FTF-WDIP-006
Revision 0

WASTE WILL BE DISPOSED OF IN ACCORDANCE WITH THE PERFORMANCE OBJECTIVES 10 CFR 61.43 INPUT PACKAGE

for the

Section 3116 Draft Basis Document for F-Tank Farm at the Savannah River Site

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ACRONYMS / ABBREVIATIONS

ALARA	As Low As Reasonably Achievable
CFR	Code of Federal Regulations
DOE	United States Department of Energy
DSA	Documented Safety Analysis
FTF	F-Tank Farm
HA	Hazard Analysis
hr	hour
mg	milligrams
mrem	millirem
mSv	milliSievert
NDAA	Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005
NPH	Natural Phenomena Hazard
NRC	United States Nuclear Regulatory Commission
OSHA	Occupational Safety and Health Administration
PA	Performance Assessment
PEL	Permissible Exposure Limit
RBA	Radiological Buffer Area
RPP	Radiation Protection Program
S/RID	Standards/Requirement Identification Document
SRS	Savannah River Site
TED	Total Effective Dose
yr	year

1.0 INPUT PACKAGE DESCRIPTION

Input package FTF-WDIP-006 provides information anticipated to be used in Section 7.0, *Waste Will Be Disposed of in Accordance With Performance Objectives in 10 CFR 61, Subpart C*, of the Draft F-Tank Farm (FTF) 3116 Basis Document. Specifically, this input package addresses Title 10 Code of Federal Regulations (CFR) 61.43, *Protection of Individuals During Operations*. Development of FTF-WDIP-006 allows for early review of this information before the Draft FTF 3116 Basis Document is submitted to the Nuclear Regulatory Commission (NRC) for further consultation, and issued for public comment. This input package provides both the anticipated approach for demonstrating compliance with 10 CFR 61.43 and wording representative of the information anticipated to be included in the Draft FTF 3116 Basis Document[1].

2.0 DRAFT FTF 3116 BASIS DOCUMENT APPROACH

The following describes the approach the Department of Energy (DOE) is considering for demonstrating compliance with performance objective in 10 CFR 61.43 as it pertains to the closure of waste tanks and ancillary structures in FTF.

- The level of information DOE is considering including in the Draft FTF 3116 Basis Document would be consistent with that provided in both the *Basis for Section 3116 Determination for Salt Waste Disposal at the Savannah River Site* [DOE-WD-2005-001] and the *Basis for Section 3116 Determination for the Idaho Nuclear Technology and Engineering Center Tank Farm Facility*. [DOE/NE-ID-11226]
- The DOE regulatory and contractual requirements for DOE facilities and activities establish dose limits based on 10 CFR 835 and relevant DOE Orders. These dose limits correspond to the radiation protection standards set out in 10 CFR 61.43, which cites 10 CFR Part 20. Similar to the previous 3116 Basis Documents mentioned above, the approach DOE is considering for the Draft FTF 3116 Basis Document would provide the necessary information to demonstrate that DOE requirements meet or exceed those specified in 10 CFR 61.43. This approach is consistent with NRC staff guidance provided in NUREG-1854.
- Also reviewed and considered to ensure any comments received from the NRC during consultation have been appropriately considered were the following documents:
    - CBU-PIT-2005-00131, *Response to Request for Additional Information on the Draft Section 3116 Determination for Salt Waste Disposal at the Savannah River Site*, associated with the approved *Basis for Section 3116 Determination for Salt Waste Disposal at the Savannah River Site*, (DOE-WD-2005-001)*;*
    - ICP/EXT-06-01204, *Response to Request for Additional Information on the Draft Section 3116 Determination, Idaho Nuclear Technology and Engineering Center Tank Farm Facility*, associated with *Basis for Section 3116 Determination for the*

[1] The purpose of developing this input package and utilizing the scoping process parallel to development of the Draft FTF 3116 Basis Document is to expedite the identification of issues and assess the reasonability of DOE's approach in addressing the NDAA Section 3116 criteria, thereby allowing for more informed and efficient consultation with the NRC and a more informed draft for public comment. Changes in the described approaches and information presented in this input package may occur based on discussions during the scoping process.

Idaho Nuclear Technology and Engineering Center Tank Farm Facility (DOE/NE-ID-11226); and

- CBU-PIT-2006-00065, *Response to Request for Additional Information on the Draft 3116 Determination for Closure of Tank 19 and Tank 18 at the Savannah River Site* and LWO-PIT-2007-00025, *Response to the NRC's Request for Additional Information Comment #15* associated with the *Draft Section 3116 Determination for Closure of Tank 19 and Tank 18 at the Savannah River Site*, (DOE-WD-2005-002).

