DOE/SRS-WD-2011-001
Revision 0

Approach to Documenting Removal of Radionuclides to Support DOE Closure Authorization

June 2011

APPROVALS

Approval:

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June 15, 2011
Date

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ACRONYMS/ABBREVIATIONS

DOE	United States Department of Energy
DOE-SR	United States Department of Energy-Savannah River Operations Office
EPA	United States Environmental Protection Agency
FTF	F-Tank Farm
HEPA	High Efficiency Particulate Air
HRR	Highly Radioactive Radionuclide
HTF	H-Tank Farm
NDAA	Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005
PA	Performance Assessment
SCDHEC	South Carolina Department of Health and Environmental Control
SRS	Savannah River Site

1.0 EXECUTIVE SUMMARY

The discussions presented in this document outline and describe the approach used by the Department of Energy (DOE) for each of the Savannah River Site (SRS) waste tanks or ancillary structures to document removal of radionuclides, with emphasis on highly radioactive radionuclides (HRRs), as documented in the applicable Basis Document supporting the applicable determination by the Secretary, in consultation with the Nuclear Regulatory Commission, under Section 3116(a) of the Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005 (NDAA). This approach consists of the following phases: initial technology selection, technology implementation, technology execution, technology effectiveness evaluation and additional technology evaluation. For each waste tank or ancillary structure, documentation or information collected from each phase of the process eventually contributes to a removal report describing removal of radionuclides, with emphasis on HRRs, for that particular waste tank or ancillary structure. In some instances a report may be written to capture more than one tank or ancillary structure if several are removed from service at the same time. The removal report further integrates into documentation supporting removal from service and stabilization of waste tanks and ancillary structures in support of eventual closure of the SRS tank farms. The information documented in the removal report is utilized by the Department of Energy-Savannah River Operations Office (DOE-SR) to support Tier 2 Closure Authorization.

2.0 CLOSURE APPROACH

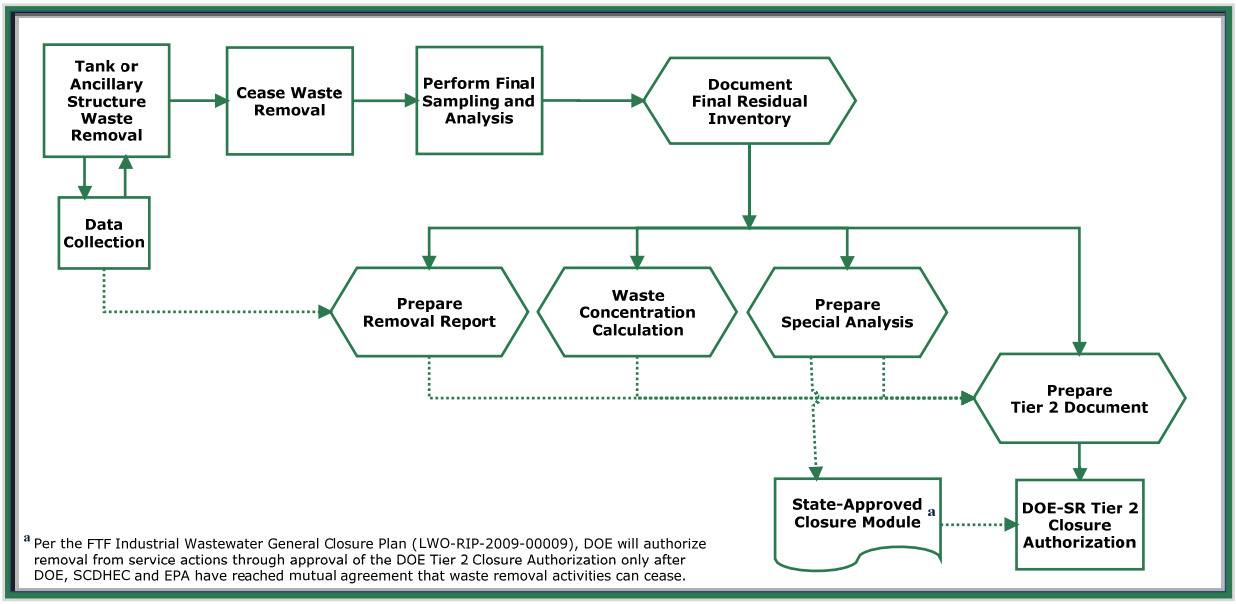
In order to proceed with closure of the F-Tank Farm (FTF) and the H-Tank Farm (HTF) at the SRS, DOE Manual 435.1-1, DOE Guide 435.1-1 and DOE practice requires that DOE issue Tier 1 Closure Authorization specifying the requirements necessary to achieve closure. The Tier 1 closure documentation defines the parameters, approach and plans by which tank farm closure activities will be accomplished. Once the specified documentation has been approved, an Authorization to Proceed will be issued. [DOE M 435.1-1, DOE G 435.1-1] At SRS, separate Tier 1 closure documentation will be issued for FTF and HTF. The tank farm-specific Tier 1 closure documentation requirements are anticipated to include the following documentation:

