DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Washington, DC 20004-2901

April 27, 2018

The Honorable James Richard Perry
Secretary of Energy
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585-1000

Dear Secretary Perry:

On February 15, 2018, Under Secretary for Science, the Honorable Paul M. Dabbar provided written comments (see enclosure) on a draft recommendation transmitted by the Defense Nuclear Facilities Safety Board regarding atmospheric dispersion modeling at the Savannah River Site. On April 4, 2018, the Board decided not to make a final recommendation to you on this matter. We have also enclosed the Board's proposed final recommendation as amended, the notational votes, and vote comments for your information.

Yours truly,

Bruce Hamilton
Acting Chairman

Enclosures

c: The Honorable Paul M. Dabbar
The Honorable Lisa E. Gordon-Hagerty
The Honorable Anne M. White
Mr. Joe Olencz

Under Secretary for Science
Washington, DC 20585

February 15, 2018

The Honorable Bruce Hamilton
Vice Chairman
Defense Nuclear Facilities Safety Board
625 Indiana Avenue NW, Suite 700
Washington,DC 20004

Dear Vice Chairman Hamilton:

Thank you for the opportunity to review the Defense Nuclear Facilities Safety Board (Board) Draft Recommendation 2017-1, *Atmospheric Dispersion Modeling at the Savannah River Site.* The Department of Energy (DOE) believes that the actions that it has already undertaken and the plans for reviewing and updating the remaining safety bases address the concerns in your draft recommendation and obviate the need for additional actions in response to a recommendation.

In May 2011, the Department issued Safety Bulletin Number 2011-02, *Accident Analysis Parameter Update,* which provided updated guidance for dispersion modeling and stated that DOE sites should consider actions recommended in this Safety Bulletin as constituting "new requirements" for which the Potential Inadequacy in the Safety Analysis process, including associated compensatory measures, does not apply. Shortly thereafter, Savannah River Site (SRS) contractors identified concerns with the way SRS used meteorological data as input into MELCOR Accident Consequence Code Systems (MACCS2) but determined that resolving these errors constituted a change in safe harbor methodology, again not invoking the need for compensatory measures.

Contractor review of the K-Area Complex (KAC) Documented Safety Analyses (DSA) has identified existing conservatisms that essentially offset projected dispersion analysis result increases. To further reduce risk, DOE has revised the KAC Authorization Agreement prohibiting the use of the californium shuffler and refilling the digital radiography unit with mineral oil. DOE Savannah River Operations Office and contractor review of the Defense Waste Processing Facility (DWPF) and Concentration, Storage, and Transfer Facilities (CSTF) DSAs anticipate limited physical changes will be required and there is no expectation that the resulting postulated mitigated offsite consequences for the CSTF or the DWPF will be greater than 25 rem. The enclosure provides additional information.

With respect to the Tritium Facilities, as the draft recommendation correctly points out, the public dose consequences from the postulated design basis accidents for these facilities are not expected to exceed evaluation guidelines for the maximally exposed offsite individual even with the revised dispersion model.

With regard to our collocated workers, the current Tritium Facilities safety analysis identifies appropriate safety significant controls. The draft recommendation would not drive the need for any additional actions on the part of the National Nuclear Security Administration (NNSA).

Since NNSA maintains the Tritium Facilities DSA and Technical Safety Requirements to ensure protection of DOE's workers, there is no need for additional actions in response to the draft recommendation. In addition, in light of the limitations on the Board's authority under its enabling statute at 42 U.S. Code (U.S.C.) § 2286a, *Mission and Functions of Board*, to make recommendations "necessary to ensure adequate protection of *public* health and safety" [emphasis added], all references to these facilities should be removed from the draft recommendation.

We appreciate the Board's perspectives and look forward to continued positive interactions with you and your staff. If you have any questions, please contact Mr. Jack Craig, Manager of the Savannah River Operations Office, at (803) 952-7243, or Ms. Nicole Nelson-Jean, Manager of the Savannah River Field Office, at (803) 208-3689.

Sincerely,

Paul M. Dabbar

Enclosure

Enclosure – Comments on Draft Board Rec 2017-1
Atmospheric Dispersion Modeling at the Savannah River Site

General Comments

The changes in Deposition Velocity (DV) did not warrant interim compensatory measures. HSS Safety Bulletin 2011-02, *Accident Analysis Parameter Update* provided the Department of Energy (DOE) the update in guidance for the default DV parameter. The safety bulletin stated upgrading site consequence calculations for existing facilities to reflect use of a more conservative DV should be treated as a new requirement versus a potential inadequacy in the safety analysis to be processed in accordance with DOE G 424.1-1B, *Implementation Guide for Use in Addressing Unreviewed Safety Question Requirements*.