Based on the above outlined approach, the following section provides wording similar to that anticipated to be contained in the Draft FTF 3116 Basis Document. Although the wording will be revised as DOE further develops and refines the Draft FTF 3116 Basis Document, the information provided represents the level of information and general compliance demonstrations anticipated to be provided in the Draft FTF 3116 Basis Document.

3.0 WASTE WILL BE DISPOSED OF IN ACCORDANCE WITH PERFORMANCE OBJECTIVES IN 10 CFR 61, SUBPART C

Section Purpose

This section demonstrates that operations for disposal of the stabilized residuals, tanks and ancillary structures in the FTF will comply with the performance objectives in 10 CFR Part 61, Subpart C, Section 61.43, *Protection of Individuals During Operations*, for the purpose of the Draft FTF 3116 Basis Document.

Section Contents

This section outlines the relevant DOE regulatory and contractual requirements which ensure compliance with 10 CFR 61.43 for the purpose of the Draft FTF 3116 Basis Document.

Key Points

- The DOE regulatory and contractual requirements for DOE facilities and activities establish dose limits based on 10 CFR 835 and relevant DOE Orders. These dose limits correspond to the radiation protection standards set out in 10 CFR 20, as cross-referenced in 10 CFR 61.43.

3.1 Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005 (NDAA) Criterion

NDAA Section 3116(a) provides in pertinent part:

> *[T]he term "high-level radioactive waste" does not include radioactive waste resulting from the reprocessing of spent nuclear fuel that the Secretary of Energy..., in consultation with the Nuclear Regulatory Commission…, determines –*
>
> *(3) (A)(i) [will be disposed of] in compliance with the performance objectives set out in subpart C of part 61 of title 10, Code of Federal Regulations[.]*

3.2 10 CFR Part 61 Subpart C Performance Objectives

The 10 CFR 61, Subpart C, Sections 61.40 through 61.44 detail performance objectives the NRC established for land disposal of radioactive waste. These performance objectives address protection of the general population from radioactivity releases, individuals from inadvertent intrusion on the disposal site, protection of workers during disposal facility operations, and the stability of the disposal site after closure. The following subsections discuss the 10 CFR 61.40 through 61.44 compliance requirements.

3.2.1 10 CFR 61.40

The general requirement of 10 CFR 61.40 states:

> *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 through 61.44.*

The 10 CFR 61.40 general provision calls for "reasonable assurance" that exposures are within the limits of the subsequent performance objectives for 10 CFR 61.41 through 10 CFR 61.44 and are discussed below:

- The DOE will maintain an FTF Performance Assessment (PA) to demonstrate compliance with 10 CFR 61.41, *Protection of the General Population from Releases of Radioactivity,* and 10 CFR 61.42, *Protection of Individuals from Inadvertent Intrusion*. The FTF PA will demonstrate the annual dose to a member of the public is within dose limits established in 10 CFR 61.41, and dose to an inadvertent intruder is within dose limits established in 10 CFR 61.42. Compliance with these performance objectives is described in FTF-WDIP-005.
- The DOE will implement programs to ensure facility operations are in compliance with standards for radiation protection specified in 10 CFR 61.43, *Protection of Individuals During Operations*. Compliance with this performance objective is demonstrated in this section of the Draft FTF 3116 Basis Document.
- The DOE will demonstrate the FTF is sited, designed, used, operated, and closed to meet requirements of 10 CFR 61.44, *Stability of the Disposal Site After Closure*. Compliance with these performance objectives is described in FTF-WDIP-007.

3.2.2 10 CFR 61.43

Provisions in 10 CFR 61.43 states:

> *Operations at the land disposal facility must be conducted in compliance with the standards for radiation protection set out in part 20 of this chapter, 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.*

This requirement references 10 CFR 20, which contains radiological protection standards for workers and the public. The DOE requirements for occupational radiological protection are provided in 10 CFR 835 and those for radiological protection of the public and the environment are provided in DOE Order 5400.5 (DOE O 5400.5).

