Lessons Learned in Management of U.S. Department of Energy Waste Incidental to Reprocessing

Waste Management Working Group
Energy Facility Contractors Group
Workshop at the WM2013 Symposium
Phoenix, Arizona

April 2013

Preparer: _____ Date 4/27/13
Jim McNeil, Consultant to DOE-West Valley

EFCOG Reviewer: _____ Date 4/28/13
Scott Saunders, High-Level Waste Subgroup Chair
EFCOG Waste Management Working Group
Washington River Protection Solutions

ACKNOWLEDGEMENTS

Many individuals contributed to the success of the workshop and the Waste Management Working Group thanks them for their support:

Ginger Dickert and John Tseng of Savannah River Remediation, who were the Chief Organizers of the Embedded Track Sessions and Lessons Learned Workshop. Ms. Dickert not only organized the Sessions and recruited the participants, but facilitated the Workshop all day on Thursday of that week.

The staff of Waste Management Symposia, especially Gary Benda, Jim Voss, LeighAnn Spandola, Mary Young, Melanie Ravalin, and Linda Lehman;

The Board of Directors of Waste Management Symposia, especially Larry Camper and John Longenecker;

The Energy Facility Contractor Group Board of Director sponsors, Billy Morrison and Susan Stiger;

Those persons who graciously served on WM2013 panels that discussed various aspects of waste incidental to reprocessing; and

Those persons who prepared and presented technical papers on various aspects of waste incidental to reprocessing at WM2013.

CONTENTS

ACRONYMS AND ABBREVIATIONS

ALARA	as low as reasonably achievable
CFR	Code of Federal Regulations
DOE	U.S. Department of Energy
EFCOG	Energy Facilities Contractors Group
EM	Environment Management (DOE)
EPA	U.S. Environmental Protection Agency
FR	Federal Register
HLW	high-level waste
LLW	low-level radioactive waste
NRC	U.S. Nuclear Regulatory Commission
PA	performance assessment
SCDHEC	South Carolina Department of Health and Environmental Control
UK	United Kingdom
US	United States
USDOE	U.S. Department of Energy
USEPA	U.S. Environmental Protection Agency
WIR	waste incidental to reprocessing
WM	Waste Management
WMWG	Waste Management Working Group (of the EFCOG)
WVDP	West Valley Demonstration Project

EXECUTIVE SUMMARY

This report describes lessons learned in management of the U.S. Department of Energy (DOE) waste incidental to reprocessing (WIR) as discussed in panel discussions, technical presentations, and a one-day workshop held from February 25-28, 2013 at the Waste Management Symposium (WM2013) in Phoenix, Arizona. For the sake of completeness, this report also describes lessons learned about the WIR process as discussed in earlier Waste Management symposia and in the site-wide review for updating DOE Order 435.1, *Radioactive Waste Management.*

The WM2013 workshop focused on the three processes used by DOE to determine waste incidental to processing:

- The citation process of DOE Manual 435.1-1, *Radioactive Waste Management Manual*;
- The evaluation process of DOE Manual 435.1-1; and
- The process for making waste determinations under Section 3116 of the *Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005*, commonly known as Section 3116.

WM2013 provided an opportunity for policy-makers, regulators, practitioners, and other stakeholders to celebrate successes and discuss opportunities for improvement for DOE's WIR processes. Using the Section 3116 process, DOE closed 11 underground waste tanks at the Idaho National Laboratory in 2006 and in 2012 closed two underground waste tanks at the Savannah River Site. Using the DOE Manual 435.1-1 evaluation process, DOE determined that the vitrification melter and two other vessels from the West Valley Demonstration Project are not high-level waste (HLW) and may be disposed of as low-level waste (LLW). Using the citation process, DOE has also disposed of hundreds of decontaminated tools and other low-risk materials in DOE-owned LLW disposal facilities.

WM2013 included several embedded track sessions focusing on the Section 3116 and DOE Manual 435.1-1 WIR processes as listed in attachment B. Section 2 of this report describes highlights of these panel and oral sessions. All of the papers and presentations from these sessions are available from Waste Management Symposia.

A complete list of lessons learned in implementation of the citation process, the evaluation process, and the Section 3116 process follows this Executive Summary. Among the more important:

- Sites that take full advantage of the citation process can dispose of as LLW many reprocessing wastes streams that are incidental to reprocessing, reducing risk and eliminating unnecessary costs related to storage and surveillance.
- In using the evaluation process it is important to include in the evaluation details on estimates for residual material and residual radioactivity in the waste – such as

characterization data quality objectives, data quality assurance, data variability, and estimate uncertainty – as well as clearly describing the basis for the estimates.

- Clear, open, and frequent communications between DOE and its regulators and other stakeholders on matters related to the Section 3116 process are extremely important for success and informal communications with stakeholders are also important.
- Public participation in the Section 3116 process and underground waste tank closure has proven to be very important. The public, especially the site citizens' advisory board, should be encouraged to participate as early and as much as practical in various aspects of future determination basis documents and other tank closure activities.
- Scoping meetings to promote collaboration in development of the performance assessment (PA) that involve staff members from each regulator can be useful to build trust, promote interagency working relationships, and instill a spirit of partnership in protecting public health and the environment.
- The U.S. Nuclear Regulatory Commission (NRC) staff has found that having the DOE models during their reviews has allowed them to better focus on risk-significant issues.

Key recommendations based on the lessons learned include:

(1) The upcoming revision to DOE Order 435.1 include citation process requirements that are equivalent to the current requirements, which have served to minimize the costs for disposal of very low risk waste streams. Guidance for citation process implementation under DOE Order 435.1A should address how to technically support using the citation process for wastes that may be incidental to reprocessing.

(2) DOE consider development of a strategy for vitrification melter shutdown near the end of melter life that balances production goals, costs, and disposal options.

(3) DOE work with its contractors to develop and define the scope of consultation with the NRC for Section 3116-required consultation activities, with a guidance document based on a rigorous project management approach being prepared for this purpose and used as a basis for a memorandum of agreement with the NRC for these activities.

(4) DOE and NRC explore methods to shorten the NRC consultation cycle without compromising safety or agency independence, in addition to holding scoping meetings which have been used effectively to this end.

(5) DOE work with its contractors to develop and define the scope of Section 3116-required monitoring activities, with a guidance document based on a rigorous project management approach being prepared for this purpose and used as a basis for a memorandum of agreement with the NRC for these activities. NRC and DOE should jointly develop the monitoring process, including formally agreeing on the precise meaning of terms such as *noncompliance with performance objectives* and the different types of noncompliance to be used by NRC in its monitoring program.

SUMMARY OF LESSONS LEARNED

The following lessons learned were discussed at WM2013 or earlier Waste Management symposia or identified during the site-wide review performed in preparation for updating DOE Order 435.1. Many individuals contributed to the site-wide review, including representatives of DOE field offices, DOE contractors, and the EFCOG, as well as DOE consultants.

A. Citation Process

Refer to Section 3.1 for the context for the lessons learned, which included:

(1) Many reprocessing waste streams consist of equipment used in some aspect of management of HLW that was not produced in reprocessing of spent nuclear fuel and most of this equipment has a low potential for retaining significant amounts of waste due to its configuration and use.

(2) Sites managing HLW are required by DOE directives, policies, and technical standards to implement the as low as reasonably achievable (ALARA) principle to decontaminate equipment and decontamination performed in the field effectively removes most of the residual waste by simple processes such as flushing and rinsing with water.

(3) Characterization data typically show that radionuclide concentrations in waste packages containing the decontaminated equipment meet waste acceptance criteria for disposal as LLW and meeting the waste acceptance criteria for disposal in a shallow-land LLW disposal facility ensures that the equipment does not require geologic isolation and would not impact performance of the disposal site.

(4) Small pieces of equipment which would be classified as transuranic waste after decontamination can be blended with LLW in accordance with DOE and NRC guidance for ultimate disposal as LLW, which would reduce risks and disposal costs.

(5) The concept of secondary waste affords a convenient method of defining those waste streams that are candidates for the citation process.

(6) DOE HLW sites that take full advantage of the citation process can dispose of certain waste incidental to reprocessing that has been at the site for many years, reducing risk and eliminating unnecessary costs related to storage and surveillance.

(7) Consultation with the Office of Environmental Management when revising site implementing procedures for waste incidental to reprocessing is important to ensure that the requirements and guidance are being properly followed and to maintain appropriate consistency among the DOE HLW sites in this area.

(8) Utilization of the citation process and the associated guidance has provided insight into the proper classification of radioactive wastes prior to disposal, ensuring that risk and costs are reduced in cases where questions exist as to the nature and definition of reprocessing wastes.

(9) The citation process has worked well in recent years. Additional citation-process waste streams added by DOE at Hanford, Savannah River, and West Valley were well supported technically and clearly not within the definition of HLW. Since implementation of the citation process at the Savannah River Site, for example, over 3,000 cubic meters of secondary waste

were managed and safely disposed as LLW meeting the PA performance objectives, thus reducing the risk to workers, the public, and the environment posed by continued storage of this waste.

B. Evaluation Process

Refer to Sections 4.1 through 4.4 for the context for the lessons learned, which included:

(1) It is important for consistency to use language identical to that used in previous evaluations and in Section 3116 basis documents to the extent practicable.

(2) Time should be factored into the schedule for the necessary consultation with the DOE Office of General Counsel and NRC staff.

(3) It is important to include in the evaluation details on estimates for residual material and residual radioactivity in the waste – such as characterization data quality objectives, data quality assurance, data variability, and estimate uncertainty – as well as clearly describing the basis for the estimates.

(4) It is useful for completeness to consider in the evaluation an alternate method of estimating residual radioactivity in the waste as a cross check on the accuracy of the primary estimating method, when practical.

(5) Descriptions of cost-benefit analyses included in the evaluation must be clear and complete and the analyses supportable.

(6) While the evaluation must include information on potential disposal facilities for the waste, the language in the evaluation scope must make it clear that disposal of the waste is not within the scope of the evaluation, because actual disposal would be the subject of a separate effort.

(7) A new PA does not have to be developed in support of most DOE Manual 435.1-1 waste-incidental-to-reprocessing evaluations if the subject waste will be disposed of in an existing LLW disposal facility, which would already have an approved PA, although a special analysis might be required to verify that the waste would have negligible impact on disposal facility performance depending on the results of waste stream screening.

(8) It is appropriate to limit PA information in the evaluation to (1) that necessary to show that each potential disposal site meets its performance objectives, using information, for example, from the disposal facility annual report, and (2) a brief description of the estimated impact (generally negligible) from disposal of the waste (except in a case where a new or updated disposal site PA is required in support of the evaluation).

(9) Informal technical clarification telephone discussions between NRC analysts and DOE contractors on questions and information needed in advance of submittal of the formal requests for information have proven to be useful to reducing the time necessary for DOE to respond to the requests for information.

(10) Appendices to the evaluation showing that DOE and NRC dose standards and LLW disposal standards are comparable are appropriate to avoid questions on these matters with respect to the criterion "Will be managed to meet safety requirements comparable to the performance objectives set out in 10 CFR Part 61, Subpart C, *Performance Objectives*."

(11) It is important to clearly identify the scope of the NRC consultation review in the interagency agreement used for this purpose to ensure that the review covers all appropriate matters.

(12) Open communication with NRC staff throughout the consultation process – such as conference telephone calls to discuss planned responses to requests for information – is important to ensure that information provided by DOE to NRC to support its review is complete and appropriate.

(13) There must be a strong DOE-HQ advocate working with the NRC to help define interagency scope and lead teleconferences to clarify comments and comment responses. Draft comment responses should be discussed with NRC in advance of formal issue of RAI's so that all parties understand the issues and resolve them in a timely manner.

(14) Waste incidental to reprocessing that must be classified as transuranic waste can be very difficult to dispose of compared to waste classified as LLW.

C. Section 3116 Process

Refer to Sections 5.1 through 5.3 for the context for the lessons learned, which are divided into three categories.

C.1 General

(1) Clear, open, and frequent communications between DOE and its regulators and other stakeholders on matters related to the Section 3116 process are extremely important for success. The PA scoping meetings held at Savannah River Site and Hanford are good examples of this and lessons learned in these meetings are discussed below under PA lesson learned. Frequent communications with stakeholders are also important.

(2) Complete transparency on the part of DOE in its activities related to Section 3116 determinations and underground waste tank closure is necessary to build and maintain trust with regulators and other stakeholders, which is essential for effective partnerships. In all meetings with the regulators and other stakeholders, a key to success is to always have the Project Manager present and in a lead role in the meetings to help lend consistency.

(3) Regulatory interactions are much more efficient when DOE and its regulators effectively work in partnership and such teamwork can result in regulatory documents being approved before fieldwork is ready to begin, thereby accelerating risk reduction and saving considerable time and money without sacrificing regulator independence or integrity. It is important to note that during all of the discussions at the WM2013 panel discussions, technical sessions, and the EFCOG Workshop, many participants believed that timeliness of reviews should be improved. This could be improved by application of project management scheduling techniques noted in (7) below.

(4) The site citizens' advisory board, should be encouraged to participate as early and as much as practical in various aspects of future determinations and other tank closure activities.

(5) It is useful for the regulatory agencies to establish common goals and values and display these at public meetings to help show that all parties are working together to protect worker and public health and safety and the environment.

(6) It is important that representatives from all agencies involved speak at public meetings to demonstrate to stakeholders that they are effectively working together.

(7) The use of a project management approach has proven to be beneficial in work related to developing Section 3116 basis documents and the supporting documentation at both Idaho and Savannah River, especially in the areas of communications, reviews, and risk management. Project schedules that include the timelines and interactions (depicted as "swim lanes" by Savannah River Remediation, LLC) among all DOE, contractors, regulators and stakeholders are a key to success and improvement in the time to completion of these closures. Development of a project risk review program is also a key to success. The project schedule should be designed so that regulatory reviews are complete when the actual closure in the field is ready to start

(8) It is important to involve senior management of all agencies early in the Section 3116 process. The identification of key decision makers in each organization and the ability to access them in a timely fashion should be built into the project,

(9) It is important to maintain a core technical/engineering group focused on the Section 3116 process to ensure adequate institutional memory of the process. This group must not only be knowledgeable, but be skilled in the ability to successfully communicate complex technical information in a way that all stakeholders could understand and trust the information.

