIF. Subtract 10 points because of the slight increase in transportation risk inherent in transporting drums of liquid waste in the treatment site.
Regulatory Parameters		
• need for variance	80	Process will comply with regulations without requiring a variance.
• ability to obtain a permit	80	The process is well-defined.
• waste disposal	20	Final wasteform, which has greater volume than the original waste stream, will require disposal in HW/MW facility.
Public Acceptance		
• public acceptance	80	Public has indicated acceptance to solidification as a method of treating large volumes of waste (e.g., Z-Area saltstone).
Cost Considerations		
• life-cycle cost	98	
• funding availability	80	Life-cycle cost can be supported within target budgets.
Industry Involvement		
• market for technology	20	Technology exists.
• private sector involvement	20	SRS facility evaluated.

IDOA Score: **Technical** 63 **Total** 77

Waste Stream Number & Name: SR-W071 Wastewater from TRU Drum Dewatering
Option Number: SR-W071-2
Facility: CIF
Treatment Technology: Ashcrete Stabilization

Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled

Module Location: SRS

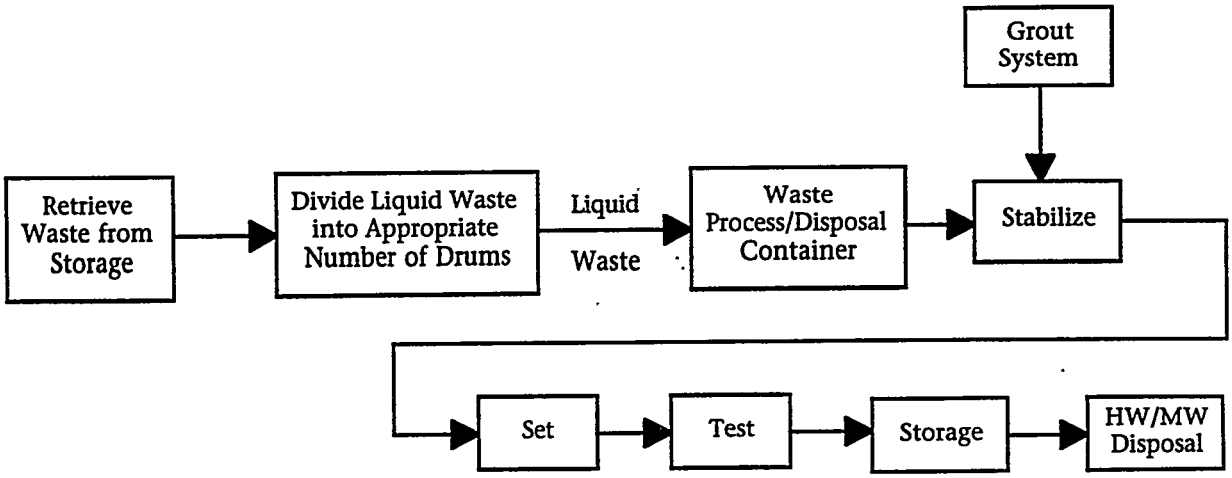
Module Status: [ ] Existing [√] New [ ] Small generator [√] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 1	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 5	
		1.3.2 Safety Assurance Documentation	$ 1	
		1.3.3 Permitting	$	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$	
		TOTAL PRE-OPERATIONS		$ 155
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 31	
	2.2	Inspection	$ 7	
	2.3	Project Management	$ 9	
	2.4	Building Construction (inc. indirect)	$	
	2.5	Equipment (inc. indirect)	$ 29	
	2.6	Construction Management	$ 2	
	2.7	Contingency	$ 14	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 53
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 28	
	3.2	Annual Utilities	$ 1	
	3.3	Annual Materials	$ 17	
	3.4	Annual Maintenance	$ 10	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 55	
		X NUMBER OF YEARS OF OPERATION	5.00	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 277
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 23	
	4.2	Closure, Post-Closure, Monitoring	$ 1	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 24
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 20
		SUB COST FOR ASHCRETE STABILIZATION MODULE		$ 532
		ESCALATION		1.305
		TOTAL COST		$ 694

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W071 Wastewater from TRU Drum Dewatering
Option Number: SR-W071-3
Facility: Containment Buildings
Treatment Technology: Vendor Stabilization

Treatment Cycle Flow Diagram:



Pros

- Few or no secondary wastes generated.
- Cement stabilization immobilizes the constituent of concern.
- This is a proven process in use both in the DOE complex and the commercial world.
- Requires fewer non operational workers than comparably sized facilities. Experience in similar facilities indicates little maintenance is required.
- Public has indicated acceptance to solidification as a method of treating large volumes of waste.

Cons

- Waste volume will significantly more than double.
- Final wasteform will require disposal in HW/MW facility.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	10	Gross volume of waste will increase. Subtract 10 points from low median of 20 because waste volume will significantly more than double.
• secondary waste generation	80	Few or no secondary wastes generated.
• destruction removal and demobilization efficiency	80	All applicable LDR standards are met.
• flexibility	80	Process can handle a variety of waste liquids. Widely used in the commercial world.
• ability to be shipped	80	Waste can be shipped without further treatment.
• final wasteform	80	Final wasteform will meet waste disposal WAC.
Engineering Parameters		
• system implementability	100	Add 20 points to the high median score of 80 because this is a proven process in use both in the DOE Complex and the commercial world.

Waste Stream Number & Name: SR-W071 Wastewater from TRU Drum Dewatering
Option Number: SR-W071-3
Facility: Containment Buildings
Treatment Technology: Vendor Stabilization

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• availability	80	Similar commercial systems have availability of 80%.
• scalability	50	Throughout fixed by design.
• remedial measures	50	Reprocessing failed wasteforms would require additional facilities.
• schedule for treatment of waste	70	This is a mature technology, but subtract 10 point from the high median of 80 because of uncertainties surrounding procurement and funding.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Containment building will control emissions.
• non operational worker potential exposure	80	Requires fewer non operational workers than comparably sized facilities. Experience in similar facilities indicates little maintenance as required.
• operational worker potential exposure	40	An average number or operational workers will be required to tend this process. Subtract 10 points from the medium median of 50 because of concerns surrounding TRU waste handling.
• transportation potential exposure	50	Waste will require some additional characterization before transportation to storage.
Regulatory Parameters		
• need for variance	80	Process will comply with regulations without requiring a variance.
• ability to obtain a permit	50	Must demonstrate that the waste meets treatment standards.
• waste disposal	20	Final wasteform will require disposal in HW/MW facility.
Public Acceptance		
• public acceptance	80	Public has indicated acceptance to solidification as a method of treating large volumes of waste (e.g., Z-Area saltstone).
Cost Considerations		
• life-cycle cost	92	
• funding availability	50	Life-cycle cost can be supported with 10% increase in funding levels.
Industry Involvement		
• market for technology	20	Technology exists.
• private sector involvement	50	Vendor could perform treatment.

IDOA Score: Technical 59 Total 72

Waste Stream Number & Name: SR-W071 Wastewater from TRU Drum Dewatering
Option Number: SR-W071-3
Facility: Containment Building
Treatment Technology: Vendor Stabilization

Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled

Module Location: SRS

Module Status: [ ] Existing [ ] New [ ] Small generator [√] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 25	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 101	
		1.3.2 Safety Assurance Documentation	$ 25	
		1.3.3 Permitting	$ 125	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 18	
		TOTAL PRE-OPERATIONS		$ 444
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 110	
	2.2	Inspection	$ 32	
	2.3	Project Management	$ 50	
	2.4	Building Construction (inc. indirect)	$ 400	
	2.5	Equipment (inc. indirect)	$	
	2.6	Construction Management	$ 35	
	2.7	Contingency	$ 261	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 888
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 28	
	3.2	Annual Utilities	$ 1	
	3.3	Annual Materials	$ 17	
	3.4	Annual Maintenance	$ 10	
	3.5	Annual Contingency	$	
		TOTAL ANNUAL O & M	$ 55	
		X NUMBER OF YEARS OF OPERATION	5.00	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 277
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 400	
	4.2	Closure, Post-Closure, Monitoring	$ 1	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 401
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$ 100	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$ 100
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 20
		SUB COST FOR STABILIZATION MODULE		$ 2,129
		ESCALATION		1.305
		TOTAL COST		$ 2,779

If above numbers do not appear to add correctly, it is the result of computer rounding.

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Summary Page – Initial Screening

Waste Stream Number & Name: SR-W072 Supernate or Sludge Contaminated Debris from High-Level Waste (HLW) Operations

Background Information

This future waste stream consists of a wide variety of metal debris and other metal items contaminated with radioactive materials and characteristically hazardous waste. The waste is derived from contact with high-level radioactive waste with the majority of the radioactive contamination being surface contamination. Future generation rates are dependent upon construction activities, operations and maintenance activities, and site decontamination and decommissioning activities.

Volume
- Current volume through 09/30/94 is 0 m^3.
- Expected 1995-1999 generation volume will be 1,065 m^3.

Waste Stream Composition
- Inorganic debris

Waste Code
- D005A (TCLP Ba)
- D006A (TCLP Cd)
- D007 (TCLP Cr)
- D008 (TCLP Pb)
- D009 (TCLP Hg)
- D010 (TCLP Se)
- D011 (TCLP Ag)
- D018 (Benzene)

LDR Treatment Standard
- D005 = concentration based standard = 100 mg/l
- D006 = concentration based standard = 1.0 mg/l
- D007 = concentration based standard = 5.0 mg/l
- D008 = concentration based standard = 5.0 mg/l
- D009 = concentration based standard = 0.2 mg/l
- D010 = concentration based standard = 5.7 mg/l
- D011 = concentration based standard = 5.0 mg/l
- D018* = concentration based standard = 10 mg/kg
- Alternative debris technology may be applied.

*D012-D043 nonwastewaters must be treated to meet the Universal Treatment Standards (UTS) for any underlying constituents that may be present.

Waste Characterization
- Process knowledge used to characterize the waste stream.
- Confidence level is medium since this waste stream had not been generated yet.

Radiological Characterization
- Beta/gamma emitters are Cs^{137}, I^{129}, and Tc^{99}
- Alpha emitters are Pu^{238} and Np^{237}.
- Waste is contact handled.
- Mixed low-level waste

- Typical radiation levels
  - Supernatant 100,000 nCi/g
  - Cs^{137} 10,000 d/m
  - I^{129} <10 d/m
  - Tc^{99} 50,000 d/m
  - Np^{237} 50,000 d/m

Initial Screening

The initial screening identified inappropriate treatment options. These options appear in the Initial Rejections table.

Initial Rejections

Treatment Facility	Treatment Technology	Reasons for Rejection
CIF	Ashcrete Stabilization	The ashcrete system is not designed to handle equipment of this size.
CIF	Incineration/ Stabilization	Incineration is an inappropriate treatment since this waste is metal.
ETF	Ion Exchange	ETF is not designed to treat metal waste.
Lab	Lab-scale process flowsheet	This is an inappropriate treatment since this system is not sized to treat large equipment or large volumes of waste.
LETF	Ion Exchange	This treatment option is not designed to treat metal waste.
M Area	Vitrification	Vitrifier is not designed to treat metal waste of this size and volume.
Z Area	Stabilization	Z-Area can treat only those wastes that come by pipeline from Tank 50. This waste stream is metal. The Z-Area process lacks flexibility to treat and dispose of a variety of waste streams.

Summary Page – Technology Success Factor (TSF) & In-Depth Options Analysis (IDOA)

Waste Stream Number & Name: SR-W072 Supernate or Sludge Contaminated Debris from High-Level Waste (HLW) Operations

Feasible Options

Option No.	Treatment Facility	Treatment Technology	TSF Score	IDOA Scores Tech.	IDOA Scores Total	COST (x 1,000)	PO
SR-W072-1	Cont. Bldg.	Extraction	94	58	66	16,587	√
SR-W072-2	HW/MW-TB	Extraction	94	57	63	20,292	
SR-W072-3	INEL ICPP	Decontamination	*	47	47	149,896	
SR-W072-4	Cont. Bldg.	Macro-encapsulation	94	48	53	23,001	

* No TSF required for proposed or existing non-Savannah River Site-DOE facilities.

Options Rejected Due To Low Technology Success Factor (TSF)

- No options were rejected.

Engineering Assessment

Preferred Option Justification

The preferred treatment for the Supernate or Sludge Contaminated Debris from High-Level Waste is an alternative debris technology (either Extraction or Immobilization) in a 90-day staging area. If extraction is effective, waste is disposed of as low-level waste; if the extraction is ineffective, the waste is immobilized in a stainless steel box and disposed of as mixed waste.

This option treats the constituents of concern, either by separating them from the waste substrate (i.e., debris) and sending them to high level waste processing (vitrification) or by isolating them from the environment in containers that have been welded shut.

This option is preferred because:
- The waste satisfies the debris rule.
- The process employs well known techniques (e.g., acid leaching, welded containers).
- LDR standards are met.
- Amount of mixed waste requiring disposal is reduced because of decontamination.

Options Rejected During IDOA

Extraction in a Hazardous Waste Mixed Waste Treatment Building

Extraction in a Hazardous Waste Mixed Waste Treatment Building was rejected because:
- This option is less cost-effective than the preferred option.
- HW/MW-TB has no technological advantage over the preferred option.

Decontamination at INEL ICPP

Decontamination at INEL ICPP was rejected because:
- An integrated facility has not been demonstrated.
- Uncertainties exist regarding the effectiveness of this treatment for removing contamination from internal crevices of equipment.
- This option is much less cost-effective than an onsite treatment option.
- Waste must be transported thousands of miles for treatment.

Macroencapsulation of all waste in stainless steel boxes in a Containment Building without attempting to decontaminate the waste

Macroencapsulation in stainless steel boxes in a Containment Building was rejected because:

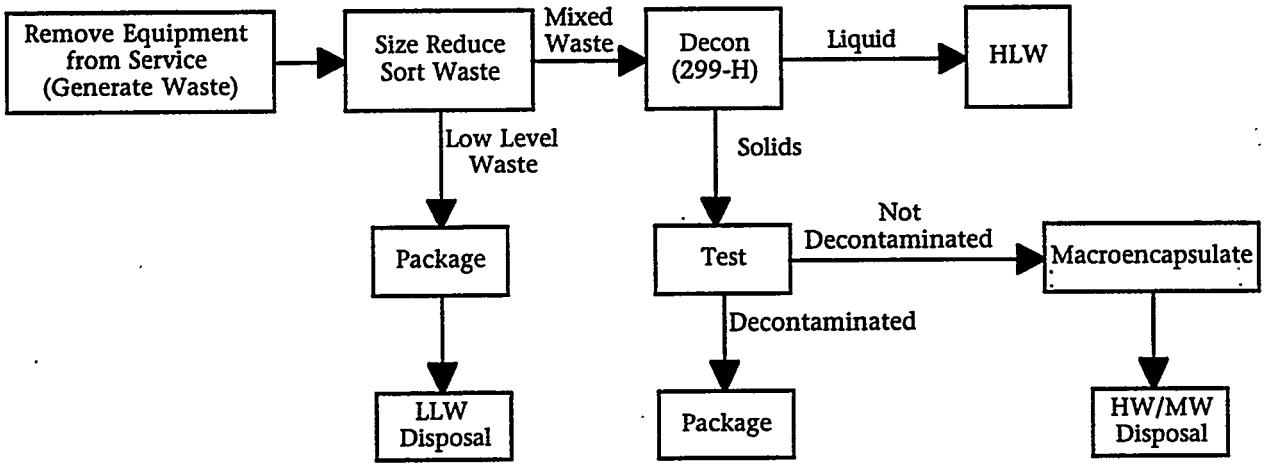
- All waste must be disposed as mixed waste.
- The constituents of concern remain.
- This option is much less cost-effective than the preferred option.

Waste Stream Number & Name: SR-W072 **Supernate or Sludge Contaminated Debris from High-Level Waste (HLW) Operations**

Option Number: SR-W072-1
Facility: Containment Building

Treatment Technology: Extraction

Treatment Cycle Flow Diagram:



Pros

- All applicable LDR standards are met.
- Can process a wide range of materials
- Containers will meet current DOT shipping requirements.
- Final wasteform will meet waste disposal WAC.
- All processes involved are existing technology.
- Similar systems have demonstrated availability of less than 80%.
- Due to process simplicity, a schedule can be developed easily.
- During routing operations and all but catastrophic accident scenarios, process does not create uncontrolled emissions.

Cons

- Not a budget item and will require line item funding for disposal
- Throughput is set by existing facilities, and capacity is not easily expanded.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	60	Add 10 points to median score of 50 because successfully decontaminated waste will be disposed of as low-level waste.
• secondary waste generation	50	Some quantity of secondary waste produced that can be handled by existing technologies. This liquid effluent will go to the HLW tank farm for treatment.
• destruction removal and demobilization efficiency	80	All applicable LDR standards are met.
• flexibility	80	Can process a wide range of materials.

Waste Stream Number & Name: SR-W072 **Supernate or Sludge Contaminated Debris from High-Level Waste (HLW) Operations**

Option Number: SR-W072-1
Facility: Containment Building

Treatment Technology: Extraction

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• ability to be shipped	80	Containers will meet current DOT shipping requirements.
• final wasteform	80	Final wasteform will meet waste disposal WAC.
Engineering Parameters		
• system implementability	90	Add 10 points to the median score of 80 because all processes involved are existing technology.
• availability	80	Similar systems have demonstrated availability of >80%.
• scalability	40	Throughput is set by existing facilities. Subtract 10 points from median score of 50 because capacity is not easily expanded.
• remedial measures	80	The process failure does not produce wasteform that cannot be remediated with existing technology.
• schedule for treatment of waste	80	Due to process simplicity, a schedule can be developed easily.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	During routine operations and all but catastrophic accident scenarios, process would not create uncontrolled emissions.
• non operational worker potential exposure	50	Number of non operational workers and potential exposure levels are not increased by processing these wastes.
• operational worker potential exposure	50	Number of operational workers and potential exposure levels are not increased by process these wastes
• transportation potential exposure	60	Add 10 points to the median score because no additional characterization needed.
Regulatory Parameters		
• need for variance	80	Process satisfies requirements of the "debris rule."
• ability to obtain a permit	80	Permitting process is well defined and precedents for success have been established.
• waste disposal	50	Some waste will require disposal as HW/MW.
Public Acceptance		
• public acceptance	50	Public concern should be limited due to the simplicity of the process.
Cost Considerations		
• life-cycle cost	15	
• funding availability	20	Not a budget item and will require line item funding for disposal.
Industry Involvement		
• market for technology	0	Subtract 20 points from the median score of 20 because this is an existing technology.
• private sector involvement	0	Subtract 20 points from the median score of 20 because this is an existing technology.