Briefings provided to Board members and staff in November 2016 and October 2017 described impacts from implementing the new dispersion coefficients into the Defense Waste Processing Facility (DWPF) and Concentration, Storage, and Transfer Facilities (CSTF) Documented Safety Analyses (DSA). One impact discussed in these briefings would be the need to reassess the overall conservatisms in some of the Design Basis Accidents (DBA) to compensate for the increase in airborne dispersion coefficients, and another impact would be to credit existing safety class controls for additional events or elevate other existing controls. Limited physical changes are expected. The resulting postulated mitigated offsite consequences for the CSTF or the DWPF are not expected to exceed 25 rem.

At the K-Area Complex, increased impacts from the new dispersion model were more than offset by actions that reduce postulated radiological doses. The DSA update that incorporates the new dispersion modeling reduces the postulated post-seismic event fire dose from 13.6 rem to about 12 rem. In addition, on January 9, 2018, the Savannah River Site (SRS) issued a revision to the K-Area Complex Authorization Agreement which prohibits the use of the californium shuffler and refilling the digital radiography unit with mineral oil. Savannah River Nuclear Solutions issued Revision 13 of the K-Area Complex DSA to DOE for review at the end of January 2018. Revision 13 updates the facility safety analysis to include the atmospheric modeling changes. Further, facility schedules expeditiously implement the new DSA revision.

Specific Comments

1. The Draft Recommendation is not consistent with the latest approved DWPF DSA. The currently approved DWPF DSA shows a postulated worst case mitigated offsite consequence of < 5 rem. This is a result of feed restrictions specifically required in the DSA. If re-assessment of the overall conservatisms, as discussed above, was not performed, the postulated worst case mitigated offsite consequence would be < 15 rem versus the 27-rem noted in Table RA-2 of the Draft Recommendation.

2. The Draft Recommendation refers to site Procedure E7, Procedure 2.25, dated November 2012, whereas the latest revision of the procedure (Rev. 22) is dated June 2016. The Draft Recommendation states the site procedure defines challenging the DOE evaluation guideline when an unmitigated offsite consequence is in the 5 - 25 rem Total Effective Dose (TED) Equivalent range. Site Procedure E7/2.25, Revision 22, section 5.8.3.B, states, "Consequences of 5 rem TED up to less than 25 rem TED are evaluated on a case by case basis to determine the need for Safety Class (SC) controls. The rationale for classifying a Structure, Systems and Components (SSC) as SC in this range (or not classifying the SSC as SC) must be justified." The current effective SRS site procedure does not define "challenging the DOE evaluation guideline" as an offsite consequence of 5 - 25 rem.

Enclosure 2

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Washington, DC 20004-2901

The Honorable James Richard Perry
Secretary of Energy
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585-1000

Dear Secretary Perry:

On March XX, 2018, the Defense Nuclear Facilities Safety Board (Board), in accordance with 42 U.S.C. § 2286d(a)(1), approved Recommendation 2018-1, *Atmospheric Dispersion Modeling at the Savannah River Site*, which is enclosed for your consideration. Recommendation 2018-1 identifies the need to address deficiencies in the safety bases for facilities at the Savannah River Site related to the atmospheric dispersion modeling methodology and implement safety measures as needed to provide adequate protection of the public (including collocated workers), and workers with responsibilities for ensuring adequate protection of the public.

After you have received this Recommendation, and as required by 42 U.S.C. § 2286d(b), the Board will promptly make the Recommendation and any related Secretarial correspondence available to the public. The Board believes that this Recommendation contains no information that is classified or otherwise restricted. To the extent that this Recommendation does not include information restricted by DOE under the Atomic Energy Act of 1954, as amended, please arrange to have it and any related Secretarial correspondence placed promptly on file in your regional public reading rooms. The Board will also publish this Recommendation in the Federal Register.

The Board will evaluate DOE's response to this Recommendation in accordance with the Board's Policy Statement 1, *Criteria for Judging the Adequacy of DOE Responses and Implementation Plans for Board Recommendations*.

Sincerely,

Bruce Hamilton
Acting Chairman

Enclosure

c: Mr. Mark Do

RECOMMENDATION 2018-1 TO THE SECRETARY OF ENERGY
Pursuant to 42 U.S.C. § 2286a(b)(5)
Atomic Energy Act of 1954, as Amended

Dated: March XX, 2018

The Department of Energy (DOE) should address identified deficiencies in atmospheric dispersion models used in the safety analyses for defense nuclear facilities at the Savannah River Site (SRS) in a timely manner and implement appropriate compensatory measures in the interim to ensure adequate protection of the public (including collocated workers), and workers with responsibilities for ensuring adequate protection of the public. The anticipated corrections to the atmospheric dispersion models will increase the calculated offsite and/or onsite dose consequences from postulated accidents, and could drive the need for additional safety controls or upgrades to existing controls. While DOE has updated several SRS safety bases to include the corrected models, several facilities require updated atmospheric dispersion modeling, including the K-Area Complex (KAC), the Tritium Facilities, and the SRS liquid waste facilities.