(10) It is essential that a complete administrative record that documents key decisions and policy choices in an open and transparent manner be maintained.

(11) A change control program needs to be in place that can gain technical evaluation and appropriate management approval of discoveries or proposed changes. The "Unreviewed Waste Management Question Evaluation" approach should be institutionalized and required.

C.2 Waste Retrieval

(1) An agreed-to definition of the term *maximum extent practical* would be useful to ensure a common understand among agencies and other stakeholders.

(2) Certain underground waste tanks can dominate predicted future doses from a closed tank farm because they contain more residual highly radioactive radionuclides that are important to long-term dose than other tanks after heel removal, or because of their particular location within the tank farm, or both, and these tanks may require additional heel removal consistent with ALARA requirements.

(3) A detailed analysis of the costs and benefits of further removal would be appropriate in such a case, taking into account various factors such as predicted reductions in dose to a future member of the public, the increase in worker dose, the monetary costs for additional waste retrieval and treatment, and schedule impacts. It is good practice for perspective to compare the predicted dose reduction to a hypothetical future individual over 50 years to the estimated worker radiation dose to retrieve additional waste, and to compare the estimated unit cost of the predicted risk reduction to the actual unit cost of risk reduction on other DOE remediation projects.

C.3 Performance Assessments

(1) It is important that PAs be developed in a transparent fashion so that the agencies that will review them and other stakeholders fully understand the basis for their content, including the conceptual models and mathematical models used.

(2) Scoping meetings to promote collaboration in development of the PA that involve staff members from DOE, the DOE contractor, NRC, the U.S. Environmental Protection Agency (EPA), and State regulators can be useful to build trust, promote interagency working relationships, and instill a spirit of partnership in protecting public health and the environment.

(3) The scoping meeting process can be effectively implemented with public meetings as well as meetings that are not open to the public, based on experience at the Hanford site.

(4) Public participation in the scoping meeting process can be enhanced by providing briefings or other information necessary to help laypersons understand the PA process.

(5) The scoping meeting process provides insights into key factors that influence facility performance, which can reduce the number of regulatory agency review comments on the PA.

(6) The scoping meeting process can lead to improvements in PAs, such as development of a probabilistic model to evaluate uncertainty in deterministic model predictions.

(7) The NRC staff review of PAs has added considerable value but prolonged interactions between NRC analysts and DOE contractor engineers and scientists can add considerable time to the overall process for making Section 3116 determinations. The EFCOG believes that DOE and NRC should explore other ways to shorten the NRC consultation cycle without comprising safety or agency independence.

(8) It is better to have the PA describe the results of the analyses without stating the interpretations and conclusions about compliance with the performance measures, instead incorporating these interpretations and conclusions in the "basis documents" where they are more appropriate, so reviewers of the PA can focus on whether it is thorough and technically supported.

(9) A graded and iterative approach that helps focus efforts on those aspects of the disposal system that have the greatest influence on whether there is a reasonable expectation that the facility will meet its performance objectives has proven to be useful.

(10) A hybrid approach to PA development – wherein probabilistic modeling results that evaluate model uncertainties and sensitivities are considered along with the deterministic base-case modeling results – has proven more effective than previous deterministic-only modeling in predicting the future behavior of the disposal system, including the probability of catastrophic consequences from radioactivity that could be released in the far future.

(11) The use of a "top-down, bottom-up" approach has proven useful in understanding the total behavior of the disposal system.

(12) Compliance with DOE PA maintenance plan requirements has resulted in a process of continual improvement where new information and better analytical tools are used to reduce uncertainties in PA results and better inform the related decisions, with this process continuing throughout the life of the disposal facility. DOE PA maintenance should include methods to increase confidence in the key assumptions and inputs and could include performance testing with simulated materials. However, the risk reduction that results from tank closure should not be delayed to await a technical breakthrough that may only improve the knowledge that has already supported a conclusion that reasonable assurance exists that performance objectives will be met.

(13) To achieve the primary goal in making use of the results of a tank farm closure PA – that is, to provide a better understanding of the risks associated with the fate and transport of contaminants following final closure of the tank farm – it is important for the PA to provide results concentrating on the relative magnitude of risk while identifying the conceptual model decisions and critical assumptions most impacting these results.

(14) It would be useful for DOE to define in writing key terms used in connection with PAs – such as *reasonable expectation*, *reasonable assurance*, and *reasonably conservative* – so that all parties will have a common understand of what these terms mean.

(15) Barrier analyses form essential elements of PAs in that understanding the performance of individual and multiple barriers is essential to understanding radionuclide fate and transport to the point of compliance along with the associated uncertainties, especially in cases where information indicates that one particular barrier will not perform as initially expected.

(16) It is important for DOE and NRC staff to share plans and designs for research and development work and status/results of the studies.

(17) The NRC staff has found that having the DOE models during their reviews has allowed them to better focus on risk-significant issues.

(18) The NRC staff has found that the use of software that allows visualization of intermediate PA results facilitates their review of PAs.

(19) DOE and its contractors believe that it would be helpful if NRC can share its independent models, inputs, and results so they could better understand how data provided by DOE in connection with the PA are used and interpreted by NRC staff.

(20) It is important to provide for retention of knowledge by scientists and engineers involved with PA development as the current generation of practitioners moves toward retirement.

(21) Based on experience at the Savannah River Site, information in PAs can be used to improve the design, construction, operation, and closure of disposal facilities, with improved safety and considerable monetary savings, so long as the relevant information is clearly communicated to operations personnel, system planners, and key decision-makers.

(22) It may be possible to leverage the DOE PA Community of Practice to assist in standardization of key assumptions and the use of key parameters such as uptake factors.

1.0 INTRODUCTION

1.1 Purpose

The purpose of this report is to identify lessons learned in management of DOE's waste incidental to reprocessing as discussed in panel discussions, technical presentations, and a day-long workshop held from February 25-28, 2013 at the WM2013 Symposium in Phoenix, Arizona. This workshop was sponsored by the High-Level Waste Sub-group of the Energy Facility Contractors Group (EFCOG) Waste Management Working Group and Waste Management Symposia in cooperation with DOE, the U.S. Nuclear Regulatory Commission (NRC), the U.S. Environmental Protection Agency (EPA), state regulatory organizations, and other stakeholders.

Some Key Terms Used in this Report

*The **EFCOG Waste Management Working Group (WMWG)** is an organization consisting of DOE contractors directed by senior level executives from DOE contractors, sustained by managers and subject matter experts from member contractors, and sponsored by DOE senior level executives. The EFCOG WMWG is operational in its activities. As such, it tackles issues and problems suggested by DOE sponsors and EFCOG Directors providing solutions through complex-wide integration of resources. In addition the EFCOG provides for the exchange of information useful to the membership in enhancing excellence in operations. This includes, but is not limited to, lessons learned, best management practices, industry benchmarks/standards, appraisal findings/resolutions, advances in technical and managerial areas, and new ideas/practices.*

***High-Level Waste** (HLW) is (A) The highly radioactive material resulting from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid material derived from such liquid waste that contains fission products in sufficient concentrations; and (B) other highly radioactive material that the NRC, consistent with existing law, determines by rule requires permanent isolation.*

***Waste incidental to reprocessing** (or WIR) is defined by DOE as follows: Those wastes that were associated with reprocessing of spent nuclear fuel or with the storage of wastes that were created during reprocessing of spent nuclear fuel that are not the highly radioactive material resulting from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid material derived from such liquid waste and do not contain fission products in sufficient concentrations, or other highly radioactive material that is determined, consistent with existing law, to require permanent isolation.*

***Performance assessment** is defined as follows: An iterative process involving site-specific, prospective modeling evaluations of the post-closure time phase for disposal or closure actions involving radioactive waste with two primary objectives: (1) to determine whether reasonable assurance of compliance with quantitative performance objectives can be demonstrated; and (2) to identify critical data, facility design, and model development needs for defensible and cost-effective licensing and/or certification decisions and to develop and maintain operating limits (i.e., waste acceptance criteria).*

1.2 Scope

Sessions at WM2013 explored the regulatory processes, reviews, roles, approvals, and interactions for waste incidental to reprocessing leading to disposal of this material as non- HLW. It focused on three processes related to waste incidental to processing:

- The citation process of DOE Manual 435.1-1, *Radioactive Waste Management Manual*;
- The evaluation process of DOE Manual 435.1-1; and
- The process for making waste determinations under Section 3116 of the *Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005*, commonly known as Section 3116.

These processes are discussed in Sections 3, 4, and 5 of this report, respectively, along with the lessons learned in implementation of each process. Information related to underground waste tank closure is included since two of the three Section 3116 determinations made to date have involved tank closure. However, the lessons learned are intended to focus on waste-incidental-to-reprocessing. As such, they cover tank waste retrieval and performance assessments (PAs) which directly relate to compliance with Section 3116 criteria, but they generally do not cover aspects of tank closure which are unrelated to compliance with the waste-incidental-to-reprocessing criteria.

WM2013 included a series of imbedded topical discussions on various aspects of waste incidental to reprocessing which lay the foundation for the workshop. Applicable lessons learned discussed at these sessions are included in this report, as are lessons learned related to waste incidental to reprocessing that were discussed in previous Waste Management symposia and other forums. Section 6 identifies the relevant technical papers and other cited documents. In several cases, for the sake of completeness, additional information was used in developing the lessons learned, such as technical papers presented at earlier Waste Management symposia (e.g., Sullivan, et al. 2012) and information developed for the updated HLW guidance for DOE Order 435.1A that was based largely on lessons learned in use of citation and evaluation processes by the HLW sites as identified during the site-wide review for updating DOE Order 435.1.

Appendix A summarizes the differences between the DOE Manual 435.1-1 evaluation process and the Section 3116 process. Attachment B lists panel discussions and technical papers at WM2013 that pertain to DOE waste incidental to reprocessing.

1.3 Background

The basis for the concept that certain wastes that are incidental to reprocessing are not HLW was initially established by the Atomic Energy Commission in the Statement of Proposed Policy (34 FR 8712) for Appendix D, 10 CFR Part 50, *Policy Relating to the Siting of Fuel Reprocessing Plants and Related Waste Management Facilities*. This position has since been continually supported by DOE and NRC.

In 1999, DOE issued DOE Manual 435.1-1, which provided requirements for determining whether certain reprocessing wastes were incidental to reprocessing. The Manual describes two processes to this end: the citation process and the evaluation process. The citation process focuses on

reprocessing wastes that cannot be HLW based on factors such as their origin and characteristics. The evaluation process focuses on more complex reprocessing wastes that require engineering analyses to determine whether or not they are HLW.

Four DOE sites manage HLW – the Hanford Site, the Idaho National Laboratory, the Savannah River Site, and the West Valley Demonstration Project. Each site developed its own implementing procedure for the waste-incidental-to-reprocessing requirements of DOE Manual 435.1-1 considering guidance in DOE Guide 435.1-1, *Implementation Guide For Use With DOE M 435.1-1*.

Each site determined by the citation process that many types of reprocessing wastes – such as tools, protective clothing, and certain equipment – were not HLW. Some HLW sites also determined by the evaluation process that more complex equipment used in connection with reprocessing was not HLW. The most recent such evaluations were performed by the West Valley Demonstration Project for its vitrification melter (DOE 2012) and for the two vessels used to mix and feed HLW slurry and glass formers to the melter (DOE 2013). These evaluations showed that this equipment was not HLW and could be managed as low-level radioactive waste (LLW).

In October 2004, the *Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005* was signed into law. Section 3116 of the Act contains criteria similar to the DOE Manual 435.1-1 evaluation criteria and provides that the Secretary of Energy, in consultation with NRC, may determine that waste resulting from reprocessing of spent nuclear fuel at DOE facilities in South Carolina and Idaho, that is to be disposed of within those states, is not HLW in cases where those criteria are met.

Energy Secretary Bodman made the first determination under Section 3116 in January 2006 for the Saltstone Disposal Facility at the Savannah River Site. (Saltstone is a cementitious waste form used to immobilize low-activity decontaminated salt solution removed from underground waste tanks.) Decontaminated salt solution continues to be disposed of as LLW at the Saltstone Disposal Facility.

Secretary Bodman made the second Section 3116 determination in November 2006 for the Tank Farm Facility at the Idaho National Laboratory. Grouting of the tanks began that month. All but four tanks have been grouted and operationally closed.

Secretary Chu made the third Section 3116 determination in March 2012 for F-Tank Farm at the Savannah River Site. Savannah River Remediation filled Tanks 18 and 19 in F-Tank Farm with grout and operationally closed them six months later. Preparations to grout and operationally close the other tanks in F-Tank Farm are underway[1].

[1] DOE filled two F-Tank Farm tanks (numbers 17 and 20) with grout and operationally closed them in 1997 before the current requirements were issued. DOE coordinated the tank closure strategy with NRC, the EPA, and the South Carolina Department of Health and Environmental (SCDHEC), the State agency that regulations the Savannah River Site underground waste tanks. Tanks 5 and 6 are scheduled to be operationally closed in 2013.

2.0 2013 WASTE MANAGEMENT SYMPOSIUM

With support of the Board of Directors for the Waste Management Symposia and the EFCOG, the WM2013 Program Advisory Committee and the EFCOG Waste Management Working Group jointly organized a series of panel discussions, technical presentations, and a workshop on waste incidental to reprocessing that are embedded in WM2013. WM2013 provided an opportunity and a forum for policy makers, practitioners, regulators and other stakeholders to celebrate successes and discuss opportunities for improvement.

