

**Technical Justification for an Exemption from  
Application of Waste Incidental to Reprocessing  
Criteria in DOE Manual 435.1-1, *Radioactive Waste  
Management Manual* for Savannah River Site Defense  
Waste Processing Facility Recycle Wastewater**



**U.S. Department of Energy  
Office of Environmental Management**

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## Executive Summary

This document provides the technical justification for an Exemption from the Waste Incidental to Reprocessing (WIR) requirements contained in the Department of Energy's (DOE) Manual 435.1-1, *Radioactive Waste Management Manual*, Chapter II, Section B.<sup>1, 2</sup> The Exemption applies to a small quantity (up to eight gallons) of Savannah River Site Defense Waste Processing Facility (DWPF) recycle wastewater.<sup>3</sup> The DWPF recycle wastewater is classified as Class B low-level radioactive waste (LLW) in accordance with DOE's interpretation of the statutory definition of high-level radioactive waste (HLW).

The Office of Environmental Management (EM) is a technical organization with a strong safety-conscious culture. As part of this safety culture, EM continuously evaluates established practices and procedures to assess whether better processes and practices could enhance safety and improve environmental remediation. This practice of constant process improvement has led EM to analyze the application of the HLW interpretation to the DWPF recycle wastewater. The HLW interpretation allows for the classification of reprocessing waste to be based on the radiological contents of a specific waste form and not solely the source of the waste. EM has analyzed the DWPF recycle wastewater under the HLW interpretation. Both the technical analyses as well as the potential safety and environmental benefits associated with the HLW interpretation approach support an Exemption.

The express criteria for granting an Exemption from the WIR requirements contained in Chapter II, Section B of DOE Manual 435.1-1 are set forth in DOE Manual 435.1-1, paragraph 4, and DOE Order 251.1D, *Departmental Directives Program*, Appendix E. Consistent with these established criteria for granting an Exemption from DOE Manual 435.1-1, EM has determined that the classification of the small quantity (up to eight gallons) of DWPF recycle wastewater as Class B LLW under the HLW interpretation is: (1) is fully protective of public health, safety, and the environment; (2) commensurate with the level of protection required by DOE Manual 435.1-1, Chapter II, Section B; and (3) does not conflict with existing federal laws and regulations. In short, the safety and environmental benefits associated with applying the HLW interpretation to this waste support the requested Exemption.

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<sup>1</sup> Refer to the Table B in Section 4.1(c) for specific details of the Exemption from the WIR requirements contained in Chapter II, Section B of DOE Manual 435.1-1.

<sup>2</sup> DOE M 435.1-1 Chapter II, Section B(2)(b) does not apply as the DWPF recycle wastewater is not transuranic waste.

<sup>3</sup> This document provides the technical analysis to support an Exemption; the decision to grant the Exemption is documented in an Action Memo signed by the Under Secretary for Science, dated July 15, 2020.

## Acronyms

AEA	Atomic Energy Act of 1954, as amended
CFR	Code of Federal Regulations
DOE	U.S. Department of Energy
DWPF	Defense Waste Processing Facility
EA	Environmental assessment
EPA	Environmental Protection Agency
FINAL EA	<i>Final Environmental Assessment for the Commercial Disposal of Defense Waste Processing Facility Recycle Wastewater from the Savannah River Site</i>
FR	Federal Register
FWF	Federal Waste Facility
FONSI	<i>Finding of No Significant Impact for the Commercial Disposal of Defense Waste Processing Facility Recycle Wastewater from the Savannah River Site</i>
HLW	High-level radioactive waste
LLW	Low-level radioactive waste
M	Manual
NEPA	National Environmental Policy Act
NRC	Nuclear Regulatory Commission
NWPA	Nuclear Waste Policy Act of 1982, as amended
OPI	Office of Primary Interest
O	Order
PA	Performance Assessment
RCRA	Resource Conservation and Recovery Act
SOF	Sum of fractions
SRNL	Savannah River National Laboratory
SRR	Savannah River Remediation
SRS	Savannah River Site
TAC	Texas Administrative Code
Technical Evaluation	<i>Technical Evaluation for Non-High-Level Radioactive Waste (Non-HLW) Determination under the HLW Interpretation: Commercial Disposal of Defense Waste Processing Facility Recycle Wastewater from the Savannah River Site</i>
TCEQ	Texas Commission on Environmental Quality
WAC	Waste acceptance criteria
WCS	Waste Control Specialists

## 1. Introduction

On June 10, 2019, the DOE issued its *Supplemental Notice Concerning U.S. Department of Energy Interpretation of High-Level Radioactive Waste* (Supplemental Notice), explaining the proper interpretation of the statutory term “high-level radioactive waste”, as defined in the Atomic Energy Act of 1954, as amended (AEA, 42 U.S.C. 2011 *et seq.*) and Nuclear Waste Policy Act of 1982, as amended (NWPA, 42 U.S.C. 10101 *et seq.*). The Supplemental Notice states:

DOE interprets those statutes to provide that reprocessing wastes are properly classified as non-HLW [non-high-level radioactive waste] where the radiological characteristics of the waste in combination with appropriate disposal facility requirements for safe disposal demonstrate that disposal of such waste is fully protective of human health and the environment.

In addition, the Supplemental Notice states:

DOE has not made, and does not presently propose, any changes or revisions to current policies, legal requirements, or agreements with respect to HLW [high-level radioactive waste]. Decisions about whether and how this interpretation of HLW will apply to existing wastes and whether such wastes may be managed as non-HLW will be the subject of subsequent actions.

DOE explained in its Supplemental Notice that its interpretation of the statutory term HLW (HLW interpretation) differs from the Department’s existing WIR method set forth in DOE M 435.1-1, *Radioactive Waste Management Manual*. The Supplemental Notice concludes that although the development of the DOE M 435.1-1 WIR Criteria was an important step forward in the Department’s management of HLW, in that it allows DOE in limited circumstances to determine that certain waste is not ‘highly radioactive,’ the Department’s interpretation of the statutory definition of HLW confirms that an alternate approach exists for determining whether some reprocessing waste is not HLW.

Based on this interpretation of the statutory definition of HLW, the application of the WIR requirements is not necessary to determine that reprocessing waste is not HLW based on its radiological characteristics.

This document provides the technical justification for an Exemption from the WIR requirements in DOE M 435.1-1.<sup>4</sup> The Exemption would be applied to a small quantity (up to eight gallons) of SRS DWPF recycle wastewater.

The Exemption is being implemented in accordance with the express criteria for granting an Exemption from the WIR requirements contained in Chapter II, Section B of DOE M 435.1-1, which are set forth in DOE M 435.1-1, paragraph 4, and DOE O 251.1D, *Departmental*

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<sup>4</sup> Refer to Table B in Section 4.1(c) for specific details of the Exemption from the WIR requirements contained in Chapter II, Section B of DOE Manual 435.1-1.

*Directives Program*, Appendix E. As demonstrated below, the justification for the Exemption is that the HLW interpretation requirements provide a commensurate level of protection of health, safety, and the environment as the existing DOE M 435.1-1 WIR process.<sup>5</sup>

Under the Exemption, a small quantity (up to eight gallons) of the SRS DWPF recycle wastewater may be classified as non-HLW, and be disposed of at a commercial LLW facility outside of South Carolina, licensed by either the NRC or an Agreement State under Title 10 of the CFR Part 61. Consistent with the Finding of No Significant Impact (FONSI), within the next 12 months, DOE intends to initiate the shipment of up to eight gallons of the DWPF recycle wastewater to the WCS Federal Waste Facility (FWF), a licensed commercial disposal facility located in Andrews, Texas, for stabilization and disposal.<sup>6</sup>

DOE has evaluated representative samples of the DWPF recycle wastewater and prepared a technical evaluation<sup>7</sup> and an official determination<sup>8</sup> for a small quantity that demonstrate and document that the DWPF recycle wastewater would meet Criterion 1 for non-HLW under DOE HLW interpretation.

Based upon the application of the HLW interpretation, EM has determined that the classification of the small quantity of DWPF recycle wastewater as Class B LLW under the HLW interpretation: (1) is fully protective of public health, safety, and the environment; (2) is commensurate with the level of protection required by DOE Manual 435.1-1, Chapter II, Section B; and (3) does not conflict with existing federal laws and regulations. For these reasons, granting an Exemption from the WIR requirements in DOE M 435.1-1, Chapter II, Section B is appropriate.<sup>9</sup> EM has reached this determination in accordance with the Exemption process as outlined in DOE M 435.1-1, paragraph 4 and DOE O 251.1D, Appendix E.

