

March 30, 2015

To: J. N. McKamy, Manager, US DOE Nuclear Criticality Safety Program (NCSP)

From: Fitz Trumble, Chair, US DOE NCSP Criticality Safety Support Group (CSSG)



**Subject: CSSG Tasking 2015-04 Response**

In Tasking 2015-04 the CSSG was requested to provide input and comments to a provided draft of a Handbook (Section 2.3.b) for DOE-STD-1020-2012 that discusses Section 2.3.7 of the Standard.

The CSSG Task 2015-04 Team Members were:

- Kevin Kimball (Team Leader)
- Dave Hayes
- Dave Heinrichs
- NNSA Charles Keilers, NA-511
- NNSA CSCT member, Jerry Hicks

The attached response contains a revised Handbook Section (2.3.b) for DOE-STD-1020-2012. This revised section was reviewed by the entire CSSG and all comments were addressed and incorporated into the final version prepared in the tasking response.

Cc: CSSG Members

G. O. Udentia

M. Dunn

A. N. Ellis

L. Scott

C. Keilers, NA-511

J. Hicks, NNSA CSCT

Attachment: Response to CSSG Tasking 2015-04

## **Response to CSSG Tasking 2015-04**

### ***DOE –STD-1020 Nexus to Criticality Safety***

March 30, 2015

#### **Executive Summary**

In Tasking 2015-04 (Attachment 1) the CSSG was directed to develop a subteam to assist in ensuring that the DOE-STD-1020 Handbook, currently in preparation, appropriately incorporates criticality safety during facility design, in concert with other safety disciplines during NPH events. Special emphasis has been placed on ensuring that the intent of DOE-STD-3007-2007 in regards to the ANSI/ANS 8.1 process analysis requirement is maintained and is consistent with the guidance provided. The team also considered the CSSG response to Tasking 2014-05 and feels this guidance for 2015-04 and that from 2014-05 are consistent. This tasking response has been reviewed by the entire CSSG, comments incorporated and thus represents a consensus opinion of that body.

#### **CSSG Subteam**

The CSSG Task 2015-04 Team Members were:

- Kevin Kimball (Team Leader)
- Dave Hayes
- Dave Heinrichs
- NNSA Charles Keilers, NA-511
- NNSA CSCT member, Jerry Hicks

#### **Revised Handbook Section**

Revised Section 2.3.b for the draft NPH Handbook that complements STD 1020-2012 [initial wording taken from DRAFT Handbook 1020 Rev.1, dated 2/10/15 as noted in the 2015-04 tasking]

Section 2.3.7 of the Standard provides special NPH design categorization methods and criteria from the standpoint of criticality prevention. SSCs, whose NPH-initiated failure alone does not lead directly to a criticality accident, can be assigned NDCs based on the dose consequences calculated per DOE-STD-1020-2012 (Section 2.2.2.1) using the criteria in DOE-STD-1189-2008 Appendix A. The following guidance applies:

- One of the major purposes of Section 2.3.7 is to put an upper limit on what needs to be addressed in the design, and effectively put an upper limit on the magnitude of natural phenomena that are considered for design of SSCs relied upon for criticality safety purposes.
- For SSCs relied on for criticality safety, the design basis NPH events are established in the same way that they are for all other radiological hazards, based on consequences alone, using the DOE-STD-1189 Table A-1. This would generally limit the design basis event to an NDC level of NDC-1 or NDC-2. In addition to the NDC, an associated limit state is established based on what is needed to perform

the safety function. Qualitative engineering judgment is sufficient to evaluate those process conditions initiated by a credible NPH event, in accord with the ANSI/ANS-8.1 process analysis requirement

