SAFETY EVALUATION REPORT

DOCKET NO.: 70-1151

LICENSE NO.: SNM-1107

LICENSEE: Westinghouse Electric Company, LLC

SUBJECT: REQUEST FOR ALTERNATE DISPOSAL AND EXEMPTIONS FOR COLUMBIA FUEL FABRICATION FACILITY WASTE TO THE US ECOLOGY IDAHO FACILITY

1.0 INTRODUCTION

On November 5, 2021, Westinghouse Electric Company, LLC (WEC or licensee) requested that the U.S. Nuclear Regulatory Commission (NRC) approve an alternate disposal request (ADR) (Agencywide Documents Access and Management System (ADAMS) Accession No. ML21309A095), in accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) 20.2002, "Method for obtaining approval of proposed disposal procedures," (20.2002) for the disposal of certain low-activity radioactive materials, including byproduct and special nuclear material (SNM), from the Columbia Fuel Fabrication Facility (CFFF). US Ecology, Inc. (USEI) requested corresponding specific exemptions from 10 CFR 30.3 and 10 CFR 70.3 pursuant to 10 CFR 30.11(a) and 10 CFR 70.17(a) (ADAMS Accession No. ML21166A092) to accept the material for disposal. Approval of the 20.2002 request and granting of exemptions would allow WEC to dispose of the waste as requested and supports the exemption requested by USEI to possess and dispose of the material on their site instead of at a 10 CFR Part 61 low-level waste disposal facility.

The NRC staff has previously approved three separate ADRs to ship specific volumes of specific waste CFFF for disposal at USEI (e.g., ADAMS Accession Nos. ML20304A341, ML21053A336, and ML21202A112). Unlike previous requests, this ADR from WEC is for approval to dispose of multiple volumetrically and surface-contaminated wastes based upon bounding volumes of each material and maximum allowable radionuclide concentrations in accordance with USEI's Waste Acceptance Criteria (WAC). Annual doses associated with these proposed disposal actions will be restricted using the sum of fractions method, considering exposures from both the volumetrically contaminated and surface-contaminated wastes. Use of this approach is discussed in further detail below. WEC proposes this approach as a method for minimizing the number of requests needed for the review and approval of comparable material during remediation of the CFFF site in accordance with Consent Agreement 19-02-HW between WEC and the South Carolina Department of Health and Environmental Control.[1]

2.0 REGULATORY EVALUATION

An approval of a 10 CFR 20.2002 alternate disposal request from WEC along with exempting USEI from the requirements in 10 CFR 30.3 and 10 CFR 70.3 pursuant to 10 CFR 30.11(a) and 10 CFR 70.17(a) for byproduct and SNM, respectively, would allow WEC to package, ship, and

[1] Consent Agreement 19-02-HW can be found at https://scdhec.gov/environment/environmental-sites-projects-permits-interest/westinghouse/westinghouse-bureau-land-waste-management

dispose of the specific waste associated with activities performed at CFFF at the USEI disposal site. To obtain approval for 20.2002 alternate disposal requests, the licensee must meet the requirements in the regulation, which includes demonstrating that doses will be maintained as low as (is) reasonably achievable (ALARA). As noted in SECY-07-0060, Attachment 1, which was approved for use by the Commission in SRM-SECY-07-0060, and NUREG-1757, Volume 1, the NRC typically approves 20.2002 requests that result in doses to a member of the public that are no more than a few "millirem," defined to be between 0 and 0.05 millisieverts per year (mSv/yr) (0 and 5 millirem per year (mrem/yr)). This criterion ensures that public doses resulting from 20.2002 requests are a fraction of the natural background radiation dose and a fraction of the annual public dose limit.

The USEI disposal facility is a Subtitle C Resource Conservation and Recovery Act (RCRA) hazardous waste disposal facility permitted by the State of Idaho to receive radioactive waste that is not licensed or has been exempted from licensing by the NRC. The Idaho Department of Environmental Quality (IDEQ) maintains the regulatory authority over the specific disposal actions at USEI through the use of USEI's site-specific WAC. Since USEI is not licensed by the NRC, it must either obtain an NRC license or an exemption from NRC licensing requirements in order to accept and dispose of waste at its site. In accordance with the Section 30.11 and Section 70.17 exemption provisions, "[t]he Commission may, upon application by an interested person or upon its own initiative, grant such exemption from the requirements of the regulation … as it determines are authorized by law and will not endanger life or property or the common defense and security and are otherwise in the public interest."

3.0 TECHNICAL EVALUATION

WEC requests to ship and dispose of volumetrically contaminated and surface-contaminated waste containing byproduct material and special nuclear material at USEI based on bounding volumes for each material and maximum concentrations for radionuclides based on USEI's annual WAC limit of 3,000 pCi/g. As proposed, this request includes restrictions that limit the total volume of materials shipped in a calendar year based on the 0.05 mSv (5 mrem) per year dose limit to USEI workers. Approval of this approach would enable WEC to make multiple shipments of material to USEI without the need for individual NRC reviews and approvals. This technical evaluation considers the request against the four subparts of 10 CFR 20.2002.