There are many benefits associated with utilizing the HLW interpretation, as documented in the Supplemental Notice:

- enhancing safety at DOE sites by using lower-complexity waste treatment and immobilization approaches to reduce the risks of long-term waste storage and management;
- reducing time that untreated radioactive waste is stored on-site at DOE facilities;
- furthering the Department's commitment to state and local communities to move radioactive material out of the generator state;

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<sup>5</sup> DOE M 435.1-1 Section B(2)(b) of Chapter II does not apply as the DWPF recycle wastewater is not transuranic waste.

<sup>6</sup> FONSI, August 2020. The FONSI is based upon the analysis in the *Final Environmental Assessment for the Commercial Disposal of Defense Waste Processing Facility Recycle Wastewater from the Savannah River Site* (Final EA).

<sup>7</sup> *Technical Evaluation for Non-High-Level Radioactive Waste (Non-HLW) Determination under the HLW Interpretation: Commercial Disposal of Defense Waste Processing Facility Recycle Wastewater from the Savannah River Site*, August 2020.

<sup>8</sup> *Waste Determination*, August 2020.

<sup>9</sup> Refer to Table B in Section 4.1(c) for specific details of the Exemption from the WIR requirements contained in Chapter II, Section B of DOE Manual 435.1-1.

- utilizing mature and available commercial facilities and capabilities to shorten mission completion schedules and reduce taxpayer financial liability;
- aligning with international guidelines for management and disposal of radioactive waste based on radiological risk; and
- establishing risk-informed disposal practices, consistent with current regulatory requirements for LLW.

In short, the safety and environmental benefits associated with applying the HLW interpretation to the DWPF recycle wastewater strongly support the Exemption request.

## 2. Background

### 2.1 Overview of HLW Interpretation

On October 10, 2018, DOE published a notice in the *Federal Register* ([83 FR 50909](#)) requesting public comment on its interpretation of the definition of the statutory term, “high-level radioactive waste,” as set forth in the AEA and NWPA. In that notice, DOE explained the history and basis for its interpretation to classify the reprocessing waste based on its radiological contents and not solely on the origin of the waste.

Subsequently, on June 10, 2019, DOE published a Supplemental Notice in the *Federal Register* ([84 FR 26835](#)) that provided additional explanation of its interpretation of the statutory term HLW as informed by public review and comment and further consideration by DOE. As discussed in the Supplemental Notice, DOE has the long-standing authority and responsibility under the AEA to ensure that all radioactive waste from the United States’ defense program—including reprocessing waste—is managed and disposed of in a safe manner. The AEA and NWPA define HLW as:

(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 Commission, consistent with existing law, determines by rule requires permanent isolation. [42 U.S.C. 10101(12); see 42 U.S.C. 2014(dd)].

This statutory definition of HLW makes clear that not all radioactive wastes from spent nuclear fuel reprocessing are HLW. DOE has the legal authority to interpret the term HLW defined in these statutes to determine that certain of its reprocessing wastes are not HLW based on their radiological characteristics and not just the source of the waste. Accordingly, DOE interprets those statutes to provide that reprocessing wastes are properly classified as non-HLW where the radiological characteristics of the waste, in combination with appropriate disposal facility requirements for safe disposal, demonstrate that disposal of such waste is fully protective of human health and the environment. Under the Department’s interpretation, a reprocessing waste may be determined to be non-HLW if the waste meets either of the following two criteria:

1. does not exceed concentration limits for Class C low-level radioactive waste as set out in section 61.55 of title 10, Code of Federal Regulations, and meets the performance objectives of a disposal facility; or
2. does not require disposal in a deep geologic repository and meets the performance objectives of a disposal facility as demonstrated through a PA conducted in accordance with applicable requirements.

Reprocessing waste meeting either 1 or 2 of the above criteria is non-HLW, and—pursuant to appropriate processes—may be classified and disposed in accordance with its radiological characteristics in an appropriate facility provided all applicable requirements of the disposal facility are met.

## **2.2 Comparison of Reprocessing Waste Classification Approaches**

Table A below outlines tank waste classification approaches available to DOE to determine whether waste from the reprocessing of spent nuclear fuel can be disposed of as non-HLW.

- WIR process as defined in DOE M 435.1–1, Chapter II, Section B;
- Section 3116 of the Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005 (Section 3116, Public Law 108–375) (2005 NDAA Section 3116); and
- HLW interpretation as described in the Supplemental Notice Concerning U.S Department of Energy Interpretation of High-Level Radioactive Waste (84 FR 26835).



**Table A. Tank Waste Classification Approaches**

Key Attributes	Tank Waste Classification Approach		
	WIR Evaluation <sup>10</sup>	2005 NDAA Section 3116	HLW Interpretation
<b>Where Applicable</b>	<ul style="list-style-type: none"> <li>▪ Hanford onsite</li> <li>▪ WVDP onsite</li> <li>▪ All sites for offsite waste disposal</li> <li>▪ All sites pursuing offsite waste disposal of reprocessing waste</li> </ul>	<ul style="list-style-type: none"> <li>▪ Idaho onsite</li> <li>▪ SRS onsite</li> </ul>	<ul style="list-style-type: none"> <li>▪ Currently SRS Defense Waste Processing Facility Recycle Wastewater only</li> </ul>
<b>Key Technical Criteria</b>	<ul style="list-style-type: none"> <li>▪ Remove key radionuclides to the maximum extent that is technically and economically practical</li> <li>▪ Comply with requirements comparable to NRC 10 CFR 61, Subpart C performance objectives</li> <li>▪ Comply with Atomic Energy Act of 1954</li> <li>▪ Comply with DOE M 435.1-1 LLW or transuranic waste requirements</li> <li>▪ Requires a solid physical form</li> <li>▪ Comply with 10 CFR 61.55; or meets alternative requirements</li> </ul>	<ul style="list-style-type: none"> <li>▪ Remove highly radioactive radionuclides to the maximum extent practical</li> <li>▪ Comply with 10 CFR 61, Subpart C performance objectives</li> <li>▪ Requires State-approved closure plan or permit</li> <li>▪ If concentration limits of 10 CFR 61.55 exceeded, requires plans developed by DOE in consultation with the NRC</li> <li>▪ NRC and State shall monitor disposal actions</li> <li>▪ Does not apply to waste transported out of state</li> </ul>	<ul style="list-style-type: none"> <li>▪ Comply with 10 CFR 61.55 and meets the performance objectives of a disposal facility;</li> </ul> <p>or,</p> <ul style="list-style-type: none"> <li>▪ Meets the performance objectives of a disposal facility as demonstrated through a PA</li> </ul>
<b>Examples of Successful Application</b>	<ul style="list-style-type: none"> <li>▪ Hanford WM Area-C Tank Farm (ongoing)</li> <li>▪ Hanford Vitrified Low-Activity Waste (ongoing)</li> <li>▪ Hanford Test Bed Initiative (3-gal) (2016)</li> <li>▪ WVDP Concentrator Feed Makeup Tank and Melter Hold Tank (2013)</li> <li>▪ WVDP Melter (2012)</li> </ul>	<ul style="list-style-type: none"> <li>▪ SRS H Tank Farm (2014)</li> <li>▪ SRS F Tank Farm (2012)</li> <li>▪ SRS Saltstone Disposal Facility (2006)</li> <li>▪ Idaho Nuclear Technical and Engineering Center Tank Farm Facility (2006)</li> </ul>	<ul style="list-style-type: none"> <li>▪ SRS DWPF Recycle Wastewater</li> </ul>

### 2.3 SRS DWPF Recycle Wastewater

DWPF recycle wastewater is a combination of several dilute waste streams consisting primarily of condensates from the vitrification of tank waste at the SRS DWPF. SRS can generate approximately 1.5 million gallons per year of DWPF recycle wastewater. The wastewater is

<sup>10</sup> DOE M 435.1-1 sets forth two WIR processes: (1) “citation” allows a limited number of secondary solid waste items to be excluded from HLW (e.g., clothing, tools, and equipment); (2) “evaluation” includes a consideration of the risk-related characteristics of the waste.

transferred from DWPF to Tank 22 (1.3 million gallon capacity) at the H Tank Farm where it is managed as HLW.

