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January 6, 2012

The Honorable Peter S. Winokur
Chairman
Defense Nuclear Facilities Safety Board
625 Indiana Avenue, NW, Suite 700
Washington, DC 20004-2901

Dear Mr. Chairman:

The purpose of this letter is to transmit the Department of Energy's (DOE) report on improvement areas for DOE Standard 3009, *Preparation Guide for US. Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses*.

This report was developed per Milestone 6.1.1 of the Department's Implementation Plan (IP) for Defense Nuclear Facilities Safety Board Recommendation 2010-1, *Safety Analysis Requirements for Defining Adequate Protection for the Public and the Workers*, as well as updating the target dates for revision of DOE Standard 3009 and for other deliverables which are dependent upon the revision of DOE Standard 3009 in the IP. These scheduled adjustments were needed to implement the identified improvements.

We also acknowledge the helpful input from members of your staff in our efforts to develop this report and look forward to continued coordination with them as we move forward with revising DOE Standard 3009 and executing the Department's Implementation Plan. Please contact Jim O'Brien, the responsible manager, at (301) 903-1408, if you have any questions.

Sincerely,

A handwritten signature in black ink, appearing to read "Dae-Y. Chung".

Dae-Y. Chung
Principal Deputy Chief for Nuclear Safety and
Technical Matters
Office of Health, Safety and Security

Enclosure



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***Evaluation of Improvement Areas
For the Department of Energy (DOE)
Safety Analysis Development Standard (DOE-STD-3009)***

**Defense Nuclear Facilities Safety Board Recommendation 2010-1
Milestone 6.1.1 Report**



**Office of Nuclear Safety
Office of Health, Safety and Security
U.S. Department of Energy**

December 2011

1.0 INTRODUCTION

As part of the Implementation Plan (IP) for Defense Nuclear Facilities Safety Board (DNFSB) Recommendation 2010-1, *Safety Analysis Requirements for Defining Adequate Protection for the Public and the Workers*, the Department of Energy (DOE) committed (in Milestone 6.1.1) to:

As part of this effort, the current draft revision to DOE Standard 3009 will be evaluated in areas of hazard assessments, accident analysis, and hazard control identification to identify where further improvements are warranted to ensure consistent and predictable implementation of these processes (including use of appropriate input parameters and analysis methods). As part of this evaluation, a determination will be made of whether any identified improvements should be made in the current draft revision to DOE Standard 3009, a Code guidance document, or a future revision to DOE Standard 3009 (or a new DOE Standard). This determination will be based on the best fit for the new criteria or guidance and the time needed to develop the new criteria or guidance relative to the priority for completing current improvements to DOE Standard 3009.

This report discusses the process for and results of the evaluation of the draft revision to DOE Standard (STD) 3009, *Preparation Guide for U.S Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses*. It includes a description of additional areas of improvements to safety analysis preparation standards or guidance documents and plans for implementing them.

2.0 PROCESS

The following process was being utilized in this evaluation:

Scoping: The Office of Nuclear Safety, within the Office of Health, Safety and Security (HSS), led a discussion with DOE contractors and Program and Field Office subject matter experts on documented safety analysis (DSA) preparation and review to scope out potential areas for improving the conduct of Documented Safety Analyses (DSA) based upon their experience. The focus was on improving the consistent and appropriate conduct of hazard analysis, accident analysis, and hazard control identification and classification.

Draft Report: Based upon the outcome of the scoping discussion, the Office of Nuclear Safety developed a draft report on:

- Improvements that have been made in the current revision of DOE STD 3009.
- Additional improvements that should be made in the revision of DOE STD 3009.
- Improvements that should be made outside of DOE STD 3009 and options for these improvements.