Consistent with NDAA Section 3116 (a), the cross-referenced "standards for radiation protection" in 10 CFR 20 that are considered in detail in this Draft FTF 3116 Basis Document are the dose limits for the public and the workers during disposal operations set forth in 10 CFR 20.1101(d), 10 CFR 20.1201(a)(1)(i), 10 CFR 20.1201(a)(1)(ii), 10 CFR 20.1201(a)(2)(i), 10 CFR 20.1201(a)(2)(ii), 10 CFR 20.1201(e), 10 CFR 20.1208(a), 10 CFR 20.1301(a)(1), 10 CFR 20.1301(a)(2), and 10 CFR 20.1301(b)[2]. [NDAA_3116] Consistent with NUREG-1854, the following sections discuss that these dose limits correspond to the dose limits in 10 CFR 835 and relevant DOE Orders which establish DOE regulatory and contractual requirements for DOE facilities and activities. The following subsections show the FTF closure meets these dose limits and that doses will be maintained as low as reasonably achievable (ALARA)[3].

3.2.2.1 Air Emissions Limit for Individual Member of the Public (10 CFR 20.1101(d))

The NRC regulation at 10 CFR 20.1101(d) provides in relevant part:

> *[A] constraint on air emissions of radioactive material to the environment, excluding Radon-222 and its daughters, shall be established … such that the individual member of the public likely to receive the highest dose will not be expected to receive a total effective dose equivalent in excess of 10 mrem(0.1 mSv), per year from these emissions.*

[2] The introductory "notwithstanding" phrase to Section 3116 makes it clear that the provisions of Section 3116 (a) are to apply in lieu of other laws that "define classes of radioactive waste". As is evident from the plain language of this introductory "notwithstanding" phrase, Section 3116 (a) pertains to classification and disposal, and radiation protection standards for disposal, of certain waste at certain DOE sites. Thus, the factors for consideration set forth in subsection (a) 1 through (3) of Section 3116 are those which pertain to classification and disposal of waste, and the radiation protection standards for disposal. The Joint Explanatory Statement of the Committee of Conference in Conference Report 108-767, accompanying H.R. 4200 (the NDAA), also confirms that 3116 (a) concerns classification, disposal, and radiation protection standards associated with disposal, and does not concern general environmental laws or laws regulating radioactive waste for purposes other than disposal. Moreover, in the plain language of Section 3116, Congress directed that the Secretary of Energy consult with the NRC but did not mandate that DOE obtain a license or any other authorization from NRC, and did not grant NRC any general regulatory, administrative, or enforcement authority for disposal of the DOE wastes covered by Section 3116. As such, the "standards for radiation protection" in 10 CFR Part 20 (as cross-referenced in the performance objective at 10 CFR 61.43), which are relevant in the context of Section 3116 of the NDAA, are the dose limits for radiation protection of the public and the workers during disposal operations, and not those which address general licensing, administrative, programmatic, or enforcement matters administered by NRC for NRC licensees. Accordingly, this Draft FTF 3116 Basis Document addresses in detail the radiation dose limits for the public and the workers during disposal operations that are contained in the provisions of 10 CFR Part 20 referenced above. Although 10 CFR 20.1206(e) contains limits for planned special exposures for adult workers, there will not be any such planned special exposures for closure operations at FTF. Therefore, this limit is not discussed further in this Draft 3116 Basis Document. Likewise, 10 CFR 20.1207 specifies occupational dose limits for minors. However, there will not be minors working at FTF who will receive an occupational dose. Therefore, this limit is not discussed further in this Draft 3116 Basis Document.

[3] In addition, 10 CFR Part 835, like Part 20 for NRC licensees, includes requirements that do not set dose limits, such as requirements for radiation protection programs, monitoring, entrance controls for radiation areas, posting, records, reporting, and training.

The DOE similarly limits effective dose equivalent from air emissions to the public at 10 millirem (mrem)/year (yr) in DOE O 5400.5. The DOE is also subject to and complies with the Environmental Protection Agency requirement in 40 CFR 61.92, which has the same limit[4]. The estimated dose per year from airborne emissions to the maximally exposed individual member of the public located at or beyond the Savannah River Site (SRS) boundary from all operations at SRS ranged from 0.04 mrem to 0.11 mrem from 1997 through 2008. [WSRC-TR-97-00322, WSRC-TR-98-00312, WSRC-TR-99-00299, WSRC-TR-2000-00328, WSRC-TR-2001-00474, WSRC-TR-2003-00026, WSRC-TR-2004-00015, WSRC-TR-2005-00005, WSRC-TR-2006-00007, WSRC-TR-2007-00008, WSRC-STI-2008-00057, SRNS-STI-2009-00190] These values (0.04 mrem to 0.11 mrem from 1997 to 2008) for the SRS operations, not only FTF closure operations, are well below the dose limit specified in 10 CFR 20.1101(d) of 10 mrem, 0.1 milliSievert (mSv)/yr.