This Exemption evaluation applies to up to eight gallons of DWPF recycle wastewater stored in Tank 22. Treatment and disposal of the DWPF recycle wastewater would be in accordance with all applicable licenses and permits. The WCS FWF is licensed by the TCEQ for the disposal of Class A, B, and C LLW. Based on representative sampling analyses and as discussed in Section 4 of this report, the DWPF recycle wastewater would be classified as Class B LLW under the NRC waste classification tables in 10 CFR Section 61.55. Regarding chemical properties, the liquid DWPF recycle wastewater exhibits the RCRA hazardous waste characteristic of corrosivity and toxicity. The DWPF waste will be neutralized to remove corrosivity and stabilized to treat the RCRA toxicity characteristic (40 CFR 268.48).

## **2.4 National Environmental Policy Act Analysis**

NEPA requires federal agencies to consider potential environmental impacts before making a decision regarding a proposed major federal action. It also provides a mechanism for public review and input and the consideration of reasonable alternative actions for major federal actions. As summarized below, DOE has completed the appropriate NEPA analysis for DWPF recycle wastewater from SRS for disposal at a licensed commercial disposal facility, in accordance with Council on Environmental Quality and DOE NEPA implementing regulations at 40 CFR Parts 1500 through 1508 and 10 CFR Part 1021, respectively.

DOE issued the Final EA.<sup>11</sup> The proposed action in the Final EA is the disposal of up to 10,000 gallons of stabilized (grouted) DWPF recycle wastewater from the SRS H-Area Tank Farm at a commercial LLW disposal facility located outside of South Carolina and licensed by either the NRC or an Agreement State under 10 CFR Part 61. The Final EA was informed by a 62-day public comment period (December 10, 2019, through February 10, 2020) on the Draft EA, issued on December 10, 2019 (84 FR 67438).<sup>12</sup> The public comment period included a 32-day extension in response to requests for an extension by various entities. During the public comment period, DOE held an informational meeting in Augusta, Georgia, on December 17, 2019, and an informational internet webinar, on December 19, 2019, to provide the public and stakeholders with an overview of the Draft EA and HLW interpretation.<sup>13</sup>

As documented in the FONSI, and based on the information and analysis in the Final EA, DOE intends to ship up to eight gallons of the DWPF recycle wastewater to the WCS FWF, a licensed commercial disposal facility located in Andrews, Texas, for stabilization and disposal.

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<sup>11</sup> Final EA, August 2020.

<sup>12</sup> On December 30, 2019, DOE extended the original 30-day public comment period by 32 days, such that the public comment period ended February 10, 2020 (84 FR 71909).

<sup>13</sup> Presentations given by DOE at the informational meetings are available online at: <https://www.energy.gov/em/program-scope/high-level-radioactive-waste-hlw-interpretation>

## 2.5 Waste Determination under the HLW Interpretation

The Department's Technical Evaluation<sup>7</sup> assessed whether up to eight gallons of DWPF recycle wastewater in Tank 22 at SRS meets the DOE HLW interpretation for treatment and disposal as non-HLW at the WCS FWF. The HLW interpretation provides that a reprocessing waste may be determined to be non-HLW and disposed of in accordance with its radiological characteristics in combination with appropriate disposal facility requirements for safe disposal. Based on the Technical Evaluation, DOE determined the up to eight gallons of DWPF recycle wastewater is Class B LLW, and may be disposed of at the WCS FWF in Andrews County, Texas, as LLW in accordance with the facility's waste acceptance criteria (WAC), license conditions, environmental permits, and all other applicable requirements.

## 3. DOE Order 251.1D Exemption Process

Paragraph 4 of DOE Manual 435.1-1 specifically authorizes the use of an Exemption to waive or modify any requirements of the Manual:

**IMPLEMENTATION:** Any of the requirements in this Manual may be waived or modified through application of a DOE-approved requirements tailoring process, such as the "Necessary and Sufficient Closure Process" in DOE P [Policy] 450.3 and DOE M 450.3-1 and DOE P 450.4, Safety Management System Policy, the applicable or relevant and appropriate requirements identification process for actions taken pursuant to the Department's Comprehensive Environmental Response, Compensation, and Liability Act authorities, **or by an Exemption processed in accordance with the requirements of DOE M 251.1-1A, Directives System Manual.** (emphasis added). DOE M 251.1-1A has been superseded by DOE O 251.1D.

As outlined in DOE O 251.1D, Appendix E, E-1:

When an organization seeks an Equivalency or Exemption, the responsible Head of the Departmental Element or designee may grant an Equivalency or Exemption to the requirements in a DOE directive after seeking advice from the OPI [Office of Primary Interest]. Organizations should make full use of Exemptions and equivalencies, as appropriate, to avoid unnecessary burden. Central Technical Authority concurrence, through their relevant Directives Review Board member, is required prior to the granting of equivalencies or Exemptions for nuclear safety directives identified in the current version of DOE O 410.1, *Central Technical Authority Responsibilities Regarding Nuclear Safety Requirements*.

The Appendix E process to obtain an Exemption is as follows:

1. The organization seeking the Equivalency or Exemption must include the following information in the Exemption/Equivalency request and obtain advice from the OPI and their relevant [Office of General Counsel] office before submitting the request to the Head of the Departmental Element for approval. The content of the memorandum must:

- a. identify the requirement(s) for which the Equivalency/Exemption is being sought;
  - b. explain the Equivalency/Exemption;
  - c. justify the reasons for the Equivalency/Exemption;
  - d. identify the offices or sites for which the Equivalency/Exemption is being sought;
  - e. confirm that the application of the Exemption or Equivalency does not conflict with applicable federal law or regulations;
  - f. indicate when compliance will be achieved in cases of an Equivalency;
  - g. describe any alternative or mitigating actions, to include associated risks, that have been or will be taken to ensure adequate protection of the public, workers, and the environment for the period during which the Exemption will be effective, when applicable; and
  - h. describe conclusions and recommendations from the OPI review of the Exemption/Equivalency and resolution of recommendations.
2. The Head of the Departmental Element or designee may grant an Exemption only if the Exemption:
- a. is not contrary to law or regulations;
  - b. ensures adequate protection of the public, workers, and the environment; and
  - c. remains consistent with the primary goal and purpose of the directive.

#### 4. **Exemption Request: Demonstration of DOE Order 251.1D Exemption Requirements**

##### 4.1 **Required Content of Request under DOE O 251.1D, Appendix E:**

**Section 1(a): Identify the requirement(s) for which the Equivalency/Exemption is being sought.**

This document provides the technical analysis to support an exemption from the WIR requirements contained in DOE Manual 435.1-1, Chapter II, Section B.<sup>14</sup> The specific WIR requirements that the Exemption is being requested from are as follows:

- Chapter II, Section B.(1), Citation
- Chapter II, Section B.(2)(a)1, Evaluation
- Chapter II, Section B.(2)(a)2, Evaluation
- Chapter II, Section B.(2)(a)3, Evaluation

**Section 1(b): Explain the Equivalency/Exemption.**

As detailed in the June 10, 2019, Supplemental Notice, through the AEA, Congress conferred on DOE the responsibility of safely and permanently disposing of the radioactive waste from the United States' defense program, including reprocessing wastes. While DOE has made important progress in fulfilling this responsibility,

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<sup>14</sup> DOE M 435.1-1 Chapter II, Section B (2)(b) does not apply as the DWPF recycle wastewater is not transuranic waste.

there has been widespread recognition that the current approach to managing and disposing of these wastes has shortcomings, and that alternative strategies should be explored and developed. Further justification for this Exemption is supported by the following statement in the Supplemental Notice:

DOE has the legal authority to interpret the term HLW in these statutes to determine that certain of its reprocessing wastes are not HLW based on their radiological characteristics. Accordingly, DOE interprets those statutes to provide that reprocessing wastes are properly classified as non-HLW where the radiological characteristics of the waste in combination with appropriate disposal facility requirements for safe disposal demonstrate that disposal of such waste is fully protective of human health and the environment.

EM is a technical organization with a strong safety-conscious culture. As part of this safety culture, EM continuously evaluates established practices and procedures to assess whether better processes and practices could enhance safety and improve environmental remediation. This practice of constant process improvement has led EM to analyze the application of the HLW interpretation to the DWPF recycle wastewater. The HLW interpretation allows for the classification of reprocessing waste to be based on the radiological contents of a specific waste form and not solely the source of the waste. EM has analyzed the DWPF recycle wastewater under the HLW interpretation. Both the technical analyses as well as the potential safety and environmental benefits associated with the HLW interpretation approach support an Exemption.