3.1 20.2002(a) – A description of the waste containing licensed material to be disposed of, including the physical and chemical properties important to risk evaluation, and the proposed manner and conditions of waste disposal

Details provided to address the requirements in Paragraph 20.2002(a) are discussed and evaluated in the subsections below.

3.1.1 Description of Waste

The waste being considered for disposal in this ADR originates from the chemical conversion of uranium hexafluoride (UF_6) to uranium dioxide (UO_2) using the Ammonium Diuranate Process performed at CFFF. Activities associated with these fabrication processes produce multiple surface-contaminated and volumetrically contaminated materials that WEC is seeking to dispose of at USEI. WEC notes that the waste being considered under this request is contaminated with isotopic uranium (U-234, U-235, and U-238) and technicium-99 (Tc-99).

This review is limited to the volumetrically contaminated and surface-contaminated waste at the volume limits identified in the submittal. Volumes of volumetrically contaminated and surface-contaminated waste exceeding the proposed limits as well as shipments of other waste not identified in the submittal would either need a separate ADR or require disposal in a licensed low-level waste disposal facility.

Volumetrically Contaminated Waste

The different types of volumetrically contaminated waste being considered for disposal, including the maximum volumes for each material type associated with this request, are listed in Table 1.

Table 1. Volumetrically contaminated waste considered for disposal at USEI in accordance with this 20.2002 request

Volumetrically Contaminated Waste	Maximum Project Volume m^3	ft^3
CaF2 sludge dredged from site lagoons	11,327	400,000
Sanitary Lagoon sludge (including liner)	2,832	100,000
Contaminated soil, including small stones, rocks, and incidental amounts of vegetation from under and adjacent to the sanitary lagoons	8,495	300,000
Contaminated soil, including small stones, rocks, and incidental amounts of vegetation from the CaF2 pad repairs	2,124	75,000

Some shipments may require the use of absorbent materials such as Portland Cement©, Power Pellets®, DrySorb®, or equivalent material that may be mixed with the volumetrically contaminated waste to ensure no free-standing liquids are present in the shipping packages. The additional volume of these absorbent materials is included when considering the volumes of material being shipped to USEI for disposal.

Calcium Fluoride Sludge

During operations, low concentrations of calcium fluoride, a by-product of site operations, is pumped into onsite lagoons where the solids settle and are periodically dredged, dewatered, and placed in a pile for further drying prior to disposal. The CaF_2 sludge being considered in this request, which will not exceed 11,327 m^3 (400,000 ft^3), comes from the North, South, West 1, and West 2 lagoons. Although differences between each lagoon were not considered, the concentrations of uranium and Tc-99 in the sludge are expected to be similar to concentrations considered in previous approvals and less than the bounding maximum concentrations summarized in Table 4.

Sanitary Lagoon Waste

Sanitary sewage from the site is treated and discharged to a polishing lagoon known as the Sanitary Lagoon. Waste being considered for disposal from the Sanitary Lagoon includes up to 2,832 m^3 (100,000 ft^3) of lagoon sludge, the lagoon liner, and up to 8,495 m^3 (300,000 ft^3) of soil, rock, and incidental amounts of vegetation immediately under and adjacent to the lagoon that may be contaminated.

CaF_2 Pad Repair Waste

WEC states that in 2022 it plans to repair the CaF_2 pad used to dry the CaF_2 sludge removed from the lagoons. Activities are expected to generate up to 2,124 m^3 (75,000 ft^3) of soil and

waste with contamination levels, which are bounded by the CaF_2 sludge results mentioned above. The CaF_2 sludge approved for disposal in March 2021 (ADAMS Accession No. ML21053A336) was the last material stored on the pad.

Surface-Contaminated Waste

The different types of surface-contaminated waste being considered for disposal, including the maximum volumes for each material type associated with this request, are listed in Table 2.

Table 2. Surface-contaminated waste considered for disposal at USEI in accordance with this 20.2002 request

Surface Contaminated Waste	Maximum Project Volume m^3	ft^3
Obsolete UF_6 cylinders	1,416	50,000
Debris associated with CaF_2 pad and sanitary lagoon demolition debris[1]	4,248	150,000

[1]Surface-contaminated demolition debris will be evenly distributed (2,124 m^3 or 75,000 ft^3) from two environmental improvement projects

UF_6 Cylinders

The UF_6 cylinders are empty, solid form steel containers that were previously used as transportation containers. Although the containers were cleaned following their last use and prior to being stored pending disposal, they are internally contaminated with SNM. WEC plans to downsize the containers to eliminate void space prior to shipping them via truck to USEI for disposal. Approval of this request would allow for a maximum of 1,000 cylinders totaling 1,416 m^3 (50,000 ft^3) of waste volume to be shipped for disposal.