- Appropriate National Environmental Policy Act documentation
- Tank Farm specific (FTF or HTF) Performance Assessment (PA)
- SRS Composite Analysis
- Tank Farm specific (FTF or HTF) NDAA 3116 Determination by the Secretary, and its supporting 3116 Basis Document
- State-approved Tank Farm specific (FTF or HTF) Industrial Wastewater General Closure Plan

At the completion of waste removal activities for a specific waste tank or ancillary structure, the individual tank or structure is removed from service. As required by DOE Manual 435.1-1, DOE Guide 435.1-1 and DOE practice, approval to proceed with permanent stabilization of the specific waste tank or ancillary structure will be based on Tier 2 closure documentation. [DOE M 435.1-1, DOE G 435.1-1] This Tier 2 closure documentation provides the waste tank-specific or ancillary structure-specific information demonstrating that the process described in the Tier 1 closure documentation has been implemented and the criteria required by the Tier 1 closure

documentation have been met. Figure 2-1 shows the documentation pathway that leads to Tier 2 Closure Authorization. Tier 2 Authorization to proceed with closure (e.g., stabilization activities) will be issued by the Manager for DOE-SR.

Figure 2-1: Tier 2 Closure Authorization



3.0 RADIONUCLIDE REMOVAL PROCESS TO SUPPORT TIER 2 CLOSURE AUTHORIZATION

3.1 General Approach

The following section describes the progression of defined stages that must be utilized to support Tier 2 Closure Authorization. The process presented begins following the bulk removal of the solids and liquid from a waste tank or ancillary structure. This final waste removal phase is typically referred to as "heel removal." Waste removal will continue per the progression described in the following section. Proceeding with operational closure activities, e.g., stabilization, must be authorized through the Tier 2 approval process.

It should be noted that in some ancillary structures it may not be practical to undertake further removal of HRRs following bulk waste removal efforts. As a general matter, such a situation may arise if HRRs are present in such low quantities that they make an insignificant contribution to potential doses to workers, a hypothetical future member of the public, and the hypothetical future human intruder.

The contamination remaining in a waste tank or ancillary structure following successful completion of heel removal is referred to as "residuals."

3.2 Activities and Steps

The approach is outlined in Figure 3-1 and consists of the following phases, which are described in more detail in subsequent sections of this document:

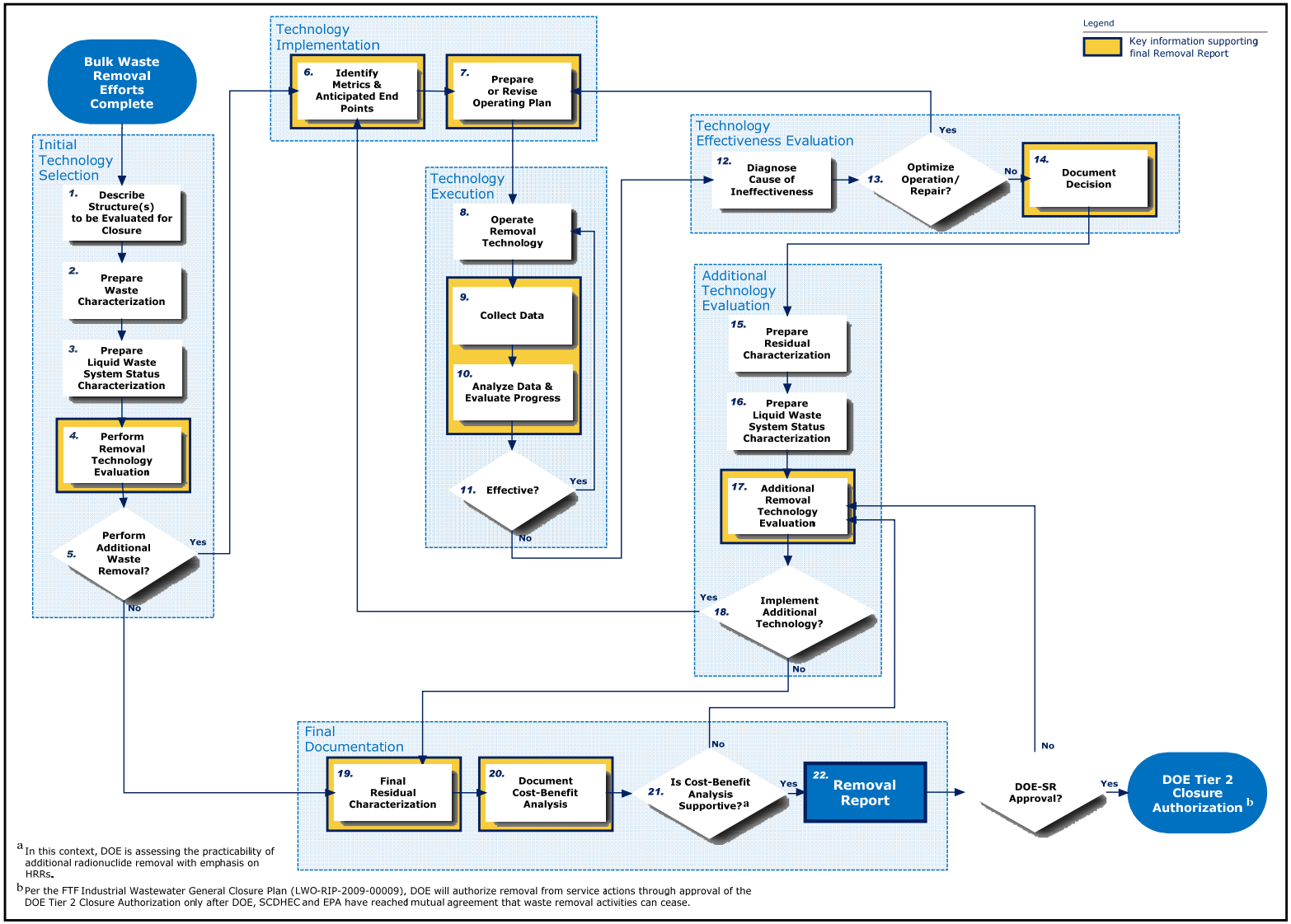
- Initial Technology Selection

- Technology Implementation
- Technology Execution
- Technology Effectiveness Evaluation
- Additional Technology Evaluation

Throughout the waste tank or ancillary structure cleaning process various reports, evaluations, analyses, data, operational documents, and presentations are developed to support DOE's final documentation supporting Tier 2 Closure Authorization. The level of specific data collection or documentation for each waste tank or ancillary structure will vary depending upon the attributes of the waste tank or ancillary structure and the technologies being implemented. For example, the documentation may be as simple as a memo to file when the planned technology is the same as the baseline (e.g., use of mixing pumps for mechanical heel removal) due to similar waste characteristics as a previously completed tank. However, a more formal report or documented systems engineering evaluation may be conducted if it is expected that the deployment of a new type of technology is needed.

For each waste tank or ancillary structure, documentation or information collected from each phase of the process eventually contributes to a final removal report supporting Tier 2 Closure Authorization. In some instances a report may be written to capture more than one tank or ancillary structure if several are removed from service at the same time.

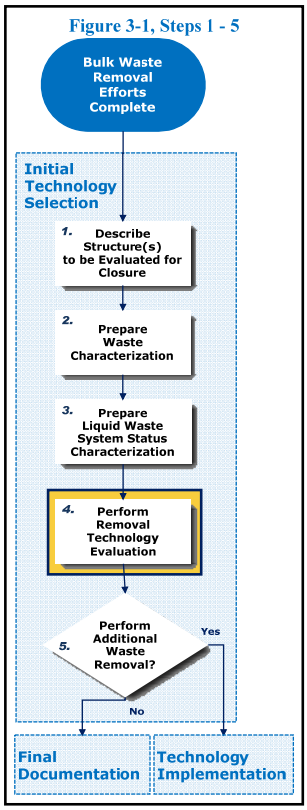
Figure 3-1: Approach



3.2.1 Initial Technology Selection (Figure 3-1, Steps 1-5)

This section outlines the technology selection methodology that DOE will utilize to choose the optimal technology for radionuclide removal, with emphasis on HRRs, given the conditions at the time of evaluation. This process requires an initial systematic, documented evaluation of the options available, with a quantitative analysis arriving at the optimal technology choice. The specific methodology that DOE utilizes for choosing a removal technology and the formality of the associated documentation can vary (See Section 3.2) depending on the waste properties, waste location and timing of the waste removal, but will include the following activities, which are described in subsequent sub-sections:

1. Clear description of the structure, or structures, being evaluated for closure (i.e., waste tanks or ancillary structure) (See Section 3.2.1.1)
2. Characterization of waste remaining in the structure (See Section 3.2.1.2)
3. Characterization of associated Liquid Waste System status and the impact to this overall system posed by waste removal actions for the structure (See Section 3.2.1.3)
4. Systematic evaluation of removal technologies and selection of best available technology (See Section 3.2.1.4)
5. Assessment of whether to perform additional removal utilizing the selected technology (See Section 3.2.1.5)



3.2.1.1 Description of Structure to be Evaluated (Figure 3-1, Step 1)

The components associated with the specific structure (or structures) that are to be evaluated for radionuclide removal and eventual stabilization pending closure will be described. These structures could include either a waste tank or ancillary structure. In all cases, waste tank refers to the entire structure including both primary tank and annulus.[1] The description of the structure could include assembly of engineering drawings, schematics, maps of obstructions to cleaning efforts, lists of components, operating status and location of integral equipment, boundaries between the tank or structure and tank farm system, photographs, and other pertinent documentation.