IDOA Score: Technical 58 Total 66

Waste Stream Number & Name: SR-W072 Supernate or Sludge Contaminated Debris from High-Level Waste (HLW) Operations

Option Number: SR-W072-1
Facility: Containment Building and Macroencapsulation
Cost Estimate Sheet

Treatment Technology: Extraction

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled

Module Location: SRS

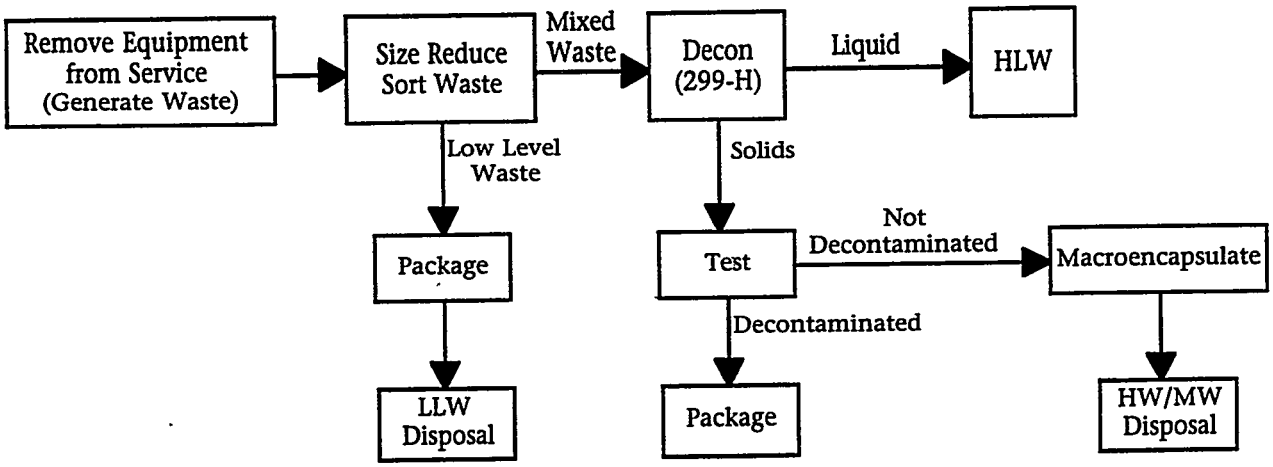
Module Status: [ ] Existing [√] New [ ] Small generator [√] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
1.1	Studies and Bench Scale Tests		$ 44	
1.2	Demonstration Costs		$	
1.3	Operations Budget Funded Activities			
1.3.1		Conceptual Design	$ 176	
1.3.2		Safety Assurance Documentation	$ 44	
1.3.3		Permitting	$ 0	
1.3.4		Preparation for Operations	$ 150	
1.3.5		Project Management	$ 0	
		TOTAL PRE-OPERATIONS		$ 414
2.0	Facility Construction Cost			
2.1	Design (Title I and II)		$ 209	
2.2	Inspection		$ 38	
2.3	Project Management		$ 38	
2.4	Building Construction (inc. indirect)		$ 0	
2.5	Equipment (inc. indirect)		$ 950	
2.6	Construction Management		$ 67	
2.7	Contingency		$ 456	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 1757
3.0	Operation and Maintenance			
3.1	Annual Operating Labor		$ 150	
3.2	Annual Utilities		$ 1	
3.3	Annual Materials		$ 309	
3.4	Annual Maintenance		$ 5	
3.5	Annual Contingency		$ 0	
		TOTAL ANNUAL O & M	$ 465	
		X NUMBER OF YEARS OF OPERATION	5.00	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 2,325
4.0	Decontamination & Decommissioning			
4.1	Facility D&D		$ 760	
4.2	Closure, Post-Closure, Monitoring		$ 355	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 1,115
5.0	Contracted Services			
5.1	Commercial Treatment/Disposal		$ 0	
5.2	Mobile Treatment		$ 0	
		TOTAL CONTRACTED SERVICES		$ 0
6.0	Offsite Treatment (DOE)			$ 0
7.0	Transportation			$ 0
8.0	Disposal			$ 7,100
	SUB COST FOR DECON AND MACROENCAPSULATION MODULE			$ 12,711
		ESCALATION		1.305
		TOTAL COST		$ 16,587

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W072 **Supernate or Sludge Contaminated Debris from High-Level Waste (HLW) Operations**

Option Number: SR-W072-2
Facility: HW/MW-TB
Treatment Technology: Extraction
Treatment Cycle Flow Diagram:



Pros

- Process satisfies requirements of the "debris rule" and all applicable LDR standards are met.
- Can process a wide range of materials
- Containers will meet current DOT shipping requirements.
- All processes involved are existing technology
- Similar systems have demonstrated availability of >80%.
- Process failure does not produce altered wasteform. A failed container is easily fixed.
- Due to process simplicity, a schedule can be developed easily.
- Process does not create emissions related to the waste stream. Process simply involves container welding.
- Exposure controlled by design and less than average number of workers. Low potential for exposure.
- Little secondary waste

Cons

- Not a budget item and will require line item funding.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	60	Add 10 points to median score of 50 because successfully decontaminated waste will be disposed of as low level waste.
• secondary waste generation	50	Some quantity of secondary waste produced that can be handled by existing technologies. This liquid effluent will be transported to the HLW tank farm for treatment.
• destruction removal and demobilization efficiency	80	All applicable LDR standards are met.
• flexibility	80	Can process a wide range of materials.

Waste Stream Number & Name: SR-W072 Supernate or Sludge Contaminated Debris from High-Level Waste (HLW) Operations

Option Number: SR-W072-2
Facility: HW/MW-TB

Treatment Technology: Extraction

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• ability to be shipped	80	Containers will meet current DOT shipping requirements.
• final wasteform	80	Final wasteform will meet waste disposal WAC.
Engineering Parameters		
• system implementability	90	Add 10 points to the median score of 80 because all processes involved are existing technology..
• availability	80	Similar systems have demonstrated availability of >80%.
• scalability	50	Throughput is set by design.
• remedial measures	80	The process failure does not produce wasteform that cannot be remediated with existing technology..
• schedule for treatment of waste	50	Design and construction of a new facility cannot be scheduled with accuracy..
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	During routine operations and all but catastrophic accident scenarios, process would not create uncontrolled emissions.
• non operational worker potential exposure	40	Number of non operational workers and potential exposure levels are average. Subtract 10 points from median score of 50 because of potential for exposure during D&D of an additional facility.
• operational worker potential exposure	50	Exposure controlled by design and an average number of workers. Low potential for exposure.
• transportation potential exposure	40	No additional characterization needed. Subtract 10 points from the median score of 50 because secondary waste must be trucked to treatment.
Regulatory Parameters		
• need for variance	80	Process satisfies requirements of the "debris rule."
• ability to obtain a permit	80	Permitting process is well defined and precedents for success have been established.
• waste disposal	50	Some waste will require HW/MW disposal.
Public Acceptance		
• public acceptance	50	Public concern should be limited due to the simplicity of the process.
Cost Considerations		
• life-cycle cost	3	
• funding availability	20	Not a budget item and will require line item funding.
Industry Involvement		
• market for technology	0	Subtract 20 points from the median score of 20 because this is an existing technology.
• private sector involvement	0	Subtract 20 points from the median score of 20 because this is an existing technology.

IDOA Score: **Technical** 57 **Total** 63

Waste Stream Number & Name: SR-W072 **Supernate or Sludge Contaminated Debris from High-Level Waste (HLW) Operations**

Option Number: SR-W072-2
Facility: HW/MW-TB
Treatment Technology: Extraction
Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled

Module Location: SRS

Module Status: [ ] Existing [√] New [ ] Small generator [√] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 73	
	1.2	Demonstration Costs	$	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 293	
		1.3.2 Safety Assurance Documentation	$ 73	
		1.3.3 Permitting	$ 125	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$	
		TOTAL PRE-OPERATIONS		$ 728
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 341	
	2.2	Inspection	$ 71	
	2.3	Project Management	$ 85	
	2.4	Building Construction (inc. indirect)	$ 300	
	2.5	Equipment (inc. indirect)	$ 1250	
	2.6	Construction Management	$ 109	
	2.7	Contingency	$ 759	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 2,914
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 150	
	3.2	Annual Utilities	$ 6	
	3.3	Annual Materials	$ 309	
	3.4	Annual Maintenance	$ 5	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 465	
		X NUMBER OF YEARS OF OPERATION	5.00	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 2,325
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 1240	
	4.2	Closure, Post-Closure, Monitoring	$ 355	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 1,595
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$ 0
6.0	Offsite Treatment (DOE)			$ 0
7.0	Transportation			$ 0
8.0	Disposal			$ 7,100
	SUB COST FOR DECON AND MACROENCAPSULATION MODULE			$ 14,662
		ESCALATION		1.384
		TOTAL COST		$ 20,292

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W072 **Supernate or Sludge Contaminated Debris from High-Level Waste (HLW) Operations**

Option Number: SR-W072-3
Facility: INEL/ICPP

Treatment Technology: Decontamination

Treatment Technology

Idaho National Engineering Laboratory (INEL) Idaho Chemical Processing Plant (ICPP) is a decontamination facility that is currently under design. It is envisioned to employ mechanical decontamination methods (e.g., carbon dioxide pellet blasting) that are useful in removing surface contamination. Flow diagrams for DOE offsite facilities are not required.

Pros

- The facility can treat waste streams similar in composition to those assumed in the design basis without modification.
- Decontaminated waste and treatment secondary waste streams could be shipped without additional treatment.
- Final wasteform is anticipated to meet the SRS waste disposal WAC.
- The facility is anticipated to have less than 20% down time.
- Process failures are not anticipated to create a waste stream that cannot be treated.
- Few emissions for the facility are anticipated during normal operation and most accident scenarios.

Cons

- The facility is currently being designed. Although individual treatment methods have been proven, an integrated facility has not been demonstrated.
- A schedule for waste treatment can be provided; however, acceptance of SRS waste will be contingent upon permit modifications approved by the State of Idaho. In addition, since this is a proposed facility, the operating schedule is contingent upon receipt of DOE funding. The early stage of design also adds uncertainties.
- The waste must be transported thousands of miles.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	50	Decontamination will cause the total waste volume to remain unchanged.
• secondary waste generation	50	Addition waste (i.e., liquid mercury) will need treatment by amalgamation.
• destruction removal and demobilization efficiency	50	Additional treatment for some waste streams may be required to ensure LDR standards are met.
• flexibility	80	The facility can treat waste streams similar in composition to those assumed in the design basis without modification.
• ability to be shipped	80	Decontaminated waste and treated secondary waste streams waste could be shipped without additional treatment.
• final wasteform	80	Final wasteform is anticipated to meet the SRS waste disposal WAC.

Waste Stream Number & Name: SR-W072 **Supernate or Sludge Contaminated Debris from High-Level Waste (HLW) Operations**

Option Number: SR-W072-3
Facility: INEL/ICPP

Treatment Technology: Decontamination

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Engineering Parameters		
• system implementability	40	The facility is currently being designed. Although individual treatment methods envisioned have been proven, subtract 10 points from median score of 50 because an integrated facility has not been determined.
• availability	80	The facility is anticipated to have less than 20% down time.
• scalability	50	The process is currently in the early design phase so additional modification could be incorporated.
• remedial measures	80	Process failures are not anticipated to create a waste stream that cannot be treated.
• schedule for treatment of waste	20	A schedule for waste treatment cannot be provided. Additionally, acceptance of SRS waste will be contingent upon State of Idaho approved permit modifications. In addition, as this is a proposed facility, the operating schedule is contingent upon receipt of DOE funding. The early stage of design also adds uncertainties.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Few emissions for the facility anticipated during normal operation and most accident scenarios.
• non operational worker potential exposure	50	Average number of non operational workers is anticipated.
• operational worker potential exposure	50	Personnel exposure is expected to be average for operations of this type.
• transportation potential exposure	20	The waste must be transported thousands of miles.
Regulatory Parameters		
• need for variance	50	Process will be permitted under RCRA Part B Permit. Acceptance of offsite waste requires submission of a permit modification.
• ability to obtain a permit	50	Permitting process is well defined; however, the State of Idaho acceptance of offsite waste treatment is unknown. Approval may be difficult.
• waste disposal	50	50% of the treated waste will be classified as mixed waste which will require disposal in a RCRA facility.
Public Acceptance		
• public acceptance	40	Public acceptance for decontamination is reasonably positive; however, the treatment of offsite waste is anticipated to reduce the overall public acceptance of this process at INEL's location. Subtract 10 points from the median score of 50 because the public will have concerns about transporting large amounts of untreated waste for thousands of miles.

Waste Stream Number & Name: SR-W072 Supernate or Sludge Contaminated Debris from High-Level Waste (HLW) Operations

Option Number: SR-W072-3
Facility: INEL/ICPP

Treatment Technology: Decontamination

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Cost Considerations		
• life-cycle cost	0	
• funding availability	50	Funding for treatment cost can be provided using the operating budget; however, the additional costs may result in an increase in the budget in excess of 10%.
Industry Involvement		
• market for technology	80	The facility could potentially be used to treat numerous waste streams throughout the DOE complex.
• private sector involvement	0	No private sector involvement except as operators of the facility. Subtract 20 points from the median score of 20 because facility is a DOE installation.

IDOA Score: **Technical** 47 **Total** 47

Waste Stream Number & Name: SR-W072 **Supernate or Sludge Contaminated Debris from High-Level Waste (HLW) Operations**

Option Number: SR-W072-3
Facility: INEL/ICPP
Cost Estimate Sheet

Treatment Technology: Decontamination

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled
Module Location: SRS 725
Module Status: [ ] Existing [√] New [ ] Small generator [√] Large generator
[ ] Onsite [√] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 0	
	1.2	Demonstration Costs	$ 0	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 0	
		1.3.2 Safety Assurance Documentation	$ 50	
		1.3.3 Permitting	$ 125	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 0	
		TOTAL PRE-OPERATIONS		$ 325
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ N/A	
	2.2	Inspection	$ N/A	
	2.3	Project Management	$ N/A	
	2.4	Building Construction (inc. indirect)	$ N/A	
	2.5	Equipment (inc. indirect)	$ N/A	
	2.6	Construction Management	$ N/A	
	2.7	Contingency	$ N/A	
		TOTAL FACILITY CONSTRUCTION COSTS		$ N/A
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 75	
	3.2	Annual Utilities	$ 3	
	3.3	Annual Materials	$ 45	
	3.4	Annual Maintenance	$ 27	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 150	
		X NUMBER OF YEARS OF OPERATION	5.00	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 750
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ N/A	
	4.2	Closure, Post-Closure, Monitoring	$ 725	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 725
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$ N/A	
	5.2	Mobile Treatment	$ N/A	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$ 103,000
7.0	Transportation			$ 0
8.0	Disposal			$ 14500
		SUB COST FOR DECONTAMINATION MODULE		$ 111,530
		ESCALATION		1.344
		TOTAL COST		$ 149,896

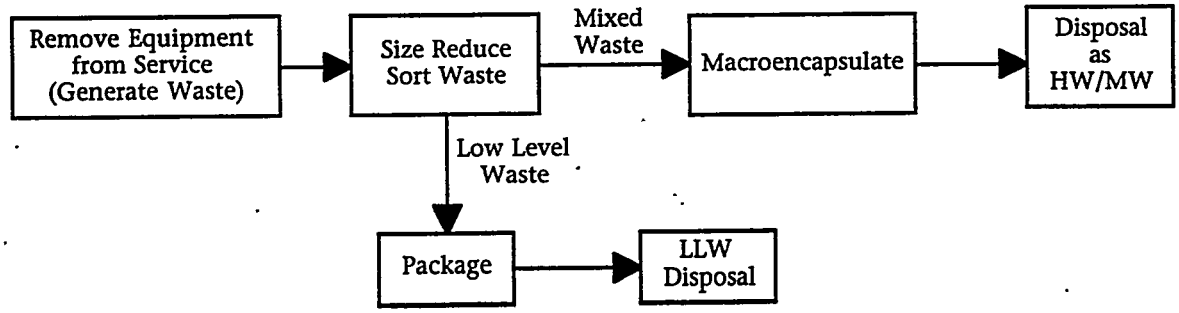
If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W072 **Supernate or Sludge Contaminated Debris from High-Level Waste (HLW) Operations**

Option Number: SR-W072-4
Facility: Containment Building

Treatment Technology: Macroencapsulation in S. S. Box

Treatment Cycle Flow Diagram:



Pros

- Few or no secondary wastes generated.
- Macroencapsulation in stainless steel boxes is a mature technology.
- Availability of 80% is easily achievable with this technology.
- Failed wasteforms are quickly and easily reprocessed.
- Few or no emissions during normal operations. Accident scenarios do not cause an increase in emissions.

Cons

- The constituents of concern will remain.
- This process requires that SCDHEC employ regulatory discretion.
- Final wasteform will require disposal in HW/MW facility.
- Public may have concerns that the constituents of concern are not treated.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	40	Subtract 10 points from median score of 50 because gross volume of waste will increase by a factor of 20%.
• secondary waste generation	80	Few or no secondary wastes generated.
• destruction removal and demobilization efficiency	20	The constituents of concern will remain.
• flexibility	80	Process will be designed to treat all expected wasteforms.
• ability to be shipped	80	Shipping requirements are met for treatment residuals.
• final wasteform	80	Final wasteform will meet waste disposal WAC.
Engineering Parameters		
• system implementability	80	Macroencapsulation in stainless steel boxes is a mature technology.
• availability	80	Availability of 80% is easily achievable with this technology.
• scalability	80	Scalability is not a factor in macroencapsulation in stainless steel boxes.

Waste Stream Number & Name: SR-W072 **Supernate or Sludge Contaminated Debris from High-Level Waste (HLW) Operations**

Option Number: SR-W072-4
Facility: Containment Building

Treatment Technology: Macroencapsulation in S. S. Box

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• remedial measures	80	Failed wasteforms are quickly and easily reprocessed.
• schedule for treatment of waste	50	System complexities and uncertainties surrounding development of a HW/MW treatment building facility make scheduling difficult.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Few or no emissions during normal operations. Accident scenarios do not cause an increase in emissions.
• non operational worker potential exposure	50	Average number of non operational workers will be required to tend this process.
• operational worker potential exposure	50	Average number of operational workers will be required to tend this process.
• transportation potential exposure	70	Subtract 10 points from median score of 80 because limited transportation over short distances required.
Regulatory Parameters		
• need for variance	20	This process requires that SCDHEC employ regulator discretion.
• ability to obtain a permit	50	Obtaining regulatory discretion may be moderately difficult.
• waste disposal	20	Final wasteform will require disposal in HW/HW facility.
Public Acceptance		
• public acceptance	20	Public may have concerns that the constituents of concern are not treated.
Cost Considerations		
• life-cycle cost	0	
• funding availability	40	Subtract 10 points from median score of 50 because more than 10% increase in target funding levels is expected.
Industry Involvement		
• market for technology	0	Technology is not unique.
• private sector involvement	0	No private companies have expressed an interest in this technology.