This report was based upon further analysis of potential areas for improvement identified during the scoping analysis and review of the draft DOE standard revision and other DOE DSA development supporting documents (such as DOE STD 5506, *Preparation of Safety Basis Documents for Transuranic (TRU) Waste Facilities*, and the draft Accident Analysis Handbook) and Nuclear Regulatory Commission (NRC) safety analysis documents (such as 10 Code of Federal Regulation (CFR) Part 70, *Domestic Licensing of Special Nuclear Material*, and NUREG/CR 6410, *Nuclear Fuel Facility Accident Analysis Handbook*).

Review of Draft Report: The draft report was reviewed during the Safety Analysis Workshop conducted the week of October 25, 2011, and refinements were made. In parallel, the draft report was shared with the DNFSB.

Development of Final Report: A final report was developed reflecting feedback from the DNFSB. This report was issued in December 2011 and will be used to guide completion of DOE STD 3009 and development of an accident analysis handbook.

Participants in the process for developing this report are listed in Appendix A.

3.0 RESULTS

As a result of this effort, the Office of Nuclear Safety (in conjunction with the Program and Field Office members participating in the revision of DOE STD 3009) will pursue making the improvements to the current draft revision to DOE STD 3009 described in Section 3.2 below. The intent of these changes is to put into effect a more efficient and appropriate method for developing DSAs that will ensure protection of the public, the workers, and the environment. This will be done by providing more detailed criteria that will limit some engineering judgment (that exists in the current DOE STD 3009) while allowing, where appropriate, additional analysis to ensure that unnecessary and costly controls are not being imposed on DOE nuclear facilities.

In addition, the Office of Nuclear Safety will establish a team to pursue the development of an accident analysis handbook that will provide additional detail (and examples) supporting hazard and accident analysis as described in Section 3.3.

3.1. Improvements made in current draft Revision to DOE STD 3009

Many important improvements to clarify and improve the criteria and guidance used development of DSAs have been addressed in the current revision to DOE STD 3009. Appendix B identifies where these improvements have been made. However, these improvements were not specifically focused on addressing DNFSB Recommendation 2010-1, and significant work remains to fully address them and to get the revised standard ready for RevCom (including coordination with the DNFSB as the revision is developed).

One important goal of these improvements was to ensure that the criteria in DOE STD 3009 is clearly articulated via sentences which include “shall” statements, so that when the standard is

invoked by 10 CFR 830, *Nuclear Safety Management*, it will be clear that these criteria are required to be implemented.

3.2 Areas for Further Improvements in DOE STD 3009

Hazard Analysis:

- Provide more detailed guidance on screening of standard industrial hazards.
- Further clarify the use of risk binning to support hazard and accident analysis.
- Improve criteria and guidance for analysis of chemical hazards including criteria for when the chemicals may be screened out.
- Provide guidance for analyzing asphyxiation hazards expanding upon that provided in DOE STD 1189, *Integrating Safety into the Design Process*.
- Clarify conditions under which in facility self protective actions (such as a worker evacuating from a scene of a fire) can be utilized as a basis for not further evaluating hazards to that same worker that may result from the fire.

Accident Analysis:

- Better define acceptable technical approach for identifying the Damage Ratio(s) to be utilized in unmitigated and mitigated Accident Analysis (Consider guidance in DOE STD 5506).
- Better define the process for arriving at acceptable Leak Path Factors to be utilized in mitigated Accident Analysis.
- Better define/describe expectations for performing reasonably conservative analysis including:
 - Values to be used estimating the material at risk; and
 - Use of bounding values for Airborne Release Fraction and Respirable Fraction from DOE-HDBK-3010-97, *Airborne Release Fractions/Rates and Respirable Fractions for Nonreactor Nuclear Facilities*.
- Better define use of Initial Conditions (e.g., material contained in casks, bunkers, storage vaults, multiple cans, etc.) in unmitigated and mitigated accident analysis.
- Clarify expectations for performance of dose calculations (consistent to the DOE adopted portion of NRC Regulatory Guide 1.145, *Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants*), including default

parameters for deposition velocity and surface roughness and expectations for addressing plume meander, wake effects, and performance of centerline calculations

- Provide expectations on analytical tools utilized in DSA preparation and verification and validation of the tools.