3.2.2.2 Total Effective Dose Equivalent Limit for Adult Workers (10 CFR 20.1201(a)(1)(i))

The NRC regulation at 10 CFR 20.1201(a), concerning occupational dose limits for adults, provides in relevant part:

> *(a) [C]ontrol the occupational dose to individual adults, except for planned special exposures…to the following dose limits.*
>
> *(1) An annual limit, which is the more limiting of –*
>
> *(i) The total effective dose equivalent being equal to 5 rems (0.05 Sv).*

The DOE regulation in 10 CFR 835.202 (a)(1) has the same annual dose limit for the annual occupational dose to general employees[5]. For the occupational dose to adults during FTF closure, the total effective dose (TED) per year will be controlled using the ALARA principles, and will be below 5 rem as described in 5Q Manual, Chapter 2, *Radiological Standards*. Occupational doses to workers have been well below the annual limits specified in 10 CFR 20.1201(a)(1)(i) for all SRS work activities. Since 1995, the highest dose received by an SRS worker is 1,808 mrem/yr. [SRR-CWDA-2010-00025] The highest total dose received by an FTF worker from 1995 - 2009 was 545 mrem. [PIT-MISC-0062, SRR-CWDA-2010-00025] The TED to workers from FTF closure is expected to remain well below the DOE/NRC limit since the highest dose received by an FTF worker in 1997 was 215 mrem. Since Tank 17 and Tank 20 were operationally closed in 1997, this dose is of particular interest in addressing the dose potential for a worker during closure operations. Given that the entire FTF highest dose was 215 mrem in 1997, reasonable assurance is provided that doses received by a worker during closure activities will be below 5 rem. [PIT-MISC-0062, SRR-CWDA-2010-00025]

[4] 40 CFR 61.92 provides in relevant part as follows: Emissions of radionuclides to the ambient air from DOE facilities shall not exceed those amounts that would cause any member of the public to receive in any year an effective dose equivalent of 10 mrem/year.

[5] The DOE regulation requires that the occupational dose per year for general employees shall not exceed both a total effective dose of 5 rems which is the sum of the equivalent dose to the whole body for external exposures and the committed effective dose which includes the weighted internal exposures to any other organ or tissue other than the skin or the lens of the eye.

3.2.2.3 Any Individual Organ or Tissue Dose Limit for Adult Workers (10 CFR 20.1201(a)(1)(ii))

The NRC regulation at 10 CFR 20.1201(a), concerning occupational dose limits for adults, provides in relevant part:

> *(a) [C]ontrol the occupational dose to individual adults, except for planned special exposures…to the following dose limits.*
>
> *(1) An annual limit, which is the more limiting of –*
>
> *(ii) The sum of the deep-dose equivalent and the committed dose equivalent to any individual organ or tissue other than the lens of the eye being equal to 50 rems (0.5 Sv).*

The dose limit specified in 10 CFR 20.1201(a)(1)(ii) is similar[6] to the dose limit specified in 10 CFR 835.202 (a)(2). For the occupational dose to adults during FTF closure, the sum of the deep-dose equivalent and the committed dose equivalent to any individual organ or tissue other than the lens of the eye will be controlled to ALARA, below a maximum of 50 rem/yr. The SRS Standard Number 01064, *Radiological Design Requirements,* provides the design basis annual occupational exposure limits for any organ or tissue, other than the eye, cannot exceed 10 rem/yr, which is well below the NRC limit of 50 rem/yr. [5Q Manual, Chapter 2, WSRC-TM-95-1]

3.2.2.4 Annual Dose Limit to the Lens of the Eye for Adult Workers (10 CFR 20.1201(a)(2)(i))

The NRC regulation at 10 CFR 20.1201(a), concerning occupational dose limits for adults, provides in relevant part:

> *(a) [C]ontrol the occupational dose to individual adults, except for planned special exposures…to the following dose limits.*
>
> *(2) The annual limits to the lens of the eye, to the skin of the whole body, and to the skin of the extremities, which are:*
>
> *(i) A lens dose equivalent of 15 rems (0.15 Sv).*

The dose limit specified in 10 CFR 20.1201(a)(2)(i) is the same as that specified in the DOE regulation at 10 CFR 835.202 (a)(3). For the occupational dose to adults during FTF closure, the annual dose limit to the eye lens will be controlled using the ALARA principles, and will be below 15 rem/yr. The SRS Standard Number 01064 provides the design basis annual occupational exposure limits for the eye lens cannot exceed 3 rem/yr, which is well below the NRC limit of 15 rem/yr. [5Q Manual, Chapter 2, WSRC-TM-95-1]

[6] 10 CFR 835.202(a)(2) also excludes exposure to skin as well as exposure to the lens of the eye and the dose term is Committed Equivalent Dose.