2.1 Embedded Theme

The primary theme of the workshop and the supporting panel discussions and technical papers was waste incidental to reprocessing. Essentially all aspects were discussed, including successes as well as lessons learned.

This WIR theme linked the management, technical, regulatory, legal and stakeholder involvement aspects in the process of achieving consensus end states for the incident LLW fraction of the legacy liquid reprocessing HLW across the DOE complex.

It recognized the entire cradle-to-grave nature of the process and covered the initial selection of treatment technologies that separate the high and low level fractions of the waste, the retrieval technologies that remove the HLW from the tanks and ancillary equipment, the execution of those technologies, the unique challenges in the characterization of the LLW or residual material remaining in a tank following retrieval, the research and development performed to provide the technical bases for the development of the long term performance assessment, the modeling and evaluation of the performance assessments, the complete regulatory frameworks involving the State and other Federal agencies leading up to the final disposal or closure decisions.

At WM2013, this theme opened with two panels on Monday afternoon. The first panel (Session 14) explored the policy decisions around this process and the second (Session 15) recognized and celebrated recent successes achieved. Additional sessions across all tracks followed throughout the remainder of the symposia. These included the following:

- Session 35, Worldwide Waste Management Regulatory and Oversight Crosscutting Programs
- Session 36, Issues related to Waste Incidental to Reprocessing
- Session 68, Regulatory Challenges and Innovations
- Session 91, Progress in HLW Retrieval
- Session 92, Advancements in HLW Closure
- Session 59, Performance of Disposal Systems, Facilities and Sites
- Session 72, The Stakeholder's Voice – Involvement on Issues Related to WIR
- Sessions 101 & 117, Thursday WIR Workshop

The sessions ended with a networking reception on Thursday evening.

2.2 Major Observations

The panels included the former DOE Assistant Secretary for Environmental Management and current Deputy Assistant Secretaries, Office Directors, and Field Office Managers, along with senior officials from state regulatory organizations, the NRC, and the United Kingdom. For the United States, the sessions focused on the experiences in Section 3116 waste determinations or the DOE Order 435.1 WIR evaluation process. An overview of the national policies on HLW in the United Kingdom was also provided for comparison and contrast. The panel sessions opened with four United States panelists presenting their perspective on recent experiences of implementing 3116 and WIR Evaluation at Savannah River Site and West Valley, respectively, followed by a discussion recent similar experiences at Sellafield in the United Kingdom.

Other panel sessions featured key representatives on state regulators in the United States who are responsible for regulatory oversight of key DOE sites in Washington State, South Carolina, Tennessee, and New Mexico. Discussion topics included key challenges and examples of applied innovations in regulatory approaches which have resulted in streamlining regulatory interactions. Panelists discussed how they have influenced the various clean up or disposal missions at the respective DOE sites they regulate.

The panel sessions on Thursday focused on identification of lessons learned from development and implementation of WIR requirements from DOE Order 435.1 and the requirements from Section 3116. This was an all-day EFCOG workshop that focused on the development of key themes of the best practices and areas of improvement that were determined from the week-long embedded track on this subject. This workshop included representatives from the contractors and DOE representatives from all the DOE sites that manage HLW including: Savannah River, Idaho, West Valley and Hanford. Also included were representatives from DOE-EM and the NRC.

In this session, the results, thoughts, and ideas were critiqued for accuracy and then major lessons learned themes were bundled. All of the panelists discussed and added ideas to improve the process of development of WIR evaluations or 3116 determinations that are necessary to dispose as LLW waste items that have residual contamination resulting from HLW and to close in place underground waste storage tanks. NRC Monitoring requirements were also discussed along with development of ideas for areas of improvement.

Some of the key themes included:

- The need for a plan for institutional memory of core expertise,
- Methods for improvement of timeliness of technical reviews,
- Improved communications,
- Application of project management techniques to the development, reviews and approvals,
- Scoping meetings,
- Early engagement of decision makers,
- Growth of relationships between technical and regulatory staffs that should lead to open exchange and trust building,

- Transparency in the process,
- Jointly develop the consultation and monitoring process early with the end goal in mind, and
- Defining critical terms such as *reasonable assurance* and *non-compliance* for the NRC monitoring period and the PA development.

The lessons learned are documented in this report, which will be transmitted to DOE-EM by the EFCOG Waste Management Working Group.

Among the major observations from the workshop, panel discussions and technical papers were:

- The Citation process as currently described in DOE Manual 435.1-1 and DOE Guide 435.1-1 has worked well and three HLW sites have been able to dispose of waste incidental to reprocessing that had been stored onsite for many years by use of this process following consultation with the Office of Environmental Management and development of revised procedures supported by technical basis documents for the added waste streams.
- The DOE Manual 435.1-1 evaluation process used in recent years at the West Valley Demonstration Project worked well, and the second waste-incidental-to-reprocessing evaluation for the two vessels used to mix and feed HLW and glass formers to the vitrification melter proceeded much faster than the first evaluation for the melter by applying the lessons learned in preparation and NRC review of the melter evaluation.
- The Section 3116 consultation process used at the Idaho National Laboratory and the Savannah River Site has generally worked well. NRC review of the Savannah River Site F-Tank Farm documents started in August 2008 and ended in October 2011, with 13-15 months of actual time for NRC review, comment, and documentation in the Technical Evaluation Report. Efforts are now being made by DOE and NRC to speed up the review process for the similar H-Tank Farm performance assessment without compromising agency independence.

3.0 LESSONS LEARNED – DOE MANUAL 435.1 CITATION PROCESS

3.1 The Citation Process

The requirements for the citation process appear in Section II.B of DOE Manual 435.1-1, which states that:

> "Waste resulting from reprocessing spent nuclear fuel that is determined to be incidental to reprocessing is not high-level waste, and shall be managed under DOE's regulatory authority in accordance with the requirements for transuranic waste or low-level waste, as appropriate. When determining whether spent nuclear fuel reprocessing plant wastes shall be managed as another waste type or as high-level waste, either the citation or evaluation process described below shall be used:
>
> (1) **Citation**. Waste incidental to reprocessing by citation includes spent nuclear fuel reprocessing plant wastes that meet the description included in the Notice of Proposed Rulemaking (34 FR 8712) for proposed Appendix D, 10 CFR Part 50, Paragraphs 6 and 7. These radioactive wastes are the result of reprocessing plant operations, such as, but not limited to: contaminated job wastes including laboratory items such as clothing, tools, and equipment."

DOE Guide 435.1-1 provides guidance on implementation of the citation and evaluation processes and states that:

> "The distinction between the two processes [citation and evaluation] is important because it is clear from background events that citation process waste streams were so identified because of the ease of determining up front that they do not pose the long-term hazards associated with high-level waste. Evaluation process wastes, on the other hand, generally require a case-by-case evaluation and determination."

The citation process is therefore used for reprocessing wastes that can be demonstrated not to be HLW using readily available or observable information. The DOE HLW site implementing procedures generally include a list of items determined to not be HLW by the citation process, with the determinations being made by the DOE Field Element Manager or his or her designee.

In 2008, the Hanford Site revised its implementing procedure (Hanford 2008) to expand use of the citation process based on the definition of HLW and on lessons learned in use of the process (which are described in Section 2.2 below). This procedure introduced the term *secondary waste*, which consists of waste byproducts resulting from the management, retrieval, treatment, storage, handling, analysis, and/or disposal of HLW that have become radioactively contaminated by association with such waste. Equipment and materials that are secondary waste are therefore candidates for the use of the citation process.

In 2010, the Savannah River Site, with the assistance of the EFCOG WMWG, revised its implementing procedure (McNeil 2010) to expand use of the citation process based on the definition of HLW, the revised Hanford procedure, and an improved understanding of the

application of the guidance in DOE Guide 435.1-1. In 2011, the West Valley Demonstration revised its implementing procedure (WVDP 2011) with the assistance of an EFCOG WMWG team to take advantage of the improvements made at Hanford and Savannah River (Sullivan, et al. 2012). The West Valley procedure revision, for example, added three new waste streams to the equipment determined not to be HLW by the citation process, including a group of Main Plant Processing Building vessels and groups of tank equipment that included waste mobilization and transfer pumps.

In each case, the site made citation determinations for new waste streams that allowed disposal of more waste incidental to reprocessing as either LLW or transuranic waste. These determinations were supported by technical basis documents included with the revised procedures that considered the waste-incidental-to-reprocessing evaluation criteria of DOE Manual 435.1-1 (which are described in Section 3.1 below) and demonstrated that these criteria would be met for the new citation process waste streams. Before the determinations for the new waste streams were made, each site consulted with the DOE Office of Environmental Management to ensure that the revised implementing procedures were consistent with the intent of the requirements of DOE Manual 435.1 and with the guidance in DOE Guide 435.1-1. In addition, the DOE Office of Environmental Management consulted with the DOE Office of General Counsel, but no review of the documents was conducted by General Counsel.

3.2 Lessons Learned

The following lessons learned have come from use of the citation process by the DOE HLW sites[2]:

(1) Many reprocessing waste streams consist of equipment used in some aspect of management of HLW that was not produced in reprocessing of spent nuclear fuel and most of this equipment has a low potential for retaining significant amounts of waste due to its configuration and use.

(2) Sites managing HLW are required by DOE directives, policies, and technical standards to implement the as low as reasonably achievable (ALARA) principle to decontaminate equipment and decontamination performed in the field effectively removes most of the residual waste by simple processes such as flushing and rinsing with water.

(3) Characterization data typically show that radionuclide concentrations in waste packages containing the decontaminated equipment meet waste acceptance criteria for disposal as LLW and meeting the waste acceptance criteria for disposal in a shallow-land LLW disposal facility ensures that the equipment does not require geologic isolation and would not impact performance of the disposal site.

(4) Small pieces of equipment which would be classified as transuranic waste after decontamination can be blended with LLW in accordance with DOE and NRC guidance for ultimate disposal as LLW, which would reduce risks and disposal costs.

(5) The concept of secondary waste affords a convenient method of defining those waste streams that are candidates for the citation process.

[2] The first seven lessons learned are from Sullivan, et al. 2012.

(6) DOE HLW sites that take full advantage of the citation process can dispose of certain waste incidental to reprocessing that has been at the site for many years, reducing risk and eliminating unnecessary costs related to storage and surveillance.

(7) Consultation with the Office of Environmental Management when revising site implementing procedures for waste incidental to reprocessing is important to ensure that the requirements and guidance are being properly followed and to maintain consistency among the DOE HLW sites in this area.

(8) Utilization of the citation process and the associated guidance has provided insight into the proper classification of radioactive wastes prior to disposal, ensuring that risk and costs are reduced in cases where questions exist as to the nature and definition of reprocessing wastes.

(9) The citation process has worked well in recent years. Additional citation-process waste streams added by DOE at Hanford, Savannah River, and West Valley were well supported technically and clearly not within the definition of HLW. Since implementation of the citation process at the Savannah River Site, for example, over 3,000 cubic meters of secondary waste were managed and safely disposed as LLW meeting the PA performance objectives, thus reducing the risk to workers, the public, and the environment posed by continued storage of this waste.

The EFCOG believes that the upcoming revision to DOE Order 435.1 should include citation process requirements that are equivalent to the current requirements, which have served DOE well. The EFCOG further believes that guidance for citation process implementation under DOE Order 435.1A should address how to technically support making citation process determinations for wastes that may be incidental to reprocessing

4.0 LESSONS LEARNED – DOE MANUAL 435.1 EVALUATION PROCESS

4.1 The Evaluation Process

The requirements for the evaluation process appear in Section II.B of DOE Manual 435.1-1, which states that:

"Waste resulting from reprocessing spent nuclear fuel that is determined to be incidental to reprocessing is not high-level waste, and shall be managed under DOE's regulatory authority in accordance with the requirements for transuranic waste or low-level waste, as appropriate. When determining whether spent nuclear fuel reprocessing plant wastes shall be managed as another waste type or as high-level waste, either the citation or evaluation process described below shall be used:

(2) **Evaluation**. Determinations that any waste is incidental to reprocessing by the evaluation process shall be developed under good record-keeping practices, with an adequate quality assurance process, and shall be documented to support the determinations. Such wastes may include, but are not limited to, spent nuclear fuel reprocessing plant wastes that:

(a) Will be managed as low-level waste and meet the following criteria:

1. Have been processed, or will be processed, to remove key radionuclides to the maximum extent that is technically and economically practical; and
2. Will be managed to meet safety requirements comparable to the performance objectives set out in 10 CFR Part 61, Subpart C, *Performance Objectives*; and
3. Are to be managed, pursuant to DOE's authority under the *Atomic Energy Act of 1954*, as amended, and in accordance with the provisions of Chapter IV of this Manual, provided the waste will be incorporated in a solid physical form at a concentration that does not exceed the applicable concentration limits for Class C low-level waste as set out in 10 CFR 61.55, *Waste Classification*; or will meet alternative requirements for waste classification and characterization as DOE may authorize.

(b) Will be managed as transuranic waste and meet the following criteria:

1. Have been processed, or will be processed, to remove key radionuclides to the maximum extent that is technically and economically practical; and
2. Will be incorporated in a solid physical form and meet alternative requirements for waste classification and characteristics, as DOE may authorize; and
3. Are managed pursuant to DOE's authority under the *Atomic Energy Act of 1954*, as amended, in accordance with the provisions of Chapter III of this Manual, as appropriate."

Use of the DOE Manual 435.1-1 evaluation process typically involves the following major steps:

- First, a draft evaluation report is prepared to describe the subject waste, its source, and its radiological characteristics and how each of the relevant evaluation criteria has been or will be met. This draft evaluation provides preliminary conclusions about whether the subject waste is HLW or instead may be managed as LLW or transuranic waste.