Demolition Debris

WEC has two environmental improvement projects planned at CFFF that will generate surface-contaminated waste: the repairs to the CaF_2 pad and the removal of the Sanitary Lagoon. Repairs to the CaF_2 pad will generate concrete and drainage piping debris while removal of the Sanitary Lagoon waste will include tanks, piping, valves, concrete, brick, mortar, and rebar from the lagoon as well as other components impacted as a result of the process. The proposed request will limit the disposal of demolition debris to a maximum of 4,248 m^3 (150,000 ft^3) evenly divided between the two projects.

3.1.2 Radionuclides of Concern

As noted above, instead of providing specific radionuclide concentrations associated with each waste material being considered for disposal on a case-by-case basis, WEC is proposing to use maximum radionuclide concentrations. These bounding radionuclide concentrations for volumetrically contaminated waste and surface-contaminated waste are summarized in Table 3. Use of these bounding concentrations ensure that annual disposal activities do not exceed USEI's site-specific WAC of 3,000 pCi/g of total activity. Shipments containing material with radionuclide concentrations exceeding these values or with other radionuclides not included in this review would either need a separate 20.2002 alternate disposal request or require disposal in a licensed low-level waste disposal facility.

Table 3. Bounding radionuclide concentrations for use in determining acceptable shipping criteria

	Volumetrically contaminated waste		Surface-contaminated waste	
	pCi/g	Ratio to WAC[1]	pCi/g	Ratio to WAC[1]
Tc-99	10	0.003		
U-234	2482.7	0.828	2,491	0.830
U-235	103.7	0.035	104	0.035
U-238	403.6	0.135	404.9	0.135

[1]WAC = waste acceptance criteria

3.1.3 Proposed Manner and Conditions of Waste Disposal

Beyond the approach used to determine the volume of material and associated radionuclide concentrations, the process for preparing, shipping, and disposing of the material being considered in this 20.2002 request remains the same as previously approved CFFF disposals at USEI. Packaging of the waste at CFFF will performed in accordance with licensing requirements, U.S. Department of Transportation requirements, and USEI's site-specific waste acceptance requirements. WEC expects to ship the majority of the surface-contaminated material to USEI via truck and the volumetrically contaminated material by rail in gondola cars. Shipments containing both volumetrically contaminated waste and surface-contaminated waste would likely also be shipped via gondola cars. Upon arrival at USEI, the waste will be processed as needed and transferred to trucks for transport to the disposal cell. A waste cell operator then spreads and compacts the waste in the waste cell with a bulldozer or similar equipment. Specifics related to the disposal actions at USEI are provided with the NRC's approval of USEI's Site-Specific Dose Assessment (SSDA) (ADAMS Accession Nos. ML18164A073 [cover letter] and ML18164A071 [TER]). Doses associated with the actions performed at USEI for this review are discussed in Section 3.4.2, Dose Assessment.

3.1.4 Conditions of Waste Disposal

As proposed, CFFF waste being considered for disposal at USEI are limited by the conservative radionuclide concentrations based on USEI's WAC and bounding volumes calculated using the SSDA. WEC determined that a maximum annual volume of 322,000 ft^3 of volumetrically contaminated waste or 122,000 ft^3 of surface-contaminated waste from CFFF or some combination of the two material types could be disposed of at USEI annually without exceeding the worker dose limit of 0.05 mSv/yr (5 mrem/yr).

Sampling of volumetrically contaminated waste and surface-contaminated waste will be performed prior to shipping to ensure the waste meets the USEI WAC using various methods that are specific to the waste material being considered. To ensure that the waste does not exceed the bounding limits proposed in this request, WEC developed dose factors for both the volumetrically contaminated waste and the surface-contaminated waste based on the dose limit and the corresponding annual volume limit for each waste category. These values, calculated below, will assist with determining whether waste materials being prepared for shipment to USEI meet the criteria.

For volumetrically contaminated waste:

$$\frac{0.05\ \text{mSv/year}}{9{,}118\ \text{m}^3\text{/year}} = \frac{5.48\text{E-}06\ \text{mSv}_{vc}}{\text{m}^3}$$

$$\frac{5 \text{ mrem/year}}{322{,}000 \text{ ft}^3\text{/year}} = \frac{1.55\text{E-}05 \text{ mrem}_{vc}}{\text{ft}^3}$$

For surface-contaminated waste:

$$\frac{0.05 \text{ mSv/year}}{3{,}455 \text{ m}^3\text{/year}} = \frac{1.45\text{E-}05 \text{ mSv}_{sc}}{\text{m}^3}$$

$$\frac{5 \text{ mrem/year}}{122{,}000 \text{ ft}^3\text{/year}} = \frac{4.1\text{E-}05 \text{ mrem}_{sc}}{\text{ft}^3}$$

WEC also proposes to keep track of the multiple shipments of volumetrically contaminated waste and surface-contaminated waste in accordance with the sum of fractions approach using the equations below to ensure that total doses associated with waste shipped in any calendar year do not exceed 0.05 mSv/yr (5 mrem/yr). Disposal at USEI also requires that the material meets other regulatory requirements established by the IDEQ.