Hazard Control Identification:

- Clarify the criteria and process for establishing the control set needed for accident risk reduction (e.g., that a control set is adequate and complete).
 - Improve guidance on application of the hierarchy of controls;
 - Include guidance on when emergency evacuation cannot be solely relied on for protection of workers; and
 - Include guidance on situations for when sole reliance on safety management programs is not appropriate.
- Establish a definition of (and expectations for documentation of controls) “equipment important to safety” to support evaluation of this control set as part of implementation of the Unreviewed Safety Questions process.

One important part of this effort will be to ensure that the critical criteria for developing a DSA in DOE STD 3009 is clearly articulated via sentences which include “shall” statements, so that when the standard is invoked by 10 CFR 830 it will be clear that these criteria are required to be implemented.

3.3 Potential Areas to Further Enhance DSA Preparation Guidance (Outside of DOE STD 3009)

Besides the areas in DOE STD 3009, the Office of Nuclear Safety will establish a team to pursue the development of other tools to support further improvements in DSA preparation, such as:

- Updating, refining, and issuing as a DOE Handbook parts of the draft hazard and accident analysis handbook that was developed by Energy Facility Contractors Group. This refinement should include specific examples of acceptable hazard analysis and accident analysis for more common hazards and types of operations at DOE facilities. It should also provide detailed guidance on performing appropriate dispersion analysis and use of dispersion analysis codes.
- Developing detailed guidance for performing chemical hazard analysis that can be utilized at DOE nuclear facilities as well as non-nuclear facilities. This may involve an update to DOE Handbook 1100-2004, *Chemical Process Hazards Analysis*, and potentially development of examples such as was provided in DOE/EH-0340, *Example Process Hazard Analysis of a Department of Energy Water Chlorination Process*.

- Performing a technical study on the feasibility and appropriateness of identifying safety margin as part of the development of DSAs.
- Evaluating developing a model DSA for a hypothetical facility that includes the attributes (hazards and processes) typical of many of DOE higher hazard nuclear facilities that can be utilized for training purposes.

4.0 SUMMARY

The current draft revision to DOE STD 3009 was evaluated in areas of hazard assessments, accident analysis, and hazard control identification to identify where further improvements are warranted to ensure consistent and predictable implementation of these processes.

As a result of this evaluation, several important areas for improvement were identified to address DNFSB Recommendation 2010-1 as described in Section 3.2. Additional areas in need of criteria or requirements will be identified during the course of STD-3009 revision process to improve the consistency and clarity of requirements for providing adequate protection of the workers, the public, and the environment. While the requirements will be identified in the near term in the draft revision to DOE STD 3009, others areas in need of improvement will be considered to be longer term and more appropriately provided in a DOE handbook or other technical documents

The Office of Nuclear Safety will work with DOE Program and Field Offices and safety analysis subject matter experts in making these improvements.

5.0 SCHEDULE

5.1 Standard 3009 into RevCom Target Date (Milestone 6.1.2)

In its IP for DNFSB Recommendation 2010-1, DOE established target dates for completion of actions that were predicated on having DOE STD 3009 into RevCom by November 30, 2011 (which is identified as Milestone 6.1.2 in the IP). In order to allow for the effective development of new criteria associated with additional area topics identified in Section 3.2 of this report, it will take additional time to complete this task. Based on this need and the need to allow for effective pre-RevCom reviews of the new criteria by Program Offices and the DNFSB, the target date for Milestone 6.1.2 is now May 1, 2012. Given that most of the Milestone dates in the Recommendation 2010-1 IP are based upon the date that DOE STD 3009 is put into RevCom, most of the target dates have been changed as shown in Table 1 below.