- Consistent with DOE policy, the draft evaluation is provided to the NRC for consultation review[3] and made available for review by the public and the state(s) where the waste may be disposed of.
- NRC staff submits requests for additional information about different aspects of the draft evaluation.
- DOE provides the additional information requested by NRC staff.
- NRC issues a technical evaluation report with its conclusions about the technical adequacy of the draft evaluation considering the additional information provided by DOE.
- DOE prepares the final evaluation considering the additional information provided to NRC, the NRC technical evaluation report, and any comments on the draft evaluation received from the other stakeholders, including the public.
- With the approval of the Office of Environmental Management, the DOE Field Element Manager makes the determination as to whether the subject waste is HLW or can be disposed of as LLW or transuranic waste.
- The final evaluation, the waste determination, and written responses to comments from other stakeholders are then made available to the public on the websites of the DOE site and the Office of Environment Management.

The draft and final evaluation reports are typically prepared by a subject matter expert, such as a consultant or staff member at the site where to waste is located, with extensive experience in radioactive waste management and waste incidental to reprocessing. They undergo review by site contractor engineers and managers with similar experience and by the DOE Office of Environmental Management, who consults with the DOE Office of General Counsel in connection with its review to ensure that the evaluation is legally defensible. Quality assurance is consistent with applicable DOE quality assurance requirements including those in DOE Order 414.1D, *Quality Assurance*.

4.2 Examples of Use of the Evaluation Process

The West Valley Demonstration Project vitrification melter waste-incidental-to-reprocessing evaluation provides a good example of use of the DOE Manual 435.1-1 evaluation process. A WM 2012 technical paper (McNeil, et al. 2012a) and a related article in *Radwaste Solutions* magazine (McNeil, et al. 2012b) describe this evaluation. The abstract of the WM 2012 paper summarizes this evaluation as follows:

> "The Department of Energy (DOE) has determined that the vitrification melter used in the West Valley Demonstration Project can be disposed of as low-level waste (LLW) after completion of a waste-incidental-to-reprocessing evaluation performed in accordance with the evaluation process of DOE Manual 435.1-1, *Radioactive Waste Management Manual*. The vitrification melter – which consists of a ceramic lined, electrically heated box structure – was operated for more than 5 years melting and fusing high-level waste (HLW) slurry and glass formers and

[3] Such consultation is consistent with guidance in DOE Guide 435.1-1 and, for West Valley, with the West Valley Demonstration Project Act.

pouring the molten glass into 275 stainless steel canisters. Prior to shutdown, the melter was decontaminated by processing low-activity decontamination flush solutions and by extracting molten glass from the melter cavity. Because it could not be completely emptied, residual radioactivity conservatively estimated at approximately 170 TBq (4,600 Ci) remained in the vitrification melter. To establish whether the melter was incidental to reprocessing, DOE prepared an evaluation to demonstrate that the vitrification melter: (1) had been processed to remove key radionuclides to the maximum extent technically and economically practical; (2) would be managed to meet safety requirements comparable to the performance objectives for LLW established by the Nuclear Regulatory Commission (NRC); and (3) would be managed by DOE in accordance with DOE's requirements for LLW after it had been incorporated in a solid physical form with radionuclide concentrations that do not exceed the NRC concentration limits for Class C LLW. DOE consulted with the NRC on the draft evaluation and gave other stakeholders an opportunity to submit comments before the determination was made. The NRC submitted a request for additional information in connection with staff review of the draft evaluation; DOE provided the additional information and made improvements to the evaluation, which was issued in January 2012. DOE considered the NRC Technical Evaluation Report as well as comments received from other stakeholders prior to making its determination that the vitrification melter is not HLW, does not require permanent isolation in a geologic repository, and can be disposed of as LLW."

The more-recent evaluation process waste-incidental-to-reprocessing evaluation for the two vessels that fed this vitrification melter – the concentrator feed makeup tank and the melter feed hold tank – was prepared and processed in a similar manner. The Director of the West Valley Demonstration Project made the determination for DOE that these two vessels are not HLW and may be disposed of as LLW in February 2013.

As explained in the waste-incidental-to-reprocessing evaluations for West Valley vitrification melter and the two related vessels, this equipment will not be disposed of onsite but at an offsite LLW disposal facility such as the Area 5 Radioactive Waste Management Site at the Nevada National Security Site or the Waste Control Specialists LLW disposal facility in Texas. Given this situation, no PA had to be developed for disposal of the waste as is typically required in connection with Section 3116 waste determinations. Instead, the evaluations described the PAs of the Area 5 and Waste Control Specialists LLW disposal facilities in general terms and explained that disposal of the waste would have negligible impact on disposal site performance and described the basis for this conclusion[4].

Earlier waste-incidental-to-reprocessing evaluations include two that were prepared by the Savannah River Site in 2001. Both involved equipment wetted by HLW in underground waste tanks. One evaluation involved three slurry pumps used in Tank 40 (WSRC 2001a). The other involved a telescoping transfer jet used in Tank 41 (WSRC 2001b). Both were approved by DOE-Savannah River. Another early waste-incidental-to-reprocessing evaluation involved vitrification facility expended materials at the West Valley Demonstration Project (WVNSCO 2001).

[4] However, there may be cases where a new performance assessment would have to be prepared or an existing performance assessment updated in support of a DOE Manual 435.1-1 WIR evaluation, such as for closure of underground waste tanks at the Hanford site, where the Section 3116 process does not apply.

4.3 A More-Complicated Case

It is useful for context to mention one other case about waste-incidental-to-reprocessing involving the first vitrification melter used in HLW solidification at the Defense Waste Processing Facility at the Savannah River Site. This case is more complicated than the case of the West Valley vitrification melter because this melter could not be effectively emptied prior to shutdown and would be classified as transuranic waste instead of LLW.[5]

This spent vitrification melter reached its effective end of life after six years of radioactive operation. Prior to shutdown, the amount of molten glass in the melter cavity was reduced to a level of 16 inches above the cavity bottom by use of the standard high vacuum method to pull molten glass through the pour spout. However, attempts to further reduce the molten glass inventory using the bottom drain valve failed because the valve could not be made to operate as designed. The melter was then shutdown with the 16 inches (approximately 5,100 pounds) of glass remaining inside the unit, placed inside a steel waste package, and moved to temporary storage.

The melter was characterized using the radionuclide concentrations in the last batch of material it processed averaged over the 5,100 pounds of residual glass to determine the radionuclide inventory, which totaled approximately 3,900 curies[6]. The estimated radionuclide inventory was averaged over the mass of the melter and residual glass (approximate 175,000 pounds) to evaluate the Class C sums of fractions. This calculation showed that the Table 1 (long-lived radionuclides) sum of fractions exceeds 1.0 by a large margin. The total concentration of alpha-emitting radionuclides with half-lives greater than 20 years was estimated to be approximately 820 nanocuries per gram. The Table 2 (short-lived radionuclides) sum of fractions was estimated to be much less than one.

Even though melter waste package would normally be classified as transuranic waste, it could not be disposed of at the Waste Isolation Pilot Plant because it would be too large and too heavy to be accommodated in that facility. However, onsite disposal may be practical if the waste package were to meet all of the applicable evaluation process criteria.

Application of the evaluation process criteria to this melter would first involve determining the best onsite location for disposal of the melter waste package. Two options would be a purpose-built disposal cell and the onsite LLW disposal facility.

The purpose-built disposal cell could be constructed near but separate from the existing onsite LLW disposal facility. This disposal cell would have to meet the applicable requirements of DOE Order 435.1, such as maintaining waste confinement and incorporating monitoring and leak detection

[5] This matter was discussed only briefly at the workshop. Details about the vitrification melter and its potential disposal paths were developed in connection with preparation of guidance for managing HLW in support of DOE Order 435.1A. The EGCOG considered it to be useful to include this information here to illustrate potential difficulties associated with waste incidental to reprocessing that turns out to be transuranic waste, especially large and heavy equipment that cannot be sent to the Waste Isolation Pilot Plant.

[6] The West Valley Demonstration Project vitrification melter at shutdown contained approximately the same amount of residual radioactivity in about one-fifth of the residual material in the Defense Waste Processing Plant melter. However, the latter contained much higher concentrations of alpha-emitting transuranic radionuclides.

capabilities. It would have to be regulated by DOE as a transuranic waste disposal facility and meet all requirements that apply to such facilities.

The second step would be preparation of a PA that demonstrates a reasonable expectation that the facility (the purpose-built disposal cell) would meet the performance measures of 40 CFR Part 191. The third step would be to prepare a waste-incidental-to-reprocessing evaluation, which would include addressing each of the applicable evaluation process criteria.

A potential alternative approach for onsite disposal of this vitrification melter would involve making use of the third exception in the definition of transuranic waste: "(C) waste that the Nuclear Regulatory Commission has approved for disposal on a case-by-case basis in accordance with 10 CFR Part 61." With this approach, the vitrification melter would not be classified as transuranic waste.

This approach may be viable if plans were made to dispose of the melter in the onsite LLW disposal facility and a special analysis for melter disposal were to show that it would have a negligible impact on disposal site performance. With this approach, the special analysis would replace the PA with respect to 40 CFR 191 performance measures. The waste-incidental-to-reprocessing evaluation would be similar and the NRC consultation process would have to result in NRC approval of the disposal plan. This approach would require coordination with NRC staff early in the process to ensure that consultation with NRC could result in formal NRC approval of the disposal plan.

4.4 Hanford Underground Waste Tanks

The DOE Manual 435.1-1 evaluation process will apply to the underground waste tanks at the Hanford Site because the Section 3116 process does not apply to Hanford. Hanford plans to have one WIR evaluation for each waste management area, with the first being Waste Management Area C.

The PA for Waste Management Area C must be prepared before the WIR evaluation can be completed. Hanford is in the early stages of PA development, which is not currently proceeding due to funding limitations. However, based on experience at the Savannah River Site with development of the F-Tank Farm PA, Hanford held a series of 11 technical exchanges with regulatory agencies and other stakeholders in preparation for the PA. The resulting lessons learned are discussed in Section 4.4.

As a milestone for the Hanford Tri Party Agreement (TPA), M-045-80-1, in preparation for the first Hanford tank farm waste management area closure, the RPP-PLN-43725, Rev 1., *Radioactive Waste Determination Process Plan for Waste Management Area C Tank Residuals,* was developed. This document has been reviewed and accepted by the Washington State Department of Ecology. Portions of the demonstration plan include a description of the radioactive waste determination process that DOE will utilize for the component of tank waste residuals subject to the DOE authority. The waste determination process plan will outline the process used for the WIR Evaluation. The following tables are excerpts from this plan and outline the differences in classification authorities and information requirements.

Table 1. Key Differences Between Waste Classification Authorities

Area of Difference	NDAA Section 3116	DOE O 435.1 WIR Evaluation Process	DOE O 435.1 WIR Evaluation Process as Modified by DOE ORP Procedure
DOE Authority	Federal Law (NDAA)	DOE Order, based on authority granted by *Atomic Energy Act of 1954*	DOE Order, based on authority granted by *Atomic Energy Act of 1954*
State Role	Disposal must be conducted pursuant to a State-approved closure plan or State-issued permit. State coordinates with NRC on disposal monitoring. Not applicable to waste transported out of South Carolina and Idaho; not applicable in Washington.	No involvement required in waste determination decisions. Involvement in disposal actions is as defined in applicable state regulations (e.g., closure plan for dangerous waste landfill) and/or Federal facility agreement.	State and public involvement in waste classification determinations are recommended but are required only if alternate concentration limit must be used to meet 3rd criterion (i.e., if concentrations are not LTCC). State and public involvement in disposal action would occur with processing of required State closure plans/permits and NEPA/SEPA documents. State monitors using information generated through State-approved closure plan and permit.
NRC Role	Requires consultation on waste determinations, as well as disposal monitoring in perpetuity.	NRC consultation on waste determinations is strongly encouraged.	NRC consultation is recommended, but is required only if alternate concentration limit must be used to meet 3rd criterion (i.e., if concentrations are not LTCC). For determinations made prior to completion of waste retrieval, NRC monitors using PAs updated as retrieval actions are completed.
Congressional Role	Congress is notified if NRC monitoring indicates disposal action is not in compliance with performance objectives.	No direct involvement required.	No direct involvement required.

DOE = U.S. Department of Energy
LTCC = lower than Class C
NDAA = *Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005*, Public Law 108-375
NEPA = *National Environmental Policy Act of 1969*, 42 USC 4321, et seq.
NRC = U.S. Nuclear Regulatory Commission ORP = Office of River Protection
PA = Performance Assessment SEPA = *Revised Code of Washington* 43.21C, "State Environmental Policy Act"
WIR = waste incidental to reprocessing

References:
Atomic Energy Act of 1954, 42 USC 2011, et seq.
DOE O 435.1, 1999, *Radioactive Waste Management*, U.S. Department of Energy, Washington, D.C.

Note: it is anticipated that residuals concentrations in retrieved tanks will likely be both above and below Class C concentrations in various locations.