3.2.2.5 Annual Dose Limit to the Skin of the Whole Body and to the Skin of the Extremities for Adult Workers (10 CFR 20.1201(a)(2)(ii))

The NRC regulation at 10 CFR 20.1201(a), concerning occupational dose limits for adults, provides in relevant part:

> *(a) [C]ontrol the occupational dose to individual adults, except for planned special exposures…to the following dose limits.*
>
> *(2) The annual limits to the lens of the eye, the skin of the whole body, or to the skin of the extremities, which are:*
>
> *(ii) A shallow-dose equivalent of 50 rem (0.5 Sv) to the skin of the whole body or to the skin of any extremity.*

This NRC dose limit specified in 10 CFR 20.1201(a)(2)(ii) is the same as the DOE dose limit specified at 10 CFR 835.202 (a)(4). For the occupational dose to adults during FTF closure, which involve limited hands-on activity, the annual dose limit to the skin of the whole body or to the skin of any extremity will be controlled using the ALARA principles, and will be below a shallow-dose equivalent of 50 rem/yr. [5Q Manual, Chapter 2]

3.2.2.6 Limit on Soluble Uranium Intake (10 CFR 20.1201(e))

The NRC regulation at 10 CFR 20.1201(e), concerning occupational dose limits for adults, provides in relevant part:

> *(e) In addition to the annual dose limits,…limit the soluble uranium intake by an individual to 10 milligrams in a week in consideration of chemical toxicity[.]*

In addition to the adult annual dose limits during FTF closure, the soluble uranium intake by an individual is controlled to less than 10 milligrams (mg) per week. The DOE Order 440.1A soluble uranium intake requirements are the more restrictive concentrations in the American Conference of Governmental Industrial Hygienists Threshold Limit Values (0.2 mg per cubic meter, same as noted in 10 CFR 20 Appendix B footnote 3) or the Occupational Safety and Health Administration (OSHA) Permissible Exposure Limit (PEL) (0.05 mg per cubic meter). The soluble uranium OSHA PEL limit, which equates to a soluble uranium intake of 2.4 mg per week, is the more restrictive of the two. The soluble uranium intake, if any, during FTF closure will be controlled to 2.4 mg per week, which is below the NRC limit in 10 CFR 20.1201(e). [4Q1.1, Procedure 101A]

3.2.2.7 Dose Equivalent to an Embryo/Fetus (10 CFR 20.1208(a))

The NRC regulation at 10 CFR 20.1208(a), concerning the dose equivalent to an embryo/fetus, provides in relevant part:

> *(a) [E]nsure that the dose equivalent to the embryo/fetus during the entire pregnancy, due to the occupational exposure of a declared pregnant woman, does not exceed 0.5 rem (5 mSv).*

The DOE regulation at 10 CFR 835.206 (a) has the same dose limit. For the embryo/fetus occupational dose during FTF closure, doses will be controlled so the dose equivalent to the embryo/fetus during the entire pregnancy for a declared pregnant worker will not exceed 0.5 rem. Furthermore, after pregnancy declaration, DOE provides a mutually agreeable

assignment option of work tasks, without loss of pay or promotional opportunity, such that further occupational radiation exposure during the remainder of the gestation period is unlikely. In addition, personnel dosimetry is provided and used to carefully track exposure as controlled by the 5Q Manual, Chapter 2.

3.2.2.8 Dose Limits for Individual Members of the Public (10 CFR 20.1301(a)(1))

The NRC regulation at 10 CFR 20.1301(a), concerning dose limits for individual members of the public, provides in relevant part:

(a) [C]onduct operations so that -

(1) The total effective dose equivalent to individual members of the public …does not exceed 0.1 rem (1 mSv) in a year, exclusive of the dose contributions from background radiation, from any medical administration the individual has received, from exposure to individuals administered radioactive material and released…, from voluntary participation in medical research programs, and from the …disposal of radioactive material into sanitary sewerage[.]