5.2 Development of Accident Analysis Handbook

The Office of Nuclear Safety will establish a team to pursue the development of an accident analysis handbook that will provide additional detail (and examples) supporting hazard and accident analysis as described in Section 3.3 of this report.

The target date for initiation of this effort is January 2012. This effort will include the following steps (and associated target dates):

1. Establishment of subject matter experts working group (January)
2. Meeting of working group to scope out effort and assign tasks (February)
3. Draft handbook developed (September 2012)
4. Draft handbook into RevCom (January 2013)
5. Handbook issued May 2013

Throughout the effort, DOE will keep DNFSB informed on status and provide early drafts to ensure good communication and support effective development.

Table 1 – Summary of Products/Deliverables

No.	Milestones/Commitment	Product/Deliverable	Anticipated Delivery Date
6.1.1	Evaluation of improvements to DOE Standard 3009	<u>Product</u> – Report on Improvements	December 31, 2011
6.1.2	Update DOE Standard 3009	<u>Product</u> – Draft Standard into RevCom <u>Deliverable</u> – Final Standard Issued	May 1, 2012 September 1, 2012
6.1.3	Update DOE Standard 1120, DOE Standard 3011, and DOE Standard 1189	<u>Product</u> – Draft Standard into RevCom <u>Deliverable</u> – Final Standard Issued	February 1, 2013 July 1, 2013
6.2.1	Review of DSAs for Facilities with Mitigated Doses Above the Evaluation Guideline	<u>Deliverable</u> – Report on evaluation of DSAs	See ¹
6.3.1	Update DOE Standard 1104	<u>Product</u> – Draft Standard into RevCom <u>Deliverable</u> – Final Standard Issued	June 1, 2012 October 1, 2012
6.4.1	Update Independent Oversight Protocols	<u>Product</u> – Draft Protocol <u>Deliverable</u> – Final Protocol	November 1, 2012 January 1, 2013

¹ By next DSA update following issuance of DOE STDs 3009 and 1104, but no later than June 2014

No.	Milestones/Commitment	Product/Deliverable	Anticipated Delivery Date
6.5.1	Analysis of Regulatory Options	<u>Product</u> – Technical Paper on Regulatory Options <u>Deliverable</u> – Decision on Regulatory Options	May 1, 2012 July 1, 2012
6.5.2	Update of 10 CFR 830	<u>Product</u> – 10 CFR 830 Revision into FR <u>Deliverable</u> – 10 CFR 830 Revision Issued	June 1, 2013 December 1, 2013
6.5.3	DOE Directive requirement to invoke Standard 1104	<u>Product</u> – Draft DOE Directive requirement development <u>Deliverable</u> – DOE Directive requirement issuance	December 1, 2012 March 1, 2013

Appendix A
Participants in the Scoping and Review of DNFSB Milestone 6.1 Report

Scoping

The subject matter experts consulted as part of the scoping were:

James Goss, DOE, Y-12
James O'Neil, DOE, Los Alamos National Laboratory
James Wicks, Office of River Protection
Brad Evans, Pacific Northwest National Laboratory
Jeff Woody, Link Technologies
John Schwenker, Savannah River Site
Louis Restrepo, Omicron
Greg Jones, Office of River Protection
Kevin O'Kula, Washington Safety Management Solutions
David Pinkston, Lawrence Livermore National Laboratory
Andrew Vincent, Savannah River Site
Robert Vrooman, NNSA
Richard Englehart, HSS Consultant
Chris Everett, HSS Consultant

Also participating in the scoping effort were:

Jim O'Brien, Office of Nuclear Safety, HSS
Mark Blackburn, Office of Nuclear Safety Basis and Facility Design, HSS
Sam Rosenbloom, Office of Nuclear Safety Basis and Facility Design, HSS
Amanda Anderson, DOE Office of Departmental Representative to the DNFSB
John Vorderbrueggen, DOE Office of Departmental Representative to the DNFSB