3.2.1.2 Waste Characterization (Figure 3-1, Step 2)

With a clear description of the structure that is undergoing waste removal, DOE will prepare a characterization of the waste to be removed. The purpose of this characterization is to provide the baseline of radionuclide content, with an emphasis on HRRs, to ensure selection of optimal waste removal technologies. This characterization will take into consideration the specific HRRs within the tank or ancillary structure and may include:

[1] An exception to this is the Type IV tanks, which do not have an annulus.

- Photographs and video of waste inside the waste tank or ancillary structure
- Sample results from internal surface area and mounds
- Estimated volumes
- Historical information related to radionuclides present and associated concentrations
- Analysis from similar waste tanks or ancillary structures
- Physical properties (e.g., density, rheology, viscosity, particle size, yield strength)
- Waste composition (e.g., HRRs present, non-radioactive materials present, concentrations)
- Maps of waste locations within a waste tank or structure (e.g., layers, mounds)
- Documentation of past removal activities and their relative success
- Worker dose records for sampling activities
- Waste removal history (e.g., relative success of cleaning efforts, progress photographs, equipment used)
- Cooling coil sample analysis
- Annulus condition (e.g., leak history, photographs)
- Leak detection system historical data

Information on waste characterization will be collected from applicable lab analysis reports, drawings, mapping diagrams and other pertinent reports. This evaluation may be documented as a stand-alone document or may be included with other documentation within the Initial Technology Selection phase.

3.2.1.3 Liquid Waste System Status Characterization (Figure 3-1, Step 3)

In addition to the characterization of the waste inside the structure, DOE will characterize the Liquid Waste System status associated with the further waste removal activities for the structure. The purpose of the system characterization is to understand and document the status and condition of the Liquid Waste System, in total, at the time of the proposed waste removal evolutions. These considerations of status, at a minimum, will include:

- Available tank storage space capacity for applicable waste tanks required to support waste removal efforts
- Compatibility of potential waste, waste removal streams, or agents added to the waste to aid in waste removal (e.g., oxalic acid) with other waste stored
- Downstream processing impacts (e.g., impact of oxalates, waste volumes)
- Status of salt waste and sludge batch processing and preparation
- Impact on future waste removal activities in waste receipt tanks
- Available equipment (e.g., explanation of resources used or not used)

This status determination will either document these considerations or, in cases of similar time and circumstances, refer to previous documentation that remains valid for the current configuration and systems being evaluated. This evaluation may be documented as a stand-alone document or may be included with other documentation within the Initial Technology Selection phase.

3.2.1.4 Radionuclide Removal Technology Evaluation (Figure 3-1, Step 4)

A technology selection evaluation will be performed based on the structure undergoing waste removal, the initial waste characterization, and the system characterization outlined in Sections 3.2.1.1, 3.2.1.2 and 3.2.1.3 respectively. This evaluation will focus on removal of radionuclides, with emphasis on HRRs, as well as other closure considerations related to DOE Manual 435.1-1 and other requirements. The formality of the associated documentation of the evaluation can vary (See Section 3.2) depending on the waste properties, waste location and timing of the removal activities.

When performing a technology evaluation, DOE will take one of two paths: rely on a previously performed evaluation where conditions for a waste tank or ancillary structure are similar to previously completed waste removal evolutions; or initiate a new technology evaluation, particularly where the tank structure or wastes are different than previously evaluated tanks. The "Alternative Studies" method is an example of a technology selection process that has been used successfully at the SRS. [WSRC-IM-98-00033] The "Alternatives Studies" method uses a formal analysis based on a set of weighted decision criteria. The depth of detail required by the technology selection will depend on specific conditions associated with the waste tank or ancillary structure under evaluation. A sensitivity analysis may be included in the analysis to aid in proper selection of a preferred technology. The technology selection process generally follows the "Alternative Studies" methodology and typically includes the assembly of a small but diverse group of knowledgeable individuals with experience that is relevant to the evaluation, and typically includes activities similar to the following steps:

1. Identification of the communities of practice to be surveyed for viable technologies – In addition to the removal technologies that have previously been used at SRS, technologies from other DOE sites, DOE-sponsored technical exchanges, the industrial sector, the international sector and other relevant organizations may also be considered.
2. Identification of removal technologies – A wide range of current technologies will be considered, at a minimum, including sluicing, mixing, chemical cleaning, vacuum retrieval techniques, mechanical manipulators and robotic vehicles. Any relevant future developments in removal technologies will also be considered at the time. The DOE will consider targeted HRR-specific removal technologies as well as overall volume reduction technologies. Additionally, pertinent combinations of removal technologies will be taken into account.
3. Identification of criteria that will be used to compare the various removal technologies – Criteria will include, at a minimum, the technologies' expected radionuclide removal capability, with emphasis on HRRs, likelihood to meet the desired results effectively, costs, technical maturity, technical complexity and reusability. Furthermore, some examples of costs that will be considered are dose to workers, dose to public, financial costs, system-wide impacts (e.g., effects on downstream systems, generation of secondary waste streams), impacts to DOE's mission and schedule and radiological control requirements.
4. Evaluation of technologies against the selected criteria – Each technology is evaluated against each criterion and will be assigned a comparative ranking.