The specific WIR requirements DOE M 435.1-1, Chapter II, Section B<sup>15</sup> for which this Exemption applies are as follows:

(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.

(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

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<sup>15</sup> DOE M 435.1-1 Chapter II, Section B(2)(b) does not apply as the DWPF recycle wastewater is not transuranic waste.

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 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.

DOE M 435.1-1, Chapter II, Section B(2)(b) has not been included because it applies to transuranic waste and the DWPF recycle wastewater is not transuranic waste.

WIR citation and evaluation are not required under the HLW interpretation. As discussed in the Supplemental Notice, although the development of both 2005 NDAA Section 3116 and the DOE M 435.1-1 WIR Criteria were important steps in the Department's management of HLW because they allow DOE in limited circumstances to determine that certain waste is not "highly radioactive," the DOE analysis of the statutory definition of HLW demonstrates that 2005 NDAA Section 3116 and the DOE M 435.1-1 Criteria are not the only approaches available to determine that some reprocessing waste is not HLW.

Through application of the HLW interpretation, this Exemption demonstrates that two of the three WIR criteria (i.e., DOE M 435.1-1, Chapter II, Section B.(2)(a)2-3) would be met as a technical matter (see Appendix A). However, under the Department's HLW interpretation, addressing the WIR criteria is not required. This is because the HLW interpretation and the WIR are distinctly separate approaches for determining that some reprocessing waste is not HLW.

**Section 1(c): Justify the reasons for the Equivalency/Exemption.**

The justification for this Exemption is delineated in Table B, Exemption Justification Table.

**Table B. Exemption Justification Table**

<p><b>DOE M 435.1-1, Chapter II, Section B.(1) (Citation):</b> 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.</p>	<p><b>Exempted.</b></p> <p>The up to eight gallons of DWPF recycle wastewater does not 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. The waste stream cannot be described as contaminated job wastes, laboratory items, clothing, tools, or equipment.</p>
<p><b>DOE M 435.1-1, Chapter II, Section B.(2)(a)1 (Evaluation):</b> Have been processed, or will be processed, to remove key radionuclides to the maximum extent that is technically and economically practical.</p>	<p><b>Exempted.</b></p> <p>The up to eight gallons of DWPF recycle wastewater is Class B LLW. Therefore, the waste stream does not require processing to remove key radionuclides to the maximum extent that is technically and economically practical, because the waste meets 10 CFR 61.55, which is part of long-standing regulations for disposal of commercial industry nuclear waste disposal. 10 CFR 61.55 provides concentration limits for radionuclides in waste that is acceptable for near-surface disposal. Hence, disposition of this single waste stream as envisioned is fully protective of public health, safety, and the environment, and provides a commensurate level of protection required by DOE Manual 435.1-1, <i>Radioactive Waste Management Manual</i> Section B.(2)(a)1. See Appendix A for further details.</p>
<p><b>DOE M 435.1-1, Chapter II, Section B.(2)(a)2 (Evaluation):</b> Will be managed to meet safety requirements comparable to the performance objectives set out in 10 CFR Part 61, Subpart C, <i>Performance Objectives</i>.</p>	<p><b>Exempted.</b></p> <p>This requirement is met as a technical matter. See Appendix A for further details. However, under DOE HLW interpretation, addressing the WIR criteria is not required. This is because the HLW interpretation and the WIR process are distinctly separate approaches for determining that some reprocessing waste is not HLW.</p>
<p><b>DOE M 435.1-1, Chapter II, Section B.(2)(a)3 (Evaluation):</b> Are to be managed, pursuant to DOE authority under the <i>Atomic Energy Act of 1954</i>, 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, <i>Waste Classification</i>; or will meet alternative requirements for waste classification and characterization as DOE may authorize.</p>	<p><b>Exempted.</b></p> <p>This requirement is met as a technical matter. See Appendix A for further details. However, under DOE HLW interpretation, addressing the WIR criteria is not required. This is because the HLW interpretation and the WIR process are distinctly separate approaches for determining that some reprocessing waste is not HLW.</p>

**Section 1(d): Identify the offices or sites for which the Equivalency/Exemption is being sought.**

This Exemption is being sought by EM's Office of Waste and Materials Management. It is applicable to up to eight gallons of SRS DWPF recycle wastewater (See Section 2.3, SRS DWPF Recycle Wastewater).

**Section 1(e): Confirm that the application of the Exemption or Equivalency does not conflict with applicable federal law or regulations.**

Applicable requirements for disposal of the SRS DWPF recycle wastewater as LLW in a licensed commercial facility would not conflict with applicable federal law or regulations.

As referenced in the June 10, 2019, *Supplemental Notice Concerning U.S. Department of Energy Interpretation of High-Level Radioactive Waste*, DOE explains its interpretation of the term HLW, as defined in the AEA and NWPA. DOE has the long-standing authority and responsibility under the AEA to ensure that all radioactive waste from the United States' defense program— including reprocessing waste—is managed and disposed of in a safe manner. This definition of HLW makes clear that not all radioactive wastes from spent nuclear fuel reprocessing are HLW. DOE has the legal authority to interpret the term HLW in these statutes to determine that certain of its reprocessing wastes are not HLW based on their radiological characteristics. Accordingly, DOE interprets those statutes to provide that reprocessing wastes are properly classified as non-HLW where the radiological characteristics of the waste in combination with appropriate disposal facility requirements for safe disposal demonstrate that disposal of such waste is fully protective of human health and the environment.

In terms of regulatory requirements, the sample profile of the DWPF recycle wastewater in Tank 22 would not exceed Class C limits, in accordance with NRC waste classification tables (10 CFR 61.55). Specifically, the recycle wastewater is Class B LLW. This assumption was verified by representative sampling and analyses (see Section 1(b), "Explain the Equivalency/Exemption" above, regarding DOE M 435.1-1, Chapter II, Section B, Waste Incidental to Reprocessing).

**Section 1(f): indicate when compliance will be achieved in cases of an Equivalency.**

Not applicable—this requirement applies to equivalencies, not Exemptions.



**Section 1(g): Describe any alternative or mitigating actions, to include associated risks, that have been or will be taken to ensure adequate protection of the public, workers, and the environment for the period during which the Exemption will be effective, when applicable.**

DOE has followed and will continue to follow the existing framework of regulations, guidelines, best practices, and other mechanisms to ensure disposal of DWPF recycle wastewater at the WCS FWF is protective of human health and the environment. DOE and the commercial nuclear industry have decades of experience with the safe and effective disposal of LLW at commercial facilities. The DWPF recycle wastewater has been properly characterized to ensure it meets disposal requirements at the WCS FWF. The waste will be treated (stabilized) prior to disposal to meet regulatory requirements. The waste will be packaged and shipped to the WCS FWF in accordance with U.S. Department of Transportation requirements. Waste verification will be performed on incoming shipments at the WCS FWF. Upon stabilization, the waste will be emplaced by WCS at the FWF, which is licensed by TCEQ for the disposal of Class A, B, and C LLW. Application of the HLW interpretation to the up to eight gallons does not change any of the Department's existing legal authorities or those of its regulators at the federal, state, or local levels for protection of human health and the environment.

The disposal of up to eight gallons of DWPF recycle wastewater as non-HLW includes:

- Identifying and evaluating potential disposal facilities (this was done in the Final EA);
- Issuing the Final EA, which included responses to public comments;
- Issuing a FONSI as part of the NEPA process;
- Holding an information session(s) related to DWPF recycle wastewater;
- Coordinating with the regulators of both South Carolina and Texas;
- Characterization to include sampling (completed as discussed in Appendix A);
- Stabilization of the DWPF recycle wastewater; and
- Application of the disposal facility's WAC, including generator certification, waste profile approval, waste shipment approval and verification.

**Section 1(h): Describe conclusions and recommendations from the OPI review of the Exemption/Equivalency and resolution of recommendations.**

Based upon the application of the HLW interpretation, EM has determined that the classification of the small quantity of DWPF recycle wastewater as Class B LLW under the HLW interpretation: (1) is fully protective of public health, safety, and the environment; (2) is commensurate with the level of protection required by DOE Manual 435.1-1, Chapter II, Section B; and (3) does not conflict with existing federal laws and regulations. Hence, an Exemption from the WIR requirements of DOE M

435.1-1, Chapter II, Section B is warranted.<sup>16</sup> EM has reached this determination in accordance with the Exemption process as outlined in DOE M 435.1-1, paragraph 4 and DOE O 251.1D, Appendix E.