IDOA Score: **Technical** 48 **Total** 53

Waste Stream Number & Name: SR-W072 Supernate or Sludge Contaminated Debris from High-Level Waste (HLW) Operations

Option Number: SR-W072-4
Facility: Containment Building

Treatment Technology: Macroencapsulation in S. S. Box

Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[√] alpha [ ] non-alpha [√] contact handled [ ] remote handled

Module Location: SRS

Module Status: [ ] Existing [√] New [ ] Small generator [√] Large generator
[ ] Onsite [√] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 64	
	1.2	Demonstration Costs	$ 0	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 258	
		1.3.2 Safety Assurance Documentation	$ 64	
		1.3.3 Permitting	$ 125	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 18	
		TOTAL PRE-OPERATIONS		$ 680
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 297	
	2.2	Inspection	$ 66	
	2.3	Project Management	$ 84	
	2.4	Building Construction (inc. indirect)	$ 400	
	2.5	Equipment (inc. indirect)	$ 950	
	2.6	Construction Management	$ 95	
	2.7	Contingency	$ 688	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 2,560
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 150	
	3.2	Annual Utilities	$ 1	
	3.3	Annual Materials	$ 390	
	3.4	Annual Maintenance	$ 5	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 465	
		X NUMBER OF YEARS OF OPERATION	5.00	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 2,235
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 1080	
	4.2	Closure, Post-Closure, Monitoring	$ 475	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 1,555
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$ N/A	
	5.2	Mobile Treatment	$ N/A	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 9,500
	SUB COST FOR MACROENCAPSULATION IN S.S. BOX MODULE			$ 16,619
		ESCALATION		1.384
		TOTAL COST		$ 23,001

If above numbers do not appear to add correctly, it is the result of computer rounding.

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Summary Page – Initial Screening

Waste Stream Number & Name: SR-W073 Plastic/Lead/Cadmium Raschig Rings

Background Information

This waste stream is composed of approximately 78% plastic material, 10% lead, and 12% cadmium (by volume). These raschig rings were used as a criticality prevention measure in certain sumps in the Separations H-Area facility. These raschig rings were reported under Low Level Waste Lead (SR-W013B) in the DSTP, but were segregated into their own waste stream after reexamining the stream.

Volume
- Current volume through 09/30/94 is 1.8 m^3.
- Future generation is not anticipated.

Waste Stream Composition
- Other organic particulates

Waste Codes
- D006A (TCLP Cd)
- D008A (TCLP Pb)

LDR Treatment Standard
- D006 = concentration based standard = 1.0 mg/kg
- D008 = concentration based standard = 5.0 mg/kg

Waste Characterization
- Process knowledge used to characterize the waste stream.
- Confidence level is high since materials of construction are inherently hazardous.

Radiological Characterization
- Radioactive contamination is below detection limits for alpha and beta/gamma.
- Material was generated in a contamination area.

Initial Screening

The initial screening identified inappropriate treatment options. These options appear in the Initial Rejections table.

Initial Rejections

Treatment Facility	Treatment Technology	Reasons for Rejection
ETF	Ion Exchange	ETF is not equipped to treat solid wastes.
M Area	Vitrification	Ring substrate is plastic. M-Area vitrifier off-gas system is not designed to handle the vapors created by combustion of plastic.
Z Area	Stabilization	Saltsone is not equipped to treat solid wastes.

Summary Page – Technology Success Factor (TSF) & In-Depth Options Analysis (IDOA)

Waste Stream Number & Name: SR-W073 Plastic/Lead/Cadmium Raschig Rings

Feasible Options

Option No.	Treatment Facility	Treatment Technology	TSF	IDOA Scores		COST (x 1,000)	PO
			Score	Tech.	Total		
SR-W073-1	CIF	Incineration/ Stabilization	94	62	74	3,075	√
SR-W073-2	Cont. Bldg.	Vendor stabilization	100	57	70	1,918	

Options Rejected Due To Low Technology Success Factor (TSF)

- No options were rejected.

Engineering Assessment

Preferred Option Justification

The preferred treatment option for the Raschig Rings with Lead and Cadmium is Incineration followed by Stabilization at CIF.

This option is preferred because:

- Rotary kiln technology is very mature and well known.
- Volume will decrease by a factor of more than ten.
- Few or no emissions during normal operations. Accident scenarios do not cause an increase in emissions.
- Only a small percentage of the final waste will require disposal as mixed waste.

Options Rejected During IDOA

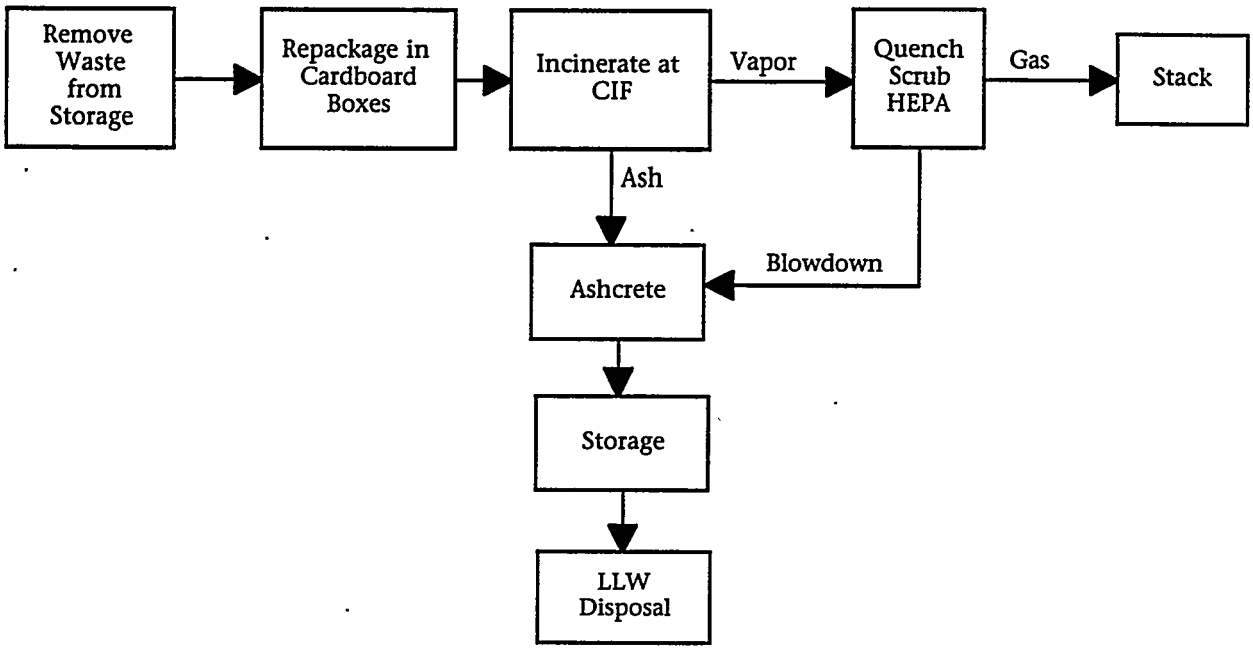
Stabilization of the waste stream with polymer with a vendor's process in a containment building.

Stabilization with cement was rejected because:

- Waste volume will more than double.
- Final wasteform will require disposal in HW/MW facility.
- Commercial experience indicates a greater than average number of operational workers will be required to tend this process.
- Public may feel concern because this wasteform is not as stable as others (e.g., vitrification).

Waste Stream Number & Name: SR-W073 Plastic/Lead/Cadmium Raschig Rings
Option Number: SR-W073-1
Facility: CIF
Treatment Technology: Incineration/ Stabilization

Treatment Cycle Flow Diagram:



Pros

- Rotary kiln technology is very mature and well known.
- Volume will decrease by a factor of more than ten.
- Shipping requirements are met for treatment residuals.
- Availability of 80% is easily achievable with this technology.
- Few or no emissions during normal operations. Accident scenarios do not cause an increase in emissions.
- Fewer than average number of non operational workers will be required to tend this process.
- Only a small percentage of the final waste will require disposal as mixed waste.

Cons

- Public has expressed concern about incineration as a waste treatment process.
- Containment building features unbudgeted and will require a line item.

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	90	Volume will be reduced. Add 10 points to high median of 80 because volume will decrease by a factor of more than ten.
• secondary waste generation	50	Ash will require stabilization in ashcrete to immobilize the constituents of concern.

Waste Stream Number & Name: SR-W073 Plastic/Lead/Cadmium Raschig Rings
Option Number: SR-W073-1
Facility: CIF
Treatment Technology: Incineration/ Stabilization

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• destruction removal and demobilization efficiency	80	All applicable LDR standards are met.
• flexibility	100	Treatment residuals are immobilized with cement. Add 20 points to high median of 80 because of the wide variety in this waste stream that incineration can accommodate.
• ability to be shipped	80	Shipping requirements are met for treatment residuals.
• final wasteform	80	Final wasteform will meet waste disposal WAC.
Engineering Parameters		
• system implementability	100	Commercial process. Add 10 points to high median score of 80 because of rotary kiln technology is very mature and well known.
• availability	80	Availability of 80% is easily achievable with this technology.
• scalability	50	Total throughput is fixed by design.
• remedial measures	70	Only the solidified treatment residuals can fail. Subtract 10 points from high median score of 80 because of the difficulty in size-reducing the stabilized wasteform.
• schedule for treatment of waste	50	Waste stream will require repackaging to meet CIF WAC, which introduces some uncertainty in the schedule.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Few or no emissions during normal operations. Accident scenarios do not cause an increase in emissions.
• non operational worker potential exposure	80	Fewer than average number of operational workers will be required to tend this process.
• operational worker potential exposure	50	Fewer than average number of operational workers will be required to tend the incineration part of this process, but potential for exposure increases with the need to repackage the material to meet CIF WAC.
• transportation potential exposure	80	Waste will require characterization before transport to CIF.
Regulatory Parameters		
• need for variance	80	Process will comply with regulations without requiring a variance.
• ability to obtain a permit	80	The process is well defined.
• waste disposal	80	Only a small percentage of the final waste will require disposal as mixed waste.
Public Acceptance		
• public acceptance	20	Public has expressed concern about incineration as a waste treatment process.

Waste Stream Number & Name: SR-W073 Plastic/Lead/Cadmium Raschig Rings
Option Number: SR-W073-1
Facility: CIF
Treatment Technology: Incineration/ Stabilization

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Cost Considerations		
• life-cycle cost		
• funding availability	20	Containment building features are unbudgeted and will require a line item.
Industry Involvement		
• market for technology	20	Technology exists.
• private sector involvement	20	SRS facility evaluated.

IDOA Score: **Technical** 62 **Total** 74

Waste Stream Number & Name: SR-W073 Plastic/Lead/Cadmium Raschig Rings
Option Number: SR-W073-1
Facility: CIF
Treatment Technology: Incineration/ Stabilization

Cost Estimate Sheet

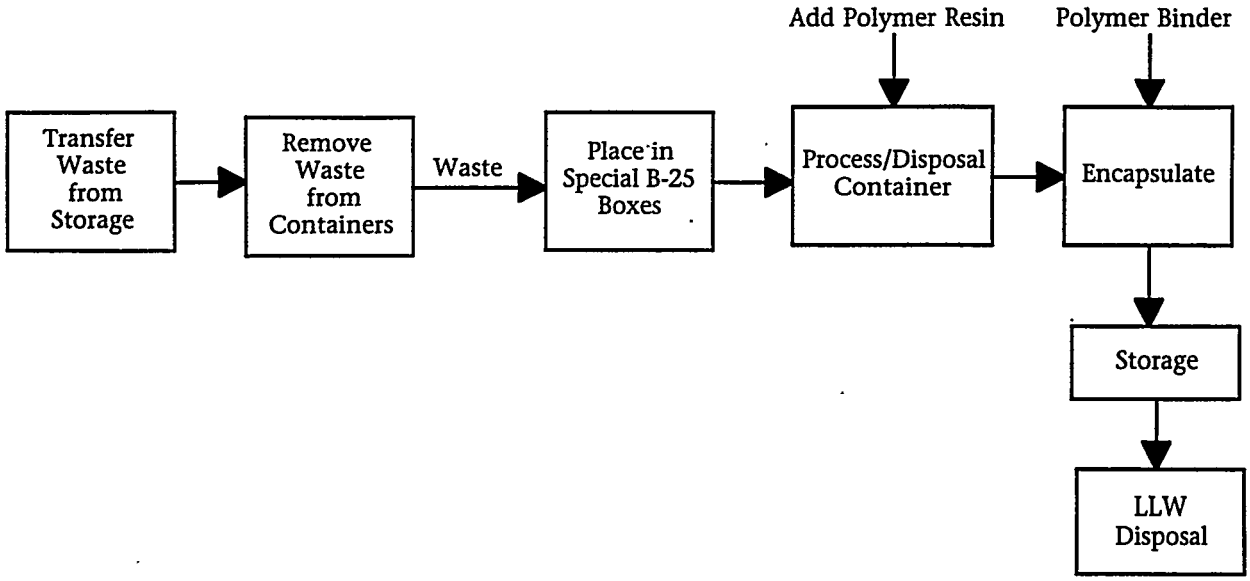
Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[ ] alpha [ ] non-alpha [√] contact handled [ ] remote handled
Module Location: SRS
Module Status: [ ] Existing [√] New [ ] Small generator [ ] Large generator
[√] Onsite [ ] Offsite [ ] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 26	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 105	
		1.3.2 Safety Assurance Documentation	$ 26	
		1.3.3 Permitting	$ 125	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$ 1	
		TOTAL PRE-OPERATIONS		$ 433
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 125	
	2.2	Inspection	$ 23	
	2.3	Project Management	$ 24	
	2.4	Building Construction (inc. indirect)	$ 16	
	2.5	Equipment (inc. indirect)	$ 550	
	2.6	Construction Management	$ 40	
	2.7	Contingency	$ 272	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 1,049
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 150	
	3.2	Annual Utilities	$ 6	
	3.3	Annual Materials	$ 90	
	3.4	Annual Maintenance	$ 54	
	3.5	Annual Contingency	$ 0	
		TOTAL ANNUAL O & M	$ 300	
		X NUMBER OF YEARS OF OPERATION	1.00	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 300
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 453	
	4.2	Closure, Post-Closure, Monitoring	$ 3	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 456
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 50
		SUB COST FOR INCINERATION MODULE		$ 2,288
		ESCALATION		1.344
		TOTAL COST		$ 3,075

If above numbers do not appear to add correctly, it is the result of computer rounding.

Waste Stream Number & Name: SR-W073 Plastic/Lead/Cadmium Raschig Rings
Option Number: SR-W073-2
Facility: Containment Building
Treatment Technology: Polymer Stabilization

Treatment Cycle Flow Diagram:



Pros

- No secondary wastes are generated.
- Polymer encapsulation immobilizes the constituents of concern.
- This is a proven process in use both in the DOE Complex and the commercial world.
- Requires fewer non operational workers than comparably sized facilities. Experience in similar facilities indicates little maintenance is required.

Cons

- Waste volume will more than double.
- Final wasteform will require disposal in HW/MW facility.
- Commercial experience indicates a greater than average number of operational workers will be required to tend this process.
- Public may feed concern because this wasteform is not as stable as others (e.g., vitrification).

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Process Parameters		
• volume alteration	10	Gross volume of waste will increase. Subtract 10 points from low median score of 20 because waste volume will more than double.
• secondary waste generation	100	Add 20 points to high median score of 80 because no secondary wastes generated.
• destruction removal and demobilization efficiency	80	All applicable LDR standards are met.

Waste Stream Number & Name: SR-W073 Plastic/Lead/Cadmium Raschig Rings
Option Number: SR-W073-2
Facility: Containment Building
Treatment Technology: Polymer Stabilization

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
• flexibility	80	Process can handle a variety of wastes. Widely used in the commercial world.
• ability to be shipped	80	Waste can be shipped without further treatment.
• final wasteform	100	Final wasteform will meet WAC. Add 20 points to high median score of 80 because no additional treatment is required. Wasteform is disposable in the form in which it exits the process.
Engineering Parameters		
• system implementability	100	Add 20 points to the high median score of 80 because this is a proven process in use both in the DOE Complex and the commercial world.
• availability	60	Add 10 points to the medium median score of 50 because similar commercial systems have availability of 50+%.
• scalability	50	Throughput fixed by design.
• remedial measures	50	Failed final wasteforms can be overpacked or ground up and reprocessed.
• schedule for treatment of waste	80	This is a mature technology; vendor can bring facility onsite in a predictable time frame.
Personnel Parameters		
• consequence of unmitigated accident scenarios	80	Containment building will control emissions.
• non operational worker potential exposure	70	Requires fewer non operational workers than comparably sized facilities. Experience in similar facilities indicates little maintenance is required. Subtract 10 points from high median score because of uncertainties surrounding D&D effort.
• operational worker potential exposure	40	Subtract 10 points from the medium median score of 50 because commercial experience indicates a greater than average number of operational workers will be required to tend this process.
• transportation potential exposure	60	Waste will require no additional characterization before transportation to storage. Add 10 points to the medium median score of 50 because the wasteform is easily handable.
Regulatory Parameters		
• need for variance	80	Process will comply with regulations without requiring a variance.
• ability to obtain a permit	80	This process is specified technology for lead.
• waste disposal	80	Final wasteform will require disposal in LLW facility.
Public Acceptance		
• public acceptance	20	Public may feel concern because this wasteform is not as stable as others (e.g., vitrification).

Waste Stream Number & Name: SR-W073 Plastic/Lead/Cadmium Raschig Rings
Option Number: SR-W073-2
Facility: Containment Building
Treatment Technology: Polymer Stabilization

In-Depth Options Analysis (IDOA) Score Sheet

Attribute	Score	Discussion/Notes
Cost Considerations		
• life-cycle cost	95	
• funding availability	20	Not a budgeted item.
Industry Involvement		
• market for technology	20	Technology exists.
• private sector involvement	20	Vendor could perform treatment.