Sum of fractions ratio:

$$\frac{\sum [(5.48\text{E-}06 \text{ mSv}_{vc} \times \text{total}_{vc} \text{ m}^3)}{\text{m}^3} + \frac{(1.55\text{E-}05 \text{ mSv}_{sc} \times \text{total}_{sc} \text{ m}^3)]}{\text{m}^3} < 0.05 \text{ mSv}$$

$$\frac{\sum [(1.55\text{E-}5 \text{ mrem}_{vc} \times \text{total}_{vc} \text{ ft}^3)}{\text{ft}^3} + \frac{(4.10\text{E-}5 \text{ mrem}_{sc} \times \text{total}_{sc} \text{ ft}^3)]}{\text{ft}^3} < 5 \text{ mrem}$$

3.1.5 Disposal Area

The USEI facility is an RCRA Subtitle C hazardous waste disposal facility permitted by the IDEQ and is not an NRC licensee. It is located near Grand View, Idaho in the Owyhee Desert. Specific details regarding the acceptability of USEI for accepting, processing, and disposing of the CFFF waste material is included in Section 3.2.

3.2 20.2002(b) - An analysis and evaluation of pertinent information on the nature of the environment

Satisfaction of 20.2002(b) requires an understanding of the environment in which the material would be disposed.

The USEI facility includes natural site features that limit the migration of disposed radioactive material such as a low precipitation rate (i.e., 18.4 cm/yr (7.4 inches per year)) and a long vertical distance to groundwater (i.e., a 61-meter (203-ft) thick, on average, unsaturated zone below the disposal zone). As is usual with an RCRA Subtitle C site, engineered features are also present to enhance confinement of contaminants over the long term. These features include an engineered cover, liners, and leachate monitoring systems. Operations at the site include systems that minimize the potential for exposure to workers from any waste handled by the facility. These systems include a closed facility with filtered ventilation exhaust for processing and transferring incoming waste material from the shipping conveyance to trucks for transport to the disposal cell, mechanized equipment for disposition of waste material in the cell, and the application of an asphaltic spray at the end of each day's operations. The site is permitted by the State of Idaho to receive non-Atomic-Energy-Act material or exempted radioactive material that meets site permit requirements. Specific characteristics of the site are discussed in Attachment 7 of the "Hazardous Waste Facility Site License Application for Cell

16," (ADAMS Accession No. ML100320540) and "Summary of Hydrogeologic Conditions and Groundwater Flow Model for US Ecology Idaho Facility, Grand View, Idaho," which was included as Exhibit B to a 20.2002 request to dispose of waste from the Humboldt Bay Power Plant (ADAMS Accession No. ML101170554).

As discussed in reviews of previous 20.2002 requests for the disposal of radioactive waste at USEI, the material in question may include special nuclear material (SNM) and therefore, although not likely, criticality could be a concern. A site-specific criticality safety assessment was previously performed as part of a prior ADR by WEC for material coming from the Hematite site (License No. SNM-0033; Docket No. 070-36). The report, "Nuclear Criticality Safety Assessment of the US Ecology (USEI) Site for the Land Fill Disposal of Decommissioning Waste from the Hematite Site, Rev. 2 (Nuclear Safety Associates, 2011)" (ADAMS Accession No. ML12135A301) (Hematite Report) concluded that waste containing U-235 may be sent to USEI for disposal on the basis that the concentrations of SNM associated with these requests are low; large margins of safety have been incorporated into the normal operating conditions associated with processing these wastes; and the probability for serious abnormal conditions is acceptably small. The report establishes, with respect to criticality safety, a maximum fissile concentration of 0.1 grams of U-235 per liter, which corresponds to an equivalent concentration of 216 pCi/g in soil. This concentration exceeds USEI's WAC value of 167 pCi/g, meaning the USEI's WAC is the limiting factor with regards to whether the material can be accepted for disposal at USEI. The range of material types and forms (i.e., soils and debris) being considered for disposal in this review are similar to those evaluated in the Hematite Report. Therefore, the determination that the WAC adequately manages any concern for criticality is still valid.

3.3 20.2002(c) – The nature and location of other potentially affected licensed and unlicensed facilities

Approval of the ADR requires consideration of other licensed and unlicensed sites that may be impacted by exempting the material from future licensing and permitting its disposal at a site that does not possess an NRC license.

Activities related to this request that occur at CFFF, an NRC-licensed facility in South Carolina, occur in a small, centralized area of the site and are performed in accordance with CFFF's license. Therefore, the NRC staff does not expect the requested action to impact other licensed or unlicensed sites in vicinity of the licensee.

USEI is a Subtitle C RCRA hazardous waste disposal facility permitted by the State of Idaho to receive and dispose of radioactive waste that is not licensed or is exempted from licensing by the NRC or an Agreement State. USEI is not an NRC licensee. However, NRC staff considered the characteristics and environmental conditions of the USEI disposal site and the processes associated with preparing and disposing of the waste being considered in this request and does not expect these disposals to impact licensed or unlicensed sites in the vicinity.