Background. In May 2011, DOE's Office of Health, Safety, and Security issued Safety Bulletin 2011-02 [1], which noted the default dry deposition velocity that DOE recommended for complex-wide use in the *Methods for Estimation of Leakages and Consequences of Releases Accident Consequences Code System Version 2* (MACCS-2) dispersion modeling software was non-conservative. In an August 19, 2011, letter to the National Nuclear Security Administration (NNSA), the Board identified an additional concern with the use of non-conservative dispersion coefficients in MACCS-2 at SRS tritium facilities [2]. At this time, Savannah River Nuclear Solutions, LLC (SRNS) and Savannah River Remediation, LLC (SRR) also discovered errors in the way SRS used meteorological data as input into MACCS-2.

As a result of these findings, in January 2014, DOE's Savannah River Operations Office (DOE-SR) and NNSA's Savannah River Field Office (SRFO) accepted SRNS's implementation plan [3] that provided a strategy for revising the atmospheric dispersion analyses at SRNS-run facilities. SRNS has since revised several safety bases for SRS defense nuclear facilities consistent with this plan. In December 2014, SRR approved a safety basis strategy outlining the potential impacts from the revised dispersion analyses at SRS liquid waste facilities and a preliminary schedule for updating the applicable safety bases with the revised analyses and new and upgraded controls by 2017 [4]. SRR submitted a revised strategy to DOE-SR in July 2017, noting that it would update the safety bases during fiscal years 2018–2020 [5].

Dispersion Modeling at KAC. During a November 2016 review, members of the Board's staff found that in SRNS's 2016 submittal of revision 11 of the KAC documented safety analysis (DSA), and in DOE-SR's approval, neither SRNS nor DOE-SR had addressed the impact of planned corrections to K-Area atmospheric dispersion models [6]. Using SRNS's preliminary estimate that offsite dose consequences could increase by a factor of 2.6 specifically for K-Area, the corrections could lead to mitigated dose consequences exceeding DOE's evaluation guideline specified in DOE Standard 3009-94, CN3, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses*, for the identification of safety class structures, systems, and components in DSAs [7].

The October 2013 SRNS plan for updating SRNS-managed safety bases with the corrected atmospheric dispersion models prioritized the safety basis upgrades as low, moderate, or high, based on the potential impacts of the dispersion modeling changes on the calculated dose consequences and control sets. The plan targeted revision 12 of the KAC DSA for incorporating the changes. It assigned the revision a moderate priority based on SRNS's expectation that the mitigated offsite dose consequences would remain below 5 rem total effective dose equivalent (TEDE) and the KAC control set would not be impacted. At the time, the KAC DSA reported a mitigated offsite dose consequence of 0.028 rem TEDE for the bounding accidents (full-facility wildland fire and a post-seismic fire).

In April 2016, SRNS submitted revision 11 of the KAC DSA to DOE-SR for review and approval. In the revision, the mitigated offsite dose consequences increased for several postulated accidents, moving into the 5–25 rem TEDE range where SRS procedures indicate the rationale for classifying or not classifying a Structure, Systems, and Components as Safety Class must be justified [8]. The accidents with the highest mitigated dose consequences to the public are a fire in the K-Area interim surveillance (KIS) vault (13.5 rem TEDE), a fire in the shuffler room that propagates to the assembly area (9.54 rem TEDE), and a post-seismic fire (13.6 rem TEDE). In evaluating the adequacy of the controls for these accidents, neither SRNS nor DOE-SR considered the impacts of the pending atmospheric dispersion modeling changes. When accounting for the changes, the mitigated consequences for KIS vault fire scenario and the post-seismic fire scenario will likely exceed DOE's evaluation guideline. The KAC DSA identifies safety significant controls to protect the collocated worker for those accident scenarios. Some of the safety significant controls, such as the fire suppression systems in the KIS vault and shuffler room, cannot be credited as safety class for protection of the public without evaluation and modification.

In June 2016, SRNS deferred the dispersion modeling corrections to revision 13 of the KAC DSA, which it plans to implement in September 2018. During a November 2016 review by members of the Board's staff, DOE-SR personnel indicated they would look for opportunities ahead of revision 13 to reduce the potential accident consequences, such as removing equipment with significant quantities of flammable and combustible materials and imposing additional inventory restrictions on radiological materials.