Table 2. Key Differences Between Waste Classification Technical Criteria Applicable to On-Site Disposal

Area of Difference	NDAA Section 3116	DOE O 435.1 WIR Evaluation Process	DOE O 435.1 WIR Evaluation Process as Modified by DOE ORP Procedure
Requirement for Source Removal	Remove highly radioactive radionuclides to the maximum extent practical.	Remove key radionuclides to the maximum extent that is technically and economically practical.	Remove key radionuclides to the maximum extent that is technically and economically practical.
Requirements related to concentration limits	Determine waste does not exceed Class C LLW limits and will be disposed of in compliance with 10 CFR 61, Subpart C OR Determine waste exceeds Class C LLW limits but will be disposed of in compliance with 10 CFR 61, Subpart C AND pursuant to plans developed by the Secretary of Energy in consultation with the NRC.	Manage waste pursuant to DOE M 435.1-1 LLW requirements Incorporate waste into solid physical form such that concentrations do not exceed Class C LLW levels OR meet alternative requirements as authorized by DOE Manage waste to meet safety requirements comparable to performance objectives of 10 CFR 61, Subpart C	Manage waste pursuant to DOE M 435.1-1 LLW requirements Incorporate waste into solid physical form such that concentrations do not exceed Class C LLW levels OR meet alternative requirements as authorized by DOE in consultation with NRC Manage waste to meet safety requirements comparable to performance objectives of 10 CFR 61, Subpart C

DOE = U.S. Department of Energy
LLW = low-level waste
NDAA = *Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005*, Public Law 108-375
NRC = U.S. Nuclear Regulatory Commission
ORP = Office of River Protection
WIR = waste incidental to reprocessing

References:

10 CFR 61, Subpart C, "Performance Objectives," *Code of Federal Regulations*, as amended.
DOE M 435.1-1, 1999, *Radioactive Waste Management Manual*, U.S. Department of Energy, Washington, D.C.
DOE O 435.1, 1999, *Radioactive Waste Management*, U.S. Department of Energy, Washington, D.C.

Table 3. Information Required to Meet Waste Incidental to Reprocessing Evaluation Process Criteria

DOE M 435.1-1 WIR Evaluation Process Criterion	Information required under "WIR Determinations" (ESQ-EM-IP-M435.1-1-01)
Criterion 1: Process waste to remove key radionuclides to the maximum extent technically and economically practical.	Document ongoing waste retrieval actions to demonstrate meeting this criterion, taking care to provide specific analysis of removal of key radionuclides. Document radioactive material removal effectiveness and efficiency, programmatic and technical risk, possible constraints due to physical or chemical incompatibility, and potential impacts to the public, workers, and environment.
Criterion 2: Manage waste to meet requirements comparable to the performance objectives of 10 CFR 61, Subpart C.	Develop performance assessment consistent with requirements of DOE M 435.1-1, Chapter IV and include summary information in the Waste Determination basis document. Include planned methods for waste stabilization, tank backfill, and intrusion barriers. Waste Determination basis document must also address requirements of 10 CFR 61.43 and 61.44.
Criterion 3: Manage waste in accordance with DOE M 435.1-1 Chapter IV. Incorporate waste into solid physical form at a concentration not exceeding limits for Class C LLW (or meet alternative requirements as authorized by DOE).	Document waste stabilization method to be used, recording rationale for concentration averaging. Document calculations demonstrating radionuclide concentrations will not be greater than Class C limits **OR** demonstrate, in consultation with NRC, that the disposal system will provide appropriate measure of protectiveness.

DOE = U.S. Department of Energy LLW = low-level waste WIR = waste incidental to reprocessing

References:

10 CFR 61, Subpart C, "Performance Objectives," *Code of Federal Regulations*, as amended.

10 CFR 61.43, "Protection of Individuals During Operations," *Code of Federal Regulations*, as amended.

10 CFR 61.44, "Stability of the Disposal Site After Closure," *Code of Federal Regulations*, as amended.

Atomic Energy Act of 1954, 42 USC 2011, et seq.

DOE M 435.1-1, 1999, *Radioactive Waste Management Manual*, U.S. Department of Energy, Washington, D.C.

DOE O 435.1, 1999, *Radioactive Waste Management*, U.S. Department of Energy, Washington, D.C.

ESQ-EM-IP-M435.1-1-01, Rev. 0, "Waste Incidental to Reprocessing (WIR) Determinations," U.S. Department of Energy, Office of River Protection, Richland, Washington.

4.5 Lessons Learned

The following lessons learned have come from use of the evaluation process by the DOE HLW sites and from consideration of the situation with the first spent Defense Waste Processing Plant vitrification melter:

(1) It is important for consistency to use language identical to that used in previous evaluations and in Section 3116 basis documents to the extent practicable.

(2) Time should be factored into the schedule for the necessary consultation with the DOE Office of General Counsel and NRC staff.

(3) It is important to include in the evaluation details on estimates for residual material and residual radioactivity in the waste – such as characterization data quality objectives, data

quality assurance, data variability, and estimate uncertainty – as well as clearly describing the basis for the estimates.

(4) It is useful for completeness to consider in the evaluation an alternate method of estimating residual radioactivity in the waste as a cross check on the accuracy of the primary estimating method, when practical.

(5) Descriptions of cost-benefit analyses included in the evaluation must be clear and complete and the analyses supportable.

(6) While the evaluation must include information on potential disposal facilities for the waste, the evaluation scope must make it clear that disposal of the waste is not within the scope of the evaluation, because actual disposal would be the subject of a separate effort.

(7) A PA does not have to be developed in support of most DOE Manual 435.1-1 waste-incidental-to-reprocessing evaluations because the subject waste can be disposed of in an existing LLW disposal facility, which would already have an approved PA, although a special analysis might be required to verify that the waste would have negligible impact on disposal facility performance.

(8) In cases where a new or updated disposal site PA is not required in support of the evaluation, it is appropriate to limit PA information in the evaluation to that necessary to show that each potential disposal site meets its performance objectives, using information, for example, from the disposal facility annual report, and the estimated impact (generally negligible) from disposal of the waste.

(9) Informal telephone discussions between NRC analysts and DOE contractors on questions and information needed in advance of submittal of the formal requests for information have proven to be useful to reducing the time necessary for DOE to respond to the requests for information.

(10) Appendices to the evaluation showing that DOE and NRC dose standards and LLW disposal standards are comparable are appropriate to avoid questions on these matters with respect to the criterion "Will be managed to meet safety requirements comparable to the performance objectives set out in 10 CFR Part 61, Subpart C, *Performance Objectives*."

(11) It is important to clearly identify the scope of the NRC consultation review in the interagency agreement used for this purpose to ensure that the review is appropriate.

(12) Open communication with NRC staff throughout the consultation process – such as conference telephone calls to discuss planned responses to requests for information – is important to ensure that information provided by DOE to NRC to support its review is complete and appropriate.

(13) There must be a strong DOE-HQ advocate working with the NRC to help define interagency scope and lead teleconferences to clarify comments and comment responses. Draft comment responses should be discussed with NRC in advance of

formal issue of RAI's so that all parties understand the issues and deal in a timely manner with them.

(14) Waste incidental to reprocessing that must be classified as transuranic waste can be very difficult to dispose of compared to waste classified as LLW, as indicated in the discussion about the first vitrification melter used in the Defense Waste Processing Facility.

The EFCOG believes that DOE should consider development of a strategy for vitrification melter shutdown near the end of melter life that balances production goals, costs, and disposal options. In a case where a PA must be developed in support of a DOE Manual 435.1-1 waste-incidental-to-reprocessing evaluation, it would be important to make use of lessons learned related to PAs prepared in support of the Section 3116 process, such as the importance of regulatory involvement in the early stages of PA development. These lessons learned are discussed below in Section 5.4.

5.0 LESSONS LEARNED – SECTION 3116 PROCESS

5.1 The Section 3116 Process

The criteria appear in Subsection (a) of Section 3116. Section 3116(a) provides:

"IN GENERAL—Notwithstanding the provisions of the Nuclear Waste Policy Act of 1982, the requirements of section 202 of the Energy Reorganization Act of 1974, and other laws that define classes of radioactive waste, with respect to material stored at a Department of Energy site at which activities are regulated by a covered State pursuant to approved closure plans or permits issued by the State, the term 'high-level radioactive waste' does not include radioactive waste resulting from the reprocessing of spent nuclear fuel that the Secretary of Energy (in this section referred to as the 'Secretary'), in consultation with the Nuclear Regulatory Commission (in this section referred to as the 'Commission'), determines—

(1) does not require permanent isolation in a deep geologic repository for spent fuel or high-level radioactive waste;

(2) has had highly radioactive radionuclides removed to the maximum extent practical; and

(3) (A) does not exceed concentration limits for Class C low-level waste as set out in Section 61.55 of title 10, Code of Federal Regulations, and will be disposed of—

(i) in compliance with the performance objectives set out in subpart C of part 61 of title 10, Code of Federal Regulations; and

(ii) pursuant to a State-approved closure plan or State-issued permit, authority for the approval or issuance of which is conferred on the State outside of this section; or

(B) exceeds concentration limits for Class C low-level waste as set out in section 61.55 of title 10, Code of Federal Regulations, but will be disposed of –

(i) in compliance with the performance objectives set out in subpart C of part 61 of title 10, Code of Federal Regulations;

(ii) pursuant to a State-approved closure plan or State-issued permit, authority for which is conferred on the State outside of this section; and

(iii) pursuant to plans developed by the Secretary in consultation with the Commission."

Subsection (b) of Section 3116 addresses monitoring by NRC. Subsection (c) addresses inapplicability to certain materials (i.e., materials transported from the covered State). Subsection (d) identifies the covered States (South Carolina and Idaho.) Subsection (e) addresses certain matters concerning construction of section 3116, and provides that the section does not establish any precedent in any State other than South Carolina and Idaho, and does not amend the West Valley Demonstration Act. Subsection (f) provides for judicial review of determinations made pursuant to section 3116 and of any failure by NRC to carry out its monitoring responsibilities.

The Section 3116 requirements were developed to expedite cleanup at the Idaho National Laboratory and the Savannah River Site. They provide a legal framework for determining that residual waste in underground storage tanks at those sites is waste incidental to reprocessing and, as such, reaffirm DOE's authority to classify radioactive waste.

It is important to note that Section 3116 provides requirements for host State involvement in the process by requiring a State closure plan or permit for the covered activity. As a result, the State regulatory organizations are integrally involved in the reviews and approvals of the HLW Tank closure programs at the covered States of Idaho and South Carolina.

The following information from the *Basis for Section 3116 Determination for the Idaho Nuclear Technology and Engineering Center Tank Farm Facility* (DOE 2006b) provides perspective on the first Section 3116 criteria[7]. Attachment A summarizes key differences between the DOE Manual 435.1-1 evaluation criteria and the Section 3116 criteria.

The first criterion or clause in Section 3116(a), as set forth in Section 3116(a)(1), provides that the waste "does not require permanent isolation in a deep geologic repository for spent fuel or high-level radioactive waste." DOE Manual 435.1-1 does not contain an identical consideration, but similarly provides in relevant part in Chapter II.B.(2)(a) that the waste "will be managed as low-level waste" and meet the criteria in Section II.B.(2)(a).

With respect to the first criterion or clause, as provided in Section 3116(a)(1), the DOE, in consultation with the NRC, has explained:

> "Clause (1), noted above, is a broader criterion for the Secretary, in consultation with the NRC, to consider whether, notwithstanding that waste from reprocessing meets the other two criteria, there are other considerations that, in the Secretary's judgment, require its disposal in a deep geologic repository. Generally, such considerations would be an unusual case because waste that meets the third criterion would be waste that will be disposed of in a manner that meets the 10 CFR 61, Subpart C performance objectives and either falls within one of the classes set out in 10 CFR 61.55 that the NRC has specified are considered "generally acceptable for near-surface disposal" or for which the Secretary has consulted with NRC concerning DOE's disposal plans. As the NRC explained in *In the Matter of Louisiana Energy Services, L.P. (National Enrichment Services)* (NRC 2005), the 10 CFR Part 61, Subpart C performance objectives in turn "set forth the ultimate standards and radiation limits for (1) protection of the general population from releases of radioactivity; (2) protection of individuals from inadvertent intrusion; (3) protection of individuals during operations; and (4) stability of the disposal site after closure." It follows that if disposal of a waste stream in a facility that is not a deep geologic repository will meet these objectives, in the ordinary case that waste stream does not "require disposal in a deep geologic repository" because non-repository disposal will be protective of public health and safety.

[7] This same information appears in appendices to the West Valley Demonstration Project vitrification melter and vessel waste-incidental-to-reprocessing evaluations (DOE 2012 and DOE 2013, respectively).

It is possible that in rare circumstances a waste stream that meets the third criterion might have some other unique radiological characteristic or may raise unique policy considerations that warrant its disposal in a deep geologic repository. Clause (1) is an acknowledgement by Congress of that possibility. For example, the waste stream could contain material that, while not presenting a health and safety danger if disposed of at near- or intermediate-surface, nevertheless presents non-proliferation risks that the Secretary concludes cannot be adequately guarded against absent deep geologic disposal. Clause (1) gives the Secretary, in consultation with NRC, the authority to consider such factors in determining whether waste that meets the other two criteria needs disposal in a deep geologic repository in light of such considerations."

The second criterion of Section 3116(a) specifies that the waste "has had highly radioactive radionuclides removed to the maximum extent practical." DOE Manual 435.1-1, Chapter II.B.(2)(a)1, contains a similar provision, which specifies that such wastes "[h]ave been processed, or will be processed, to remove key radionuclides to the maximum extent that is technically and economically practical." The second Section 3116 criterion and the second DOE Manual 435.1-1 criteria are comparable because the terms *key radionuclides* and *highly radioactive* radionuclides are equivalent in this context as acknowledged by NRC staff (NRC 2007).

The third criterion in section 3116(a)(3) concerns whether the waste meets the concentration limits for Class C LLW in 10 CFR 61.55 and whether the waste will be disposed of in accordance with the performance objectives at 10 CFR 61, Subpart C. The criteria in DOE Manual 435.1-1, Chapter II (B)(2)(a)2 and (a)3 similarly provide that waste "[w]ill be managed to meet safety requirements comparable to the performance objectives set out in 10 CFR Part 61, Subpart C" and "will be incorporated in a solid physical form at a concentration that does not exceed the applicable concentration limits for Class C low-level waste as set out in 10 CFR 61.55", respectively. These two criteria are therefore comparable.

Another difference between the Section 3116 and the DOE manual 435.1-1 processes is that a Section 3116 waste determination must be signed by the Secretary of Energy. The waste determinations for the West Valley vitrification melter and the related vessels were signed by the Director of the West Valley Demonstration Project after he received authorization to do so by the Office of Environmental Management.