3.4 20.2002(d) – Analyses and procedures to ensure that doses are maintained ALARA and with the dose limits in this part

This section summarizes the processes, procedures, and monitoring practices implemented at CFFF and USEI associated with the proposed request and ensure that these activities are and will be maintained at levels that are as low as (is) reasonably achievable (ALARA). This

includes steps taken to minimize exposures to individuals associated with the proposed disposal actions as well as long-term post-closure exposures that may occur once USEI site operations have been completed.

3.4.1 Proposed Processes for Minimizing Exposures

WEC's submittal outlines a variety of measures that ensure the processes used to prepare, package, ship, process, and dispose of the CFFF waste material at USEI will maintain doses that are ALARA. These include:

- Onsite monitoring of the workers at CFFF involved in both the sampling and packaging of the waste material will be performed. Oversight of these onsite monitoring actions is already incorporated into CFFF's license. This includes the use of dosimetry, when appropriate, as well as the development of an ALARA analysis and Radiation Work Permit for each action. Established processes, which are outlined above, ensure minimal exposure to workers associated with processing and disposing of the waste at USEI.

- Performing surveys of the waste to ensure that the shipments meet the established criteria, which includes a total annual volume value for all material as well as annual volumes for each waste stream. This includes the use of dose factors for the volumetrically contaminated and surface-contaminated wastes to ensure that the material leaving CFFF satisfies the criteria outlined in the ADR and the regulatory requirements associated with USEI's WAC. As previously noted, packaged waste determined to exceed these values would not be disposed of at USEI.

- The use of USEI's maximum WAC concentration for an individual radionuclide and a maximum dose to the USEI workers of 0.05 mSv/yr (5 mrem/yr), which is well below the 1 mSv/yr (100 mrem/yr) public dose limit, for defining the amount of material that can be shipped to USEI for disposal in any one year.

- Using bounding concentrations and volumes when needed to characterize waste shipments. This includes when combining different waste streams and when mixing volumetrically contaminated and surface-contaminated waste for shipping.

3.4.2 Dose Assessment

Doses were evaluated using USEI's Site-Specific Dose Assessment (SSDA), Version 3B, methodology. Since this approval is based on current USEI processes incorporated into the SSDA, Version 3B calculations, additional evaluations would be needed to assess impacts associated with any future changes to the processes for preparing, shipping, processing, and disposing of this material.

Doses evaluated for this approach considered the same reasonably foreseeable exposure scenarios that are used when evaluating individual, case-by-case ADRs for shipping material to USEI for disposal. These include transportation workers and USEI workers as well as post-closure doses associated with potential future exposures to the general public as well as different inadvertent intruder scenarios. CFFF workers are employees and/or contractors of WEC, an NRC licensee, and are monitored in accordance with requirements in the license. Therefore, their doses are not considered in this review.

In order to more accurately assess the doses associated with the material being proposed for disposal, this review considers the volumetrically contaminated and surface-contaminated waste streams separately. As indicated in the submittal, there is the potential for shipments to contain a mixture of volumetrically contaminated waste and surface-contaminated waste. Those shipments would be sent via rail, and the analysis for volumetrically contaminated waste would be used as it is the more conservative analysis (i.e., requires a smaller dose per volume of material). Table 4 provides a summary of the specific inputs used with the SSDA to calculate doses to the individual workers associated with the proposed disposal actions, post-closure doses, and doses to inadvertent intruders for each waste stream. These doses are based on the maximum volumes of waste associated with USEI's 0.05 mSv/yr (5 mrem/yr) dose limit that would be shipped for disposal in one calendar year. The table includes a list of key information used in the analysis but does not include all of the specific values considered in the calculations. Additional details related to the exposure scenario dose calculations are discussed below.

Table 4. SSDA input parameters used to calculate doses to individuals associated with the shipping and disposal of the annual volumes of waste limits

Waste Stream Information	**Volumetrically contaminated Waste**	**Surface-contaminated Waste**
Volume of waste (ft^3)	322,000	122,000
Primary waste form	Soil	Debris
Method of shipment	Rail and Truck (Both)	Truck
Front-end truck driving (miles)	5	2,500
Containerized or bulk shipping?	Bulk	Bulk
Waste density (lb/ft^3)	75	31.8
Does waste contain Source Material (U or Th)?	No	No
Does waste contain Special Nuclear Material?	Yes	Yes
Radionuclide concentrations (pCi/g)		
Tc-99	10.0	
U-234	2482.7	2491.0
U-235	103.7	104.0
U-238	403.6	404.9

Transportation and USEI Worker Exposure Scenarios and Doses

USEI workers and the transportation workers responsible for transporting the material from CFFF to USEI are considered members of the public. WEC's proposal to use different transportation methods for the volumetrically contaminated and surface-contaminated waste streams means doses to different transportation workers and USEI workers involved in processing the material upon arrival need to be considered. Table 5 provides a summary of the workers used for each shipping method, the worker contact times, and estimated repetitions involved with transporting and disposing of the two types of waste, as well as the SSDA-calculated doses.