5. Selection of a preferred technology – A scoring methodology will be used to select the optimum technology from among the set of technologies.

The anticipated result of this process will be the identification of the optimal technology, or technologies, to remove radionuclides, with emphasis on HRRs, from the defined structure accounting for the specific characterization of the waste, surrounding Liquid Waste System status, schedule, and current technological maturity at the time the evaluation is performed.

3.2.1.5 Assessment of Additional Removal (Figure 3-1, Step 5)

The activities described in Section 3.2.1.4, will identify which available technology, or technologies, is the most viable option for additional radionuclide removal. The progression advances to the implementation of the technology as discussed in Section 3.2.2 (Figure 3-1, Steps 6 and 7). However, if it is not obvious that the technology can be and should be implemented to continue waste removal efforts (beyond bulk waste removal efforts previously completed), data for a cost-benefit analysis should be collected. The types of data supporting a cost-benefit analysis are described in Section 3.2.6 (Figure 3-1, Steps 19-22). If, during the course of collecting this information, it appears probable that implementation and execution of any additional waste removal technology (beyond bulk waste removal efforts previously completed) is not practical, then a qualitative analysis will be performed and documented. As required by the FTF General Closure Plan (LWO-RIP-2009-00009), DOE will review this information with the South Carolina Department of Health and Environmental Control (SCDHEC) and the Environmental Protection Agency (EPA) and, if the three agencies (DOE, SCDHEC, EPA) concur, DOE would suspend waste removal activities and move into final sampling and analysis (Figure 3-1, Step 19).

The Technology Evaluation and Assessment steps will be documented or, if the current technology has not changed significantly, referenced to a previous report. For example, when two similar tanks (in construction and waste type) are undergoing similar waste removal processes at the same time, it is not necessary to undertake a selection and determination process for the second tank if the assumptions and parameters of the first still apply and no new technology has become available. This decision, however, will be documented. As discussed in Section 3.2, the formality of the associated documentation can vary depending on the waste properties, waste location and timing of the removal activities.

Examples of documentation/information that support this step are:

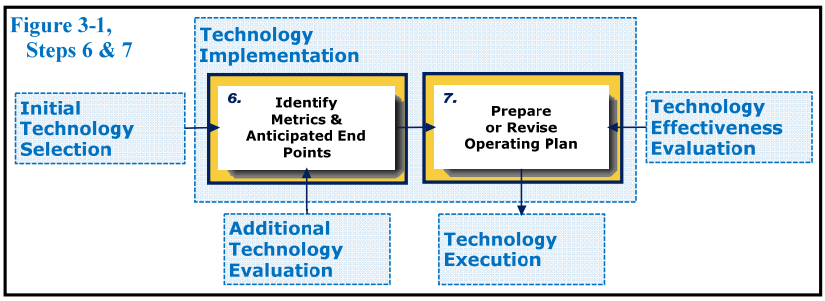
- Operational history
- Selection, operational performance and effectiveness of cleaning technologies used during each cleaning phase
- Rationale for suspending use of each cleaning technology
- Effectiveness in removing overall waste volume
- Cost-benefit analysis of continuing waste removal efforts

3.2.2 Technology Implementation (Figure 3-1, Steps 6-7)

An Operating Plan will be developed on how best to implement the selected technology safely for the particular waste tank or ancillary structure. An Operating Plan is a document that describes the cleaning process to be implemented, the methods of implementation,

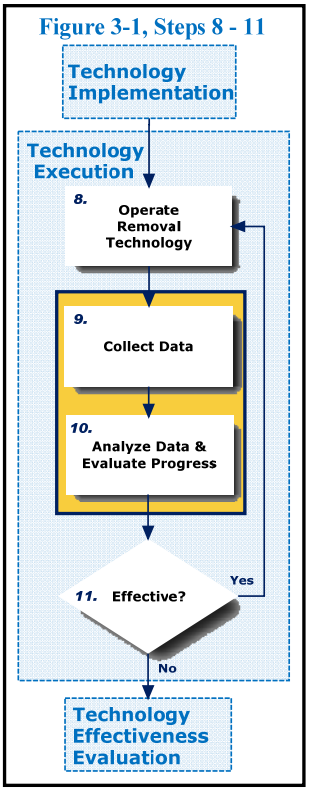
identification of anticipated end states and identification of specific metrics that ideally provide real-time indication of effectiveness.