Carrying out the Section 3116 process is generally more time consuming and complex than carrying out the similar to the DOE Manual 435.1-1 process due to factors such as:

(1) The greater complexity of the subject waste, for example, a large and complex underground waste tank farm compared to a single piece of equipment such as a vitrification melter;

(2) The need to develop or update a supporting PA in most cases[8]; and

[8] If the Section 3116 process were to be used for evaluation of a waste stream such as a piece of equipment to be disposed of in an existing onsite radioactive waste disposal facility, then a new or updated performance assessment would not be required. The Section 3116 process has not yet been used for such a case.

(3) The additional levels of review from the NRC consultation, the State Regulator (due to the State approval of a permit or closure plan), and the Secretary of Energy.

5.2 The Idaho Tank Farm Facility Section 3116 Determination

As noted previously, the Secretary of Energy made the Section 3116 determination for Idaho Nuclear Technology and Engineering Center Tank Farm Facility in November of 2006 (DOE 2006b). Retrieving waste from the Idaho tanks proved to be relatively easy because these tanks are made of stainless steel without internal cooling coils and contained no solids. The tanks were cleaned to a greater extent than initially planned. The PA modeling for the Idaho site was simpler than for the Savannah River Site because of Idaho's much greater depth to groundwater. Lessons learned in grouting the tanks led to process improvements in grouting of Tank 18 and Tank 19 at the Savannah River Site.

5.3 The Savannah River Site F-Tank Farm Section 3116 Determination

As noted in Section 1.3, the Secretary of Energy has made the Section 3116 determination In March 2012 for F-Tank Farm at the Savannah River Site (DOE 2012). It is useful to briefly review the F-Tank Farm experience to illustrate the complexity of the Section 3116 process and to help provide context for the lessons learned discussed in Section 5.3.

F-Tank Farm contains 22 underground waste tanks, two of which were operationally closed in 1997 as noted previously. These tanks and the related facilities are obviously much more complex to deal with from a waste-incidental-to-reprocessing standpoint than as single piece of equipment such as a vitrification melter.

Shortly after the National Defense Authorization Act was signed into law in 2004, DOE moved forward with preparations for operational closure in accordance with Section 3116 of two tanks in F-tank Farm, Tanks 18 and 19, which are located within the same group as Tanks 17 and 20 that were operationally closed in 1997. In support of this effort, the site contractor prepared a draft Section 3116 basis document (DOE, 2005) and a supporting performance assessment demonstration document (Buice, et al., 2005), along with the required State-approved closure plans.

However, during this period a new mechanical tank heel removal technology was developed. DOE determined that a similar device could be used to remove additional waste from Tanks 18 and 19. Rather than proceeding with operational closure of Tanks 18 and 19 as planned, DOE had a similar tethered robotic crawler called the Sand Mantis developed, which was used to breakup and remove additional residual material from Tanks 18 and 19.

While preparations for this additional waste removal were being made, DOE determined that it would be more efficient to make a single Section 3116 determination for the entire F-Tank Farm, rather than just for Tanks 18 and 19. The site contractor then began work on a draft Section 3116 basis document, a PA, and the other supporting technical documents for operational closure of F-Tank Farm.

Meanwhile, DOE and NRC managers met to share lessons learned in connection with NRC review of the Section 3116 draft determination basis documents. One lesson had to do with NRC review of the associated PAs, which accounted for over 95 percent of the requests for additional information. DOE and NRC concluded that discussion of the PA inputs, the alternatives considered, and the basis for the various assumptions early in the process could reduce the number of requests for additional information and this conclusion led to use of a new scoping process.[9]

Eleven scoping meetings on the F-Tank Farm PA were held over an 18 month period ending in June 2008. Participants included DOE staff, DOE contractors, NRC staff, SCDHEC staff, and EPA Region IV staff, including the scientists and analysts to be involved in development and review of the PA. (The EPA was involved due to the fact that the Savannah River Site tanks are within an area with will be closed under the *Comprehensive Environmental Response, Compensation, and Liability Act* in the future.) The DOE contractor prepared information packages to support the meetings, which covered various aspects of the planned F-Tank Farm conceptual model, along with the mathematical models planned to be used.[10] While these scoping meetings were not open to members of the public, DOE prepared meeting summaries and made them publically available. The DOE contractor also conducted a workshop (referred to as PA 101) to simply explain the PA process to members of the public.

The DOE contractor prepared the F-Tank Farm PA in parallel with the scoping meetings, considering general comments from NRC staff and other scoping meeting participants, and completed Revision 0 of the PA in June 2008. Review by NRC staff produced 80 comments. For example, NRC questioned the level of model support for a number of assumptions, including the hybrid approach to modeling, the conceptual model within cases such as water table rise and fast pathways, and the parameter and model basis, including inventory, which could result in changes to the results. The 80 comments were far fewer than those submitted on the Saltstone Disposal Facility PA. And the overall time spent to prepare, review, and approve the PA was a significant improvement.

In March 2010, the DOE contractor completed Revision 1 to the PA, which addressed the comments from NRC and other stakeholders on Revision 0. Review of Revision 1 and the draft Waste Determination by NRC staff produced 94 more requests for additional information and clarifying comments.[11] The DOE contractor provided the additional information and addressed the comments in the special analysis developed for Tanks 18 and 19 that made use of the final residual inventories inside those tanks.

The NRC issued its Technical Evaluation Report on the Draft Section 3116 Waste Determination Basis Document in November 2011. After consideration of this report, the Secretary of Energy made the Section 3116 determination for F-Tank Farm in March 2012.

---

[9] The information in this paragraph and the two paragraphs that follow came from Letourneau and Suttora 2010.

[10] A performance assessment makes use of two types of models. One or more conceptual models describe all of the relevant properties of the disposal site, including the estimated radionuclide inventory at closure. One or more mathematical models are used with the conceptual model to calculate potential doses under different scenarios.

[11] McKenney, et al. 2013b discusses the reduction in risk-significant comments from NRC staff on the F-Tank Farm performance assessment and includes a chart showing the relative numbers of comments in different areas that NRC made during the scoping process and on Revision 0 and Revision 1 of the F-Tank Farm PA.

5.4 Lessons Learned

The following lessons learned have come with use of the Section 3116 requirements at the Idaho National Laboratory and the Savannah River Site. They are divided into four categories: (1) general, (2) those associated with waste retrieval (tank cleaning), (3) those associated with PAs, and (4) those associated with NRC monitoring.

General

Lessons learned of a general nature have included:

(1) Clear, open, and frequent communications between DOE and its regulators and other stakeholders on matters related to the Section 3116 process are extremely important for success. The PA scoping meetings held at Savannah River Site and Hanford are good examples of this and lessons learned in these meetings are discussed below under PA lesson learned. Frequent communications with stakeholders are also important.

(2) Complete transparency on the part of DOE in its activities related to Section 3116 determinations and underground waste tank closure is necessary to build and maintain trust with regulators and other stakeholders, which is essential for effective partnerships. In all meetings with the regulators and other stakeholders, a key to success is to always have the Project Manager present and in a lead role in the meetings to help lend consistency.

(3) Regulatory interactions are much more efficient when DOE and its regulators effectively work in partnership and such teamwork can result in regulatory documents being approved before fieldwork is ready to begin, thereby accelerating risk reduction and saving considerable time and money without sacrificing regulator independence or integrity. It is important to note that during all of the discussions at the WM2013 panel discussions, technical sessions, and the EFCOG Workshop, many participants believed that timeliness of reviews should be improved. This could be improved by application of project management scheduling techniques noted in (7) below.

(4) The site citizens' advisory board, should be encouraged to participate as early and as much as practical in various aspects of future determinations and other tank closure activities.

(5) It is useful for the regulatory agencies to establish common goals and values and display these at public meetings to help show that all parties are working together to protect worker and public health and safety and the environment.

(6) It is important that representatives from all agencies involved speak at public meetings to demonstrate to stakeholders that they are effectively working together.

(7) The use of a project management approach has proven to be beneficial in work related to developing Section 3116 basis documents and the supporting documentation at both Idaho and Savannah River, especially in the areas of communications, reviews, and risk management. Project schedules that include the timelines and interactions (depicted as "swim lanes" by Savannah River Remediation) among all DOE, contractors, regulators and stakeholders are a key to success and improvement in the time to completion of these closures. Development of a project risk review program is also a key to success. The project

schedule should be designed so that regulatory reviews are complete when the actual closure in the field is ready to start

(8) It is important to involve senior management of all agencies early in the Section 3116 process. The identification of key decision makers in each organization and the ability to access them in a timely fashion should be built into the project,

(9) It is important to maintain a core technical/engineering group focused on the Section 3116 process to ensure adequate institutional memory of the process. This group must not only be knowledgeable, but be skilled in the ability to successfully communicate complex technical information in a way that all stakeholders could understand and trust the information.

(10) It is essential that a complete administrative record that documents key decisions and policy choices in an open and transparent manner be maintained.

(11) A change control program needs to be in place that can gain technical evaluation and appropriate management approval of discoveries or proposed changes. The "Unreviewed Waste Management Question Evaluation" approach should be institutionalized and required.

The EFCOG believes that:

(a) DOE should work with its Contractors to develop and define the scope of the conduct of consultation with the NRC for Section 3116 required consultation activities and for WIR Evaluations when consultation is desired. A guidance document should be prepared for the DOE activities concerning NRC consultation activities and used as a basis for a Memorandum of Agreement with the NRC for these activities. This guidance document should be based on a rigorous project management approach.

(b) DOE and NRC should explore other methods including, but not limited to scoping meetings to shorten the NRC consultation cycle without comprising safety or agency independence.

Waste Retrieval

Retrieval of residual material from underground waste tanks – that is, cleaning the tanks – is necessary to satisfy the second Section 3116 criterion: "has had highly radioactive radionuclides removed to the maximum extent practical." Lessons learned in waste retrieval efforts to date include:

(1) An agreed-to definition of the term *maximum extent practical* would be useful to ensure a common understand among agencies and other stakeholders.

(2) Certain underground waste tanks can dominate predicted future doses from a closed tank farm because they contain more residual highly radioactive radionuclides that are important to long-term dose than other tanks after heel removal, or because of their particular location within the tank farm, or both, and these tanks may require additional heel removal consistent with ALARA requirements.

(3) A detailed analysis of the costs and benefits of further removal would be appropriate in such a case, taking into account various factors such as predicted reductions in dose to a future member of the public, the increase in worker dose, the monetary costs for additional waste

retrieval and treatment, and schedule impacts. It is good practice for perspective to compare the predicted dose reduction to a hypothetical future individual over 50 years to the estimated worker radiation dose to retrieve additional waste, and to compare the estimated unit cost of the predicted risk reduction to the actual unit cost of risk reduction on other DOE remediation projects.

Performance Assessments

A new or updated PA has been a key element in each of the three Section 3116 waste determinations made to date to demonstrate that disposal of the subject waste will meet criterion 3.A(i): "in compliance with the performance objectives set out in subpart C of Part 61 of title 10, Code of Federal Regulations." Lessons learned regarding PAs related to Section 3116 determinations include[12]:

(1) It is important that PAs be developed in a transparent fashion so that the agencies that will review them and other stakeholders fully understand the basis for their content, including the conceptual models and mathematical models used.

(2) Scoping meetings to promote collaboration in development of the PA that involve staff members from DOE, the DOE contractor, NRC, EPA, and State regulators can be useful to build trust, promote interagency working relationships, and instill a spirit of partnership in protecting public health and the environment.

(3) The scoping meeting process can be effectively implemented with public meetings as well as meetings that are not open to the public, based on experience at the Hanford site.

(4) Public participation in the scoping meeting process can be enhanced by providing briefings or other information necessary to help laypersons understand the PA process.

(5) The scoping meeting process provides insights into key factors that influence facility performance, which can reduce the number of regulatory agency review comments on the PA.

(6) The scoping meeting process can lead to improvements in PAs, such as development of a probabilistic model to evaluate uncertainty in deterministic model predictions[13].

(7) The NRC staff review of PAs has added considerable value but prolonged interactions between NRC analysts and DOE contractor engineers and scientists can add considerable time to the overall process for making Section 3116 determinations. The EFCOG believes that DOE and NRC should explore other ways to shorten the NRC consultation cycle without comprising safety or agency independence.

(8) It is better to have the PA describe the results of the analyses without stating the interpretations and conclusions about compliance with the performance measures, instead incorporating these interpretations and conclusions in the "basis documents"

[12] The sources for many of these lessons learned are Letourneau and Suttora 2010; McKenney, et al. 2013b; and Suttora and Seitz 2013.

[13] NRC staff considers this to be the most significant improvement in the F-Tank Farm PA to come out of the scoping meeting process (McKenney, et al., 2013b).

where they are more appropriate, so reviewers of the PA can focus on whether it is thorough and technically supported.

(9) A graded and iterative approach that helps focus efforts on those aspects of the disposal system that have the greatest influence on whether there is a reasonable expectation that the facility will meet its performance objectives has proven to be useful.

(10) A hybrid approach to PA development – wherein probabilistic modeling results that evaluate model uncertainties and sensitivities are considered along with the deterministic base-case modeling results – has proven more effective than previous deterministic-only modeling in predicting the future behavior of the disposal system, including the probability of catastrophic consequences from radioactivity that could be released in the far future.[14]

(11) The use of a "top-down, bottom-up" approach has proven useful in understanding the total behavior of the disposal system.[15]

(12) Compliance with DOE PA maintenance plan requirements has resulted in a process of continual improvement where new information and better analytical tools are used to reduce uncertainties in PA results and better inform the related decisions, with this process continuing throughout the life of the disposal facility. DOE PA maintenance should include methods to increase confidence in the key assumptions and inputs and could include performance testing with simulated materials. However, the risk reduction that results from tank closure should not be delayed to await a technical breakthrough that may only improve the knowledge that has already supported a conclusion that reasonable assurance exists that performance objectives will be met.