**Section 2(a): Is not contrary to law or regulations.**

As stated in the introduction section, the Supplemental Notice outlines the Departments explanation of the proper interpretation of the statutory text of the AEA and NWPA. The Supplemental Notice states:

DOE interprets those statutes to provide that reprocessing wastes are properly classified as non-HLW where the radiological characteristics of the waste in combination with appropriate disposal facility requirements for safe disposal demonstrate that disposal of such waste is fully protective of human health and the environment.

The AEA and NWPA define HLW as:

- 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 in products in sufficient concentrations; and
- B. other highly radioactive material that the Commission, consistent with existing law, determines by rule requires permanent isolation. [42 U.S.C. 10101(12); see 42 U.S.C. 2014(dd)].

Under DOE interpretation, a reprocessing waste may be determined to be non-HLW if the waste meets either of the following two criteria:

- 1. does not exceed concentration limits for Class C low-level radioactive waste as set out in section 61.55 of title 10, Code of Federal Regulations, and meets the performance objectives of a disposal facility; or
- 2. does not require disposal in a deep geologic repository and meets the performance PA conducted in accordance with applicable requirements.

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<sup>16</sup> This small quantity (up to 8 gallons) would enable DOE to initiate the transportation, stabilization, and disposal within the next 12 months. Supporting technical documents are available at: <https://www.energy.gov/em/program-scope/high-level-radioactive-waste-hlw-interpretation>.

Reprocessing waste meeting either 1 or 2 of the above criteria is non-HLW, and—pursuant to appropriate processes—may be classified and disposed in accordance with its radiological characteristics in an appropriate facility provided all applicable requirements of the disposal facility are met. Further, as stated in the Supplemental Notice:

Each reprocessing waste stream has unique radiological characteristics and, accordingly, the interpretation will be implemented in subsequent actions on a site-specific basis, following consideration of: Evaluation and characterization of specific reprocessing waste streams in conjunction with the waste acceptance criteria and requirements of a specific waste disposal facility; input from affected stakeholders (*e.g.*, Federal, State, local and tribal officials; and members of the public); and compliance with applicable federal and state laws, regulations, and agreements. This interpretation does not, and will not be used to, abrogate DOE's responsibilities under existing laws, regulations, agreements, or permit requirements. Nor does it change DOE's existing statutory authorities or those of its regulators at the federal, state, or local level. DOE anticipates continued engagement and productive involvement of members of the public and the regulatory community in subsequent activities that may follow this HLW interpretation, including the NEPA process described in the NOI [Notice of Intent].

**Section 2(b): Ensures adequate protection of the public, workers, and the environment.**

With the focus of the Exemption being on up to eight gallons based on the FONSI, it has been determined to meet Criterion 1 of DOE HLW interpretation and, upon stabilization, can be disposed of in an existing commercial LLW disposal facility as Class B LLW consistent with the facility's radioactive material license, WAC, permits, and other applicable requirements. These requirements ensure that the waste meets the facility's performance objectives for protection of the public, workers, and the environment.

As stated in the Supplemental Notice:

This definition of HLW makes clear that not all radioactive wastes from nuclear fuel reprocessing are HLW. DOE has the legal authority to interpret the term HLW in these statutes to determine that certain of its reprocessing wastes are not HLW based on their radiological characteristics. Accordingly, DOE interprets those statutes to provide that reprocessing wastes are properly classified as non-HLW where the radiological characteristics of the waste in combination with appropriate disposal facility requirements for

safe disposal demonstrate that disposal of such waste is fully protective of human health and the environment.

**2(c): Remains consistent with the primary goal and purpose of the directive.**

The objective of DOE O 435.1 and DOE M 435.1-1 is to ensure that all DOE radioactive waste is managed “in a manner that is protective of worker and public, health and safety, and the environment.” As indicated in Section 2.4., DOE has completed a NEPA analysis for disposal of DWPF recycle wastewater at a licensed commercial LLW facility and has found that the proposed disposal of this material will have no significant impact on the human health and the environment. The up to eight gallons of DWPF recycle wastewater has been determined to meet Criterion 1 of the DOE HLW interpretation and can be disposed of as Class B LLW at a licensed commercial facility (i.e., WCS FWF), without removal of key radionuclides.

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## Appendix A – Detailed Technical Justification Supporting Section 4.1(c)

Appendix A provides detailed justification to support the Exemption discussed in Section 4.1(c) related to the WIR Evaluation.

### I. **DOE Manual 435.1-1, Chapter II, Section B.(2)(a)(1): Have been processed, or will be processed, to remove key radionuclides to the maximum extent that is technically and economically practical.**

Because radioactive wastes that already meet existing regulatory requirements for safe disposal as LLW without any radionuclide removal do not present risks to the public and the environment DOE has determined, from an overall health, safety and risk perspective, that compliance with the HLW interpretation Criterion 1 requirement to meet 10 CFR 61.55, provides a commensurate level of protection as the WIR process.

As stated in the June 10, 2019, Supplemental Notice, nothing in the statutory text of the AEA or the NWSA requires that radionuclides be removed to the maximum extent technically and economically practical prior to determining whether waste is HLW. The DOE HLW interpretation is consistent with and informed by analysis of the risk presented to the public and the environment from radioactive wastes. Radioactive wastes that already meet existing regulatory requirements for safe disposal as LLW without any radionuclide removal do not present risks to the public and the environment that would necessitate their classification as HLW under the AEA and NWSA. Further, 10 CFR 61.55, as part of long-standing regulations for disposal of commercial industry nuclear waste disposal, sets concentration limits for radionuclides in waste that is acceptable for near-surface disposal and hence does not require permanent isolation to be protective of human health and the environment.

The DWPF recycle wastewater, as indicated in the sampling data below, is in compliance with NRC's 10 CFR 61.55 concentration limits for long-lived and short-lived radionuclides, is Class B LLW, and hence by definition is safe for near-surface disposal and does not require permanent isolation to be protective of human health and the environment. As confirmed by sampling and analyses results, the up to eight gallons of DWPF recycle wastewater would meet the WCS WAC and, therefore, does not require removal of radionuclides (see Tables 1 and 2 below). The DOE SRS Liquid Waste contractor, SRR, collected representative samples of the DWPF recycle wastewater in Tank 22 in December 2018, November 2019, and February 2020. These samples were analyzed by the SRNL to determine the concentrations of radionuclides present in the DWPF recycle wastewater. SRR summarized the results of these waste characterization activities in a report titled "Concentration of Tank 22 Defense Waste Processing Facility Recycle Wastewater for Use in Phase 1 Off-site Disposition Activities," SRR-CWDA-2020-00025, Rev. 0, March 2020. Based on results of the sample analyses and other waste characterization activities, SRR prepared a waste profile report titled "Characterization of Tank 22 DWPF Recycle Wastewater," Calculation Number Q-CLC-H-0061, March 2020. This report documented the radiological and chemical characterization of the DWPF Recycle Wastewater to support off-site disposition of up to eight gallons of wastewater. The SRR report provides the detailed calculations used to determine the NRC waste classification for up to eight gallons of DWPF recycle wastewater. The SRR report

(section 6.6 and Table A3-1 of the SRR report) concluded that the up to eight gallons of DWPF recycle wastewater would be Class B LLW.

#### **Detailed Explanation of NRC Radionuclide Concentration Limits:**

The DWPF wastewater contains a mixture of radionuclides, some of which are listed in NRC 10 CFR 61.55 Table 1 (Long-Lived Radionuclides), and some of which are listed in Table 2 (Short-Lived Radionuclides). Hence, in accordance with NRC 10 CFR 61.55(a)(5), the following two-step process applies:

“(5) Classification determined by both long- and short-lived radionuclides. If radioactive waste contains a mixture of radionuclides, some of which are listed in Table 1, and some of which are listed in Table 2, classification shall be determined as follows:

- (i) If the concentration of a nuclide listed in Table 1 does not exceed 0.1 times the value listed in Table 1, the class shall be that determined by the concentration of nuclides listed in Table 2.