These tailored metrics, which are necessary to track progress in waste removal evolutions, will be defined in the Operating Plan. Such metrics are dependent on the technology being implemented and structure undergoing waste removal but are expected to include such things as:



- Monitoring radiation levels on transfer line
- Waste removal equipment operating parameters (e.g., current drawn by a mixer pump, transfer rates)
- Monitoring density readings for a solution
- Monitoring solids concentration being removed
- Waste volume reduction achieved by comparing pictures, video and mapping results
- Effective cleaning radius of mixing devices

The Operating Plan will reference estimated end states and metrics, and detail how the data will be obtained. The Operating Plan will also reflect any planned chemical cleaning flow sheets, include the projected mixing strategy (e.g., hours of operation, orientation, mode of operation, liquid level, mixer speed), and incorporate lessons learned from earlier waste removal efforts. If modifications to the equipment operation and/or the Operating Plan can result in greater technology effectiveness, then DOE will revise the Operating Plan to reflect this advantage.



3.2.3 Technology Execution (Figure 3-1, Steps 8-11)

DOE will execute the technology until it is no longer considered an effective means of radionuclide removal, with an emphasis on HRR removal. Effectiveness will be assessed based on the technical data (i.e., metrics) outlined in the Operating Plan and captured throughout the execution of the removal technology.

Data collection during this phase is expected to include such things as:

- Photographs of any tank modification required for waste removal installation
- Video mapping and high quality digital still photographs (before and after cleaning photographs from the same location) inside the primary tank and annulus
- High quality photographs of obstructions to mixing
- Records of daily operational decisions and their underlying reasons (e.g., logbooks, memos)
- Solids volume reduction for each cleaning phase
- Process sample analysis results
  - Volume and radionuclide concentration reductions
  - Weight percent solids in slurry
  - Tank temperature and pH
- Impact of high efficiency particulate air (HEPA) filter loading
- Liquid additions to the system
- Secondary waste generation
- Activities to address equipment issues
- Costs of modifications, installation and operation
- Mixer and transfer pump amps
- Effective cleaning radius
- Transfer line radiation dose rate data
- Worker dose data
- Historical timeline of events
- Documentation of each cleaning phase and reasons for proceeding to the next phase

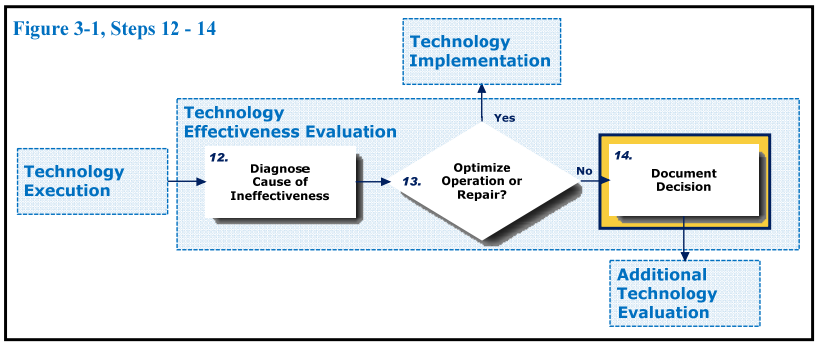
This data will be analyzed on an ongoing basis and used to determine whether the technology has reached the point of diminished effectiveness. Actual results will be compared with the expected results to support the evaluation of effectiveness. If the technology continues to be effective (Figure 3-1, Step 11), then DOE will continue to execute the technology (Figure 3-1, Steps 8-10). If the technology is determined to be at the point of diminished effectiveness, the technology will be evaluated to determine whether to further deploy this technology.

3.2.4 Technology Effectiveness Evaluation (Figure 3-1, Steps 12-14)

If a technology is no longer effective, the reason must be diagnosed and recorded. Examples for diminished effectiveness include:

- Technology limitation (i.e., the inability of the current configuration to clean any further due to physical limitations of equipment)
- Deterioration or failure of the equipment utilized by the technology
- An outside factor that decrease effectiveness

The diagnosed reason for diminished effectiveness determines what assessment will be done to establish whether to stop further execution of this technology or to modify the system or system parameters and continue execution (Figure 3-1, Step 12). If the technology is no longer yielding effective results due to a technological limitation, DOE will assess whether it is practical to optimize the existing system to increase effectiveness. Optimization could include such things as adjusting pump indexing, altering flow rates, changing cleaning patterns or changing the concentration of a cleaning agent such as oxalic acid. Major modifications of equipment, such as identification and installation of an alternative transfer or mixing pump, are not considered optimization of the existing system.