Provisions in DOE O 5400.5 (II.1.a) similarly limit public doses to less than 100 mrem/yr. However, the DOE application of the limit is more restrictive, in that it requires DOE to make a reasonable effort to ensure multiple sources (e.g., DOE sources and NRC regulated sources) do not combine to cause the limit to be exceeded. For individual members of the public during FTF closure, the TED limit to an individual member of the public will be controlled to less than 0.1 rem/yr. [5Q Manual, Chapter 2] The air pathway is the predominant pathway for doses to the public from SRS operations. The air pathway doses to members of the public have been, and are expected to continue to be, well below the 0.1 rem annual limit specified in 10 CFR 20.1301(a). [WSRC-TR-97-00322, WSRC-TR-98-00312, WSRC-TR-99-00299, WSRC-TR-2000-00328, WSRC-TR-2001-00474, WSRC-TR-2003-00026, WSRC-TR-2004-00015, WSRC-TR-2005-00005, WSRC-TR-2006-00007, WSRC-TR-2007-00008, WSRC-STI-2008-00057, SRNS-STI-2009-00190]

3.2.2.9 Dose Limits for Individual Members of the Public (10 CFR 20.1301(a)(2))

The NRC regulation at 10 CFR 20.1301(a), concerning dose limits for individual members of the public, provides in relevant part:

(a) [C]onduct operations so that –

(2) The dose in any unrestricted area from external sources, exclusive of the dose contributions from patients administered radioactive material and released …, does not exceed 0.002 rem (0.02 millisievert) in any one hour.

The DOE regulation at 10 CFR 835.602 establishes the expectation that TED in controlled areas will be less than 0.1 rem in a year. For individual members of the public during FTF closure, operations will be conducted such that the dose in any unrestricted area from external sources, exclusive of the dose contributions from patients administered radioactive material, will be less than 0.00005 rem per hour above background. The 5Q Manual, Chapter 2, also restricts the TED in controlled areas to less than 0.1 rem in a year. To ensure these dose limits are met, the following measures have been instituted within controlled areas. Per 10 CFR 835.603, radioactive materials areas have been established for radioactive

material accumulation possibly resulting in a radiation dose of 100 mrem in a year or greater. In addition, SRS has established Radiological Buffer Areas (RBAs) around posted radiological areas. Standard SRS practice is to assume a 2,000 hour per year continuous occupancy at the outer boundary of these areas; therefore, the dose rate at a RBA boundary is 0.00005 mrem/hour (hr) (100 mrem/2,000 hrs = 0.05 mrem/hr or 0.00005 rem/hr). Since the controlled area encompasses a RBA, it is ensured the dose in the controlled area (but outside of radioactive material areas and RBA) will be less than 0.1 rem in a year. [5Q Manual, Chapter 2] Therefore, SRS implementation of the provisions at 10 CFR 835.602 and 10 CFR 835.603 provide limit protective of the dose limit specified in 10 CFR 20.1301(a)(2). Training is required for individual members of the public for entry into controlled areas. In addition, to ensure no member of the public exceeds radiation exposure limits, use of dosimetry is required if a member of the public is expected to enter a controlled area and receive a dose that may exceed 0.05 rem/yr[7]. [5Q Manual, Chapter 5]

3.2.2.10 Dose Limits for Individual Members of the Public (10 CFR 20.1301(b))

The NRC regulation at 10 CFR 20.1301(b), concerning dose limits for individual members of the public, provides in relevant part:

> *(b) If … members of the public [are permitted] to have access to controlled areas, the limits for members of the public continue to apply to those individuals.*

The DOE regulation at 10 CFR 835.208 has the same dose limit. The TED limit to an individual member of the public granted access to controlled areas during FTF closure will be controlled to 0.1 rem/year. Furthermore, training is required for individual members of the public for entry into controlled areas. In addition, to ensure no member of the public exceeds radiation exposure limits, use of dosimetry is required if a member of the public is expected to enter a controlled area and receive a dose that may exceed 0.05 rem/year[8]. [5Q Manual, Chapter 5]

3.2.2.11 As Low As reasonably Achievable (ALARA) (10 CFR 20.1003)

The NRC regulation at 10 CFR 20.1003 defines ALARA in relevant part:

> *ALARA … means making every reasonable effort to maintain exposures to radiation as far below the dose limits … as is practical consistent with the purpose for which the … activity is undertaken…[.]*

The DOE has a similar requirement, and the DOE regulation at 10 CFR 835.2 defines ALARA as "… the approach to radiation protection to manage and control exposures (both individual and collective) to the work force and to the general public to as low as reasonable…". For radiological work activities during FTF closure, every reasonable effort will be made to maintain exposures to radiation as far below the dose limits as is practical consistent with the purpose for which the activity is undertaken. Furthermore, the DOE

[7] 10 CFR 20.1003 defines restricted areas as "an area, access to which is limited … for the purpose of protecting individuals against undue risks from exposure to radiation and radioactive materials". This is the same as the definition in 10 CFR 835.2 for a controlled area.