In a March 16, 2017, letter [9], DOE-SR directed SRNS to: (1) drain the mineral oil from the digital radiography unit in the KIS vault by July 31, 2017, and (2) revise the plan to measure special nuclear material with the shuffler by September 30, 2017, so that the shuffler, or at least the polyethylene from the shuffler, can be removed from K-Area. On March 27, 2017, DOE-SR informed members of the Board's staff that the next DSA revision would use a lower lung absorption rate for americium-241 materials that meet certain criteria, which would reduce the calculated dose consequences for accident scenarios involving those materials [10].

In January 2018, DOE-SR reviewed and approved a KAC Authorization Agreement that specified the KIS Vault digital radiography unit is removed from service and that refilling the unit with mineral oil is not allowed [11]. It also specified that the californium shuffler is removed from service and not allowed to be returned to service.

Conclusion. Given the pending increase in the predicted dose consequences accompanying planned corrections to atmospheric dispersion models, the current safety controls at several SRS defense nuclear facilities may not be adequate to protect the public (including collocated workers), and workers with responsibilities for ensuring adequate protection of the public.

DOE should expeditiously evaluate the current control strategy and, as needed, implement compensatory measures at facilities that have yet to update their safety basis to incorporate the atmospheric dispersion modeling changes. The Board acknowledges that DOE took actions to reduce the hazards at K-Area.

The Board understands that DOE is in the process of updating the Tritium Facilities DSA to incorporate the corrected atmospheric dispersion models. The Board also acknowledges that DOE's review of the proposed updates to the Tritium Facility safety basis documents notes that there are multiple events that are credible and result in high dose consequences to the collocated worker. DOE has requested that SRNS develop a strategy to reduce these consequences.

Recommendations. To address the deficiencies summarized above, the Board recommends that DOE take the following actions:

For the K-Area Complex, the Concentration, Storage, and Transfer Facilities, the Tritium Facilities, and the Defense Waste Processing Facility at SRS:

1. Given the potential impact of the atmospheric dispersion modeling changes, re-evaluate and document the effectiveness of the credited engineered and administrative safety controls to protect the public (including collocated workers), and workers with responsibilities for ensuring adequate protection of the public. Where necessary, implement interim compensatory measures as formal controls.

2. Update the revised safety basis documents to reflect the atmospheric dispersion modeling changes.

3. Implement the updated safety basis documents (including appropriate safety control strategies) to ensure adequate protection of the public (including collocated workers), and workers with responsibilities for ensuring adequate protection of the public.

Risk Assessment for Recommendation 2018-1

This risk assessment was conducted to support Recommendation 2018-1, *Atmospheric Dispersion Modeling at the Savannah River Site*, in accordance with the Defense Nuclear Facilities Safety Board's (Board) enabling statute and Policy Statement 5, *Policy Statement on Assessing Risk* [12]. The recommendation addresses deficiencies in the safety bases at the Savannah River Site (SRS) defense nuclear facilities that have not addressed required changes to the atmospheric dispersion modeling methodology. Because the review by members of the Board staff leading to the creation of this recommendation focused on the K-Area Complex (KAC), the risk assessment similarly focuses on the KAC.

The Board's assessment of risk uses information and calculations from Savannah River Nuclear Solutions, LLC (SRNS) documents that were approved by the Department of Energy (DOE). "Risk" is defined here as involving both the probability that an event will occur and the consequences of that event. The current KAC documented safety analysis (DSA) contains three design basis accidents that have mitigated dose consequences to the maximally exposed offsite individual (MOI) above 5 rem total effective dose equivalent (TEDE): a fire in the K Area interim surveillance (KIS) vault, a fire in the shuffler room that propagates to the assembly area, and a post-seismic fire [6]. SRNS's implementation plan for the atmospheric dispersion modeling corrections estimates that the dose consequence for the KAC will increase by up to a factor of 2.6 [3]. Using this factor, the KIS vault fire scenario and the post-seismic fire scenario are predicted to exceed DOE's evaluation guideline of 25 rem TEDE specified in DOE Standard 3009-94, CN3 [7]. From revision 11 of the KAC DSA, these three events are described as having a mitigated frequency of "Unlikely" (10^{-2}/yr – 10^{-4}/yr). The frequency and consequences for the three design basis accidents of concern are summarized in Table RA-1.

Table RA-1. Summary of K-Area Complex Design Basis Accidents of Concern.