Review of Draft Document

The Office of Nuclear Safety briefed DOE and contractor safety analysis experts at the October 2011 Energy Federal Contractors Owners Group Safety Analysis Working Group Workshop on the draft Milestone 6.1 report. Members involved were:

Tom Forker, Los Alamos Site Office
Alan Ramble, DOE-Richland
Phillip Montgomery, Babcock & Wilcox, Y-12
Keith Voss, Sandia National Laboratories
Stephen Coffin, Sandia National Laboratories
Mukesh Gupta, URS Corporation
Brad Evans, Pacific Northwest National Laboratory
David Pinkston, Lawrence Livermore National Laboratory

Mike Grigsey, Hanford
Bob Nelson, EM-21
Jim O'Neil, Los Alamos Site Office
Denise Olguin, NA-30
Richard Englehart, HSS Consultant
Andrew Vincent, Savannah River Site
Terry Ortner, Savannah River Nuclear Solutions, LLC
Chuck Voloness, NNSA/Savannah River Site Office
Bob Lowrie, URS Corporation
Rob Mckeehan, Oak Ridge National Laboratory
Craig Kullberg, Los Alamos Site Office
Mark Mitchell, Lawrence Livermore National Laboratory
Bruce Wilson, Y-12
Jeff Woody, Link Technologies

Feedback from the workshop and a subsequent telecon with DOE contractors and Program and Field Office personnel supported finalizing this report.

Appendix B
Improvement Made in Current (October 2011)
Draft Revision of DOE STD 3009

As part of the development of the current revision of DOE STD 3009, DOE formed six working groups of subject matter experts to scope out and perform the revisions to improve the efficiency and effectiveness of development of DSAs. The following describes the efforts of three of the Working Groups, which assignments related to hazard analysis, accident analysis, and hazard control identification:

Group 1: Hazard Assessment Process and Worker Safety Controls, and Defense in Depth

Writing Group Lead: David Pinkston
Writing Group Members: John Schwenker, Jeff Woody, Grant Ryan, Jim Wicks

Areas evaluated:

- Define threshold for what is considered to be standard industrial hazard (chemicals).
- Define low, moderate, and high hazard (consistent with 1189).
- Clarify guidance on the requirements and expectations related to unmitigated analysis of both facility and collocated workers.
- Clarify guidance on how the hazard analysis (HA) risk binning is to be performed and used.
- Modify/clarify guidance for identifying when a Safety Significant (SS) hazard control is needed in facility worker safety, collocated worker safety, and defense in depth (DID).
- Clarify whether 3009 does or does not establish controls below the level of SS (e.g., is the intent of 3009 to establish a DID or important to safety category and are these controls to be specifically identified in DSA and if so what does this mean regarding performance criteria/Quality Assurance).
- Clarify how criteria for multiple layers of protection is to be applied and what is a layer of control (with respect to worker safety).

Group 2: Accident Analysis and Public Safety Controls

Writing Group Lead: Louis Restrepo
Writing Group Members: Mukesh Gupta, Kamiar Jamali, Jim Hutton, Jose Munoz,
Mark Blackburn

Areas evaluated:

- Provide guidance on how credit can be taken for preventors (as part of DID and when mitigators cannot reduce consequences below the evaluation guideline (EG)).
- Clarify what is meant by *the EG*.
- Clarify process for evaluating the adequacy of hazard controls (i.e., must hazard controls mitigate below EG?).

- Clarify how criteria for multiple layers of protection is to be applied and what is a layer of control (with respect to public safety).
- Evaluate whether any clarification of guidance and criteria for design basis accidents is needed.

Group 3: Criticality Controls

Writing Group Lead: Larry Berg

Writing Group Members: Louis Restrepo, David Erickson, Kevin Carroll, Brenda Hawks

Areas evaluated:

- Address inclusion of criticality safety evaluation information in the HA.
- Address identification of safety significant and other hazard controls.
- Address which controls should be included in TSR.