The analysis of the USEI workers involved assumes a specific number of workers will be available to carry out each of the job functions and that the dose is divided equally among all workers for a specific job function. Specific job functions are not shared among the excavator

operator, truck driver, and landfill cell operator groups since the work crews are not assumed to overlap. However, the gondola surveyors, gondola cleanout crews, and truck surveyors may include the same individual employees. Table 5 summarizes the job function scenario assumptions. The "Waste Contact Time" is the amount of time for one person to perform each function one time. A review of the calculated doses for job functions in which workers may overlap showed that even if one worker carried out all of the tasks for all three functions, an impossible scenario, the resulting project dose would be not be significant.

Table 5. Summary of maximum annual doses and related details for transportation workers and USEI workers involved with the transport, processing, and disposal of waste

Job Function	Minimum Number of Workers	Waste Contact Time (hr)	Total Number of Repetitions	Dose per Worker (mrem/yr)[1]
Maximum Dose – Transport and Disposal of Volumetric/Mixed Waste				
Front-End Dray Truck Drivers	4	0.09	604	5.58E-02
Gondola Railcar Surveyors	4	0.33	121	2.80E-02
Bulk/IMC Truck Surveyors (RTF)	4	0.08	356	2.27E-02
RTF Excavator Operator	2	0.75	121	4.98E+00
Gondola Railcar Cleanout	4	0.16	121	5.34E-01
Back-End Dray Truck Drivers	8	0.75	356	1.36E-01
Landfill Cell Operators	2	0.25	242	3.28E+00
Maximum Dose – Transport and Disposal of Surface-Contaminated Waste				
Long-Haul Truck Drivers	5	45.45	158	4.98E+00
Bulk/IMC Truck Surveyors (Disposal Site)[2]	4	0.08	158	8.89E-03
Landfill Cell Operators	2	0.25	38	5.16E-01

[1]Multiply mrem/y by 0.01 to convert doses to mSv/yr

[2]The submittal reported four workers receiving a Dose per Worker of 4.45E-03 mrem/yr. This submitted dose was based on 8 workers and was corrected by the licensee.

Post-Closure and Intruder Scenarios and Doses

In addition to evaluating transportation and USEI worker scenarios, WEC also considered long-term post-closure exposures by evaluating doses associated with a residential scenario. This is a site-specific exposure scenario that is incorporated into the SSDA that considers an individual residing on the USEI site following closure and includes ingestion (except for aquatic foods), inhalation, and external dose pathways. The SSDA also considers three inadvertent human intruder scenarios: a construction scenario, a well-drilling scenario, and a driller occupancy scenario. These analyses were performed using the same input parameters used to calculate the doses to transportation and USEI workers. Modifications, however, were made to the dilution factor used to calculate inadvertent intruder doses, taking into account the differences between the maximum annual volume of material being considered relative to the

average annual volume of all material disposed of at USEI between 2015 – 2020 (1.41E+05 m^3 or 4.99E+06 ft^3).

Volumetrically contaminated waste dilution factor (fd_{vc})

$$fd_{vc} = \frac{322{,}000\ ft^3}{4.99E+06\ ft^3} = 6.45E-02$$

Surface-contaminated waste dilution factor (fd_{sc})

$$fd_{sc} = \frac{122{,}000\ ft^3}{4.99E+06\ ft^3} = 2.44E-02$$

Table 6 summarizes the doses calculated for the post-closure and inadvertent intruder scenarios provided by WEC in the submittal as well as the comparable doses independently calculated by NRC staff. Although doses associated with the inadvertent intruder construction scenario are larger than the other inadvertent intruder scenarios, the NRC staff does not consider this scenario to be feasible due to the configuration of the disposal cells and USEI disposal practices (e.g., waste is disposed deeper than the excavation depth assumed in the scenario).

Table 6. Projected post-closure and inadvertent intruder doses

Scenario	Volumetrically contaminated waste (mrem/yr)[1]	Surface-contaminated waste (mrem/yr)[1]	Total dose (mrem/yr)[1]
WEC-calculated doses			
Post-Closure Residential Dose	1.01E+00	2.60E-02	1.04E+00
Inadvertent Intruder – Construction	3.64E+00	7.07E-01	4.35E+00
Inadvertent Intruder – Well Driller	2.50E-01	1.15E-01	3.65E-01
Inadvertent Intruder – Driller Occupancy	5.41E-01	2.24E-01	7.65E-01
NRC-calculated doses			
Post-Closure Residential Dose	1.01E+00	2.62E-02	1.04E+00
Inadvertent Intruder – Construction	3.64E+00	5.75E-1	4.22E+00
Inadvertent Intruder – Well Driller	2.50E-01	9.39E-2	3.44E-01
Inadvertent Intruder – Driller Occupancy	5.41E-01	2.24E-01	7.65E-01

[1]Multiply mrem/yr by 0.01 to convert dose to mSv/yr

Additional Analyses

Although the SSDA analysis of volumetrically contaminated waste considered the primary material to be soil, WEC identifies the waste as containing a variety of different material, including small stones and rocks, CaF_2 and other sediments dredged from the site lagoons, sludge, as well as absorbent materials such as Portland Cement®, DrySorb® or equivalent material used to ensure no free-standing liquids are present in the shipping packages, and filter media. The NRC staff modified the SSDA inputs to consider the volumetrically contaminated material as both “debris” and “mix” in order to evaluate the impact these different material types have on the individual worker doses. These additional analyses confirm that considering these materials to be soil calculates a bounding dose to the workers associated with the transportation and disposal activities.