(13) To achieve the primary goal in making use of the results of a tank farm closure PA – that is, to provide a better understanding of the risks associated with the fate and transport of contaminants following final closure of the tank farm – it is important for the PA to provide results concentrating on the relative magnitude of risk while identifying the conceptual model decisions and critical assumptions most impacting these results.

(14) It would be useful for DOE to define in writing key terms used in connection with PAs – such as *reasonable expectation*, *reasonable assurance*[16], and *reasonably conservative* – so that all parties will have a common understand of what these terms mean.

(15) Barrier analyses form essential elements of PAs in that understanding the performance of individual and multiple barriers is essential to understanding radionuclide fate and transport to the point of compliance along with the associated uncertainties, especially in

[14] DOE staff considers that "Over time, the approaches to assess sensitivity and uncertainty have demonstrated the most significant improvements to DOE PAs" (Suttora and Seitz 2013).

[15] The concept of starting from an understanding of the conceptual site model and safety functions of different barriers to establish the scenarios to be considered is referred to as a "top down" approach. Using this top-down approach as a starting point, more recent DOE PAs have also been using approaches based on international lists of features, events and processes as an audit tool to check for elements that may not have been addressed as part of the top-down approach. Internationally, this combined approach has been referred to as "top down, bottom up," reflecting the fact that features, events and processes based approaches for scenario development have often been referred to as "bottom up" approaches. (Suttora and Seitz 2013).

[16] DOE has described the general concepts related to the acceptability or unacceptability of the level of evidence needed to defend claims of reasonable assurance (Schhweitzer and Sastre 1987). However, this paper does not include a concise definition of the term *reasonable assurance*.

cases where information indicates that one particular barrier will not perform as initially expected.

(16) It is important for DOE and NRC staff to share plans and designs for research and development work and status/results of the studies.

(17) The NRC staff has found that having the DOE models during their reviews has allowed them to better focus on risk-significant issues.

(18) The NRC staff has found that the use of software that allows visualization of intermediate PA results facilitates their review of PAs.

(19) DOE and its contractors believe that it would be helpful if NRC can share its independent models, inputs, and results so they could better understand how data provided by DOE in connection with the PA are used and interpreted by NRC staff.

(20) It is important to provide for retention of knowledge by scientists and engineers involved with PA development as the current generation of practitioners moves toward retirement.

(21) Based on experience at the Savannah River Site, information in PAs can be used to improve the design, construction, operation, and closure of disposal facilities, with improved safety and considerable monetary savings, so long as the relevant information is clearly communicated to operations personnel, system planners, and key decision-makers.

(22) It may be possible to leverage the DOE PA Community of Practice to assist in standardization of key assumptions and the use of key parameters such as uptake factors.

NRC Monitoring

NRC has been performing monitoring under Section 3116 of the Idaho National Laboratory Tank Farm Facility and the Savannah River Site Saltstone Disposal Facility. Monitoring of the Saltstone Disposal Facility has included review of the revised PA. There are currently three open issues related to NRC monitoring of the Saltstone Disposal Facility, two dating from 2007 (Pinkston, et al. 2013).

In support of its monitoring program, NRC has identified three types of noncompliance as shown in Figure 1:

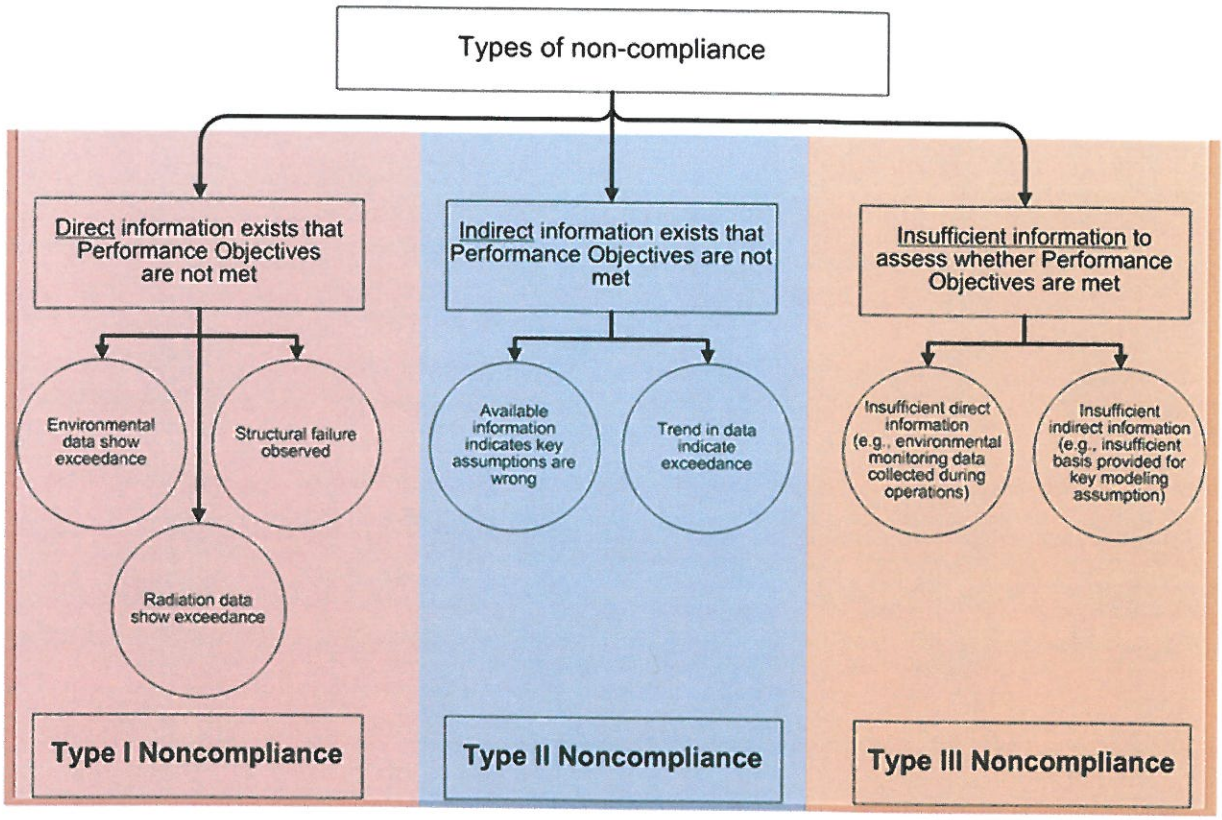

Figure 1. Types of Noncompliance *(from Pinkston, et al. 2013)*

NRC plans to update the monitoring portion of the Section 3116 implementation guidance in NUREG-1854, *NRC Staff Guidance for Activities Related to U.S. Department of Energy Waste Determinations* (NRC 2007) to reflect lessons learned in its monitoring program.

Lessons learned in NRC monitoring efforts to date include:

(1) The NRC monitoring role under Section 3116 will continue indefinitely and will include NRC review of updated information related to the disposal facility, including the facility PA if it is to be revised.

(2) It is important for the term *noncompliance with performance objectives,* as used in NRC monitoring under Section 3116, to be clearly defined and this definition understood by all stakeholders. NRC has defined three types on non-compliances as shown in Figure 1. DOE has its own definition of noncompliance..

The EFCOG believes that DOE should work with its contractors to develop and define the scope of the conduct of monitoring with the NRC for Section 3116 required monitoring activities. A guidance document should be prepared for the DOE activities concerning NRC monitoring activities and used as a basis for a Memorandum of Agreement with the NRC for these activities. This guidance document should be based on a rigorous project management approach. The EFCOG believes that NRC and DOE should jointly develop the monitoring process, including formally agreeing on the

precise meaning of terms such as noncompliance with performance objectives and the different types of noncompliance to be used by NRC in its monitoring program.

6.0 REFERENCES

Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005, Public Law 108-375, 118 Stat. 1811. 108th United States Congress, October 28, 2004.

10 CFR Part 50, *Licensing of Production and Utilization Facilities.*

10 CFR Part 61, Subpart C, *Licensing Requirements for Land Disposal of Radioactive Waste, Performance Objectives.*

40 CFR Part 191, *Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes.*

34 FR 8712, *Proposed Rule Making Statement of Proposed Policy; Siting of Commercial Fuel Reprocessing Plants and Related Waste Management Facilities, 10 CFR Part 50, Licensing of Production and Utilization Facilities.* U.S Atomic Energy Commission, Washington, D.C., June 3, 1969.

DOE Order 414.1D, *Quality Assurance*. U.S. Department of Energy, Washington, D.C., April 25, 2011.

DOE Order 435.1, *Radioactive Waste Management*, Change 1. U.S. Department of Energy, Washington, D.C., August 28, 2001.

DOE Manual 435.1-1, *Radioactive Waste Management Manual*, Change 1. U.S. Department of Energy, Washington, D.C., June 19, 2001.

DOE Guide 435.1-1, *Implementation Guide For Use With DOE M 435.1-1*. U.S. Department of Energy, Washington, D.C., July 9, 1999.

Buice, et al. 2005, *Performance Objective Demonstration Document (PODD) for the Closure of Tank 19 and Tank 18 Savannah River Site*, CBU-PIT-2005-00106, Rev. 1. Buice, J.M., R.K. Cauthen, R.R. Haddock, B.A. Martin, J.A. McNeil, J.L. Newman, and K.H. Rosenberger, Westinghouse Savannah River Company. Aiken, South Carolina, 2005.

DOE 2005. *Draft Section 3116 Determination for Closure of Tank 19 and Tank 18 at the Savannah River Site*. DOE-WD-2005-002. DOE-Savannah River, Aiken, South Carolina, September 2005.

DOE 2006a, *Program Execution Plan For Making Determinations that Certain Wastes from Spent Fuel Reprocessing are Not High-Level Waste*. U.S. Department of Energy, Office of Environmental Management, Washington, D.C., June 2006.

DOE 2006b, *Basis for Section 3116 Determination for the Idaho Nuclear Technology and Engineering Center Tank Farm Facility*, DOE/NE-11226, Revision 0. DOE Idaho, Idaho Falls, Idaho, November 2006.

DOE 2012, *Basis for Section 3116 Determination for Closure of F-Tank Farm at the Savannah River Site*, DOE/SRS-WD-2012-001, Revision 0. DOE – Savannah River, Aiken, South Carolina, March 2012.

Hanford 2008, *Waste Incidental to Reprocessing (WIR) Determinations*, Procedure ESQEM-IP-M435.1-1-01, Revision 0. Office of River Protection. U.S. Department of Energy, Richland, Washington, September 11, 2008.

Layton 2013, "Communicating Performance Assessment Results." Technical Paper 13609, WM2013 Conference, Phoenix, Arizona, February 24 – 28, 2013.

Letourneau and Suttora 2010, "Lessons Learned About Communicating with Regulators and Stakeholders from the U.S. Department of Energy's Performance Assessment Scoping Process," Technical Paper 10445, WM2010 Conference, Phoenix, Arizona, March 7- 11, 2010.

McKenney, et al. 2013a, "NRC Perspectives on Waste Incidental to Reprocessing Consultations and Monitoring," Technical Paper 13398, WM2013 Conference, Phoenix, Arizona, February 24 – 28, 2013.

McKenney, et al. 2013b, "Transition from Consultation to Monitoring – NRC's Increasingly Focused Review of Factors Important to F-Area Tank Farm Facility Performance," Technical Paper 13153, WM2013 Conference, Phoenix, Arizona, February 24 – 28, 2013.

McNeil 2010, *Waste Incidental to Reprocessing Citation Determination*, Procedure Q-CIT-G-00001, Revision 0. McNeil, J., Savannah River Nuclear Solutions and Savannah River Remediation, Aiken, South Carolina, April 13, 2010.

NRC 2007, *NRC Staff Guidance for Activities Related to U.S. Department of Energy Waste Determinations*, NUREG-1854. Draft Final Report for Interim Use. U.S. Nuclear Regulatory Commission, Washington, D.C., August 2007.

Picha, et al. 2007, "Department of Energy's First Waste Determinations Under Section 3116: How Did the Process Work?" Picha, K.G., R. Kaltreider, L. Suttora, M. Letourneau, W.D. Clark, S. Ross, and K. Lockie, Technical Paper, WM2007 Conference, Tucson, Arizona, February 25 – March 1, 2007.

Pinkston, et al. 2013, "NRC Monitoring of Salt Waste Disposal at the Savannah River Site," Technical Paper 13147, WM2013 Conference, Phoenix, Arizona, February 24 – 28, 2013.

Sams, et al. 2013, "Methods for Heel Removal for Tanks C-101, C-102, and C-111 at the Hanford Site." Technical Paper 13064, WM2013 Conference, Phoenix, Arizona, February 24 – 28, 2013.

Schweitzer and Sastre 1987, *Level of Evidence for Reasonable Assurance, Guides to Prediction*, BNL-52075. Schweitzer, D.G. and C. Sastre, Brookhaven National Laboratory Associated Universities, Inc., Long Island, New York, April 1987.

Sullivan, et al. 2012, "Use of the Waste-Incidental-Reprocessing Citation Process at the West Valley Demonstration Project." Sullivan, D., L. Suttora, S. Goldston, R. Petras, L. Rowell, and J. McNeil, Technical Paper 12250, WM2012 Conference, Phoenix, Arizona, February 26 – March 1, 2012.

Suttora and Seitz 2013, "Evolution of USDOE Performance Assessments Over 20 Years," Technical Paper 13597, WM2013 Conference, Phoenix, Arizona, February 24 – 28, 2013.

Thomas and Mahoney 2013, "Management Challenges in Developing Performance Assessments and Effectively Communicating Their Results." Technical Paper 13612, WM2013 Conference, Phoenix, Arizona, February 24 – 28, 2013.