IDOA Score: **Technical** 56 **Total** 70

Waste Stream Number & Name: SR-W073 Plastic/Lead/Cadmium Raschig Rings
Option Number: SR-W073-2
Facility: Containment Building **Treatment Technology: Polymer Stabilization**

Cost Estimate Sheet

Waste Type: [√] MLLW [ ] HLW [ ] M-TRU
[ ] alpha [ ] non-alpha [√] contact handled [ ] remote handled

Module Location: SRS

Module Status: [ ] Existing [ ] New [√] Small generator [ ] Large generator
[√] Onsite [ ] Offsite [√] Commercial [ ] Portable [ ] R&D

WBS Element			($ x 1,000) Sub $	($ x 1,000) Element $
1.0	Pre-Operations			
	1.1	Studies and Bench Scale Tests	$ 16	
	1.2	Demonstration Costs	$ N/A	
	1.3	Operations Budget Funded Activities		
		1.3.1 Conceptual Design	$ 65	
		1.3.2 Safety Assurance Documentation	$ 16	
		1.3.3 Permitting	$ 125	
		1.3.4 Preparation for Operations	$ 150	
		1.3.5 Project Management	$	
		TOTAL PRE-OPERATIONS		$ 372
2.0	Facility Construction Cost			
	2.1	Design (Title I and II)	$ 77	
	2.2	Inspection	$ 14	
	2.3	Project Management	$ 14	
	2.4	Building Construction (inc. indirect)	$	
	2.5	Equipment (inc. indirect)	$ 150	
	2.6	Construction Management	$ 25	
	2.7	Contingency	$ 168	
		TOTAL FACILITY CONSTRUCTION COSTS		$ 447
3.0	Operation and Maintenance			
	3.1	Annual Operating Labor	$ 38	
	3.2	Annual Utilities	$ 2	
	3.3	Annual Materials	$ 23	
	3.4	Annual Maintenance	$ 14	
	3.5	Annual Contingency	$	
		TOTAL ANNUAL O & M	$ 75	
		X NUMBER OF YEARS OF OPERATION	1.00	
		TOTAL OPERATIONS AND MAINTENANCE COSTS		$ 75
4.0	Decontamination & Decommissioning			
	4.1	Facility D&D	$ 280	
	4.2	Closure, Post-Closure, Monitoring	$ 3	
		TOTAL DECONTAMINATION & DECOMMISSIONING		$ 283
5.0	Contracted Services			
	5.1	Commercial Treatment/Disposal	$ 200	
	5.2	Mobile Treatment	$	
		TOTAL CONTRACTED SERVICES		$ 200
6.0	Offsite Treatment (DOE)			$
7.0	Transportation			$
8.0	Disposal			$ 50
		SUB COST FOR POLYMER STABILIZATION MODULE		$ 1,427
		ESCALATION		1.344
		TOTAL COST		$ 1,918

If above numbers do not appear to add correctly, it is the result of computer rounding.

4.0 Offsite Waste Streams for which SRS Treatment is the PO

Naval Reactors has selected SRS mixed waste treatment facilities as preferred options in the Naval Reactors Program DSTP. SRS has completed its evaluation confirming its ability to treat Naval Reactors mixed wastes.

SRS cannot fully determine a schedule for treating Naval Reactors wastes at this time. The schedule for acceptance of offsite DOE Complex waste will depend on the volume and characterization of waste to be treated as well as prioritization of onsite and offsite waste treatment. WSRC has recommended that the DOE Complex develop prioritization protocols for treatment of mixed waste to ensure timely treatment of wastes subject to RCRA Land Disposal Restriction and wastes not stored in compliance with RCRA regulations.

Prior to actual acceptance of Naval Reactors wastes major changes to the SRS facility baseline documents including regulatory permits will be required prior to the initiation of waste treatment operations. The required modifications to the baseline documents have not been forecasted, and an accurate schedule for waste treatment operations has not been determined at this time.

WSRC has assumed that all waste treatment residues returned to the generating site would meet the published disposal waste acceptance criteria for the specified site.

Table 4.4.1 identifies the SRS treatment facilities selected as preferred options for Naval Reactors mixed wastes.

Table 4.1

Naval Reactors

Waste Stream No.	DOE Site/ Waste Stream	SRS Treatment Facility	Potential Issues	Current cumulative inventory through 09/30/94 (m^3)	Future forecast generation (1995-1999) (m^3)
NN-W002	Solid Waste Contaminated With Chromium	CIF	(1) (2) (3) (7)	0.0	2.05
CN-W001	Solids Containing Potassium Chromate	CIF	(1) (2) (3)	0.5	0.0
CN-W004	Organic Debris with Lead and/or Chromium	CIF	(1) (2) (3)	0.03	0.5
BT-W001	Oil Containing Heavy Metals #1	CIF	(1) (2) (3) (5)	0.21	0.21
BT-W002	Spent M-192 Solvent Rags	CIF	(1) (2) (3)	0.21	0.0
BT-W003	Oil Containing Heavy Metals #2	CIF	(1) (2) (3)	0.730	0.21
BT-W007	Solids with Solvents	CIF		0.42	0.0
KK-W008	Organic Sludges/Particulate	CIF	(1) (2) (3) (7)	0.0	0.75
KK-W009	Organic Debris without Metals	CIF	(1) (2) (3) (7)	0.0	0.4
KA-W003	Trichloroethylene	CIF	(1) (2) (3)	0.2	0.1

Waste Stream No.	DOE Site/ Waste Stream	SRS Treatment Facility	Potential Issues	Current cumulative inventory through 09/30/94 (m^3)	Future forecast generation (1995-1999) (m^3)
KA-W006	Freon® 113 on Rags	CIF	(1) (2) (3)	0.4	0.0
KA-W013	Organic Debris with Heavy Metals	CIF	(1) (2) (3) (7)	0.0	0.4
KA-W014	Organic Sludges/Particulate with Heavy Metals	CIF	(1) (2) (3) (7)	0.0	0.4
KW-W006	Organic Sludges/Particulate with Heavy Metals	CIF	(1) (2) (3) (7)	0.0	1.6
BT-W018	TCLP Extract Fluid	CIF	(1) (2) (3) (7)	0.0	0.001
KK-W003	Oils	CIF	(1) (2) (3) (7)	0.0	0.25
KK-W005	Organic Debris with Heavy Metals	CIF	(1) (2) (3) (6)	1.0	0.6
KK-W007	Inorganic Sludges/Particulate	CIF	(1) (2) (3) (4)	0.1	0.93
KK-W011	Cutting Oils and Liquids	CIF	(1) (2) (3) (7)	0.0	0.4
KA-W002	Cutting Oils, Liquids, Lubricants	CIF	(1) (2) (3) (7)	0.0	0.1
KA-W007	Oils Containing Heavy Metals and Solvents	CIF	(1) (2) (3)	0.23	2.0
KA-W009	Organic Debris with Heavy Metals	CIF	(1) (2) (3)	0.05	2.0
KA-W012	Inorganic Sludge/particulate with Heavy Metals	CIF	(1) (2) (3) (4) (7)	0.0	0.6
KW-W001	Oil with Heavy Metals	CIF	(1) (2) (3) (7)	0.0	0.45
KW-W003	Organic Debris with Heavy Metals	CIF	(1) (2) (3) (7)	0.0	1.5
KW-W004	Inorganic Debris and Equipment	CIF	(1) (2) (3) (4) (7) (8)	0.0	2.25
CN-W007	Flammable Organic Debris	CIF	(1) (2) (3) (7)	0.0	0.03
PN-W015	Solids with Potassium Chromate	CIF	(1) (2) (3) (7)	0.0	0.03

Notes for Table 4.1

1. All waste must meet the waste composition and packaging limitations of the approved CIF Waste Acceptance Criteria (WAC). The approved WAC will be issued in the SRS 1S Manual and is scheduled to be issued in 1995. A copy will be sent to NR upon approval, and arrangements for packaging of the waste to meet the CIF WAC will be made at that time.

2. Adequate NEPA documentation must be completed for the operation of CIF for onsite and applicable offsite mixed waste and for transportation of waste to SRS. NEPA coverage for transportation is the responsibility of the generator.

3. Approved RCRA permit modifications to allow treatment of offsite waste at CIF and storage of offsite wastes at appropriate SRS storage facilities will be required prior to scheduling and acceptance of NR waste.

4. EPA recently issued a policy that prohibits the incineration of specific inorganic wastes containing hazardous metals. A portion of the following NR wastes may be excluded from the CIF due to this policy.

5. The CIF WAC surface radiation limit is 10 mR/hr. NR waste is shown to have a surface rate above 200 mR/hr. SRS will dilute this waste with our own waste to meet the CIF WAC.

6. The CIF cannot treat Radioactive Lead Solids (D008c). Per the November 18, 1994, letter from Naples to Sauls, waste stream KK-W005 contains fine lead particulates from HEPA Filters. If the waste does not qualify as D008c waste, then CIF can incinerate combustible HEPA elements that exceed the lead TCLP limit as long as the CIF WAC concentration limit is not exceeded.

7. Future-generated wastes will have to be characterized at the time of generation to ensure that they meet the CIF WAC.

8. The metal debris content of this waste may require sorting of unacceptable metal objects from the waste stream prior to shipment by NR to SRS. The CIF WAC excludes metal objects with any dimension exceeding two inches.

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5.0 SUMMARY INFORMATION

5.1 Summary of Major DSTP – PSTP Changes

The Proposed Site Treatment Plan (PSTP) is a more detailed document developed from the information presented in the Draft Site Treatment Plan (DSTP). As additional information on the waste streams became known during the development of the PSTP, the document was updated to reflect this information. The major areas of change have been in waste stream names, preferred treatment options, and volumes.

Table A lists those waste streams for which the name of the waste stream has been changed since the issuance of the DSTP. The names were changed to more accurately reflect the type of waste in the waste stream.

Table A shows the waste streams that have been consolidated with another waste stream since the issuance of the DSTP. Table A also shows those waste streams that have been eliminated since the issuance of the DSTP.

The Department of Energy Options Analysis Team (OAT) recommendations provided two changes for the PSTP. The OAT recommended that the preferred treatment option be changed for waste stream SR-W034, Calcium Metal, and SR-W036, Tritiated Oil with Mercury. Both of these streams were changed from the preferred treatment options listed in the DSTP to a preferred treatment option by a DOE mobile treatment unit. This is reflected below in Table B.

Table B also lists those other waste streams for which the preferred treatment option has been changed since the issuance of the DSTP.

As the Site Treatment Plan process has developed the volumes, both current and future, for the waste streams has been further refined. This information is reflected in Table C.

Table A

DSTP Waste Stream No.	DSTP Waste Stream Name	PSTP Waste Stream No.	PSTP Waste Stream Name	Comment
SR-W001	Rad-Contaminated Solvents	SR-W001	Rad-Contaminated Solvents	
SR-W002	Rad-Contaminated Chlorofluorocarbons			Consolidated with SR-W001
SR-W006	Mixed TTA/Xylene	SR-W006	Mixed TTA/Xylene – TRU	
SR-W010	Scintillation Solution			Consolidated with SR-W001
SR-W012	Toxic Cleanup Material	SR-W012	Incinerable Toxic Characteristic (TC) Material	
SR-W013A	Low-Level Waste Lead (Uncombined Elemental Lead)	SR-W013	Low-Level Waste (LLW) Lead – to be Decontaminated	
SR-W013B	Low-Level Waste Lead (Combined Lead)	SR-W069	Low-Level Waste (LLW) Lead – to be Macroencapsulated	

DSTP Waste Stream No.	DSTP Waste Stream Name	PSTP Waste Stream No.	PSTP Waste Stream Name	Comment
SR-W013B	Low-Level Waste Lead (Combined Lead)	SR-W073	Plastic/Lead/Cadmium Raschig Rings	
SR-W014	Tritiated Mercury	SR-W014	Tritium-Contaminated Mercury	
SR-W015	Mercury Contaminated Equipment	SR-W015	Mercury /Tritium Contaminated Equipment	
SR-W019	244-H RBOF High Activity Liquid Waste			Consolidated with SR-W017
SR-W020	In-Tank Precipitation (ITP) Filters	SR-W020	In-Tank Precipitation (ITP) and Late Wash (LW) Filters	
SR-W021	Poisoned Catalyst Material			Eliminated
SR-W022	Defense Waste Processing Facility (DWPF) Benzene	SR-W022	DWPF Benzene	
SR-W023	Safety/Control Rods	SR-W023	Cadmium Safety/Control Rods	
SR-W024	Gold Traps	SR-W024	Mercury/Tritium Gold Traps	
SR-W025	Solvent Waste <100 nCi/g TRU	SR-W025	Solvent/TRU Job Control Waste <100 nCi/g	
SR-W026	Thirds TRU Waste	SR-W026	Thirds/TRU Job Control Waste	
SR-W027	Solvent TRU Waste	SR-W027	Solvent/TRU Job Control Waste	
SR-W028	Mark 15 Filter Paper – F006	SR-W028	Mark 15 Filter Paper	
SR-W030	Spent Methanol Solution			Consolidated with SR-W001
SR-W033	Thirds Waste <100 nCi/g TRU Rad	SR-W033	Thirds/TRU Job Control Waste <100 nCi/g	
SR-W035	Freon® 11/Oil Mixture	SR-W035	Mixed Waste Oil – Sitewide	
SR-W036	Radioactive Oil	SR-W036	Tritiated Oil with Mercury	
SR-W041A	Aqueous Mercury and Lead	SR-W041	Aqueous Mercury and Lead	
SR-W041B	Aqueous Mercury and Lead (Elemental Liquid Mercury)	SR-W068	Elemental (Liquid) Mercury	
SR-W041C	Aqueous Mercury and Lead (Mercury Contaminated Recorder)	SR-W062	Toxic Characteristic (TC) Contaminated Debris	
SR-W043	Lab Waste w/Tetraphenyl Borate			Consolidated with SR-W012

DSTP Waste Stream No.	DSTP Waste Stream Name	PSTP Waste Stream No.	PSTP Waste Stream Name	Comment
SR-W044	Tributyl Phosphate & N-paraffin – TRU		Tri-Butyl-Phosphate and n-Paraffin – TRU	Consolidated with SR-W045
SR-W045	Tributyl Phosphate & N-paraffin		Tri-Butyl-Phosphate and n-Paraffin	
SR-W046	Consolidated Incinerator (CIF) Ash	SR-W046	Consolidated Incineration Facility (CIF) Ash	
SR-W047	Consolidated Incinerator (CIF) Blowdown	SR-W047	Consolidated Incineration Facility (CIF) Blowdown	
SR-W048	Waste Sites/Spill Site Soil	SR-W048	Soils from Spill Remediation	
SR-W050	Mixed Waste to Support HL Waste Processing Demonstrations	SR-W050	Mixed Waste to Support High-Level Waste (HLW) Processing Demonstrations	
SR-W051	Spent Filter Cartridges	SR-W051	Spent Filter Cartridges and Carbon Filter Media	
SR-W052	Cadmium Contaminated Glovebox Section			Eliminated
SR-W054	Enriched Uranium Contaminated with Lead			Consolidated with SR-W037
SR-W055	Job Waste Containing Solvent Contaminated Wipes	SR-W055	Job Control Waste Containing Solvent Contaminated Wipes	
SR-W056	Job Waste with Enriched Uranium and Solvent Applicators	SR-W056	Job Control Waste with Enriched Uranium and Solvent Applicators	
SR-W057	D-Tested Neutron Generators			Eliminated
SR-W058	Mixed Sludge Waste with Mercury – DWPF Treatability Studies	SR-W058	Mixed Sludge Waste with Mercury from DWPF Treatability Studies	
SR-W059	Tetrabutyl Titanate (TBT)			Consolidated with SR-W001
SR-W061	DWPF Off-specification Mercury	SR-W061	DWPF Mercury	
SR-W062	Mercury Contaminated Debris-Sitewide	SR-W062	Toxic Characteristic (TC) Contaminated Debris	
SR-W063	Macroencapsulated Lead	SR-W063	Macroencapsulated Toxic Characteristic (TC) Waste	
SR-W041B	Aqueous Mercury and Lead (Elemental Liquid Mercury)	SR-W068	Elemental (Liquid) Mercury	

DSTP Waste Stream No.	DSTP Waste Stream Name	PSTP Waste Stream No.	PSTP Waste Stream Name	Comment
SR-W013B	Low-Level Waste Lead (Combined Lead)	SR-W069	Low-Level Waste (LLW) Lead – to be Macroencapsulated	
SR-W013B	Low-Level Waste Lead (Combined Lead)	SR-W073	Plastic/Lead/Cadmium Raschig Rings	

Table B

Waste Stream No.	Waste Stream Name	DSTP Preferred Option (PO)	PSTP Preferred Option (PO)
SR-W001	Rad-Contaminated Solvents	CIF – Incineration	Incineration followed by Stabilization – CIF
SR-W002	Rad-Contaminated Chlorofluorocarbons	CIF – Incineration	Consolidated with SR-W001
SR-W003	Solvent Contaminated Debris (LLW)	CIF – Incineration	Incineration followed by Stabilization – CIF
SR-W004	M-Area Plating Line Sludge from Supernate Treatment	M-Area Vendor Treatment Process	Stabilization by Vitrification – M-Area Vendor Treatment Process
SR-W005	Mark 15 Filtercake	M-Area Vendor Treatment Process	Stabilization by Vitrification – M-Area Vendor Treatment Process
SR-W006	Mixed TTA/Xylene	TRU Waste Management Plan	Characterization in TWCCF – WIPP Disposal
SR-W007	SRL (SRTC) Low Activity Waste	SRTC Ion Exchange	SRTC Ion Exchange
SR-W008	SRL (SRTC) High Activity Waste	SRTC Ion Exchange	SRTC Ion Exchange
SR-W009	Silver Coated Packing Material	Containment Bldg. – Macroencapsulation in S. S. Container	Macroencapsulation in S. S. Container – Containment Bldg.
SR-W010	Scintillation Solution	CIF – Incineration	Consolidated with SR-W001
SR-W011	Cadmium-Coated HEPA Filters	M-Area Vendor Treatment Process	Stabilization by Vitrification – M-Area Vendor Treatment Process
SR-W012	Incinerable Toxic Characteristic (TC) Material	CIF – Incineration	Incineration followed by Stabilization – CIF
SR-W013	Low-Level Waste Lead – to be Decontaminated	Offsite Vendor	Decontamination by Offsite Vendor
SR-W014	Tritium Contaminated Mercury	Offsite DOE-INEL-WEDF Amalgamation	Amalgamation – Offsite DOE-INEL-WEDF
SR-W015	Mercury/Tritium Contaminated Equipment	Containment Bldg. – Macroencapsulation in S. S. Container	Macroencapsulation in S. S. Container as 90-Day Generator
SR-W016	221-F Canyon High Level Liquid Waste	DWPF	Stabilization by Vitrification – DWPF
SR-W017	221-H Canyon High Level Liquid Waste	DWPF	Stabilization by Vitrification – DWPF
SR-W018	Filter Paper Take Up Rolls (FPTUR)	CIF – Incineration	Incineration followed by Stabilization – CIF
SR-W019	244-H RBOF High Activity Liquid Waste	Consolidated with SR-W017	Consolidated with SR-W017
SR-W020	In-Tank Precipitation (ITP) and Late Wash (LW) Filters	Approved treatability variance	Acid Washing followed by Placement in an Engineered S. S. Container – ITP
SR-W021	Poisoned Catalyst Material	Waste stream eliminated	Waste stream eliminated