[8] 10 CFR 20.1301(d) allows licensees to request NRC authorization to allow an individual member of the public to operate up to an annual dose limit of 0.5 rem (5 mSv). 10 CFR 835 is more restrictive for the dose to an individual member of the public with a limit of 0.1 rem maximum annual dose as discussed in Subsection 3.2.2.8.

regulation at 10 CFR 835.101(c) requires the contents of each Radiation Protection Program (RPP) to include formal plans and measure for applying the ALARA process to occupational exposure as further discussed in Section 3.2.2.12.1 of this document.

3.2.2.12 Reasonable Assurance

Measures that provide reasonable assurance that FTF closure will comply with the applicable dose limits and with the ALARA provisions include the documented RPP, the Documented Safety Analysis (DSA), design, regulatory and contractual enforcement mechanisms, and access controls, training, and dosimetry. These measures are discussed in the following subsections.

3.2.2.12.1 SRS Radiation Protection Program

The DOE regulates occupational radiation exposure at its facilities through 10 CFR 835, which establishes exposure limits and other requirements to ensure DOE facilities are operated in a manner such that occupational exposure to workers is maintained within acceptable limits and as far below these limits as is reasonably achievable. The requirements in 10 CFR 835, if violated, provide a basis for the assessment of civil penalties under the Atomic Energy Act of 1954, Section 234A, as amended. [42 USC 2282a]

Pursuant to 10 CFR 835, activities at SRS, including FTF closure operations, must be conducted in compliance with the documented RPP for SRS as approved by DOE. The key RPP elements include monitoring of individuals and work areas, access control to areas containing radiation and radioactive materials, use of warning signs and labels, methods to control the spread of radioactive contamination, radiation safety training qualification, objectives for the design of facilities, criteria for radiation and radioactive material workplace levels, and continually updated records to document compliance with the provisions of 10 CFR 835. The RPP also includes formal plans and measures for applying the ALARA process.

The 10 CFR 835 requirements, as contained in the RPP, are incorporated in the Standards/Requirement Identification Document system (S/RIDs). The S/RID system links the requirements of 10 CFR 835 to the site-level and lower-level implementing policies and procedures that control radiological work activities conducted across the site. These procedures control the planning of radiological work, the use of radiation monitoring devices by employees, the bioassay program, the air monitoring program, the contamination control program, the ALARA program, the training of general employees, radiological workers, radiological control inspectors, and health physics professionals and technicians, and the other aspects of an occupational RPP as required by 10 CFR 835.

3.2.2.12.2 Documented Safety Analysis

The FTF operates under a DSA in accordance with 10 CFR Part 830. As the first step in the development of the DSA, a formal Hazard Analysis (HA) was performed to systematically present the results of potential process-related hazards, Natural Phenomena Hazards (NPHs), and external hazards that can affect the public, workers, and environment through the occurrence of single or multiple failures. [DOE-STD-3009-94] The HA was performed by subject matter experts including operations, engineering, industrial hygiene, radiological protection, environmental compliance, and maintenance professionals.

The HA consisted of three phases:

1. Hazard identification
2. Hazard classification
3. Hazard evaluation [DOE-STD-3009-94]

The hazard identification phase identifies possible radiological and chemical hazardous materials associated with normal and abnormal operations as well as potential energy sources to disperse hazardous materials into the environment.

The hazard classification phase evaluates for the maximum possible quantities of hazardous materials, which are then evaluated against DOE criterion to determine the overall hazard classification. [DOE-STD-1027-92]

The hazard evaluation phase identifies possible normal and abnormal operational events that could expose the public and workers to hazardous material and, therefore, are evaluated to establish the magnitude of the risk. Additionally, the consequence and frequency of each operational event must be qualitatively determined and risk level identified. The purpose of identifying the risk level is to determine which operational events pose risk (and thus require additional evaluation) and those events which present negligible risk to the public and workers. For the waste tanks and operational facilities with reduced curie inventories, a new mode of operation was designated.

Per the DSA, when waste tanks are classified as "removed from service," in addition to their limited total effective inhalation dose potential, administrative controls and engineering controls are implemented. Engineering controls include physical isolation of air, steam, and bearing water lines that go into the waste tanks and pressurized sources to mixer/pump columns. Cooling water supply and return to the waste tank also shall be physically isolated. Administrative controls prohibit transfers into and out of the waste tanks and limit the amount of liquid additions necessary to: flush equipment, maintain tank chemistry and ballast; prevent exposed solids from drying on the waste tank floor to the point of posing special airborne release concerns, and stabilizing residuals for closure (e.g., grouting). Administrative controls also include prohibiting waste tank mixing device operation, and placing transfer lines and their secondary containments that go into and out of the tank Out-of-Service.