Table 7. Comparison of individual worker doses assuming different material types

Scenario	Dose calculated as: "Soil" (mrem/yr)[1]	"Debris" (mrem/yr)[1]	"Mix" (mrem/yr)[1]
Front-End Dray Truck Drivers	5.58E-02	4.74E-02	5.16E-02
Gondola Railcar Surveyors	2.80E-02	2.58E-02	2.69E-02
Bulk/IMC Truck Surveyors (RTF)	2.27E-02	2.00E-02	2.13E-02
RTF Excavator Operator	4.98E+00	4.97E+00	4.98E+00
Gondola Railcar Cleanout	5.34E-01	5.28E-01	5.31E-01
Back-End Dray Truck Drivers	1.36E-01	1.15E-01	1.25E-01
Landfill Cell Operator	3.28E+00	3.28E+00	3.28E+00

[1]Multiply mrem/yr by 0.01 to convert dose to mSv/yr

During a review of SSDA dose calculations for the surface-contaminated material the NRC staff identified a discrepancy associated with the "Minimum Number of Workers" for the "Bulk/IMC Truck Surveyors (disposal site)" job function. Results reported by WEC in Table 7.1 of the submittal differed from the values used to calculate the worker dose in Version 3B of the SSDA. Table 7.1 of the submittal reports that the "Minimum Number of Workers" is four and the resulting "Project Dose per Worker" is 4.45E-03 mrem. According to Version 3B of the SSDA, however, a "Project Dose per Worker" of 4.45E-03 mrem is based on a minimum of eight workers. USEI acknowledged the value used for the "Minimum Number of Workers" in the SSDA dose calculation was incorrect and submitted an updated version of the Table 7.1, noting that four "Bulk/IMC Truck Surveyors (disposal site)" workers will each receive doses of 8.89E-03 mrem for the project (ADAMS Accession No. ML21196A416). The NRC staff confirmed that this change does not impact the conclusions resulting from this review.

In addition to evaluating the doses associated with the maximum volumes of volumetrically contaminated waste and surface-contaminated waste provided by WEC in the submittal, NRC staff also calculated material-specific doses associated with the disposal of each waste type (Tables 8 and 9). These doses are also considered overly conservative as they assume that the entire volume of each material is shipped in a single calendar year. The maximum annual volume restrictions proposed by WEC along with the use of dose factors and the sum of fractions will further restrict these doses. For example, the dose to the RTF Excavator Operator associated with the disposal of CaF2 sludge dredged from the site lagoons was calculated to be 0.0617 mSv/yr (6.17E+00 mrem/yr), exceeding the 0.05 mSv/yr (5 mrem/yr) dose limit put in place as part of this request. However, this dose is based on the disposal of 11,327 m^3 (400,000 ft^3) of CaF2 sludge, a volume greater than then annual limit of 9,118 m^3 (322,000 ft^3) of volumetrically contaminated waste put in place by WEC. As noted previously, doses associated with the inadvertent intruder construction scenario also exceed the 0.05 mSv/yr (5 mrem/yr) dose limit but the NRC staff does not consider this scenario to be feasible due to the configuration of the disposal cells and USEI disposal practices (e.g., waste is disposed deeper than the excavation depth assumed in the scenario).

Table 8. Doses (mrem/yr)[1] calculated for each volumetrically contaminated waste material assuming the entire project volume is disposed in a single year

	CaF2 sludge dredged from site lagoons	Sanitary Lagoon sludge (including liner)	Contaminated soil, etc. associated with sanitary lagoons	Contaminated soil, etc. from the CaF2 pad repairs

Max volume (ft^3)	400,000	100,000	300,000	75,000
Front-End Dray Truck Drivers	6.92E-02	1.74E-02	5.20E-02	1.30E-02
Gondola Railcar Surveyors	3.48E-02	8.81E-03	2.62E-02	6.72E-03
Bulk/IMC Truck Surveyors (RTF)	2.81E-02	7.06E-03	2.11E-02	5.28E-03
RTF Excavator Operator	6.17E+00	1.56E+00	4.65E+00	1.19E+00
Gondola Railcar Cleanout	6.62E-01	1.68E-01	4.98E-01	1.28E-01
Back-End Dray Truck Drivers	1.68E-01	4.23E-02	1.26E-01	3.16E-02
Landfill Cell Operators	4.06E+00	1.02E+00	3.05E+00	7.72E-01
Post-Closure Screening Dose	1.25E+00	3.14E-01	9.41E-01	2.35E-01
Inadvertent Intruder Doses				
Construction Scenario	3.64E+00	3.64E+00	3.64E+00	3.64E+00
Well Driller Scenario	2.50E-01	2.50E-01	2.50E-01	2.50E-01
Driller Occupancy Scenario	5.41E-01	5.41E-01	5.41E-01	5.41E-01