Design Basis Accident	Mitigated Consequences to the MOI (rem TEDE)		Mitigated Frequency
	DSA, Revision 11	With 2.6 Factor	
Fire Inside the KIS Vault	13.5	35.1	10^{-2}/yr – 10^{-4}/yr
Shuffler Fire that Propagates into the Assembly Area	9.54	24.8	10^{-2}/yr – 10^{-4}/yr
Post-Seismic Fire	13.6	35.4	10^{-2}/yr – 10^{-4}/yr

The KAC DSA identifies several safety significant controls to protect the collocated worker for these accidents. The KIS vault fire suppression, detection, and alarm system is credited to meet performance category 2 requirements and automatically actuates via a single smoke detector. The KIS vault structure, fire dampers, and fire door provide a closed environment for the gaseous fire suppression agent to extinguish the fire, prevent release outside

of the KIS vault, and provide a three-hour fire barrier. The shuffler room has an automatic wet pipe fire suppression system that is designed and installed to meet performance category 2 criteria. In addition, the design of the californium shuffler instrument is credited to reduce the likelihood of a shuffler fire. DOE-SR and SRNS personnel communicated that they cannot credit these controls as safety class for protection of the public without evaluation and modification (e.g., for compliance with single failure criteria).

Based on this risk assessment, the Board concludes that credible events existed at the KAC with consequences that could exceed DOE's guideline for the health and safety of the public. DOE has taken actions to reduce the hazards at K-Area. However, DOE has not assessed the need for compensatory measures to protect the public at several other SRS defense nuclear facilities that have not yet updated their safety bases to reflect the atmospheric dispersion modeling corrections.

The estimated public dose consequence increase factor from the new atmospheric dispersion methodology is 2.9 for the Concentration, Storage, and Transfer Facilities [5]. Table RA-2 summarizes the design basis accidents at SRS defense nuclear facilities with mitigated consequences to the MOI expected to exceed the evaluation guideline with the revised dispersion models [13].

Table RA-2. Summary of Design Basis Accidents Expected to Exceed the Evaluation Guideline with Revised Dispersion Models.[1]

Accident	Mitigated Consequences to the MOI with Revised Dispersion Models (rem TED)
K-Area Complex	
Fire Inside the KIS Vault	35.1
Post-Seismic Fire	35.4
Concentration, Storage, and Transfer Facilities[2]	
Transfer Line and Transfer Line Jacket/Encasement Explosions	28
Seismic Event	>25

Additionally, the collocated worker doses at the Tritium Facilities were high (greater than 100 rem TED) before the new atmospheric dispersion model methodology was approved. When accounting for the new methodology, the collocated worker dose consequence is estimated to increase further. SRNS Implementation Plan reports that the public dose consequences from design basis accidents at the SRS Tritium Facilities are expected to be a factor of 3.45 higher, but the consequences are not expected to exceed the evaluation guideline for the MOI even with the revised dispersion models [3]. However, if the workers are impacted by the accident and unable

[1] SRR's Safety Basis Strategy issued in July 2017 listed dose consequences from a previous Defense Waste Processing Facility DSA. SRR made changes to their waste acceptance criteria specific administrative control—specifically a more restrictive inhalation dose potential criterion—that decreased the calculated dose consequences to below the evaluation guideline.

[2] These values come from the Liquid Waste Operations Safety Basis Strategy [5].

to perform actions necessary to ensure adequate protection of the public, the risk to the public could increase with potential consequences beyond evaluation guidelines.

Table RA-3 below provides the unmitigated and mitigated dose consequences as well as the credited controls identified in the current safety basis for selected accidents with high unmitigated dose consequences. It shows the dose consequences for the public, co-located worker (CW), and facility worker (FW) as listed in the current approved and implemented Tritium Facility safety analysis report (SAR) [14]. There are currently no safety class controls for these accidents, only safety significant (SS) controls. Although Administrative Programs are not functionally classified, they are denoted as SS according to the classification of the function they perform. "Prev" denotes that the accident is prevented. Table RA-4 shows the consequence evaluation levels for hazard receptors, as described in the SAR, where "C" represents the given dose consequence. It also provides definitions for the high (H), moderate (M), and low (L) qualitative dose consequences.

Table RA-3. Dose Consequences for Selected Accidents with High Unmitigated Dose Consequences in Current Tritium Facility SAR.