(7) SOF rule for mixtures of radionuclides. For determining classification for waste that contains a mixture of radionuclides, it is necessary to determine the sum of fractions by dividing each nuclide's concentration by the appropriate limit and adding the resulting values. The appropriate limits must all be taken from the same column of the same table. The sum of the fractions for the column must be less than 1.0 if the waste class is to be determined by that column.”

#### **Application for DWPF Wastewater—Long-Lived Radionuclide Limits:**

- (i) *If the concentration of a nuclide listed in Table 1 does not exceed 0.1 times the value listed in Table 1, the class shall be that determined by the concentration of nuclides listed in Table 2.*

This step applies to the **blue highlighted** fractional result for each radionuclide in the table below.

**RESULT:** In order for the concentration of radionuclides to exceed 0.1, the Nuclide Fraction (column 4) would need to exceed 0.1. This number is the DWPF wastewater concentration (column 2) divided by the NRC classification limit (column 3). As indicated in the table, the values are far below 0.1. Because 0.1 is not exceeded for any radionuclide, the classification of the DWPF wastewater shall be determined by the concentration of nuclides listed in the NRC Table for Short-Lived Radionuclides (Table 2).



**Table 1. NRC Limits for Long-Lived Radionuclides 10 CFR 61.55(a)(5)(i)<sup>17</sup>**

<b>Radionuclide (Column 1)</b>	<b>DWPF Wastewater Concentration (Column 2)</b>	<b>NRC Classification Limit (Column 3)</b>	<b>Nuclide Fraction (Column 4)</b>
Carbon-14	0.000052 Ci/m <sup>3</sup>	8 Ci/m <sup>3</sup>	0.0000065
Technetium-99	0.00219 Ci/m <sup>3</sup>	3 Ci/m <sup>3</sup>	0.00073
Iodine-129	0.0000218 Ci/m <sup>3</sup>	0.08 Ci/m <sup>3</sup>	0.0002725
Alpha-emitting transuranic nuclides with half-life (t <sub>1/2</sub> ) of >5 years: Total of Neptunium-237, Plutonium-238, Plutonium-239, Plutonium-240, and Plutonium-242	0.08063 nCi/g	100 nCi/g	0.0008063
Plutonium-241	NA	3,500 nCi/g	0.0
Curium-242	NA	20,000 nCi/g	0.0
<b>Sum of Fractions for Long-Lived Radionuclides</b>			<b>0.0018</b>

**Application for DWPF Wastewater—Sum of Fractions Rule for Mixtures of Radionuclides**

*(7) The sum of the fractions rule for mixtures of radionuclides. For determining classification for waste that contains a mixture of radionuclides, it is necessary to determine the sum of fractions by dividing each nuclide's concentration by the appropriate limit and adding the resulting values. The appropriate limits must all be taken from the same column of the same table. The sum of the fractions for the column must be less than 1.0 if the waste class is to be determined by that column.*

Waste containing a mixture of radionuclides must be classified by applying the SOF rule. The SOF is determined by calculating the fractions for each radionuclide present (the radionuclide concentration divided by the NRC Classification concentration limit) in the waste, then adding them together, resulting in the SOF. SOF is calculated, first, using the Class A concentrations; if needed, the SOF is calculated using the Class B concentrations and then, if needed, the SOF is calculated using the Class C concentrations.

<sup>17</sup> The wastewater concentrations were obtained from the SRR report titled “Characterization of Tank 22 DWPF Recycle Wastewater,” Q-CLC-H-00601, Revision 0, March 2020 (see Appendix B, Table A3-1, NRC Classification). The SRR report compares the measured concentrations to one-tenth of the NRC Limit whereas, Table 3 compares the concentrations directly to the NRC Limit. Both tables show that the radionuclide fractions, as well as the sum-of-fractions, are one-tenth of the NRC limits for long-lived radionuclides, and is therefore determined by the limits for short-lived radionuclides (i.e., Table 2 below).

**Result:** This SOF process applies to the **green highlighted** fractional result for each DWPF recycle wastewater radionuclide in Table 2 below. For the DWPF recycle wastewater (short-lived radionuclides), the SOF using the Class A concentrations equals 24.43. The NRC requirement is that, if this SOF is less than 1, the waste class is Class A. Because it is not less than 1, the SOF using Class B concentrations is calculated, and that calculation is 0.55005. The NRC requirement is that if this SOF is less than 1, the waste class is Class B. According to NRC requirements, then, once the waste has been determined to be Class B LLW, there is no need to calculate the Class C SOF.

**Table 2. NRC Limits for Short-Lived Radionuclides 10 CFR 61.55(a)(5)(i)**

Concentration and limit values in Ci/m<sup>3</sup>

Radionuclide	DWPF Recycle Wastewater Concentration <sup>1</sup>	Class A Limit	Class A SOF	Class B Limit	Class B SOF	Class C Limit	Class C SOF
Total of all nuclides with less than 5-year half-life: Barium-137m	22.9	700	0.0327	Unlimited	NA	Unlimited	
Tritium	0.0757	40	0.00189	Unlimited	NA	Unlimited	
Cobalt-60	NA	700	0.0	Unlimited	NA	Unlimited	
Nickel-63	NA	3.5	0.0	70	0.0	700	
Strontium-90	0.00791	0.04	0.19775	150	0.0000527	7000	
Cesium-137	24.2	1	24.2	44	0.55	4600	
<b>Sum of Fractions for Short-Lived Radionuclides</b>			<b>24.43</b>		<b>0.55005</b>		NA

<sup>1</sup>Values obtained from SRR report titled “Characterization of Tank 22 DWPF Recycle Wastewater,” Q-CLC-H-00601, Revision 0, March 2020 (Table A3-1)—see Appendix B.

**Conclusion:** The up to eight gallons of DWPF recycle wastewater is Class B LLW. Therefore, the waste does not require processing to remove key radionuclides to the maximum extent that is technically and economically practical, because the waste meets 10 CFR 61.55, which is part of long-standing regulations for disposal of commercial industry nuclear waste disposal. 10 CFR 61.55 provides concentration limits for radionuclides in waste that is acceptable for near-surface disposal. Hence, disposition of the up to eight gallons as envisioned is fully protective of public health, safety, and the environment, and provides a commensurate with the level of protection required by DOE M 435.1-1, Chapter II, Section B.(2)(a)(1).

**II. DOE Manual 435.1-1, Chapter II, Section B.(2)(a)2: Will be managed to meet safety requirements comparable to the performance objectives set out in 10 CFR Part 61, Subpart C, Performance Objectives.**

This document provides the technical analysis to support an Exemption. By applying the HLW interpretation, DOE is in compliance with the substance of DOE Manual 435.1-1, Chapter II, Section B.(2)(a)2: “will be managed to meet safety requirements comparable to the performance objectives set out in 10 CFR Part 61, Subpart C, Performance Objectives,” because this requirement is part of the HLW interpretation criterion 1: “does not exceed concentration limits for Class C low-level radioactive waste as set out in section 61.55 of title 10, Code of Federal Regulations, and meets the performance objectives of a disposal facility.”

Further, commercial licensees/permittees have the responsibility for health and safety of the public, workers, and the environment by compliance with specified dose limits and performance objectives. The NRC performance objectives in 10 CFR Part 61, Subpart C, apply.

WAC are developed by the disposal facility operator based on results of long-term radiological risk analysis commonly called PA, including supporting technical analyses, which evaluate potential theoretical human exposure scenarios and dose consequences. Compliance with WAC and waste acceptance plans and processes ensure that dose limits and performance objectives are met for the facility’s operation and closure.

The performance objectives set forth in [10 CFR Part 61, Subpart C](#), and which follow, are the provisions intended to protect the public, workers, and the environment:

- [10 CFR 61.40](#), General requirement: Land disposal facilities must be sited, designed, operated, closed, and controlled after closure so that reasonable assurance exists that exposures to humans are within the limits established in the performance objectives in §§61.41 - 61.44.
- [10 CFR 61.41](#), Protection of the general population from releases of radioactivity: Concentrations of radioactive material which may be released to the general environment in ground water, surface water, air, soil, plants, or animals must not result in an annual dose exceeding an equivalent of 25 millirems to the whole body, 75 millirems to the thyroid, and 25 millirems to any other organ of any member of the public. Reasonable effort should be made to maintain releases of radioactivity in effluents to the general environment as low as is reasonably achievable ([ALARA](#)).
- [10 CFR 61.42](#), Protection of individuals from inadvertent intrusion: Design, operation, and closure of the land disposal facility must ensure protection of any individual inadvertently intruding into the disposal site and occupying the site or contacting the waste at any time after active institutional controls over the disposal site are removed.
- [10 CFR 61.43](#), Protection of individuals during operations: Operations at the land disposal facility must be conducted in compliance with the standards for radiation protection set forth in 10 CFR Part 20, "Standards for Protection Against Radiation,"

except for releases of radioactivity in effluents from the land disposal facility, which shall be governed by §61.41 of this part. Every reasonable effort shall be made to maintain radiation exposures as low as is reasonably achievable.