Waste Stream No.	Waste Stream Name	DSTP Preferred Option (PO)	PSTP Preferred Option (PO)
SR-W022	DWPF Benzene	CIF – Incineration	Incineration followed by Stabilization – CIF
SR-W023	Cadmium Safety/Control Rods	Macroencapsulation in a cask, as a 90-day generator	Macroencapsulation in a cask, as a 90-day generator
SR-W024	Mercury/Tritium Gold Traps	Meets Treatment Standard	Meets LDR Treatment Standard
SR-W025	Solvent/TRU Job Control Waste <100 nCi/g	TRU Waste Management Plan	Characterization in TWCCF
SR-W026	Thirds/TRU Job Control Waste	TRU Waste Management Plan	Characterization in TWCCF – WIPP Disposal
SR-W027	Solvent/TRU Job Control Waste	TRU Waste Management Plan	Characterization in TWCCF – WIPP Disposal
SR-W028	Mark 15 Filter Paper	CIF – Incineration	Incineration followed by Stabilization – CIF
SR-W029	M-Area Sludge Treatability Samples	M-Area Vendor Treatment Process	Stabilization by Vitrification – M-Area Vendor Treatment Process
SR-W030	Spent Methanol Solution	CIF – Incineration	Consolidated with SR-W001
SR-W031	Uranium/Chromium Solution	M-Area Vendor Treatment Process	Stabilization by Vitrification – M-Area Vendor Treatment Process
SR-W032	Mercury Contaminated Heavy Water	D-Area Facility	D-Area Facility
SR-W033	Thirds/TRU Job Control Waste <100 nCi/g	TRU Waste Management Plan	Characterization in TWCCF
SR-W034	Calcium Metal	Containment Bldg. – Wet Oxidation	Deactivation by Wet Oxidation – DOE Mobile Reactive Metals Unit – Offsite
SR-W035	Mixed Waste Oil – Sitewide	CIF – Incineration	Incineration followed by Stabilization – CIF
SR-W036	Tritiated Oil with Mercury	To be determined	Incineration followed by Stabilization – DOE Mobile Packed-Bed Incinerator – Onsite
SR-W037	M-Area High Nickel Plating Line Sludge	M-Area Vendor Treatment Process	Stabilization by Vitrification – M-Area Vendor Treatment Process
SR-W038	Plating Line Sump Material	M-Area Vendor Treatment Process	Stabilization by Vitrification – M-Area Vendor Treatment Process
SR-W039	Nickel Plating Line Solution	M-Area Vendor Treatment Process	Stabilization by Vitrification – M-Area Vendor Treatment Process
SR-W040	M-Area Stabilized Sludge	Waste stream eliminated	Waste stream eliminated
SR-W041	Aqueous Mercury and Lead	Effluent Treatment Facility	Effluent Treatment Facility
SR-W042	Paints and Thinners	CIF – Incineration	CIF – Incineration
SR-W043	Lab Waste w/Tetraphenyl borate	CIF – Incineration	Consolidated with SR-W012
SR-W044	Tri-Butyl-Phosphate & n-Paraffin – TRU	Consolidated with SR-W045	Consolidated with SR-W045

Waste Stream No.	Waste Stream Name	DSTP Preferred Option (PO)	PSTP Preferred Option (PO)
SR-W045	Tri-Butyl-Phosphate & n-Paraffin	CIF – Incineration	Incineration followed by Stabilization – CIF
SR-W046	Consolidated Incineration Facility (CIF) Ash	CIF – Ashcrete	Stabilization – CIF Ashcrete Unit
SR-W047	Consolidated Incineration Facility (CIF) Blowdown	CIF – Ashcrete	Stabilization – CIF Ashcrete Unit
SR-W048	Soils from Spill Remediation	M-Area Vendor Treatment Process	Stabilization by Vitrification – M-Area Vendor Treatment Process
SR-W049	Tank E-3-1 Clean Out Material	Offsite DOE-INEL-WEDF Stabilization	Stabilization – Offsite DOE-INEL-WEDF
TBD	Mixed Waste to Support High-Level Waste (HLW) Processing Demonstrations	Pretreatment – SRTC containment building treatment – vitrification	Treatment by SRTC as a 90-Day Generator
SR-W051	Spent Filter Cartridges and Carbon Filter Media	CIF – Incineration	Incineration followed by Stabilization – CIF
SR-W052	Cadmium Contaminated Glovebox Section	Waste stream eliminated	Waste stream eliminated
SR-W053	Rocky Flats Incinerator Ash	Return to Rocky Flats	Return to Rocky Flats
SR-W054	Enriched Uranium Contaminated with Lead	Consolidated with SR-W037	Consolidated with SR-W037
SR-W055	Job Control Waste Containing Solvent Contaminated Wipes	CIF – Incineration	Incineration followed by Stabilization – CIF
SR-W056	Job Control Waste with Enriched Uranium and Solvent Applicators	CIF – Incineration	None – pursuing research program
SR-W057	D-Tested Neutron Generators	Waste stream eliminated	Waste stream eliminated
SR-W058	Mixed Sludge Waste with Mercury from DWPF Treatability Studies	Pretreatment – SRTC 90-day generator Treatment vitrification	Treatment by SRTC as a 90-Day Generator
SR-W059	Tetrabutyl Titanate (TBT)	CIF – Incineration	Consolidated with SR-W001
SR-W060	Tritiated Water with Mercury	TBD	Macroencapsulation in S. S. Container – Onsite
SR-W061	DWPF Mercury	TBD	Amalgamation – Offsite DOE-INEL WEDF
SR-W062	Toxic Characteristic (TC) Contaminated Debris	Containment Bldg. – Macroencapsulation in S. S. Container	Macroencapsulation with Polymer by a Vendor – Onsite
SR-W063	Macroencapsulated Toxic Characteristic (TC) Waste	*	Meets Treatment Standard
SR-W064	IDW Soils/Sludges/Slurries	*	Awaiting ROD, etc.
SR-W065	IDW Monitoring Well Purge/Development Water	*	Awaiting ROD, etc.
SR-W066	IDW Steel and Metal Debris	*	Awaiting ROD, etc.
SR-W067	IDW Personal Protective Equipment (PPE) Waste	*	Awaiting ROD, etc.
SR-W068	Liquid Elemental Mercury – Sitewide	Offsite DOE-INEL WEDF Amalgamation	Amalgamation – Offsite DOE-INEL WEDF
SR-W069	Low-Level Waste (LLW) Lead – to be Macroencapsulated	Macroencapsulation – Location TBD	Macroencapsulation with Polymer by a Vendor – Onsite

Waste Stream No.	Waste Stream Name	DSTP Preferred Option (PO)	PSTP Preferred Option (PO)
SR-W070	Mixed Waste from Laboratory Samples	*	Incineration followed by Stabilization – CIF
SR-W071	Wastewater from TRU Drum Dewatering	*	Incineration followed by Stabilization – CIF
SR-W072	Supernate or Sludge Contaminated Debris from HLW Operations	*	Extraction or Immobilization Alternative Debris Technologies as 90-day Generator
SR-W073	Plastic/Lead/Cadmium Raschig Rings	Offsite Vendor	Incineration followed by Stabilization – CIF

* Waste stream preferred option not listed in Draft Site Treatment Plan

Table C

Waste Stream No.	PSTP Waste Stream Name	DSTP Volumes		PSTP Volumes	
		Current cumulative inventory through 09/30/94 (m^3)	Future forecast generation (1995-1999) (m^3)	Current cumulative inventory through 09/30/94 (m^3)	Future forecast generation (1995-1999) (m^3)
SR-W001	Rad-Contaminated Solvents	0.4	2.0	8.4	5.0
SR-W002	Rad-Contaminated Chlorofluorocarbons	1.0	3.0	N/A	N/A
SR-W003	Solvent Contaminated Debris (LLW)	5.4	2.0	9.3	2.6
SR-W004	M-Area Plating Line Sludge from Supernate Treatment	356	490	850	20
SR-W005	Mark 15 Filtercake	15.4	0	15.4	0
SR-W006	Mixed TTA/Xylene	0.1	0	0.1	0
SR-W007	SRL (SRTC) Low Activity Waste	71.5	375	58.6	375
SR-W008	SRL (SRTC) High Activity Waste	77.4	375	72.2	375
SR-W009	Silver Coated Packing Material	10.2	3.1	10.2	3.1
SR-W010	Scintillation Solution	3.6	0	N/A	N/A
SR-W011	Cadmium-Coated HEPA Filters	100.2	0	100.2	0
SR-W012	Incinerable Toxic Characteristic (TC) Material	0.8	1.0	2.8	1609.6
SR-W013	Low-Level Waste Lead – to be Decontaminated	86.4	30	82.2	30
SR-W014	Tritium Contaminated Mercury	0.3	0.1	0.3	0.1
SR-W015	Mercury/Tritium Contaminated Equipment	9.8	3.1	9.9	253.2
SR-W016	221-F Canyon High Level Liquid Waste	54,160	7,350	53,800	5,464
SR-W017	221-H Canyon High Level Liquid Waste	74,180	6,220	73,240	9,970
SR-W018	Filter Paper Take Up Rolls (FPTUR)	257	5.0	260	0
SR-W019	244-H RBOF High Activity Liquid Waste	0	0	N/A	N/A
SR-W020	In-Tank Precipitation (ITP) and Late Wash (LW) Filters	0	16.3	0	32.6
SR-W021	Poisoned Catalyst Material	0	0	N/A	N/A
SR-W022	DWPF Benzene	0	380	0	1,512
SR-W023	Cadmium Safety/Control Rods	0.3	3.2	0.3	3.2
SR-W024	Mercury/Tritium Gold Traps	2.3	0.2	2.3	0.2
SR-W025	Solvent/TRU Job Control Waste <100 nCi/g	2,791.2	0	2,744.8	0
SR-W026	Thirds/TRU Job Control Waste	67	204	67	241
SR-W027	Solvent/TRU Job Control Waste	4,955.6	0	4,873.2	0
SR-W028	Mark 15 Filter Paper	1.0	0	1.0	0
SR-W029	M-Area Sludge Treatability Samples	1.0	0	1.0	0.4

Waste Stream No.	PSTP Waste Stream Name	DSTP Volumes		PSTP Volumes	
		Current cumulative inventory through 09/30/94 (m^3)	**Future** forecast generation (1995-1999) (m^3)	**Current** cumulative inventory through 09/30/94 (m^3)	**Future** forecast generation (1995-1999) (m^3)
SR-W030	Spent Methanol Solution	0.2	0	N/A	N/A
SR-W031	Uranium/Chromium Solution	0.6	0	0.6	0
SR-W032	Mercury Contaminated Heavy Water	9.6	0	9.6	0
SR-W033	Thirds/TRU Job Control Waste <100 nCi/g	8.0	25	8.0	308
SR-W034	Calcium Metal	0.8	0	0.8	0
SR-W035	Mixed Waste Oil – Sitewide	2.0	0	2.2	2.0
SR-W036	Tritiated Oil with Mercury	17.2	1.6	17.2	2.2
SR-W037	M-Area High Nickel Plating Line Sludge	1,190	0	1,579	0
SR-W038	Plating Line Sump Material	0.4	0	0.4	0
SR-W039	Nickel Plating Line Solution	5.0	0	5.0	0
SR-W040	M-Area Stabilized Sludge	0	0	N/A	N/A
SR-W041	Aqueous Mercury and Lead	0.09	0	.3	0
SR-W042	Paints and Thinners	5.3	5.0	5.4	7.0
SR-W043	Lab Waste w/Tetraphenyl Borate	0.2	2.6	N/A	N/A
SR-W044	Tri-Butyl-Phosphate & n-Paraffin – TRU	0	0	N/A	N/A
SR-W045	Tri-Butyl-Phosphate & n-Paraffin	107	0	119.6	54.5
SR-W046	Consolidated Incineration Facility (CIF) Ash	0	62	0	124
SR-W047	Consolidated Incineration Facility (CIF) Blowdown	0	400	0	800
SR-W048	Soils from Spill Remediation	18.2	0	16.8	0
SR-W049	Tank E-3-1 Clean Out Material	1.4	0	1.2	0
SR-W050	Mixed Waste to Support High-Level Waste (HLW) Processing Demonstrations	0.1	0.4	0.1	0.4
SR-W051	Spent Filter Cartridges and Carbon Filter Media	0.6	0	0.8	3.0
SR-W052	Cadmium Contaminated Glovebox Section	0	0	N/A	N/A
SR-W053	Rocky Flats Incinerator Ash	0.1	0	0.1	0
SR-W054	Enriched Uranium Contaminated with Lead	0	0	N/A	N/A
SR-W055	Job Control Waste Containing Solvent Contaminated Wipes	951	0	951	0
SR-W056	Job Control Waste with Enriched Uranium and Solvent Applicators	260	0	260	0
SR-W057	D-Tested Neutron Generators	0	0	N/A	N/A

Waste Stream No.	PSTP Waste Stream Name	DSTP Volumes		PSTP Volumes	
		Current cumulative inventory through 09/30/94 (m^3)	**Future** forecast generation (1995-1999) (m^3)	**Current** cumulative inventory through 09/30/94 (m^3)	**Future** forecast generation (1995-1999) (m^3)
SR-W058	Mixed Sludge Waste with Mercury from DWPF Treatability Studies	0.1	0	0.1	0
SR-W059	Tetrabutyl Titanate (TBT)	0.8	0	N/A	N/A
SR-W060	Tritiated Water with Mercury	0.2	0	0.2	0
SR-W061	DWPF Mercury	0	1.5	0	0.9
SR-W062	Toxic Characteristic (TC) Contaminated Debris	0.1	0	6.2	5
SR-W063	Macroencapsulated Toxic Characteristic (TC) Waste			0	42
SR-W064	IDW Soils/Sludges/Slurries				
SR-W065	IDW Monitoring Well Purge/Development Water				
SR-W066	IDW Steel and Metal Debris				
SR-W067	IDW Personnel Protective Equipment (PPE) Waste				
SR-W068	Liquid Elemental Mercury – Sitewide	0.01	0	0.1	0.2
SR-W069	Low-Level Waste (LLW) Lead – to be Macroencapsulated	86.4	30	73.5	15
SR-W070	Mixed Waste from Laboratory Samples			0	2.2
SR-W071	Wastewater from TRU Drum Dewatering			11.8	4.2
SR-W072	Supernate or Sludge Contaminated Debris from HLW Operations			0	1,065
SR-W073	Plastic/Lead/Cadmium Raschig Rings	86.4	30	1.8	0

5.2 Preferred Option Summary (by Waste Stream)

Waste Stream No.	Waste Stream Name	Preferred Option (PO)	Current cumulative inventory through 09/30/94 (m^3)	Future forecast generation (1995-1999) (m^3)
SR-W001	Rad-Contaminated Solvents	Incineration followed by Stabilization – CIF	8.4	5.0
SR-W002	Rad-Contaminated Chlorofluorocarbons	Consolidated with SR-W001	N/A	N/A
SR-W003	Solvent Contaminated Debris (LLW)	Incineration followed by Stabilization – CIF	9.3	2.6
SR-W004	M-Area Plating Line Sludge from Supernate Treatment	Stabilization by Vitrification – M-Area Vendor Treatment Process	850	20
SR-W005	Mark 15 Filtercake	Stabilization by Vitrification – M-Area Vendor Treatment Process	15.4	0
SR-W006	Mixed TTA/Xylene – TRU	Characterization in TWCCF – WIPP Disposal	0.1	0
SR-W007	SRL (SRTC) Low Activity Waste	SRTC Ion Exchange	58.6	375
SR-W008	SRL (SRTC) High Activity Waste	SRTC Ion Exchange	72.2	375
SR-W009	Silver Coated Packing Material	Macroencapsulation in S. S. Container – Containment Bldg.	10.2	3.1
SR-W010	Scintillation Solution	Consolidated with SR-W001	N/A	N/A
SR-W011	Cadmium-Coated HEPA Filters	Stabilization by Vitrification – M-Area Vendor Treatment Process	100.2	0
SR-W012	Incinerable Toxic Characteristic (TC) Material	Incineration followed by Stabilization – CIF	2.8	1609.6
SR-W013	Low-Level Waste (LLW) Lead – to be Decontaminated	Decontamination by Offsite Vendor	82.2	30
SR-W014	Tritium-Contaminated Mercury	Amalgamation – Offsite DOE-INEL-WEDF	0.3	0.1
SR-W015	Mercury/Tritium Contaminated Equipment	Macroencapsulation in S. S. Container as 90-Day Generator	9.9	253.2
SR-W016	221-F Canyon High Level Liquid Waste	Stabilization by Vitrification – DWPF	53,800	5,464
SR-W017	221-H Canyon High Level Liquid Waste	Stabilization by Vitrification – DWPF	73,240	9,970
SR-W018	Filter Paper Take Up Rolls (FPTUR)	Incineration followed by Stabilization – CIF	260	0

Waste Stream No.	Waste Stream Name	Preferred Option (PO)	Current cumulative inventory through 09/30/94 (m^3)	Future forecast generation (1995-1999) (m^3)
SR-W019	244-H RBOF High Activity Liquid Waste	Consolidated with SR-W017	N/A	N/A
SR-W020	In-Tank Precipitation (ITP) and Late Wash (LW) Filters	Acid Washing followed by Placement in an Engineered S. S. Container – ITP	0	32.6
SR-W021	Poisoned Catalyst Material	Waste stream eliminated	N/A	N/A
SR-W022	DWPF Benzene	Incineration followed by Stabilization – CIF	0	1,512
SR-W023	Cadmium Safety/Control Rods	Macroencapsulation in a cask, as a 90-day generator	0.3	3.2
SR-W024	Mercury/Tritium Gold Traps	Meets LDR Treatment Standard	2.3	0.2
SR-W025	Solvent/TRU Job Control Waste <100 nCi/g	Characterization in TWCCF	2,744.8	0
SR-W026	Thirds/TRU Job Control Waste	Characterization in TWCCF – WIPP Disposal	67	241
SR-W027	Solvent/TRU Job Control Waste	Characterization in TWCCF – WIPP Disposal	4,873.2	0
SR-W028	Mark 15 Filter Paper	Incineration followed by Stabilization – CIF	1.0	0
SR-W029	M-Area Sludge Treatability Samples	Stabilization by Vitrification – M-Area Vendor Treatment Process	1.0	0.4
SR-W030	Spent Methanol Solution	Consolidated with SR-W001	N/A	N/A
SR-W031	Uranium/Chromium Solution	Stabilization by Vitrification – M-Area Vendor Treatment Process	0.6	0
SR-W032	Mercury Contaminated Heavy Water	D-Area Facility	9.6	0
SR-W033	Thirds/TRU Job Control Waste <100 nCi/g	Characterization in TWCCF	8.0	308
SR-W034	Calcium Metal	Deactivation by Wet Oxidation – DOE Mobile Reactive Metals Unit – Offsite	0.8	0
SR-W035	Mixed Waste Oil – Sitewide	Incineration followed by Stabilization – CIF	2.2	2.0