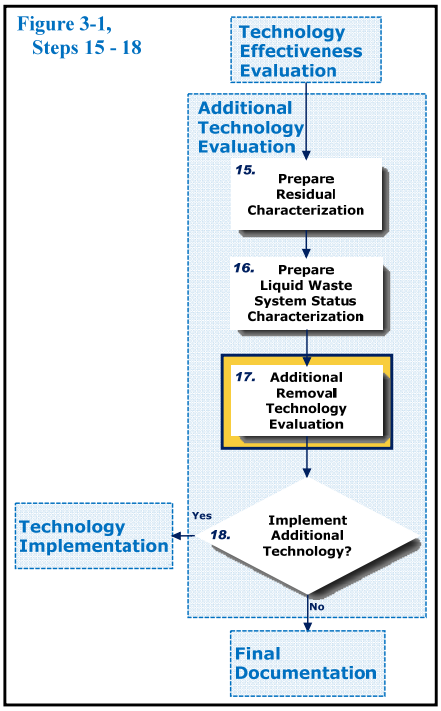
If effectiveness is reduced due to deterioration or failure of equipment, DOE will evaluate repairing or replacing the component. Likewise, if the technology is no longer effective due to an outside factor such as a constraint in the Liquid Waste System beyond the structure undergoing waste removal (see Section 3.2.1.3), DOE will evaluate whether or not resolving that factor would be a means of increasing effectiveness.

If DOE is making optimization adjustments, repairing/replacing equipment, or resolving an outside factor, (Figure 3-1, Step 13), the appropriate changes in the Operating Plan as described in Section 3.2.2 (Figure 3-1, Step 7) will be made and DOE will continue to execute the removal technology. If effecting these changes is not believed to be practical based on sound engineering judgment and the knowledge gained during the initial technology selection process, DOE will document (Figure 3-1, Step 14) that the implemented technology will no longer be used based on earlier documented metrics and move into the next phase of the progression (i.e., Additional Technology Evaluation, Figure 3-1, Steps 15-18). Although a formal cost-benefit analysis will not be performed at this stage, the underlying principles of such an evaluation will be included in the documentation supporting this decision.

3.2.5 Additional Technology Evaluation (Figure 3-1, Steps 15-18)

This section outlines the technology evaluation methodology that DOE will employ to determine whether it is practical to continue removal operations with an additional technology. The specific methodology can vary depending on the waste properties, waste location and timing of the removal at this stage, and will include the following considerations:

- Characterization of remaining residuals to be removed (See Section 3.2.5.1)
- Characterization of potential impact to the Liquid Waste System during the scheduled time required for the evolution (See Section 3.2.5.2)
- Evaluation of alternative radionuclide removal technologies and selection of best available option (See Section 3.2.5.3)
- Assessment of whether to perform additional removal utilizing the selected technology (See Section 3.2.5.4)



The process is described in the following subsections.

3.2.5.1 Residual Characterization (Figure 3-1, Step 15)

Because the removal operations may have altered the waste form, previously excluded alternative technologies may be viable at this point. The DOE will use the waste characterization methodology discussed in Section 3.2.1.2 (Figure 3-1, Step 2) to re-evaluate the remaining waste and build a basis for the subsequent alternative selection. Once again, DOE will, at a minimum, consider the quantity, physical properties, composition, location of residual waste and the success of past removal activities. It may be necessary to collect actual samples of the residual material (typically referred to as "process samples") and perform some sort of limited analysis suite to determine key characteristics.

3.2.5.2 Liquid Waste System Status Characterization (Figure 3-1, Step 16)

Changes to the Liquid Waste System status could have occurred since earlier evaluations. DOE will re-evaluate the status of the Liquid Waste System using the methodology discussed in Section 3.2.1.3 (Figure 3-1, Step 3) to consider any changes that might affect the subsequent technology selection. These characterizations will consider the information collected in the previous characterization steps as well as the operational data collected in previous technology operation steps, discussed in Section 3.2.3 (Figure 3-1, Steps 8-11). At a minimum, DOE will consider waste tank storage space capacity, compatibility of waste, downstream processing impacts and the impacts on other risk-reducing evolutions within the Liquid Waste System.

3.2.5.3 Additional Radionuclide Removal Technology Evaluation (Figure 3-1, Step 17)

DOE will perform an additional technology selection evaluation utilizing the residual and Liquid Waste System evaluations outlined in Section 3.2.5.1 and Section 3.2.5.2 (Figure 3-1, Steps 15 and 16). This analysis will review available waste removal technologies to determine if a viable technology could be practically implemented to remove additional quantities of radionuclides, with emphasis on HRRs. The alternative removal technology selection methodology will resemble the methodology discussed in Section 3.2.1 (Figure 3-1, Steps 1-5). If the residual waste has not changed greatly from the previous characterization

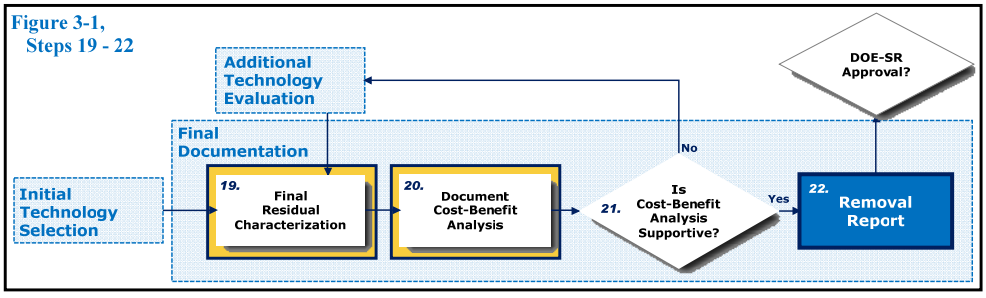
and the Liquid Waste System status characterization is similar, previous technology selection data may be used to inform the present technology selection. Technological advances since the previous technology selection will be considered.