The DSA identifies hazards in the HA that could impact the public, facility workers, and the environment during normal operations and accident conditions. The DSA also discusses summary descriptions of key SRS safety management programs.

In part, these administrative controls require: a facility manager be assigned who is accountable for safe operation and in command of activities necessary to maintain safe operation, personnel who carry out radiological controls functions have sufficient organizational freedom to ensure independence from operating pressure, personnel receive initial and continuing training including radiological control training, and an RPP shall be prepared consistent with 10 CFR 835. In addition, the design requirements implemented 10 CFR 835 and, in particular, implemented ALARA principles.

3.2.2.12.3 Radiological Design for Protection of Occupational Workers and the Public

The SRS radiological facilities and facility modifications are designed to meet the requirements of 10 CFR 835 Subpart K. The SRS Standard Number 01064 provides the requirements necessary to ensure compliance with 10 CFR 835. [WSRC-TM-95-1] The standard refers to 10 CFR 835, DOE Orders, DOE Standards, DOE handbooks, national consensus standards, SRS manuals, SRS engineering standards, SRS engineering guides, and site operating experience in order to meet the 10 CFR 835 specific requirements and additional requirements to ensure the design provides for protection of the worker and the environment.

The standard covers the full spectrum of radiological design requirements and not just radiation exposure limits. The following are the specific areas addressed in the standard: radiation exposure limits; facility and equipment layout; area radiation levels; radiation shielding; internal radiation exposure; radiological monitoring; confinement; and ventilation. [WSRC-TM-95-1]

The facility design also incorporates radiation zoning criteria to ensure exposure limits are met by providing adequate radiation shielding. Areas in which non-radiological workers are present are assumed to have continuous occupancy (2,000 hours per year) and are designed to a dose rate less than 0.05 mrem per hour to ensure the annual dose is less than 100 mrem. [WSRC-TM-95-1] Other zoning criteria are established to ensure radiological worker doses are ALARA and less than 1,000 mrem/yr to meet the 10 CFR 835.1002 design requirements.

The design is also required to provide necessary radiological monitoring or sampling for airborne and surface contamination to ensure the engineered controls are performing their function and, in the event of a failure or upset condition, workers are warned and exposures avoided. [WSRC-TM-95-1]

Radiological protection personnel ensure applicable requirements of the standard are addressed and presented in design summary documentation. The incorporation of radiological design criteria in the engineering standard ensures the requirements of 10 CFR 835 are met and the design provides for the radiological safety of the workers and environment. [WSRC-TM-95-1]

3.2.2.12.4 Regulatory and Contractual Enforcement

Any violation of the 10 CFR 835 requirements is subject to civil penalties pursuant to the Atomic Energy Act of 1954, Section 234A, as amended, 42 USC 2011 et seq., as implemented by DOE regulations in 10 CFR Part 820. In addition, the requirements in 10 CFR 835 and all applicable DOE Orders are incorporated into all contracts with DOE contractors. The DOE enforces these contractual requirements through contract enforcement measures, including the reduction of contract fees. [48 CFR 970]

3.2.2.12.5 Access Controls, Training, Dosimetry and Monitoring

Training or an escort is required for individual members of the public for entry into controlled areas. In addition, use of dosimetry is required if a member of the public is expected to enter a controlled area and exceed 0.05 rem/year to ensure no member of the public exceeds radiation exposure limits. [5Q Manual, Chapter 5, 5Q Manual, Chapter 6]

In addition, worker radiation exposure monitoring is performed for all workers expected to receive 100 mrem/yr from internal and external sources of radiation to provide assurance no worker exceeds radiation exposure limits and all radiation dose are maintained as far below the limits as is reasonably achievable. [5Q Manual, Chapter 5]

3.2.2.12.6 Occupational Radiation Exposure History for Savannah River Site

The effectiveness of the RPPs, including the effectiveness of oversight programs to ensure they are implemented properly is demonstrated by the occupational radiation exposure results. The highest annual dose received by an SRS worker from 1995-2009 was 1,808 mrem TED and the highest total dose received by an FTF worker from 1995 – 2009 was 545 mrem compared to the DOE Administrative Control Limit of 2,000 mrem/yr and the 10 CFR 835 limit of 5,000 mrem/yr. [PIT-MISC-0062, SRR-CWDA-2010-00025]

In addition, for all work activities, the average TED exposure for workers receiving a TED dose at SRS has been 134 mrem/yr over the last five years, 2004-2008. [10-ORAU-0098]

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