Waste Stream No.	Waste Stream Name	Preferred Option (PO)	Current cumulative inventory through 09/30/94 (m^3)	Future forecast generation (1995-1999) (m^3)
SR-W036	Tritiated Oil with Mercury	Incineration followed by Stabilization – DOE Mobile Packed-Bed Incinerator – Onsite	17.2	2.2
SR-W037	M-Area High Nickel Plating Line Sludge	Stabilization by Vitrification – M-Area Vendor Treatment Process	1,579	0
SR-W038	Plating Line Sump Material	Stabilization by Vitrification – M-Area Vendor Treatment Process	0.4	0
SR-W039	Nickel Plating Line Solution	Stabilization by Vitrification – M-Area Vendor Treatment Process	5.0	0
SR-W040	M-Area Stabilized Sludge	Waste stream eliminated	N/A	N/A
SR-W041	Aqueous Mercury and Lead	Effluent Treatment Facility	.3	0
SR-W042	Paints and Thinners	CIF – Incineration	5.4	7.0
SR-W043	Lab Waste w/Tetraphenyl Borate	Consolidated with SR-W012	N/A	N/A
SR-W044	Tri-Butyl-Phosphate & n-Paraffin – TRU	Consolidated with SR-W045	N/A	N/A
SR-W045	Tri-Butyl-Phosphate & n-Paraffin	Incineration followed by Stabilization – CIF	119.6	54.5
SR-W046	Consolidated Incineration Facility (CIF) Ash	Stabilization – CIF Ashcrete Unit	0	124
SR-W047	Consolidated Incineration Facility (CIF) Blowdown	Stabilization – CIF Ashcrete Unit	0	800
SR-W048	Soils from Spill Remediation	Stabilization by Vitrification – M-Area Vendor Treatment Process	16.8	0
SR-W049	Tank E-3-1 Clean Out Material	Stabilization – Offsite DOE-INEL-WEDF	1.2	0
SR-W050	Mixed Waste to Support High-Level Waste (HLW) Processing Demonstrations	Treatment by SRTC as a 90-Day Generator	0.1	0.4
SR-W051	Spent Filter Cartridges and Carbon Filter Media	Incineration followed by Stabilization – CIF	0.8	3.0
SR-W052	Cadmium Contaminated Glovebox Section	Waste stream eliminated	N/A	N/A
SR-W053	Rocky Flats Incinerator Ash	Return to Rocky Flats	0.1	0
SR-W054	Enriched Uranium Contaminated with Lead	Consolidated with SR-W037	N/A	N/A
SR-W055	Job Control Waste Containing Solvent Contaminated Wipes	Incineration followed by Stabilization – CIF	951	0

Waste Stream No.	Waste Stream Name	Preferred Option (PO)	Current cumulative inventory through 09/30/94 (m^3)	Future forecast generation (1995-1999) (m^3)
SR-W056	Job Control Waste with Enriched Uranium and Solvent Applicators	None – pursuing research program	260	0
SR-W057	D-Tested Neutron Generators	Waste stream eliminated	N/A	N/A
SR-W058	Mixed Sludge Waste with Mercury from DWPF Treatability Studies	Treatment by SRTC as a 90-Day Generator	0.1	0
SR-W059	Tetrabutyl Titanate (TBT)	Consolidated with SR-W001	N/A	N/A
SR-W060	Tritiated Water with Mercury	Macroencapsulation in S. S. Container – Onsite	0.2	0
SR-W061	DWPF Mercury	Amalgamation – Offsite DOE-INEL WEDF	0	0.9
SR-W062	Toxic Characteristic (TC) Contaminated Debris	Macroencapsulation with Polymer by a Vendor – Onsite	6.2	5
SR-W063	Macroencapsulated Toxic Characteristic (TC) Waste	Meets Treatment Standard	0	42
SR-W064	IDW Soils/Sludges/Slurries	Awaiting ROD, etc.		
SR-W065	IDW Monitoring Well Purge/Development Water	Awaiting ROD, etc.		
SR-W066	IDW Steel and Metal Debris	Awaiting ROD, etc.		
SR-W067	IDW Personnel Protective Equipment (PPE) Waste	Awaiting ROD, etc.		
SR-W068	Elemental (Liquid) Mercury	Amalgamation – Offsite DOE-INEL WEDF	0.1	0.2
SR-W069	Low-Level Waste (LLW) Lead – to be Macroencapsulated	Macroencapsulation with Polymer by a Vendor – Onsite	73.5	15
SR-W070	Mixed Waste from Laboratory Samples	Incineration followed by Stabilization – CIF	0	2.2
SR-W071	Wastewater from TRU Drum Dewatering	Incineration followed by Stabilization – CIF	11.8	4.2
SR-W072	Supernate or Sludge Contaminated Debris from High-Level Waste (HLW) Operations	Extraction or Immobilization Alternative Debris Technologies as 90-day Generator	0	1,065
SR-W073	Plastic/Lead/Cadmium Raschig Rings	Incineration followed by Stabilization – CIF	1.8	0

5.3 Preferred Option Summary (by Facility)

Waste Stream No.	Waste Stream Name	Current cumulative inventory through 09/30/94 (m^3)	Future forecast generation (1995-1999) (m^3)
Consolidated Incineration Facility (CIF)			
Treatment Standard – Incineration			
SR-W001	Rad-Contaminated Solvents	8.4	5.0
SR-W003	Solvent Contaminated Debris (LLW)	9.3	2.6
SR-W012	Incinerable Toxic Characteristic (TC) Material	2.8	1,609.6
SR-W022	DWPF Benzene	0	1,512.0
SR-W035	Mixed Waste Oil – Sitewide	2.2	2.0
SR-W055	Job Control Waste Containing Solvent Contaminated Wipes	951	0
Treatment Standard – Other Than Incineration			
SR-W018	Filter Paper Take Up Rolls (FPTUR)	260	0
SR-W028	Mark 15 Filter Paper	1.0	0.4
SR-W042	Paints and Thinners	5.4	7.0
SR-W045	Tri-Butyl-Phosphate & n-Paraffin	119.6	54.5
SR-W051	Spent Filter Cartridges and Carbon Filter Media	0.8	3.0
SR-W070	Mixed Waste from Laboratory Samples	0	2.2
SR-W071	Wastewater from TRU Drum Dewatering	11.8	4.2
SR-W073	Plastic/Lead/Cadmium Raschig Rings	1.8	0
Ashcrete Stabilization			
SR-W046	Consolidated Incineration Facility (CIF) Ash	0	124
SR-W047	Consolidated Incineration Facility (CIF) Blowdown	0	800
Effluent Treatment Facility Wastewater Treatment			
SR-W041	Aqueous Mercury and Lead	0.3	0
SRTC Low Activity Waste Storage Tanks – Ion Exchange			
SR-W007	SRL (SRTC) Low Activity Waste	58.6	375
SRTC High Activity Waste Storage Tanks – Ion Exchange			
SR-W008	SRL (SRTC) High Activity Waste	72.2	375
High-Level Waste ITP Facility			
SR-W020	In-Tank Precipitation (ITP) and Late Wash (LW) Filters	0	32.6
D-Area Heavy Water Operations Facility			
SR-W032	Mercury Contaminated Heavy Water	9.6	0

Waste Stream No.	Waste Stream Name	Current cumulative inventory through 09/30/94 (m^3)	Future forecast generation (1995-1999) (m^3)
Meet Treatment Standards			
SR-W024	Mercury/Tritium Gold Traps	2.3	0.2
SR-W040	M-Area Stabilized Sludge	N/A	N/A
SR-W063	Macroencapsulated Toxic Characteristic (TC) Waste	0	42
Macroencapsulation as a 90-Day Generator			
SR-W015	Mercury/Tritium Contaminated Equipment	9.9	253.2
SR-W023	Cadmium Safety/Control Rods	0.3	3.2
SR-W072	Supernate or Sludge Contaminated Debris from High-Level (HLW) Operations	0	1,065
M-Area Vendor Treatment Process			
Design Basis Waste Streams			
SR-W004	M-Area Plating Line Sludge from Supernate Treatment	850	20
SR-W005	Mark 15 Filtercake	15.4	0
SR-W029	M-Area Sludge Treatability Samples	1.0	0.4
SR-W037	M-Area High Nickel Plating Line Sludge	1,579	0
SR-W038	Plating Line Sump Material	0.4	0
SR-W039	Nickel Plating Line Solution	5.0	0
Newly Identified Streams			
SR-W031	Uranium/Chromium Solution	0.6	0
SR-W048	Soils from Spill Remediation	16.8	0
M-Area Liquid Effluent Treatment Facility followed by M-Area Vendor Treatment Process			
SR-W011	Cadmium-Coated HEPA Filters	100.2	0
SRS Canyon Facility – Macroencapsulation in S. S. Container			
SR-W009	Silver Coated Packing Material	10.2	3.1
SRS (Facility TBD) – Macroencapsulation			
SR-W060	Tritiated Water with Mercury	0.2	0
SR-W062	Toxic Characteristic (TC) Contaminated Debris	6.2	5
SR-W069	Low-Level Waste (LLW) Lead – to be Macroencapsulated	73.5	15

Waste Stream No.	Waste Stream Name	Current cumulative inventory through 09/30/94 (m^3)	Future forecast generation (1995-1999) (m^3)
DOE Mobile Treatment Facilities			
SR-W034	Calcium Metal	0.8	0
SR-W036	Tritiated Oil with Mercury	17.2	2.2
Offsite Vendor Facility – Decontamination			
SR-W013	Low-Level Waste (LLW) Lead – to be Decontaminated	82.2	30
Offsite DOE Facility – INEL/WEDF Amalgamation			
SR-W014	Tritium-Contaminated Mercury	0.3	0.1
SR-W061	DWPF Mercury	0	0.9
SR-W068	Elemental (Liquid) Mercury	0.1	0.2
Offsite DOE Facility – INEL/WEDF Stabilization			
SR-W049	Tank E-3-1 Clean Out Material	1.2	0
Waste Streams to be Further Characterized			
SR-W025	Solvent/TRU Job Control Waste <100 nCi/g**	2,744.8	0
SR-W033	Thirds/TRU Job Control Waste <100 nCi/g **	8.0	308
Waste Streams Undergoing Development of Treatment Technology			
SR-W056	Job Control Waste with Enriched Uranium and Solvent Applicators	260	0
TRU Waste Streams			
SR-W006	Mixed TTA/Xylene – TRU	0.1	0
SR-W026	Thirds/TRU Job Control Waste	67	241
SR-W027	Solvent/TRU Job Control Waste	4,873.2	0
Offsite DOE– Rocky Flats Environmental Technology Site			
SR-W053	Rocky Flats Incinerator Ash	0.1	0
Defense Waste Processing Facility			
SR-W016	221-F Canyon High-Level Liquid Waste	53,800	5,464
SR-W017	221-H Canyon High-Level Liquid Waste	73,240	9,970

Waste Stream No.	Waste Stream Name	Current cumulative inventory through 09/30/94 (m^3)	Future forecast generation (1995-1999) (m^3)
Pretreatment as a 90-day Generator at SRTC followed by Vitrification			
SR-W050	Mixed Waste to Support High-Level Waste (HLW) Processing Demonstrations	0.1	0.4
SR-W058	Mixed Sludge Waste with Mercury from DWPF Treatability Studies	0.1	0
Waste Streams Consolidated			
SR-W002	Rad-Contaminated Chlorofluorocarbons	N/A	N/A
SR-W010	Scintillation Solution	N/A	N/A
SR-W019	244-H RBOF High Activity Liquid Waste	N/A	N/A
SR-W030	Spent Methanol Solution	N/A	N/A
SR-W043	Lab Waste w/Tetraphenyl Borate	N/A	N/A
SR-W044	Tri-Butyl-Phosphate & n-Paraffin – TRU	N/A	N/A
SR-W054	Enriched Uranium Contaminated with Lead	N/A	N/A
SR-W059	Tetrabutyl Titanate (TBT)	N/A	N/A
Waste Streams Recharacterized			
SR-W021	Poisoned Catalyst Material	N/A	N/A
SR-W052	Cadmium Contaminated Glovebox Section	N/A	N/A
SR-W057	D-Tested Neutron Generators	N/A	N/A

** Mixed low-level waste conservatively managed as TRU (transuranic waste).

5.4 In-Depth Option Analysis Scoring Summary

Waste Stream No.	Waste Stream Name	Treatment	Facility	Feasible Option	TSF	TSF Y/N	IDOA Tech.	IDOA Total
SR-W009	Silver Coated Packing Material	Stabilization	Vendor	Y	81		56	66
SR-W009	Silver Coated Packing Material	Polymer Encapsulation	Vendor	Y	88		54	64
SR-W009	Silver Coated Packing Material	Macroencapsulation	Containment Bldg.	Y	51		53	65
SR-W009	Silver Coated Packing Material	Macroencapsulation	HW/MW	Y	94		52	61
SR-W009	Silver Coated Packing Material	Metathesis	Containment Bldg.	Y	26	N	32	44
SR-W009	Silver Coated Packing Material	Plasma Arc Cent. Treat.	Vendor	Y	1	N		
SR-W009	Silver Coated Packing Material	Plasma Hearth Process	Vendor	Y	1	N		
SR-W009	Silver Coated Packing Material	Ashcrete Stabilization	CIF	N				
SR-W009	Silver Coated Packing Material	Ion Exchange	ETF	N				
SR-W009	Silver Coated Packing Material	Vitrification	M Area	N				
SR-W009	Silver Coated Packing Material	Incineration/ Stabilization	CIF	N				
SR-W009	Silver Coated Packing Material	Ion Exchange	LETF	N				
SR-W009	Silver Coated Packing Material	Macroencapsulation	Tritium	N				
SR-W009	Silver Coated Packing Material	Stabilization	Z-Area	N				
SR-W011	Cadmium-Coated HEPA Filters	Acid Leach/ Precipitation/ Vitrification	M Area	Y	75		58	71
SR-W011	Cadmium-Coated HEPA Filters	Cement Stabilization	Vendor	Y	75		59	68
SR-W011	Cadmium-Coated HEPA Filters	Macroencapsulation	Containment Bldg.	Y	88		58	69
SR-W011	Cadmium-Coated HEPA Filters	Polymer Encapsulation	Vendor	Y	100		57	66
SR-W011	Cadmium-Coated HEPA Filters	Macroencapsulation	HW/MW	Y	94		58	60
SR-W011	Cadmium-Coated HEPA Filters	Stabilization	INEL/WEDF		*		52	65
SR-W011	Cadmium-Coated HEPA Filters	Plasma Hearth Process	Vendor	Y	1	N		
SR-W011	Cadmium-Coated HEPA Filters	Incineration/ Stabilization	CIF	N				
SR-W011	Cadmium-Coated HEPA Filters	Ion Exchange	ETF	N				
SR-W011	Cadmium-Coated HEPA Filters	Lab-Scale Process Flowsheet	Lab	N				
SR-W011	Cadmium-Coated HEPA Filters	Stabilization	Z Area	N				
SR-W013	Low-Level Waste (LLW) Lead – to be Decontaminated	Decontamination	Vendor	Y	88		69	82
SR-W013	Low-Level Waste (LLW) Lead – to be Decontaminated	Decontamination	Vendor	Y	88		69	82
SR-W013	Low-Level Waste (LLW) Lead – to be Decontaminated	Mineralization	Vendor	Y	26	N		
SR-W013	Low-Level Waste (LLW) Lead – to be Decontaminated	Decontamination	Cont. Bldg. – 299H	Y	51		47	49
SR-W013	Low-Level Waste (LLW) Lead – to be Decontaminated	Incineration/ Stabilization	CIF	N				
SR-W013	Low-Level Waste (LLW) Lead – to be Decontaminated	Vitrification	M Area	N				
SR-W013	Low-Level Waste (LLW) Lead – to be Decontaminated	Ashcrete Stabilization	CIF	N				
SR-W013	Low-Level Waste (LLW) Lead – to be Decontaminated	Ion Exchange	ETF	N				
SR-W013	Low-Level Waste (LLW) Lead – to be Decontaminated	Lab-Scale Process Flowsheet	Lab	N				

Waste Stream No.	Waste Stream Name	Treatment	Facility	Feasible Option	TSF	TSF Y/N	IDOA Tech..	IDOA Total
SR-W013	Low-Level Waste (LLW) Lead – to be Decontaminated	Ion Exchange	LETF	N				
SR-W013	Low-Level Waste (LLW) Lead – to be Decontaminated	Stabilization	Z Area	N				
SR-W014	Tritium-Contaminated Mercury	Distill/Reuse	Containment Bldg.	Y	51		50	60
SR-W014	Tritium-Contaminated Mercury	Distill/Amalgamation	Containment Bldg.	Y	51		43	53
SR-W014	Tritium-Contaminated Mercury	Amalgamation	INEL/WEDF	*			51	64
SR-W014	Tritium-Contaminated Mercury	Distill/Amalgamation	HW/MW	Y	51		43	50
SR-W014	Tritium-Contaminated Mercury	Ashcrete/ Stabilization	CIF	N				
SR-W014	Tritium-Contaminated Mercury	Vitrification	M Area	N				
SR-W014	Tritium-Contaminated Mercury	Incineration/ Stabilization	CIF	N				
SR-W014	Tritium-Contaminated Mercury	Ion Exchange	ETF	N				
SR-W014	Tritium-Contaminated Mercury	Lab-Scale Process Flowsheet	Lab	N				
SR-W014	Tritium-Contaminated Mercury	Ion Exchange	LETF	N				
SR-W014	Tritium-Contaminated Mercury	Stabilization	Z Area	N				
SR-W015	Mercury/Tritium Contaminated Equipment	Macroencapsulation	Containment Bldg.	Y	88		58	68
SR-W015	Mercury/Tritium Contaminated Equipment	In Situ Macroencapsulation	90-Day Generator	Y	94		61	75
SR-W015	Mercury/Tritium Contaminated Equipment	Roasting and Retorting	Containment Bldg.	Y	51		45	51
SR-W015	Mercury/Tritium Contaminated Equipment	Decontamination	INEL/ICPP	*			45	50
SR-W015	Mercury/Tritium Contaminated Equipment	Ashcrete Stabilization	CIF	N				
SR-W015	Mercury/Tritium Contaminated Equipment	Vitrification	M Area	N				
SR-W015	Mercury/Tritium Contaminated Equipment	Incineration/ Stabilization	CIF	N				
SR-W015	Mercury/Tritium Contaminated Equipment	Ion Exchange	ETF	N				
SR-W015	Mercury/Tritium Contaminated Equipment	Lab-Scale Process Flowsheet	Lab	N				
SR-W015	Mercury/Tritium Contaminated Equipment	Ion Exchange	LETF	N				
SR-W015	Mercury/Tritium Contaminated Equipment	Stabilization	Z Area	N				
SR-W018	Filter Paper Take Up Rolls (FPTUR)	Vitrification	M Area	Y	75		56	68
SR-W018	Filter Paper Take Up Rolls (FPTUR)	Macroencapsulation	Containment Bldg.	Y	100		58	66
SR-W018	Filter Paper Take Up Rolls (FPTUR)	Ashcrete Stabilization	CIF	Y	88		54	62
SR-W018	Filter Paper Take Up Rolls (FPTUR)	Stabilization	INEL/WEDF	*			45	59
SR-W018	Filter Paper Take Up Rolls (FPTUR)	Plasma Hearth Process	Vendor	Y	1	N		
SR-W018	Filter Paper Take Up Rolls (FPTUR)	Macroencapsulation	HW/MW	Y	100		58	65
SR-W018	Filter Paper Take Up Rolls (FPTUR)	Incineration/ Stabilization	CIF	Y	94		56	67