This methodology uses a structured approach for the identification and comparison of viable technologies to determine the most practical option for additional radionuclide removal, with an emphasis on HRR removal. This will include activities similar to those outlined in Section 3.2.1.4 (Figure 3-1, Step 4). The level of detail and formality will align with the extent the waste and the Liquid Waste System as a whole changed during the previous removal operations. The result of this selection methodology will be the identification of the best available alternative technology, or technologies, that could potentially be deployed to remove additional radionuclides, with emphasis on HRRs, from the defined structure accounting for current conditions.

3.2.5.4 Assessment of Additional Removal (Figure 3-1, Step 18)

As DOE evaluates the actions necessary to implement the potential new technology, or technologies, a qualitative evaluation will be performed to assess its implementation. This evaluation will consider: Liquid Waste System constraints; ratio of implementation costs per gallon of waste potentially removed or total curies, with emphasis on HRRs, potentially removed; potential worker exposure for technology installation; and execution. At this stage, if it is not obvious that the selected technology can be or should be implemented to continue waste removal efforts, data for a cost-benefit analysis should be collected. The types of data supporting a cost-benefit analysis are described in Section 3.2.6 (Figure 3-1, Steps 19-22). If, during the course of collecting this information, it appears probable that implementation and execution of the technology is not practical, then a qualitative analysis will be performed and documented. As required by the FTF General Closure Plan (LWO-RIP-2009-00009), DOE will review this information with SCDHEC and the EPA. If the three agencies (DOE, SCDHEC, EPA) concur, DOE will suspend waste removal and move into final sampling and analysis (Figure 3-1, Step 19).

3.2.6 Final Documentation of Radionuclide Removal (Figure 3-1, Steps 19-22)



The DOE will proceed to the sampling and analysis stage of the waste tank system operational closure process (Figure 3-1, Step 19) and perform a final characterization of the residuals with emphasis on the curies and locations of remaining HRRs. To support waste tank residual characterization, DOE will develop and document a sampling plan that minimizes uncertainty through representative sampling of the residuals. In some cases, process knowledge and historical sampling may be used to support final characterization of residuals. The process knowledge and historical sampling will be properly referenced. If process knowledge is used as a basis to support final

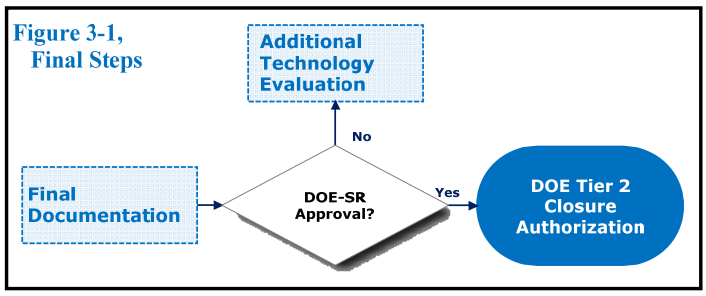
characterization, the specific basis for the process knowledge will be identified and documented. Final characterization includes a volume determination as well as radionuclide concentrations. This information is used to develop a final radionuclide inventory.

A cost-benefit analysis will be performed, informed, in part, by the qualitative dose impact results and conclusions of the associated PA with the final radionuclide inventory considered. In this analysis, cost examples may include financial costs, increased risks to workers and members of the public, generation of secondary waste streams, schedule delays and associated impacts on other risk reduction activities, and downstream Liquid Waste System impacts. Typically, the cost-benefit analyses will be relatively simple and will focus on the financial costs for implementation of new technologies versus the decrease in potential future doses resulting from the closure actions. [NUREG-1854] If the development of the characterization data or the cost-benefit analysis demonstrates that it may be practical to remove additional radionuclides, with emphasis on HRRs, then additional removal technologies, or optimization of existing technologies, will be evaluated for possible additional removal.

When final residual characterization and the cost-benefit analysis are complete, a removal report (Figure 3-1, Step 22) will be prepared. This documentation will detail the design, construction and operational service histories of each tank. It will document all waste removal activities, including bases and justifications for proceeding from one phase to another. The removal report will also document the selection, operational performance and effectiveness of technology used and will include the effectiveness of removing overall waste volume and specific HRRs. The report will combine documentation from the entire process to provide the complete demonstration of radionuclide removal to support Tier 2 Closure Authorization.

3.2.7 DOE Tier 2 Closure Authorization

The Tier 2 closure documentation, which includes, among other documentation (See Section 2.0), the removal report discussed in the preceding subsection, must be approved by the Manager for DOE-SR authorizing the cessation of waste removal activities and removal from service and stabilization of the waste tank or ancillary structure.



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