	Unmitigated Consequences				**Mitigated Consequences**		
Accident	**Public**	**CW**	**FW**	**Credited Control Set (All SS)**	**Public**	**CW**	**FW**
Explosion in process due to oxygen introduction from process connections that extend outside of secondary confinement (Room 29) results in release of tritium. (Location 233-H)	6.8 rem	H (3,200 rem) [15]	H	Explosion Prevention Program, Emergency Preparedness Program, Radiological Protection Program, Tritium Air Monitors, Worker Training	6.8 rem	M	M
Explosion in the process from introduction of hydrogen isotopes results in the release of radioactive material (Location 233-H)	6.8 rem	H (3,200 rem) [15]	H	Explosion Prevention Program, Emergency Preparedness Program, Radiological Protection Program, Tritium	6.8 rem	M	M

				Air Monitors, Worker Training			
Vehicle falls through roof results in release of tritium with or without fire (building is underground) (Location 233-H)	Not in SAR (4.7 rem) [16],[17]	H (2,300 rem) [16],[17]	H	Traffic Control Program, Emergency Preparedness Program, Worker Training	Not in SAR	Prev	Prev
Crane impact results in a release of tritium with or without a fire (Location - 233-H)	Not in SAR (4.7 rem) [16],[17]	H (2,300 rem) [16],[17]	H	Critical Lift Program, Emergency Preparedness Program, Worker Training	Not in SAR	Prev	Prev
Crane impact results in release of tritium with or without a fire (Location – 234-H)	Not in SAR (2.8 rem) [16],[17]	H (1,400 rem) [16],[17]	H	Critical Lift Program, Emergency Preparedness Program, Worker Training	Not in SAR	Prev	Prev
Fire during transport of container(s) within unmonitored area results in release of tritium	Not in SAR (1.2 rem) [17]	H (620 rem) [17]	H	Emergency Preparedness Program, Worker Training	Not in SAR	M	M
Aircraft crash causes a release of tritium with or without a fire	12 rem	H (6,200 rem) [16],[17]	H	Emergency Preparedness Program, Worker Training	12 rem	M	M
Seismic event involving all Tritium Facilities causes fire that results in release of tritium	12 rem	H (6,200 rem) [18]	H	Emergency Preparedness Program	12 rem	M	M

Table RA-4. Radiological Consequence Evaluation Levels for Hazard Receptors.

Receptor	High (H)	Moderate (M)	Low (L)	Negligible (N)
Public	C ≥ 25.0 rem	5.0 ≤ C < 25.0 rem	0.5 ≤ C < 5.0 rem	< Low
Co-located Worker (CW)	C ≥ 100 rem or high consequence injury due to radiological release or exposure	25 ≤ C < 100 rem or moderate consequence radiological related injury	5.0 ≤ C < 25 rem or low consequence radiological related injury	< Low
Facility Worker (FW)	C ≥ 100 rem or radiological material quantity exceeds HC-3 threshold or high consequence injury due to radiological release or exposure	25 ≤ C < 100 rem or moderate consequence radiological related injury	5.0 ≤ C < 25 rem or low consequence radiological related injury	< Low

Cited References

[1] Department of Energy, Office of Health, Safety, and Security, Safety Bulletin No. 2011-02, *Accident Analysis Parameter Update,* May 2011.

[2] P.S. Winokur, *Review of Safety Basis, Tritium Facilities, Savannah River Site,* Board letter with enclosure, August 19, 2011.

[3] Savannah River Nuclear Solutions, LLC, *Dispersion Modeling Project Implementation,* S-ESR-G-00033, Rev. 0, October 2013.

[4] C.D. Cope, *Safety Basis Strategy Updated Total Effective Dose Factors,* U-SBS-G-00002, Rev. 0, December 2014.

[5] C.D. Cope, *Safety Basis Strategy Updated Total Effective Dose Factors,* U-SBS-G-00002, Rev. 1, July 2017.

[6] Savannah River Nuclear Solutions, LLC, *K-Area Complex Documented Safety Analysis,* WSRC-SA-2002-00005, Rev. 11, April 2016.

[7] Department of Energy, *Preparation Guide for US Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses,* DOE-STD-3009-94, CN3, March 2006.

[8] Manual E7, *Conduct of Engineering and Technical Support Procedure Manual,* Procedure 2.25 "Functional Classification," June 2016.

[9] A.S. Morton, *Additional Activities for K-Area,* DOE letter, March 16, 2017.

[10] Savannah River Nuclear Solutions, LLC, *Thermally-induced Complete Oxidation of Plutonium Resulting in Lung Absorption Type S,* S-ESR-G-00045, Rev. 1, March 21, 2017.

[11] Department of Energy Savannah River Operations Office, *Authorization Agreement for the K Area Complex,* N-AA-K-00001, Rev. 18, January 2018.

[12] Defense Nuclear Facilities Safety Board, *Policy Statement on Assessing Risk,* PS-5, August 2013.

[13] Savannah River Nuclear Solutions, LLC, *Unit Total Effective Dose Factors for Onsite and Offsite Receptors at SRS,* S-CLC-G-00372, Rev. 2, September 2014.