Waste Stream No.	Waste Stream Name	Treatment	Facility	Feasible Option	TSF	TSF Y/N	IDOA Tech.	IDOA Total
SR-W018	Filter Paper Take Up Rolls (FPTUR)	Ion Exchange	ETF	N				
SR-W018	Filter Paper Take Up Rolls (FPTUR)	Lab-Scale Process Flowsheet	Lab	N				
SR-W018	Filter Paper Take Up Rolls (FPTUR)	Ion Exchange	LETF	N				
SR-W018	Filter Paper Take Up Rolls (FPTUR)	Stabilization	Z Area	N				
SR-W025	Solvent/TRU Job Control Waste <100 nCi/g	Incineration/ Stabilization	CIF	Y	94		56	67
SR-W025	Solvent/TRU Job Control Waste <100 nCi/g	Macroencapsulation	Containment Bldg.	Y	100		56	65
SR-W025	Solvent/TRU Job Control Waste <100 nCi/g	Incineration/ Stabilization	INEL/IWPF	*			36	60
SR-W025	Solvent/TRU Job Control Waste <100 nCi/g	Vitrification	SRS/AUF	*			53	53
SR-W028	Mark 15 Filter Paper	Vitrification	M Area	Y	75		57	71
SR-W028	Mark 15 Filter Paper	Incineration/ Stabilization	CIF	Y	94		56	70
SR-W028	Mark 15 Filter Paper	Ashcrete Stabilization	CIF	Y	88		53	65
SR-W028	Mark 15 Filter Paper	Macroencapsulation	Containment Bldg.	Y	100		58	70
SR-W028	Mark 15 Filter Paper	Macroencapsulation	HW/MW	Y	100		58	71
SR-W028	Mark 15 Filter Paper	Stabilization	INEL/WEDF	*			52	66
SR-W028	Mark 15 Filter Paper	Plasma Arc Cent. Treat.	Vendor	Y	1	N		
SR-W028	Mark 15 Filter Paper	Plasma Hearth Process	Vendor	Y	1	N		
SR-W028	Mark 15 Filter Paper	Ion Exchange	ETF	N				
SR-W028	Mark 15 Filter Paper	Ion Exchange	LETF	N				
SR-W028	Mark 15 Filter Paper	Lab-Scale Process Flowsheet	Lab	N				
SR-W028	Mark 15 Filter Paper	Stabilization	Z Area	N				
SR-W031	Uranium/Chromium Solution	Vitrification	M-Area Vendor	Y	100		57	71
SR-W031	Uranium/Chromium Solution	Polymer Emulsification	Vendor	Y	88		52	65
SR-W031	Uranium/Chromium Solution	Cement Stabilization	Vendor	Y	75		56	70
SR-W031	Uranium/Chromium Solution	Ashcrete Stabilization	CIF	Y	88		56	69
SR-W031	Uranium/Chromium Solution	In-Drum Stabilization	Containment Bldg.	Y	51		51	65
SR-W031	Uranium/Chromium Solution	Stabilization	INEL/WEDF	*			52	65
SR-W031	Uranium/Chromium Solution	Ion Exchange	ETF	N				
SR-W031	Uranium/Chromium Solution	Ion Exchange	LETF	N				
SR-W031	Uranium/Chromium Solution	Incineration/ Stabilization	CIF	N				
SR-W031	Uranium/Chromium Solution	Lab-scale Process Flowsheet	Lab	N				
SR-W033	Thirds/TRU Job Control Waste <100 nCi/g	Incineration/ Stabilization	CIF	Y	94		56	70
SR-W033	Thirds/TRU Job Control Waste <100 nCi/g	Macroencapsulation	Containment Bldg.	Y	94		56	70
SR-W033	Thirds/TRU Job Control Waste <100 nCi/g	Incineration	INEL/IWPF	*			36	50
SR-W033	Thirds/TRU Job Control Waste <100 nCi/g	Vitrification	SRS/AVF	*			53	53

Waste Stream No.	Waste Stream Name	Treatment	Facility	Feasible Option	TSF	TSF Y/N	IDOA Tech..	IDOA Total
SR-W033	Thirds/TRU Job Control Waste <100 nCi/g	Ion Exchange	EIF	N				
SR-W033	Thirds/TRU Job Control Waste <100 nCi/g	Ion Exchange	LETF	N				
SR-W033	Thirds/TRU Job Control Waste <100 nCi/g	Lab-scale Process Flowsheet	Lab	N				
SR-W033	Thirds/TRU Job Control Waste <100 nCi/g	Vitrification	M Area	N				
SR-W033	Thirds/TRU Job Control Waste <100 nCi/g	Macroencapsulation	Tritium	N				
SR-W033	Thirds/TRU Job Control Waste <100 nCi/g	Stabilization	Z Area	N				
SR-W033	Thirds/TRU Job Control Waste <100 nCi/g	Incineration/ Stabilization	INEL/WERF	N				
SR-W033	Thirds/TRU Job Control Waste <100 nCi/g	Stabilization	INEL/WEDF	N				
SR-W034	Calcium Metal	Water Oxidation	Containment Bldg.	Y	51		68	82
SR-W034	Calcium Metal	CO_2 Oxidation	Vendor	Y	100		65	78
SR-W034	Calcium Metal	Acid Oxidation	M Area	Y	88		63	77
SR-W034	Calcium Metal	Vitrification	Vendor	Y	26	N		
SR-W034	Calcium Metal	Plasma Hearth Process	Vendor	Y	1	N		
SR-W034	Calcium Metal	Water Oxidation	DOE Mobile Unit	Y	51		68	82
SR-W034	Calcium Metal	Stabilization	INEL/WEDF	*			51	65
SR-W034	Calcium Metal	Ashcrete Stabilization	CIF	N				
SR-W034	Calcium Metal	Ion Exchange	EIF	N				
SR-W034	Calcium Metal	Stabilization	Z Area	N				
SR-W036	Tritiated Oil with Mercury	Packed Bed Incineration	DOE Mobile Unit	Y	13		38	51
SR-W036	Tritiated Oil with Mercury	Storage & Incineration	CIF	Y	94		64	75
SR-W036	Tritiated Oil with Mercury	Treatability Variance		Y	100		45	59
SR-W036	Tritiated Oil with Mercury	Stabilization	INEL/WEDF	*				
SR-W036	Tritiated Oil with Mercury	Incineration/ Stabilization	INEL/WERF	*				
SR-W036	Tritiated Oil with Mercury	Thermal Destruction	Vendor	N				
SR-W036	Tritiated Oil with Mercury	Incineration/ Stabilization	CIF	N				
SR-W036	Tritiated Oil with Mercury	Vitrification	M Area	N				
SR-W036	Tritiated Oil with Mercury	Ashcrete Stabilization	CIF	N				
SR-W036	Tritiated Oil with Mercury	Ion Exchange	EIF	N				
SR-W036	Tritiated Oil with Mercury	Ion Exchange	LETF	N				
SR-W036	Tritiated Oil with Mercury	Lab-scale Process Flowsheet	Lab	N				
SR-W036	Tritiated Oil with Mercury	Stabilization	Z Area	N				
SR-W041	Aqueous Mercury and Lead	Ion Exchange	EIF	Y	94		66	80
SR-W041	Aqueous Mercury and Lead	Cement Stabilization	Vendor	Y	75		59	73
SR-W041	Aqueous Mercury and Lead	Polymer Encapsulation	Vendor.	Y	88		58	72
SR-W041	Aqueous Mercury and Lead	In-Drum Stabilization	Containment Bldg..	Y	51		52	65
SR-W041	Aqueous Mercury and Lead	Precipitation	Vendor	Y	88		44	56
SR-W041	Aqueous Mercury and Lead	Stabilization	INEL/WEDF	*			52	65
SR-W041	Aqueous Mercury and Lead	Ashcrete Stabilization	CIF	N				

Waste Stream No.	Waste Stream Name	Treatment	Facility	Feasible Option	TSF	TSF Y/N	IDOA Tech.	IDOA Total
SR-W041	Aqueous Mercury and Lead	Incineration/ Stabilization	CIF	N				
SR-W041	Aqueous Mercury and Lead	Vitrification	M Area	N				
SR-W041	Aqueous Mercury and Lead	Stabilization	Z Area	N				
SR-W042	Paints and Thinners	Incineration/ Stabilization	CIF	Y	94		60	74
SR-W042	Paints and Thinners	Stabilization	INEL/WEDF	*			52	65
SR-W042	Paints and Thinners	Incineration/ Stabilization	INEL/WERF	*			49	63
SR-W042	Paints and Thinners	Ion Exchange	EIF	N				
SR-W042	Paints and Thinners	Vitrification	M Area	N				
SR-W042	Paints and Thinners	Ion Exchange	LETF	N				
SR-W042	Paints and Thinners	Ashcrete Stabilization	CIF	N				
SR-W042	Paints and Thinners	Stabilization	Z Area	N				
SR-W045	Tri-Butyl-Phosphate and n-Paraffin	Incineration/ Stabilization	CIF	Y	94		61	75
SR-W045	Tri-Butyl-Phosphate and n-Paraffin	Fluidized Bed Combustion	Vendor	Y	13	N		
SR-W045	Tri-Butyl-Phosphate and n-Paraffin	Catalyzed Wet Oxid.	Vendor	Y	1	N		
SR-W045	Tri-Butyl-Phosphate and n-Paraffin	Pyrolysis	Vendor	Y	1	N		
SR-W045	Tri-Butyl-Phosphate and n-Paraffin	Thermal Destruction	Vendor	N				
SR-W045	Tri-Butyl-Phosphate and n-Paraffin	Vitrification	M Area	N				
SR-W045	Tri-Butyl-Phosphate and n-Paraffin	Ashcrete Stabilization	CIF	N				
SR-W045	Tri-Butyl-Phosphate and n-Paraffin	Ion Exchange	EIF	N				
SR-W045	Tri-Butyl-Phosphate and n-Paraffin	Ion Exchange	LETF	N				
SR-W045	Tri-Butyl-Phosphate and n-Paraffin	Lab-scale Process Flowsheet	Lab	N				
SR-W045	Tri-Butyl-Phosphate and n-Paraffin	Stabilization	Z Area	N				
SR-W048	Soils from Spill Remediation	Vitrification	M Area	Y	63		59	68
SR-W048	Soils from Spill Remediation	Polymer Encapsulation	Vendor	Y	100		59	68
SR-W048	Soils from Spill Remediation	Cement Stabilization	Vendor	Y	75		56	61
SR-W048	Soils from Spill Remediation	Soil Washing	Vendor	Y	75		48	55
SR-W048	Soils from Spill Remediation	Chelation	Vendor	Y	81		46	55
SR-W048	Soils from Spill Remediation	Soil Washing	HW/MW	Y	51		47	47
SR-W048	Soils from Spill Remediation	Metal Migration	Containment Bldg.	Y	26	N		
SR-W048	Soils from Spill Remediation	Plasma Hearth Process	Vendor	Y	1	N		
SR-W048	Soils from Spill Remediation	Vitrification	Vendor	Y	38	N		
SR-W048	Soils from Spill Remediation	Incineration	INEL/IWPF	*			35	49
SR-W048	Soils from Spill Remediation	Plasma Arc Remediation	Vendor.	Y	1	N		
SR-W048	Soils from Spill Remediation	Incineration/ Stabilization	CIF	N				

Waste Stream No.	Waste Stream Name	Treatment	Facility	Feasible Option	TSF	TSF Y/N	IDOA Tech.	IDOA Total
SR-W048	Soils from Spill Remediation	Ashcrete Stabilization	CIF	N				
SR-W048	Soils from Spill Remediation	Ion Exchange	ETF	N				
SR-W048	Soils from Spill Remediation	Ion Exchange	LETF	N				
SR-W048	Soils from Spill Remediation	Lab-scale Process Flowsheet	Lab	N				
SR-W048	Soils from Spill Remediation	Stabilization	Z Area	N				
SR-W049	Tank E-3-1 Clean-Out Mat'l.	Soil Washing	HW/MW	Y	51		47	61
SR-W049	Tank E-3-1 Clean-Out Mat'l.	Ashcrete Stabilization	CIF	Y	75		54	65
SR-W049	Tank E-3-1 Clean-Out Mat'l.	Metal Migration	Containment Bldg.	Y	26	N		
SR-W049	Tank E-3-1 Clean-Out Mat'l.	Stabilization	INEL/WEDF	*			55	69
SR-W049	Tank E-3-1 Clean-Out Mat'l.	Vitrification	M Area	N				
SR-W049	Tank E-3-1 Clean-Out Mat'l.	Incineration/ Stabilization	CIF	N				
SR-W049	Tank E-3-1 Clean-Out Mat'l.	Ion Exchange	ETF	N				
SR-W049	Tank E-3-1 Clean-Out Mat'l.	Lab-scale Process Flowsheet	Lab	N				
SR-W049	Tank E-3-1 Clean-Out Mat'l.	Stabilization	Z Area	N				
SR-W051	Spent Filter Cartridges and Carbon Filter Media	Incineration/ Stabilization	CIF	Y	94		59	73
SR-W051	Spent Filter Cartridges and Carbon Filter Media	Polymer Encapsulation	Vendor	Y	100		57	71
SR-W051	Spent Filter Cartridges and Carbon Filter Media	Macroencapsulation	HW/MW	Y	100		58	72
SR-W051	Spent Filter Cartridges and Carbon Filter Media	Macroencapsulation	Containment Bldg.	Y	94		58	72
SR-W051	Spent Filter Cartridges and Carbon Filter Media	Acid Leach	Containment Bldg.	Y	32	N		
SR-W051	Spent Filter Cartridges and Carbon Filter Media	Plasma Hearth Process	Vendor	Y	1	N		
SR-W051	Spent Filter Cartridges and Carbon Filter Media	Incineration/ Stabilization	INEL/WERF	*			52	66
SR-W051	Spent Filter Cartridges and Carbon Filter Media	Vitrification	M Area	N				
SR-W051	Spent Filter Cartridges and Carbon Filter Media	Ion Exchange	ETF	N				
SR-W051	Spent Filter Cartridges and Carbon Filter Media	Macroencapsulation	Tritium	N				
SR-W051	Spent Filter Cartridges and Carbon Filter Media	Stabilization	Z Area	N				
SR-W053	Rocky Flats Incinerator Ash	Ashcrete Stabilization	CIF	Y	88		54	67
SR-W053	Rocky Flats Incinerator Ash	Return To Rocky Flats	Other DOE – Ship Back	Y	100		76	90
SR-W053	Rocky Flats Incinerator Ash	Vitrification	M Area	N				
SR-W053	Rocky Flats Incinerator Ash	Incineration/ Stabilization	CIF	N				
SR-W053	Rocky Flats Incinerator Ash	Ion Exchange	ETF	N				
SR-W053	Rocky Flats Incinerator Ash	Stabilization	Z Area	N				
SR-W055	Job Control Waste Containing Solvent Contaminated Wipes	Incineration/ Stabilization	CIF	Y	94		57	67
SR-W055	Job Control Waste Containing Solvent Contaminated Wipes	Stabilization	INEL/WEDF	*			52	54

Waste Stream No.	Waste Stream Name	Treatment	Facility	Feasible Option	TSF	TSF Y/N	IDOA Tech.	IDOA Total
SR-W055	Job Control Waste Containing Solvent Contaminated Wipes	Incineration/ Stabilization	INEL/WERF	*			49	52
SR-W055	Job Control Waste Containing Solvent Contaminated Wipes	Incineration/ Stabilization	INEL/IWPF	*			36	39
SR-W055	Job Control Waste Containing Solvent Contaminated Wipes	Ion Exchange	ETF	N				
SR-W055	Job Control Waste Containing Solvent Contaminated Wipes	Vitrification	M Area	N				
SR-W055	Job Control Waste Containing Solvent Contaminated Wipes	Lab-scale Process Flowsheet	Lab	N				
SR-W055	Job Control Waste Containing Solvent Contaminated Wipes	Ion Exchange	LETF	N				
SR-W055	Job Control Waste Containing Solvent Contaminated Wipes	Macroencapsulation	Tritium	N				
SR-W055	Job Control Waste Containing Solvent Contaminated Wipes	Stabilization	Z Area	N				
SR-W060	Tritiated Water with Mercury	Macroencapsulation	None	Y	100		57	71
SR-W060	Tritiated Water with Mercury	Roast & Retort	Containment Bldg.	Y	51		47	56
SR-W060	Tritiated Water with Mercury	Repckg. Roast & Retort	Containment Bldg.	Y	51		46	54
SR-W060	Tritiated Water with Mercury	Incineration/ Stabilization	CIF	N				
SR-W060	Tritiated Water with Mercury	Ashcrete Stabilization	CIF	N				
SR-W060	Tritiated Water with Mercury	Ion Exchange	ETF	N				
SR-W060	Tritiated Water with Mercury	Amalgamation	INEL	N				
SR-W060	Tritiated Water with Mercury	Ion Exchange	LETF	N				
SR-W060	Tritiated Water with Mercury	Vitrification	M Area	N				
SR-W060	Tritiated Water with Mercury	Stabilization	Z Area	N				
SR-W061	DWPF Mercury	Amalgamation	INEL/WEDF	*			51	65
SR-W061	DWPF Mercury	Distill/Reuse	Containment Bldg.	Y	51		43	57
SR-W061	DWPF Mercury	Amalgamation	Containment Bldg.	Y	51		50	63
SR-W061	DWPF Mercury	Amalgamation	HW/MW-TB	Y	51		50	62
SR-W061	DWPF Mercury	Incineration/ Stabilization	CIF	N				
SR-W061	DWPF Mercury	Ashcrete Stabilization	CIF	N				
SR-W061	DWPF Mercury	Ion Exchange	ETF	N				
SR-W061	DWPF Mercury	Ion Exchange	LETF	N				
SR-W061	DWPF Mercury	Vitrification	M Area	N				
SR-W061	DWPF Mercury	Stabilization	Z Area	N				
SR-W062	Toxic Characteristic (TC) Contaminated Debris	Macroencapsulation	Containment Bldg.	Y	100		55	68
SR-W062	Toxic Characteristic (TC) Contaminated Debris	Macroencapsulation	Containment Bldg.	Y	94		48	58
SR-W062	Toxic Characteristic (TC) Contaminated Debris	Stabilization	INEL/WEDF	•			40	53
SR-W062	Toxic Characteristic (TC) Contaminated Debris	Incineration/ Stabilization	CIF	N				
SR-W062	Toxic Characteristic (TC) Contaminated Debris	Vitrification	M Area	N				
W062	Toxic Characteristic (TC) Contaminated Debris	Ashcrete Stabilization	CIF	N				