- [10 CFR 61.44](#), Stability of the disposal site after closure: The disposal facility must be sited, designed, used, operated, and closed to achieve long-term stability of the disposal site and to eliminate (to the extent practicable) the need for ongoing active maintenance of the disposal site following closure so that only surveillance, monitoring, or minor custodial care are required.

Commercial LLW disposal facilities are located in and licensed by Agreement States, and those Agreement States have incorporated the requirements from 10 CFR Part 61 into their corresponding regulations and as conditions for their licenses. The relevant performance objectives for the WCS FWF comply with [30 Texas Administrative Code \(TAC\) §336.723](#) and require protection of the general population, protection of individuals from inadvertent intrusion, and protection of workers and the general population during facility operations; and require the stability of the disposal site after closure, including implementation of measures modeled after the NRC's requirements, which consist of the following:

- Concentrations of radioactive material which may be released to the general environment in groundwater, surface water, air, soil, plants, or animals shall not result in an annual dose above background exceeding an equivalent of 25 millirems to the whole body, 75 millirems to the thyroid, or 25 millirems to any other organ of any member of the public. Effort shall be made to maintain releases of radioactivity in effluents to the general environment as low as is reasonably achievable ([TAC §336.724](#)).
- Design, operation, and closure of the land disposal facility shall ensure protection of any individual inadvertently intruding into the disposal site and occupying the site or contacting the waste at any time after active institutional controls over the disposal site are removed ([TAC §336.725](#)).
- Operations at the land disposal facility shall be conducted in compliance with the standards for radiation protection set out in Subchapter D of this chapter (relating to Standards for Protection Against Radiation), except for releases of radioactivity in effluents from the land disposal facility, which shall be governed by §336.724 of this title (relating to Protection of the General Population from Releases of Radioactivity). Effort shall be made to maintain radiation exposures as low as is reasonably achievable ([TAC §336.726](#)).
- The disposal facility shall be sited, designed, used, operated, and closed to achieve long-term stability of the disposal site and to eliminate to the extent practicable the need for ongoing active maintenance of the disposal site following closure so that only surveillance, monitoring, or minor custodial care are required ([TAC §336.727](#)).

The most recent PA for the WCS LLW facility, which included the FWF, was approved by TCEQ in 2019 and continues to demonstrate compliance with all applicable TAC

performance objectives.<sup>18</sup> The up to eight gallons of DWPF recycle wastewater would constitute a negligible inventory contribution to the PA WCS modeled and, therefore, would not negatively impact WCS FWF's continued compliance with the performance objectives.<sup>19</sup> Because stabilized waste from generators is considered as part of the assessed inventory of LLW planned to be disposed of in the FWF, as long as the up to eight gallons of stabilized DWPF recycle wastewater meets the WCS FWF WAC requirements, it will not affect any of the facility's performance objectives, including those performance objectives that provide for protection of the general population from releases of radioactivity, of individuals from inadvertent intrusion, and of individuals during facility operations.

The WAC contains the technical and administrative requirements a waste must meet to be accepted at a disposal facility (e.g., waste characterization, waste form acceptability, quality assurance), and are established to ensure the disposal facility, in total, meets its safety-based performance objectives.<sup>20</sup> For example:

- The stabilized WCS recycle wastewater would not exceed Class C limits;
- The up to eight gallons of DWPF recycle wastewater would constitute an extremely small percentage of the volumetric and radioactive limits for the WCS FWF; and
- The DWPF recycle wastewater would be stabilized, thus meeting the WAC requirement that all waste forms be in solid form. WCS would place the stabilized DWPF recycle waste containers in a Modular Concrete Canister to meet stability requirements for facility closure, and the top of the disposed LLW containers would be a minimum of five meters below the top surface of the disposal facility cover or would be disposed of with intruder barriers designed to protect against an inadvertent intrusion for at least 500 years.

Based on the completed waste profile, the DWPF recycle wastewater complies with the WCS WAC and, therefore, disposal of the stabilized DWPF recycle wastewater at **WCS FWF meets the second part of Criterion 1, namely, meets the performance objectives of the disposal facility.**

As stated in WCS's *Application for License to Authorize Near Surface Land Disposal of Low-Level Radioactive Waste*, Appendix 5.2-1: Waste Acceptance Plan (Revision 9):

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<sup>18</sup> TCEQ approved WCS's 2018 PA by letter on October 30, 2019. The PA and the letter are not publicly available online but may be requested from TCEQ.

<sup>19</sup> In development of the disposal regulations for LLW, the NRC recognized that there might be a situation in which a waste stream could be created that was not contemplated as part of the original technical basis for 10 CFR Part 61, which technical basis is found in the draft and final EISs for the rule. The radionuclides provided in the 10 CFR Section 61.55 waste classification tables were based on a best estimate (in 1980) of projected inventories of radioactive waste that would be disposed of in a commercial LLW disposal facility. The up to 8 gallons of DWPF recycle wastewater, and its radionuclide content and concentrations, is sufficiently comparable to projected inventories of radioactive waste that would be disposed of in a commercial LLW disposal facility and, therefore, does not warrant an additional site-specific PA to ensure performance objectives are met.

<sup>20</sup> Each disposal facility has its own WAC, which is dictated in part by the physical characteristics of a site. The WAC for the WCS facility is available at: <http://www.wcstexas.com/documents-and-forms/>.

“The final authorized WCS profile reviewer will review the documentation to verify the Waste Profile Form conformance and compliance with the Waste Acceptance Plan, the LLW license, and applicable regulations. This review will focus on ensuring the Waste Profile Form, supporting documentation, and disposal plans are complete and compatible, and there are no discrepancies within the different WCS department approvals. Any issues identified by the final reviewer must be resolved before the profile is approved. The WCS Radiation Safety Officer may conduct and complete the compliance verification review. If the waste or information associated with the profile does not comply with, cannot be brought into compliance with, or cannot be substantiated as being in compliance with the Waste Acceptance Plan, the LLW license and/or applicable regulations (including but not limited to the waste classification, waste characterization, or chelating agent evaluation) the profile will not be approved, and the customer will be notified. Once the final reviews are complete and the waste is found to be in compliance, the waste stream is considered approved and the customer will be notified.”

**Conclusion:** It is reasonable to determine that meeting the performance objectives of the WCS FWF disposal facility complies with the substance of DOE M 435.1-1, Chapter II, Section B.(2)(a)2, namely that the waste will be “managed to meet safety requirements comparable to the performance objectives set out in 10 CFR Part 61, Subpart C, Performance Objectives.”

**III. DOE Manual 435.1-1, Chapter II, Section B.(2)(a)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.**

This document provides the technical analysis to support an Exemption. By applying the HLW interpretation, DOE is in compliance with the substance of DOE Manual 435.1-1, Chapter II, Section B.(2)(a)3: “Are to be managed, [a] 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, [b] provided the waste will be incorporated in a solid physical form [c] 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.”

The three requirements [a], [b] and [c] will be met as follows:

**[a] AEA and NRC/TCEQ Equivalency and in accordance with the provisions of Chapter IV (LLW) of DOE Manual 435.1-1.**

The wastewater, if determined and classified as LLW, would be managed pursuant to the DOE AEA authority while under the Department's control. Chapter IV of the DOE Manual would be required for management of the DWPF recycle wastewater. Once an off-site disposal facility accepts the wastewater for disposal, the facility's waste acceptance process (as regulated by the applicable Agreement State) would then apply. In particular, the Manual requirements related to authorization of DOE-operated LLW disposal facilities (as required in Chapter IV, Section (P)(5) on Disposal Authorization) would be superseded as the wastewater would not be emplaced in a DOE-regulated disposal facility.