[14] *Tritium Facilities Safety Analysis Report,* WSRC-SA-1-2-VOL-1, Rev. 23, Savannah River Site, Aiken, SC, May 2017.

[15] Campbell, T.C., *Tritium Facilities Explosion Accident Analysis,* S-CLC-H-01137, Rev. 0, Washington Savannah River Company, Savannah River Site, Aiken, SC, February 2008.

[16] Lee, H.F., Allison, D.K., *Tritium Facilities Loss of Confinement Accident Analysis,* S-CLC-H-01127, Rev. 0, Washington Savannah River Company, Savannah River Site, Aiken, SC, February 2008.

[17] Raley, E.A., *Tritium Facilities Fire Accident Analysis*, S-CLC-H-01131, Rev. 0, Washington Savannah River Company, Savannah River Site, Aiken, SC, February 2008.

[18] Raley, E.A., *Tritium Facilities Natural Phenomena Hazard Plus Fire Accident Analysis*, S-CLC-H-01139, Rev. 0, Washington Savannah River Company, Savannah River Site, Aiken, SC, February 2008.

AFFIRMATION OF BOARD VOTING RECORD

SUBJECT: Atmospheric Dispersion Modeling at the Savannah River Site

Doc Control#2018-200-010

The Board, with Board Member(s) Jessie H. Roberson, Daniel J. Santos *approving,* Board Member(s) Bruce Hamilton, Joyce L. Connery *disapproving,* Board Member(s) none *abstaining,* and Board Member(s) none *not participating,* has voted to disapprove the above document on April 4, 2018.

The votes were recorded as:

	APRVD	DISAPRVD	ABSTAIN	NOT PARTICIPATING*	COMMENT	DATE
Bruce Hamilton	☐	☒	☐	☐	☒	04/02/18
Jessie H. Roberson	☒	☐	☐	☐	☒	04/04/18
Daniel J. Santos	☒	☐	☐	☐	☐	04/04/18
Joyce L. Connery	☐	☒	☐	☐	☒	04/04/18

*Reason for Not Participating:

This Record contains a summary of voting on this matter together with the individual vote sheets, views and comments of the Board Members.

Executive Secretary to the Board

Attachments:
1. Voting Summary
2. Board Member Vote Sheets

cc: Board Members
OGC
OGM Records Officer
OTD

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

NOTATIONAL VOTE RESPONSE SHEET

FROM: **Bruce Hamilton**

SUBJECT: **Atmospheric Dispersion Modeling at the Savannah River Site**

Doc Control#2018-200-010

Approved___ **Disapproved__X__** **Abstain____**

Recusal – Not Participating_____

COMMENTS: **Below__X__** **Attached____** **None____**

The Recommendation finds that identified deficiencies in atmospheric dispersion models used in the safety analysis at Savannah River Site use non-conservative dispersion coefficients which, when corrected, may result in accident consequence exposures above DOE's evaluation guidelines. The Recommendation estimates that these deficiencies at the K-Area Complex may increase maximally exposed off-site individual exposure to as much as ~35 rem TEDE with a frequency of between 10^{-2} per year to 10^{-4} per year. Similarly, estimates are ~28 rem TEDE for the Concentration, Storage, and Transfer Facilities, while the Tritium Facility would remain below the evaluation guideline.

There is no question that the non-conservative dispersion coefficients have created low estimates of accident consequences, and those estimates, when corrected, may slightly exceed DOE's evaluation guidelines in several cases. That said, DOE has identified existing conservatisms that essentially offset projected dispersion analysis increases. DOE has also revised the KAC Authorization Agreement by prohibiting the use of the californium shuffler and the refilling of the digital radiography unit with mineral oil.

Given that, it is a stretch to conclude that the public health and safety is not adequately protected. The maximum TEDE estimates are not a clear risk to the public health, and are even less so when considered in the context of only 1 chance in 100 per year to 1 chance in 10,000 per year. While DOE evaluation guidelines may be being marginally exceeded, those evaluation guidelines are themselves conservative. Making the changes proposed in this Recommendation would increase safety margin, but even without them, the adequate protection of the public health and safety (always a subjective evaluation) is still preserved.

I therefore disapprove.