[1] Multiply dose (mrem/yr) by 0.01 to get mSv/yr

Table 9. Doses (mrem/yr)[1] calculated for each surface-contaminated waste material assuming the entire project volume is disposed in a single year

	Obsolete UF_6 cylinders	Debris associated with CaF_2 pad and sanitary lagoon demolition debris[1]
Max volume (ft^3)	50,000	150,000
Long-Haul Truck Drivers	2.05E+00	6.11E+00
Bulk/IMC Truck Surveyors (Disposal Site)	3.66E-03	1.09E-02
Landfill Cell Operators	2.17E-01	6.39E-01
Post-Closure Screening Dose	1.07E-02	3.22E-02
Inadvertent Intruder Doses		
Construction Scenario	5.75E-01	5.75E-01
Well Driller Scenario	9.39E-02	9.39E-02
Driller Occupancy Scenario	2.24E-01	2.24E-01

[1] Multiply dose (mrem/yr) by 0.01 to get mSv/yr

4.0 REGULATORY FINDINGS

4.1 20.2002 Criteria

NRC staff reviewed the information provided by WEC to support their 10 CFR 20.2002 ADR and for corresponding specific exemptions from 10 CFR 30.3 and 10 CFR 70.3 to dispose of multiple individual shipments of volumetrically contaminated and surface-contaminated material at USEI based on annual volumes of each material and radionuclide concentration limits.

As documented above and consistent with Paragraph 20.2002(a), the NRC staff concludes that WEC provided an adequate description of the materials and the proposed manner and conditions of waste disposal. WEC included bounding volumes for the different types of

materials as well as doses based on maximum radionuclide concentrations associated with the material being removed from CFFF as part of their remediation activities. Consistent with Paragraph 20.2002(b), the NRC staff also concludes that sufficient details regarding the USEI disposal site and the characteristics in place to minimize exposure to current and future members of the public have been considered. Considering the physical characteristics of the USEI site and the processes associated with preparing and disposing of the waste evaluated in this request, these disposals would not be expected to impact licensed and unlicensed sites in the vicinity of USEI, satisfying the requirements in Paragraph 20.2002(c).

The NRC staff also concludes that WEC incorporated multiple conservatisms in developing its dose analyses that ensure that doses will not be more than a "few millirem" per year to any member of the public. These include using bounding annual volumes for each individual waste type as well as for the total annual volumes of volumetrically contaminated and surface-contaminated wastes, restricting radionuclide concentrations to a fraction of USEI's site-specific WAC limits, and using bounding parameter values when using the SSDA to calculate doses to workers and other members of the public who may be impacted. By incorporating these conservatisms and tying the dose limits to USEI's site-specific WAC, NRC staff conclude that these doses, which are not more than a "few millirem" per year to any member of the public, would be ALARA and consistent with Paragraph 20.2002(d).

The NRC staff also notes that WEC's proposal includes further evaluations and sampling of material prior to shipping to ensure that the waste being disposed at USEI meets the established criteria proposed and evaluated in this review.

4.2 Exemption Criteria

Pursuant to 10 CFR 70.17(a) and 10 CFR 30.11, the NRC may, upon application of any interested person or upon its own initiative, grant exemptions from the requirements of 10 CFR Part 70 and Part 30 respectively, if it determines that they (1) are authorized by law, (2) will not endanger life or property or the common defense and security, and (3) are otherwise in the public interest. First, as stated above, the NRC is authorized to grant exemptions from Parts 20 and 30. Granting the requested exemptions is also not contrary to the Atomic Energy Act of 1954, as amended, and other regulatory requirements or laws. Accordingly, granting the requested exemptions is authorized by law. Second, the analyses documented above conclude that USEI maintains an environment that is appropriate for the disposal of this material and doses to both the workers performing the disposal actions and doses associated with reasonably foreseeable future land uses are acceptable. Therefore, granting the exemptions will not endanger life or property or the common defense and security. Based on the NRC's findings outlined above, issuance of the exemptions to WEC and USEI is in the public interest because it would provide for the efficient and safe disposal of the subject waste material, would facilitate the remediation of the CFFF site consistent with the consent agreement between CFFF and the South Carolina Department of Health and Environmental Control, and would conserve low-level radioactive waste disposal capacity at licensed low-level radioactive disposal sites, while ensuring that the material being considered is disposed of safely in a regulated facility. Therefore, based upon the evaluation above, an exemption is appropriate pursuant to 10 CFR 30.11 and 10 CFR 70.17.

5.0 CONCLUSION

Based on these findings, NRC staff concludes that the requested ADR, which uses bounding volumes of material and radionuclide concentration limits based on an annual dose to workers

involved in the transportation, processing, and disposing of the specified material, is acceptable under 10 CFR 20.2002 for the duration of the proposed cleanup actions. In addition, as provided in 10 CFR 30.11 and 10 CFR 70.17, the NRC staff finds that issuance of exemptions to WEC and USEI that considers multiple disposal actions is authorized by law, will not endanger life or property, is consistent with the common defense and security, and is in the public interest.

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