Waste Stream No.	Waste Stream Name	Treatment	Facility	Feasible Option	TSF	TSF Y/N	IDOA Tech.	IDOA Total
SR-W062	Toxic Characteristic (TC) Contaminated Debris	Ion Exchange	EIF	N				
SR-W062	Toxic Characteristic (TC) Contaminated Debris	Ion Exchange	LETF	N				
SR-W062	Toxic Characteristic (TC) Contaminated Debris	Stabilization	Z Area	N				
SR-W068	Elemental (Liquid) Mercury	Amalgamation	INEL/WEDF	*			51	64
SR-W068	Elemental (Liquid) Mercury	Distill/Reuse	Containment Bldg.	Y	51		51	62
SR-W068	Elemental (Liquid) Mercury	Distill/Amalgamation	Containment Bldg.	Y	51		46	56
SR-W068	Elemental (Liquid) Mercury	Distill/Amalgamation	HW/MW	Y	51		42	49
SR-W068	Elemental (Liquid) Mercury	Ashcrete Stabilization	CIF	N				
SR-W068	Elemental (Liquid) Mercury	Ion Exchange	EIF	N				
SR-W068	Elemental (Liquid) Mercury	Vitrification	M Area	N				
SR-W068	Elemental (Liquid) Mercury	Stabilization	Z Area	N				
SR-W068	Elemental (Liquid) Mercury	Ion Exchange	LETF	N				
SR-W068	Elemental (Liquid) Mercury	Incineration/ Stabilization	CIF	N				
SR-W069	Low-Level Waste (LLW) Lead – to be Macroencapsulated	Polymer Encapsulation	Vendor	Y	100		57	64
SR-W069	Low-Level Waste (LLW) Lead – to be Macroencapsulated	Macroencapsulation	Containment Bldg.	Y	75		55	56
SR-W069	Low-Level Waste (LLW) Lead – to be Macroencapsulated	Macroencapsulation	HW/MW	Y	81		53	53
SR-W069	Low-Level Waste (LLW) Lead – to be Macroencapsulated	Stabilization	INEL/WEDF	*			46	54
SR-W069	Low-Level Waste (LLW) Lead – to be Macroencapsulated	Macroencapsulation	INEL/WEDF	*			46	54
SR-W069	Low-Level Waste (LLW) Lead – to be Macroencapsulated	Ashcrete Stabilization	CIF	N				
SR-W069	Low-Level Waste (LLW) Lead – to be Macroencapsulated	Incineration/ Stabilization	CIF	N				
SR-W069	Low-Level Waste (LLW) Lead – to be Macroencapsulated	Ion Exchange	EIF	N				
SR-W069	Low-Level Waste (LLW) Lead – to be Macroencapsulated	Ion Exchange	LETF	N				
SR-W069	Low-Level Waste (LLW) Lead – to be Macroencapsulated	Lab-scale Process Flowsheet	Lab	N				
SR-W069	Low-Level Waste (LLW) Lead – to be Macroencapsulated	Vitrification	M Area	N				
SR-W069	Low-Level Waste (LLW) Lead – to be Macroencapsulated	Stabilization	Z Area	N				
SR-W069	Low-Level Waste (LLW) Lead – to be Macroencapsulated	Macroencapsulation	Vendor Macroencapsulation	N				
SR-W069	Low-Level Waste (LLW) Lead – to be Macroencapsulated	Surface Coating	DOE	N				
SR-W070	Mixed Waste from Laboratory Samples	Incineration/ Stabilization	CIF	Y	100		65	79
SR-W070	Mixed Waste from Laboratory Samples	Ashcrete Stabilization	CIF	Y	88		63	77
SR-W070	Mixed Waste from Laboratory Samples	Stabilization	Containment Bldg.	Y	75		59	72
SR-W070	Mixed Waste from Laboratory Samples	Ion Exchange	EIF	N				

Waste Stream No.	Waste Stream Name	Treatment	Facility	Feasible Option	TSF	TSF Y/N	IDOA Tech.	IDOA Total
SR-W070	Mixed Waste from Laboratory Samples	Vitrification	M Area	N				
SR-W070	Mixed Waste from Laboratory Samples	Stabilization	Z Area	N				
SR-W071	Wastewater from TRU Drum Dewatering	Incineration/ Stabilization	CIF	Y	100		65	79
SR-W071	Wastewater from TRU Drum Dewatering	Ashcrete Stabilization	CIF	Y	88		63	77
SR-W071	Wastewater from TRU Drum Dewatering	Stabilization	Containment Bldg.	Y	75		59	72
SR-W071	Wastewater from TRU Drum Dewatering	Ion Exchange	EIF	N				
SR-W071	Wastewater from TRU Drum Dewatering	Vitrification	M Area	N				
SR-W071	Wastewater from TRU Drum Dewatering	Stabilization	Z Area	N				
SR-W072	Supernatant or Sludge Contaminated Debris from High-Level Waste (HLW) Operations	Decontamination	Containment Bldg.	Y	94		58	60
SR-W072	Supernatant or Sludge Contaminated Debris from High-Level Waste (HLW) Operations	Decontamination	HW/MW-TB	Y	94		57	57
SR-W072	Supernatant or Sludge Contaminated Debris from High-Level Waste (HLW) Operations	Decontamination	INEL/ICPP	*			47	47
SR-W072	Supernatant or Sludge Contaminated Debris from High-Level Waste (HLW) Operations	Macroencapsulation	Cont. Bldg.		94		48	48
SR-W072	Supernatant or Sludge Contaminated Debris from High-Level Waste (HLW) Operations	Ashcrete Stabilization	CIF	N				
SR-W072	Supernatant or Sludge Contaminated Debris from High-Level Waste (HLW) Operations	Incineration/ Stabilization	CIF	N				
SR-W072	Supernatant or Sludge Contaminated Debris from High-Level Waste (HLW) Operations	Ion Exchange	EIF	N				
SR-W072	Supernatant or Sludge Contaminated Debris from High-Level Waste (HLW) Operations	Ion Exchange	LETF	N				
SR-W072	Supernatant or Sludge Contaminated Debris from High-Level Waste (HLW) Operations	Lab-scale Process Flowsheet	Lab	N				
SR-W072	Supernatant or Sludge Contaminated Debris from High-Level Waste (HLW) Operations	Vitrification	M Area	N				
SR-W072	Supernatant or Sludge Contaminated Debris from High-Level Waste (HLW) Operations	Stabilization	Z Area	N				

Waste Stream No.	Waste Stream Name	Treatment	Facility	Feasible Option	TSF	TSF Y/N	IDOA Tech.	IDOA Total
SR-W073	Plastic/Lead/Cd Raschig Ring	Incineration/ Stabilization	CIF	Y	94		62	74
SR-W073	Plastic/Lead/Cd Raschig Ring	Stabilization	Containment Bldg.	Y	100		57	70
SR-W073	Plastic/Lead/Cd Raschig Ring	Ion Exchange	EIF	N				
SR-W073	Plastic/Lead/Cd Raschig Ring	Vitrification	M Area	N				
SR-W073	Plastic/Lead/Cd Raschig Ring	Stabilization	Z Area	N				

* No TSF required for proposed or existing non-Savannah River Site - DOE waste processing facilities.

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6.0 ABBREVIATIONS AND ACRONYMS

– A –

ADGAS	Venting of compressed gases into an absorbing or reacting media
AEA	Atomic Energy Act
Ag	Silver
ALARA	As Low As Reasonably Achievable
Am	Americium
AMALG	Amalgamation
AOC	Area of Contamination
As	Arsenic
ASME	American Society of Mechanical Engineers
AVF	Alpha Vitrification Facility

– B –

B/D	Blowdown
Ba	Barium
BACT	Best Available Control Technology
BDAT	Best Demonstrated Available Technology
BIODG	Biodegradation
BLEAD	Thermal Recovery of Lead
BOD	Biological Oxygen Demand
Br	Bromine
BTU	British Thermal Unit

– C –

C	Carbon
Ca	Calcium
CAA	Clean Air Act
CAB	Citizens Advisory Board
CARBN	Carbon Adsorption
CB	Containment Building
CCMC	Chemical Commodity Management Center
Cd	Cadmium
Ce	Cerium
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
Cf	Consequence of Failure
CFR	Code of Federal Regulations
CH	Contact Handled
Chem	Chemical

CHOXD	Chemical or Electrolytic Oxidation
CHRED	Chemical Reduction
Ci	Curie
CIF	Consolidated Incineration Facility
Cm	Curium
CMBST	Combustion
Co	Cobalt
CO_2	Carbon Dioxide
COBRA	Computerized Radioactive Waste Burial Record Analysis
Cont. Bldg.	Containment Building
Cr	Chromium
Cs	Cesium
CSTP	Conceptual Site Treatment Plan
CTF	Chemical Transfer Facility
CWA	Clean Water Act
°C	Degrees Celsius

– D –

D&D	Decontamination and Decommissioning
DEACT	Deactivation
Decon	Decontamination
Dest	Destruction (Thermal Destruction)
DETF	Dilute Effluent Treatment Facility
DF	Disposal Facility
Distill	Distillation
DOD	Department of Defense
DOE	Department of Energy
DOE-HQ	Department of Energy – Headquarters
DOE-SR	Department of Energy – Savannah River Office
DOT	Department of Transportation
DSTP	Draft Site Treatment Plan
DWPF	Defense Waste Processing Facility

– E –

EA	Environmental Assessment
EAV	E-Area Vaults
EC	Environmental Coordinator
ECM	Environmental Compliance Manual
EIS	Environmental Impact Statement
EM	DOE Office of Environmental Restoration and Waste Management
EPA	Environmental Protection Agency

EPCRA	Emergency Planning and Community Right-to-Know Act
EPD	Environmental Protection Department
ER	Environmental Restoration
ETF	Effluent Treatment Facility
ETWAF	Experimental Transuranic Waste Assay Facility
EU	Enriched Uranium
Eu	Europium

– F –

FBC	Fluidized Bed Combustion
FFA	Federal Facility Agreement
FFCA	Federal Facility Compliance Agreement
FFCAct	Federal Facility Compliance Act
FMWIR	Final Mixed Waste Inventory Report
FONSI	Finding of No Significant Impact
FP	Filter Paper
FPR	Functional Performance Requirements
FPTUR	Filter Paper Take-Up Rolls
FR	Federal Register
FSUBS	Fuel Substitution
FY	Fiscal Year
FYP	Five Year Plan

– G –

g or gm	Gram
GAC	Granular Activated Carbon
GAO	Government Accounting Office
GOCO	Government Owned Contractor Operated

– H –

H	Hydrogen
H^3	Tritium
HATF	High Activity Transuranic Facility
HBL	Health Based Levels
HEPA	High Efficiency Particulate Air
Hg	Mercury
HL	High Level
HLLW	High Level Liquid Waste
HLVIT	High Level Vitrification
HLW	High-Level Radioactive Waste or High-Level Waste
HSWA	Hazardous and Solid Waste Amendments

HW	Hazardous Waste
HW/MW	Hazardous Waste/Mixed Waste
HW/MW DV	Hazardous Waste/Mixed Waste Disposal Vaults
HW/MW-TB	Hazardous Waste/Mixed Waste Treatment Building
HWCTR	Heavy Water Components Test Reactor
HWSF	Hazardous Waste Storage Facility

– I –

I	Iodine
ICP	Ion Column Partitioning
ICPP	Idaho Chemical Processing Plant
ID	Idaho
IDOA	In-Depth Options Analysis
IDW	Investigation Derived Waste
IDW	Investigative Derived Waste
IMERC	Incineration of Wastes Containing Organics and Mercury
IMWIR	Interim Mixed Waste Inventory Report
INCIN	Incineration
INEL	Idaho National Engineering Laboratory
ITP	In-Tank Precipitation
IWPF	Idaho Waste Processing Facility
IWT	Interim Waste Technology

– J –

JCW	Job Control Wastes

– K –

K	Potassium
kg	Kilogram

– L –

L	Liter
LAER	Lowest Achievable Emission Rate
LATF	Low Activity Transuranic Facility
LATF	Low Activity TRU Facility
LAW	Low Activity Waste
LDR	Land Disposal Restrictions
LETF	Liquid Effluent Treatment Facility
LLNL	Lawrence Livermore National Laboratory
LLW	Low-Level Waste
LW	Late Wash

– M –

m	Meter
MACRO	Macroencapsulation
mg	Milligram
MGD	Million gallons/day
Mil	Million
mil	Millimeter
MLLW	Mixed Low-Level Waste
mm	Millimeter
MOU	Memorandum of Understanding
mrem	One-thousandth of a rem
MSDS	Material Safety Data Sheet
MTRU	Mixed Transuranic Waste
MWIP	Mixed Waste Integrated Program
MWIR	Mixed Waste Inventory Report
MWSB	Mixed Waste Storage Building
MWST	Mixed Waste Storage Tanks

– N –

N	Nitrogen
Na	Sodium
NASA	National Aeronautics and Space Administration
Nb	Niobium
NDA	Non-Destructive Analysis
NDE	Nondestructive Evaluation
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NEUTR	Neutralization
NF	Naval Fuels
Ni	Nickel
NMD	No-Migration Determination
NMP	No-Migration Petition
NMV	No Migration Variance
NOI	Notice of Intent
Np	Neptunium
NPDES	National Pollution Discharge Elimination System
NPL	National Priorities List
NPV	Net Present Value
NRC	Nuclear Regulatory Commission
NTPO	National Transuranic Program Office

NWW	Non wastewater

– O –

O	Oxygen
O&M	Operations and Maintenance
OGC	Office of General Council
OR	Oak Ridge
ORR	Operational Readiness Review
OSHA	Occupational Safety and Health Administration
OTD	Office of Technology Development
OWST	Organic Waste Storage Tank
Ox	Oxidation

– P –

P	Phosphorus
PA	Performance Assessment
PAC	Powdered Activated Carbon
Pb	Lead
Pc	Complexity Factor
PCC	Primary Combustion Chamber
PEIS	Programmatic Environmental Impact Statement
Pf	Probability Factor
Pm	Maturity Factor
Pm	Promethium
PO	Preferred Option
PPA	Pollution Prevention Act
PPE	Personal Protective Equipment
ppm	Parts Per Million
ppt	Parts Per Trillion
Pr	Praseodymium
Pre-Op	Pre-Operational
Precip	Precipitation
PRECP	Precipitation
PSD	Prevention of Significant Deterioration
psig	Pounds per Square Inch Gauge
PSTP	Proposed Site Treatment Plan
Pu	Plutonium
Pu Sep	Plutonium Separation
PUREX	Plutonium Uranium Extraction
PVC	Polyvinyl Chloride
PWIT	Process Waste Interim Treatment

PWIT/SF	Process Waste Interim Treatment/Storage Facility
Pyrol	Pyrolysis

– Q –

QA	Quality Assurance
QC	Quality Control

– R –

R&D	Research and Development
R&R	Roast/Retort
RA	Remedial Action
Rad	Radiation
RBOF	Receiving Basin for Offsite Fuel
RCA	Radiologically Controlled Area
RCRA	Resource Conservation and Recovery Act
React	Reaction
rem	Roentgen Equivalent Man
RF	Risk Factor
RFERTS	Rocky Flats Environmental Technology Site
RFP	Request For Proposal
RH	Remote-Handled Waste
Rh	Rhodium
RL	Richland, Washington (Hanford)
RLEAD	Thermal Recovery of Lead
RMERC	Retorting or Roasting
RMETL	Recovery of metals or inorganics
RMMA	Radioactive Materials Management Area
RO	Reverse Osmosis
ROD	Record of Decision
RORGS	Recovery of Organics
RTHRM	Thermal recovery of metals or inorganics
RTR	Real Time Radiography
Ru	Ruthenium

– S –

S.S.	Stainless Steel
SAA	Satellite Accumulation Area
SAR	Safety Analysis Report
SARP	Safety Analysis Report for Packaging
Sb	Antimony
Sc	Scandium

SCC	Secondary Combustion Chamber
SCDHEC	South Carolina Department of Health and Environmental Control
SCHWMR	South Carolina Hazardous Waste Management Regulation
Se	Selenium
SED	Special Equipment Development
SEIS	Supplemental Environmental Impact Statement
SFIA	Surplus Facilities Inventory Assessment
SMPD	Sample Management Program Department
SNM	Special Nuclear Material
SR	Savannah River
Sr	Strontium
SR-WXXX	Savannah River – Waste XXX
SRL	Savannah River Laboratory (old reference – currently known as Savannah River Technology Center)
SRS	Savannah River Site
SRTC	Savannah River Technology Center (previously known as Savannah River Laboratory)
Stab	Stabilization
STABL	Stabilization
STP	Site Treatment Plan
SWDF	Solid Waste Disposal Facility
SWMD	Solid Waste Management Department

– T –

TAC	Technical Advisory Committee
TB	Treatment Building
TBD	To Be Determined
TBT	Tetrabutyl Titanate
TC	Toxic Characteristic
Tc	Technetium
TCLP	Toxicity Characteristic Leaching Procedure
TEC	Total Estimated Cost
Thermal Dest	Thermal Destruction
TOC	Total Organic Carbon
TPB	Tetraphenyl borate
TRU	Transuranic
TSCA	Toxic Substance Control Act
TSD	Treatment, Storage, and Disposal
TSF	Technology Success Factor
TSS	Total Suspended Solids
TTA	Thenoyl Trifluoroacetone
TWCCF	Transuranic Waste Certification/Characterization Facility

TWF	Transuranic Waste Facility

– U –

U	Uranium
USAEC	United States Atomic Energy Commission
USC	University of South Carolina
USC	United States Code
USQ	Unreviewed Safety Question
UV	Ultraviolet

– V –

VES	Vinyl Ester Styrene
VOC	Volatile Organic Compounds
Vol	Volume

– W –

WAC	Waste Acceptance Criteria
WBS	Work Breakdown Structure
WEDF	Waste Engineering Development Facility
WERF	Waste Experimental Reduction Facility
WIPP	Waste Isolation Pilot Plant
WITS	Waste Information Tracking System
WMEIS	Waste Management Environmental Impact Statement
WMin/PP	Waste Minimization/Pollution Prevention
WSRC	Westinghouse Savannah River Company
Wt	Weight
WW	Wastewater
WWT	Wastewater Treatment
WWTF	Wastewater Treatment Facility

– X –

– Y –

Y	Yttrium

– Z –

Zr	Zirconium

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