- There is an exception to the general rule of treating SSCs relied upon for criticality safety like those relied on for other radiological hazards. The exception should be a very rare circumstance that should be avoided when designing facilities. The exception is stated in two different ways in Sect. 2.3.7, first in terms of contingencies and second in terms of SSC failures. The intent is that if there is an SSC relied upon for criticality safety and the NPH initiated failure of that SSC alone will, based on sound engineering judgment, directly and clearly lead to a criticality event, then that SSC will be designed to NDC-3. (Note that this would require DOE approval in accordance with DOE Order 420.1C, Chapter III.)
- The words "... alone can lead directly lead to ..." in DOE-STD-1020-2012 are intended to limit the analysis to the failure of the SSC alone, not considering the failure in conjunction with other SSC failures that may or may not also happen in the NPH event. If the failure of a SSC would inevitably lead to the failure of a second SSC, those two failures would be considered a single failure (e.g., if a glovebox has an internal sprinkler system and the glovebox is demonstrated or presumed to fail, then the sprinkler system would also be presumed to fail). This does not apply to a system interaction evaluation, where a SSC that is not in the direct load path supporting another SSC, could fail and damage the second SSC. When a second failure is conditional (i.e., may or may not happen given the first failure), that would not be considered part of a single failure that "alone will directly lead to a criticality event" (e.g., a failure of a glovebox without an internal sprinkler system does not result in the presumption that an external, independent sprinkler system also fails and moderates the contents of the glovebox).
- The intent of the exception is to provide added rigor to guard against a rare and unusual vulnerability that cannot be designed out of the system. In evaluating an NPH event, it can be difficult to determine true causality when determining failure sequences, and when determining which failures will occur. It is often a matter of engineering judgment to determine whether one or more SSCs should be considered as failing unconditionally, given the first failure. In all cases dealing with design basis NPH initiators, qualitative engineering judgment, amenable to peer review, is sufficient to fulfill the ANSI/ANS-8.1 process analysis requirement. In such circumstances, the project team should consider the advice of criticality safety and structural experts, when determining which sequences of failures are conditional and which are unconditional.

**CSSG TASKING 2015-04**  
Date Issued: February 13, 2015

**Task Title:** *DOE-STD-1020 Nexus to Criticality Safety*

**Task Statement:**

A handbook for DOE-STD-1020 is currently in preparation, which may lead to revision of the standard. Section 2.3.7 of the standard is discussed in the draft handbook and has been problematic for some sites. The CSSG will assist in ensuring that Section 2.3.b of the Handbook (attached), that discusses Section 2.3.7 of the STD, appropriately incorporates criticality safety during facility design, in concert with other safety disciplines during NPH events.

The CSSG is tasked with providing input/comments to a provided draft of Handbook Section 2.3.b to ensure it includes appropriate/applicable criticality safety related requirements/guidance utilizing a graded approach. Special emphasis should be placed on ensuring that the expectations for performing detailed Criticality Safety Evaluations (performed according to DOE-STD-3007-2007) meeting the ANSI/ANS-8.1 process analysis requirement is consistent with that used in the initial triage of SSC's utilizing guidance from the NNSA Central Technical Authority (i.e. incorporation of written, qualitative, peer reviewable, engineering judgment).

The team is encouraged to pay particular attention to the possibility of unintended consequences of potentially missapplied terms across disciplines involved with the nexus of NCS and NPH in the safety basis realm and from unintended consequences of placing requirements on SSC's in the name of NCS that add no safety benefit from a NCS perspective. The team should also consider the CSSG response documented in Tasking 2014-05 regarding NPH (a seismic event) and evacuation.

**Resources:**

CSSG Task 2015-04 Team Members:

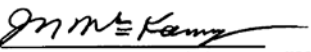
- Kevin Kimball (Team Leader)
- Dave Hayes
- Dave Heinrichs
  
- NNSA Charles Keilers, NA-511
- NNSA CSCT member, Jerry Hicks

Contractor CSSG members of the team will use their FY15 NCSP CSSG support funding as appropriate; DOE CSSG members of the team will utilize support from their site offices. It is up to the team members to utilize other expertise, or include other interested parties, as can be made available to support the tasking, without incurring additional CSSG expenses. No travel is anticipated to be necessary to support this tasking.

**Task Deliverables:**

1. CSSG Subgroup to hold task 'kickoff' telecom by February 18, 2015.
2. CSSG Subgroup to provide draft guidance/interpretation to full CSSG for review:  
March 3, 2015
3. Full CSSG to provide review comments to Task Team Leader: March 9, 2015
4. CSSG Subgroup to provide finalized guidance/interpretation to NCSP Manager:  
March 13, 2015

**Task Completion Date:** March 20, 2015

Signed:   
Jerry N. McKamy, Manager US DOE NCSP  
Office of the Chief of Defense Nuclear Safety, NA-511