WSRC 2001a, *Waste Incidental to Reprocessing Evaluation for Tank 40 Slurry Pumps*, HLW-STE-2000-00268. Memorandum from J. Dunaway to A. Doane, Westinghouse Savannah River Company, Aiken, S.C., May 15, 2001. (Approved by DOE-SR, C.E. Anderson, in letter to S.F. Piccolo of WSRC dated December 3, 2001).

WSRC 2001b, *Waste Incidental to Reprocessing Evaluation for Tank 41 Telescoping Transfer Jet*, HLW-STE-2000-00470. Memorandum from J. Dunaway to A. Doane, Westinghouse Savannah River Company, Aiken, S.C., May 31, 2001. (Approved by DOE-SR, C.E. Anderson, in letter to S.F. Piccolo of WSRC dated December 3, 2001).

WVNSCO 2001, *Waste Incidental to Reprocessing (WIR) Evaluation for Vitrification Facility Expended Materials*, Revision 1. West Valley Nuclear Services Company, West Valley, New York, October 25, 2001.

WVDP 2011, *Waste Incidental to Reprocessing Determination*, Procedure WV-929, Revision 9. West Valley Environmental Services, LLC, West Valley New York, May 19, 2011.

ATTACHMENT A

SUMMARY OF DIFFERENCES – EVALUATION PROCESS AND SECTION 3116 PROCESS

The following table shows key differences between the Evaluation Process of DOE Manual 435.1-1 and the Section 3116 process.

Requirement[1]	Evaluation Process	Section 3116 Process
First WIR Criterion	a) Will be managed as low-level waste and meet the following criteria: Have been processed, or will be processed, to remove key radionuclides to the maximum extent that is technically and economically practical; and (b) Will be managed as transuranic waste and meet the following criteria: Have been processed, or will be processed, to remove key radionuclides to the maximum extent that is technically and economically practical; and	does not require permanent isolation in a deep geologic repository for spent fuel or high-level radioactive waste;
Second WIR Criterion	(a) Will be managed as low-level waste and meet the following criteria: Will be managed to meet safety requirements comparable to the performance objectives set out in 10 CFR Part 61, Subpart C, *Performance Objectives*; and (b) Will be managed as transuranic waste and meet the following criteria: Will be incorporated in a solid physical form and meet alternative requirements for waste classification and characteristics, as DOE may authorize; and	has had highly radioactive radionuclides removed to the maximum extent practical; and
Third WIR Criterion	(a) Will be managed as low-level waste and meet the following criteria: Are to be managed, pursuant to DOE's authority under the *Atomic Energy Act of 1954*, as amended, and in accordance with the provisions of Chapter IV of this Manual, provided the waste will be incorporated in a solid physical form at a concentration that does not exceed the applicable concentration limits for Class C low-level waste as set out in 10 CFR 61.55, *Waste Classification*; or will meet alternative requirements for waste classification and characterization as DOE may authorize.	(A) does not exceed concentration limits for Class C low-level waste as set out in Section 61.55 of title 10, Code of Federal Regulations, and will be disposed of— (i) in compliance with the performance objectives set out in subpart C of part 61 of title 10, Code of Federal Regulations; and (ii) pursuant to a State-approved closure plan or State-issued permit, authority for the approval or issuance of which is conferred on the State outside of this section; or (B) exceeds concentration limits for Class C

ATTACHMENT A

Requirement[1]	Evaluation Process	Section 3116 Process
	(b) Will be managed as transuranic waste and meet the following criteria: Are managed pursuant to DOE's authority under the *Atomic Energy Act of 1954*, as amended, in accordance with the provisions of Chapter III of this Manual, as appropriate."	low-level waste as set out in section 61.55 of title 10, Code of Federal Regulations, but will be disposed of – (i) in compliance with the performance objectives set out in subpart C of part 61 of title 10, Code of Federal Regulations; (ii) pursuant to a State-approved closure plan or State-issued permit, authority for which is conferred on the State outside of this section; and (iii) pursuant to plans developed by the Secretary in consultation with the Commission."
Applicability	All DOE HLW sites.	The Idaho National Laboratory and the Savannah river Site.
Consultation with NRC	Recommended, done as a matter of policy.	Required.
Performance Assessment	Existing disposal site PA usually does not have to be changed, although a special analysis may be required in some cases. A PA would be required for closure of Hanford Site underground waste tanks using the evaluation process.[2]	A PA typically has to be developed or an existing PA updated to support onsite disposal of the subject waste stream.
Waste classification	Different criteria for LLW and transuranic waste.	Not specifically stated, although it is inferred that residual materials meeting the criteria are LLW.
Disposal location	Not specified.	Must be within the covered state, e.g. South Carolina for the Savannah River Site.
State-approved closure plan or State-issued permit	Not required.	Required.
Determination approval	DOE Field Element Manager.	Secretary of Energy.
NRC Monitoring of disposal facility	Not required.	Required.

NOTES: (1) The comparison does not consider differences not directly related to the WIR processes, such as the need for Tier 1 and Tier 2 closure plans for closure of deactivated HLW facilities such as underground waste tanks.

(2) Neither the evaluation process nor the Section 3116 process would apply to underground waste tanks at the West Valley Demonstration Project, if these tanks were to be closed in place, because NRC has specified different WIR criteria for the tanks using its authority under the West Valley Demonstration Project Act.

ATTACHMENT B

LIST OF RELATED TECHNICAL PAPERS AND PANEL DISCUSSIONS AT WM2013 SYMPOSIUM

Session	Day and Time	Subject
14	Monday, 1:30 pm	Panel: Policy Makers Perspective on the Framework for §3116 Waste Determinations and WIR Panelists included: Ines Triay, *Executive Director, Applied Research Center at Florida International University (US)* Shelly Wilson, *Federal Facilities Liaison, South Carolina Department of Health and Environmental Control (US)* Larry Camper, *Division Director, USNRC* Bill Levitan, *Director, Office of Environmental Compliance, USDOE-EM* Graham Jonsson, *Lead Program Manager, NDA (UK)*
15	Monday, 3:15 pm	Panel: Recent Successes with the Waste Incidental to Reprocessing (WIR)/§3116 Processes Panelists included: Bill Levitan, *Director, Office of Environmental Compliance, USDOE-EM* Dave Moody, *Savannah River Field Office Manager, USDOE-EM* Shelly Wilson, *Federal Facilities Liaison, South Carolina Department of Health and Environmental Control (US)* Karen Patterson, *Chair, South Carolina Governor's Nuclear Advisory Council (US)* Chris McKenney, *Manager of Performance Assessments, USNRC* Ginger Dickert, *Senior Technical Advisor, Savannah River Remediation LLC (US)*
35	Tuesday, 8:30 am	Worldwide WM Regulatory and Oversight Crosscutting Programs (Part 2 of 3) 1. Paper 13024, "Integration of Environmental Compliance at the Savannah River Site," Hoel, D., and M. Griffith. 2. Paper 13153, "Transition from Consultation to Monitoring – US NRC's Increasingly Focused Review of Factors Important to F-Area Tank Farm Facility Performance." Mckenny, C., et al. 3. Paper 13398, "NRC Perspectives on Waste Incidental to Reprocessing Consultation and Monitoring," McKenney, C., et al. 4. Paper 13663, "Regulatory Framework for Salt Waste Disposal and Tank Closure at the Savannah River Site," Thomas, S. and G. Dickert.

ATTACHMENT B

Session	Day and Time	Subject
36	Tuesday, 10:15 am	Issues Related to Waste Incidental to Reprocessing (WIR) 1. Paper 13610 "Performance Assessment Program for the Savannah River Site Liquid Waste Facilities," Rosenberger, K. 2. Paper 13147, "NRC Monitoring of Salt Waste Disposal at the Savannah River Site," Pinkston, K., et al. 3. Paper 13224, "Performance Impact of Fast Flow Paths Through Grout Monoliths Used for Radioactive Waste Disposal," Dinwiddel, C., et al. 4. Paper 13092, "Saltstone Oxidation Study: Leaching Method," Langton, C., et al.
59	Tuesday, 1:30 pm	Performance of Disposal Systems, Facilities, and Sites for LLW, ILW, MW, and NORM 1. Paper 13597, "Evolution of DOE Performance Assessments Over 20 Years," Suttora, L. and R. Seitz. 2. Paper 13161, "Advanced Simulation Capability for Environmental Management – Current Status and Phase II Demonstration Results," Seitz, R., et al. 3. Paper 13481, Cementitious Barrier Partnership (CBP): Using the CBP Software Toolbox to Simulate Sulfate Attack and Carbonation of Cement Structures, Brown K., et al. 4. Paper 13487, The Cementitious Barriers Partnership (CBP) Software Toolbox Capabilities in Assessing the Degradation of Cementitious Barriers," Flach, G. et al. 5. Paper 13229, "Probabilistic Modeling of Landfill Subsidence Introduced by Buried Structure Collapse," Foye. K. and T. Soong. 6. Paper 13034, "The Construction of the Konrad Repository – Status and Perspective." Kunze, V. 7. Paper 13431, "Improving Site-Specific Radiological Performance Assessments," Tauxe, J., et al. 8. Paper 13476, "Safety Assessment for a Surface Repository in the Chernobyl Exclusion Zone – Methodology for Assessing Disposal Under Intervention Conditions," Haverkamp, B., et al.
68	Wednesday, 8:30 am	Panel: Regulatory Challenges and Innovations Panelists included: Suzanne Dahl, *Tank Waste Treatment Manager, Washington State Department of Ecology (US)* Wesley White, *Assistant Manager of the Environmental Monitoring and Compliance Program for DOE Oversight Office,*

ATTACHMENT B

Session	Day and Time	Subject
		Tennessee Department of Environment and Conservation (US) Shelly Wilson, *Federal Facilities Liaison, South Carolina Department of Health and Environmental Control (US)* David Martin, *Cabinet Secretary, New Mexico Environment Department (US)*
69	Wednesday, 10:15 am	Panel: US DOE Featured Site: West Valley. NY Panelists included: Chad Glenn, *West Valley Senior Program Manager, USNRC* Craig Rieman, *Deputy Director, USDOE-WVDP* Paul Giardina, *Chief, Radiation and Indoor Air Branch, USEPA Region 2* Paul Bembia, *Program Director, West Valley Site Management, NYSERDA (US)*
72	Wednesday, 10:15 am	The Stakeholders' Voice – Involvement on Issues Related to WIR Issues at SRS 1. Paper 13448, "Citizen Contributions to the Closure of HLW-Level Waste (HLW) Tanks 18 & 19 at the US DOE Savannah River Site (SRS)," Lawless, B. 2. Paper 13609, "Communicating Performance Assessment Results," Layton, M. 3. Paper 13612, "Management Challenges in Developing Performance Assessments and Effectively Communicating Their Results," Thomas, S. 4. Paper 13110, Building Stakeholder Trust: Defensible Government Decisions, Franklin, V.
91	Wednesday, 1:30 pm	Progress in HLW and TRU Retrieval 1. Paper 13234, "One System Integrated Project Team: Optimizing Retrieval and Delivery of Hanford Tank Wastes for Vitrification in the Waste Treatment Plant, Harp, B., et al. 2. Paper 13585, "K-Basins Sludge Treatment and Packaging at the Hanford Site," Fogwell, T., et al. 3. Paper 13342, "A One System Integrated Approach to Simulate Selection for Hanford High-Level Waste Mixing and Sampling Tests," Thien, M. and S. Barnes. 4. Paper 13048, "UP2 400 High Activity Oxide Legacy Waste Retrieval Project Scope and Progress," Chabeuf, J. and T. Varet.

ATTACHMENT B

Session	Day and Time	Subject
92	Wednesday. 3:15 pm	Advancement on HLW [Tank] Closure 1. Paper 13064, "Methods for Heel Removal for Tanks C-101, C-102, and C-11 at the Hanford Site," Sams, T., et al. 2. Paper 13236, "Completion of Operational Closure of Tank 18F and Tank 19F by Grouting," Tisler, A. 3. Paper 13313, "Experimental Methods to Estimate Accumulated Solids in Nuclear Waste Tanks," Duignan, M., et al. 4. Paper 13375, "A Dual Regime Reactive Transport Model for Simulation of high Level Waste Tank Closure Scenarios," Sarkar, S., et al.
101	Thursday, 8:30 am	Panel: WIR and Lessons Learned – EFCOG Workshop (Part 1 of 2) Panelists included: Steve Thomas, *Savannah River Remediation LLC (US)* Kim Hauer, *Savannah River Remediation LLC (US)* Sherri Ross, *USDOE – Savannah River (US)* Bob Petras, *Savannah River Remediation LLC (US)* Linda Suttora, *USDOE – Headquarters* Keith Quigley, *Vista Engineering Technologies (US)* Dan Sullivan, *USDOE – West Valley* Susan Eberlein, *Washington River Protection Services (US)* Jay Rhoderick, USDOE – Headquarters Chris McKenney, *Manager of Performance Assessments, USNRC* Scott Saunders, *Washington River Protection Services (US)*
117	Thursday, 1:30 pm	Panel: WIR and §3116 Lessons Learned – EFCOG Workshop (Part 2 of 2) Panelists included: Mark Layton, *Savannah River Remediation LLC (US)* Jim McNeil, *Consultant (US)* Dan Sullivan, *USDOE – West Valley* Judith Nielsen, *Washington River Protection Solutions (US)* Roger Seitz, *Savannah River National Laboratory (US)* Keith Quigley, *VISTA Engineering (US)* Chris McKenney, *Manager of Performance Assessments, USNRC* Bob Petras, *Savannah River Remediation LLC (US)* Kim Hauer, *Savannah River Remediation LLC (US)* Sherri Ross, USDOE-Savannah River Kent Rosenberger, *Savannah River Remediation LLC (US)*

ATTACHMENT B

Session	Day and Time	Subject
		Susan Eberlein, *Washington River Protection Solutions (US)* Scott Saunders, *Washington River Protection Solutions (US)* Steve Thomas, *Savannah River Remediation LLC (US)*