NRC and DOE are responsible for managing radioactive waste in a manner that is protective of the human health and the environment according to all relevant laws and regulations. The SRS DWPF recycle wastewater will be safely managed and disposed of at a commercial disposal facility in accordance with all relevant laws and regulations, e.g., 10 CFR 61.55. All commercial disposal facilities must be designed, constructed, operated, monitored, and closed to meet safety standards established by either NRC or Agreement States. Commercial LLW disposal facilities are licensed by either NRC or Agreement States under 10 CFR Part 61 or equivalent state regulations and regulatory requirements.

Disposal of non-HLW at a disposal facility would have to meet existing dose limits and performance objectives for protecting the environment, workers, and the public. Performance objectives and public dose limits are factors that DOE must consider when assessing any waste stream for potential disposal under the HLW interpretation. The HLW interpretation does not change or diminish these existing safety requirements. DOE and NRC have similar requirements ensuring that the public, workers, and the environment are protected from radioactive materials:

- NRC's performance objectives for commercial LLW disposal facilities are specified in 10 CFR Part 61, Subpart C.
- The DOE performance objectives and dose limits for low-level radioactive waste (LLW) disposal facilities are specified in DOE M 435.1-1.
- The table below compares DOE and NRC performance objectives (referred to in Table 3 as the "Safety Goal").

## Comparison of DOE and NRC Performance Objectives for LLW Disposal Facilities

Safety Goal	NRC Performance Objective for Commercial Facilities	DOE Performance Objective/Measures for DOE Facilities
Protection of the General Population	Radioactive material released to the general environment in groundwater, surface water, air, soil, plants, or animals must not result in a dose to the whole body in excess of 25 millirem (mrem) annually. [10 CFR 61.41]	Dose to a representative member of the public shall not exceed 25 mrem annually from all exposure pathways excluding the dose from radon and its progeny in air. [DOE Manual 435.1-1 Ch. IV P(1)(a)]
	NRC adds organ-specific objectives: No dose to the thyroid in excess of 75 mrem/year and to any other organ of any member of the public in excess of 25 mrem/year. [10 CFR 61.41]	DOE adds air pathway objective: Dose to representative members of the public shall not exceed 10 mrem/year, excluding radon and its progeny. [DOE Manual 435.1-1 Ch. IV P(1)(b)]
	<i>- This cell intentionally blank -</i>	DOE adds an objective specifically for radon: Radon release shall not exceed an average flux of 20 pCi/m <sup>2</sup> /second at the surface of the disposal facility. Alternatively a limit of 0.5 pCi/liter of air may be applied at the facility boundary. [DOE Manual 435.1-1 Ch. IV P(1)(c)]
Protection of Individuals from Inadvertent Intrusion	Design, operation, and closure of the land disposal facility must ensure protection of any individual inadvertently intruding into the disposal site and occupying the site or contacting the waste at any time after active institutional controls over the disposal site are removed. [10 CFR 61.42]	For purposes of establishing limits on concentration of radionuclides that may be disposed of near-surface, an analysis of inadvertent human intrusion shall use <u>performance measures</u> for chronic and acute exposure scenarios of 100 mrem in a year and 500 mrem total effective dose equivalent, excluding radon. [DOE Manual 435.1-1 Ch. IV P(2)(h)]
Protection of Individuals During Operations	Operations at the land disposal facility must be conducted in compliance with radiation protection standards set out in 10 CFR Part 20 except for releases of radioactivity in effluents from the land disposal facility, which shall be governed by 10 CFR 61.41. [10 CFR 61.43]	Facilities, operations, and activities shall meet the requirements of 10 CFR Part 835 and DOE O 5400.5 (superseded by DOE O 458.1) for establishing acceptable dose rates to workers and the public. [DOE Manual 435.1-1 Ch. I 1.E(13)]
Stability of Disposal Facility	The disposal facility must be sited, designed, used, operated, and closed to achieve long-term stability of the disposal site and to eliminate to the extent practicable the need for ongoing active maintenance of the disposal site following closure so that only surveillance, monitoring, or minor custodial care are required. [10 CFR 61.44]	Disposal Facility Closure Plans includes a description of how the disposal facility will be closed to achieve long-term stability and minimize the need for active maintenance following closure and to ensure compliance with the requirements of DOE O 5400.5, (superseded by DOE O 458.1). [DOE Manual 435.1-1 Ch. IV Q(1)(b)]



**[b] Incorporated in a solid physical form.**

All disposal facilities for radioactive waste require that any waste be incorporated into a solid physical form.

The up to eight gallons of DWPF recycle wastewater will be stabilized at WCS to meet the WCS FWF WAC. Grout is a proven safe and effective technology that continues to be used by DOE and other national and international parties to stabilize radioactive wastes, including certain tank wastes, for disposal. Use of stabilization agents for this purpose is consistent with the NRC's Concentration Averaging and Encapsulation Branch Technical Position, Revision 1 (<https://www.nrc.gov/docs/ML1225/ML12254B065.pdf>), which allows mixing of nonradioactive constituents with radioactive waste (e.g., solidification, encapsulation, or additives used in thermal processing), provided the mixing has a purpose other than reducing the waste classification, such as waste stabilization or process control. Furthermore, the addition of stabilization agents to the waste is often necessary to meet the NRC requirements in [10 CFR 61.56](#), "Waste Characteristics" (e.g., to ensure stability of the waste form).

**[c] Will be 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.**

See discussion under Section I of this Appendix, regarding DOE M 435.1-1, Chapter II, Section B(2)(a)(1), where it is shown that the DWPF recycle wastewater meets 10 CFR 61.55 concentrations.

**Conclusion:** It is reasonable to determine that: [a] managing the up to eight gallons of DWPF recycle wastewater pursuant to the DOE AEA authority while under DOE control; [b] solidifying the waste in accordance with the WCS FWF WAC; and [c] compliance with 10 CFR 61.55 concentration limits, comply with DOE Manual 435.1-1, Chapter II, Section B.(2)(a)3, namely that the waste, "[will 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."

# Appendix B – NRC Classification

From “Characterization of Tank 22 DWPF Recycle Wastewater,” Q-CLC-H-00601, Revision 0, March 2020, Table A3-1

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<b>Attachment 3: NRC Classification</b>											
<b>Attachment 3, Page 1 of 1</b>											
Table A3-1: NRC Classification											
A	B	C	D	E	F	G	H	I	J	K	L
NRC Classification											
Radionuclide	Activity, Ci	Activity Concentration, AC, nCi/g [=(B/12.453)X1E09]	Activity Density, AD, Ci/m <sup>3</sup> [=B/0.00419]	Class A Limits L <sub>1</sub> , [Table 1]	Units	Class A SOF (Table 1), Equation 9	Class A Limits, L <sub>2</sub> , [Table 2]	Units	Class A SOF (Table 2), Equation 9	Class B Limits, L <sub>1</sub> , [Table 2]	Class B SOF (Table 2), Equation 9
Ba-137m	9.58E-02	7.69E+03	2.29E+01					700	Ci/m <sup>3</sup>	3.27E-02	Unlimited
C-14	2.18E-07	1.75E-02	5.20E-05	0.8	Ci/m <sup>3</sup>	6.50E-05					
Cs-137	1.01E-01	8.13E+03	2.42E+01				1	Ci/m <sup>3</sup>	2.42E+01	44	5.50E-01
H-3	3.17E-04	2.55E+01	7.57E-02				40	Ci/m <sup>3</sup>	1.89E-03	Unlimited	
I-129	9.11E-08	7.32E-03	2.18E-05	0.008	Ci/m <sup>3</sup>	2.72E-03					
Np-237	2.36E-09	1.90E-04	5.65E-07	10	nCi/g	1.90E-05					
Pu-238	1.64E-08	1.31E-03	3.91E-06	10	nCi/g	1.31E-04					
Pu-239	2.08E-07	1.67E-02	4.97E-05	10	nCi/g	1.67E-03					
Pu-240	7.65E-07	6.14E-02	1.83E-04	10	nCi/g	6.14E-03					
Pu-242	1.28E-08	1.03E-03	3.06E-06	10	nCi/g	1.03E-04					
Sr-90	3.31E-05	2.66E+00	7.91E-03				0.04	Ci/m <sup>3</sup>	1.98E-01	150	5.27E-05
Tc-99	9.15E-06	7.35E-01	2.19E-03	0.3	Ci/m <sup>3</sup>	7.28E-03					
Total	1.97E-01					1.81E-02			2.44E+01		5.50E-01
						Calculate SOF based on Table 2 Class A Limits			Calculate SOF based on Table 2 Class B limits		Class B