Bruce Hamilton

Bruce Hamilton

2 APRIL 2018

Date

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

NOTATIONAL VOTE RESPONSE SHEET

FROM: **Jessie H. Roberson**

SUBJECT: **Atmospheric Dispersion Modeling at the Savannah River Site**

Doc Control#2018-200-010

Approved__X___ **Disapproved___** **Abstain___**

Recusal – Not Participating_____

COMMENTS: **Below__X__ Attached___** **None___**

Almost one year ago the Board undertook actions to evaluate the efficacy of the currently approved safety analyses being relied on to ensure adequate protection of the public and workers in light of the newly developed atmospheric dispersion models at the Savannah River Site. The Board has monitored for more than five years the initiative at Savannah River to update the atmospheric dispersion models utilized in the safety analysis for defense nuclear facilities. The Board was very complimentary of the sites technical approach and the pace demonstrated to develop the updated models. During this period the Board held a Hearing including this topic, the full Board traveled to the site to be brief on this topic, site personnel have briefed the Board at its HQs in WDC on status, individual Board Members have visited the site to ascertain status and the Board's staff has reviewed progress in addressing this new information at the various defense nuclear facilities.

Incorporating this new information in the approved safety basis, confirming the effectiveness of safety controls, or identifying additional safety controls, has lagged at some significant defense nuclear facilities. This Recommendation is very straightforward: incorporate safety basis changes, analyze the hazards, and validate that adequate safety controls are in place to ensure adequate protection of the public and workers. I have included citations from 10CFR Part 830 for reference.

Appendix A to Subpart B of Part 830—General Statement of Safety Basis Policy

A. Introduction

This appendix describes DOE's expectations for the safety basis requirements of 10 CFR Part 830, acceptable methods for implementing these requirements, and criteria DOE will use to evaluate compliance with these requirements. This Appendix does not create any new requirements and should be used consistently with DOE Policy 450.2A, "Identifying, Implementing and Complying with Environment, Safety and Health Requirements" (May 15, 1996).

B. Purpose

1. The safety basis requirements of Part 830 require the contractor responsible for a DOE nuclear facility to analyze the facility, the work to be performed, and the associated hazards and to identify the conditions, safe boundaries, and hazard controls necessary to protect workers, the public and the environment from adverse consequences. These analyses and hazard controls constitute the safety basis upon which the contractor and DOE rely to conclude that the facility can be operated safely. Performing work consistent with the safety basis provides reasonable assurance of adequate protection of workers, the public, and the environment.

2. The safety basis requirements are intended to further the objective of making safety an integral part of how work is performed throughout the DOE complex. Developing a thorough understanding of a nuclear facility, the work to be performed, the associated hazards and the needed hazard controls is essential to integrating safety into management and work at all levels. Performing work in accordance with the safety basis for a nuclear facility is the realization of that objective.

§830.202 Safety basis.

(a) The contractor responsible for a hazard category 1, 2, or 3 DOE nuclear facility must establish and maintain the safety basis for the facility.

(b) In establishing the safety basis for a hazard category 1, 2, or 3 DOE nuclear facility, the contractor responsible for the facility must:

(1) Define the scope of the work to be performed;

(2) Identify and analyze the hazards associated with the work;

(3) Categorize the facility consistent with DOE-STD-1027-92 ("Hazard Categorization and Accident Analysis Techniques for compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports," Change Notice 1, September 1997);

(4) Prepare a documented safety analysis for the facility; and (5) Establish the hazard controls upon which the contractor will rely to ensure adequate protection of workers, the public, and the environment.

(c) In maintaining the safety basis for a hazard category 1, 2, or 3 DOE nuclear facility, the contractor responsible for the facility must:

(1) Update the safety basis to keep it current and to reflect changes in the facility, the work and the hazards as they are analyzed in the documented safety analysis;

(2) Annually submit to DOE either the updated documented safety analysis for approval or a letter stating that there have been no changes in the documented safety analysis since the prior submission; and

(3) Incorporate in the safety basis any changes, conditions, or hazard controls directed by DOE.

Jessie H. Roberson

April 4, 2018

Date

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

NOTATIONAL VOTE RESPONSE SHEET

FROM: **Daniel J. Santos**

SUBJECT: **Atmospheric Dispersion Modeling at the Savannah River Site**

Doc Control#2018-200-010

Approved X **Disapproved**____ **Abstain**___

Recusal – Not Participating_____

COMMENTS: **Below**___ **Attached**____ **None** X

Daniel J. Santos

4/4/18

Date

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

NOTATIONAL VOTE RESPONSE SHEET

FROM: Joyce L. Connery

SUBJECT: Atmospheric Dispersion Modeling at the Savannah River Site

Doc Control#2018-200-010

Approved____ **Disapproved** ✓ **Abstain**____

Recusal – Not Participating_____

COMMENTS: **Below** ✓ **Attached**____ **None**____

I believe that the amendment process created a document far from its original purpose and the Recommendation now contains information that is unsubstantiated and, as written, will not lead to an optimal safety outcome.

Joyce L. Connery

Joyce L. Connery

April 4, 2018

Date