

November 18, 2014

To: J. N. McKamy Manager, US DOE NCSP  
From: Fitz Trumble, Chair, US DOE NCSP CSSG



Subject: CSSG Tasking 2014-05 Response

In Tasking 2014-05 a subgroup of the Criticality Safety Support Group (CSSG) was requested to provide a CSSG position regarding the past application of crediting evacuation after some initiating event within existing CSSG tasking responses.

The drafting team consisted of the following CSSG members:

D. G. Erickson (lead)  
D. Hayes  
J. A. Morman  
F. Trumble

The CSSG position was reviewed by the entire CSSG. Minor comments were incorporated into the final version of the paper that is attached to this memo. This version represents a consensus position by the CSSG however a CSSG minority opinion is attached to the tasking response.

Cc: CSSG Members  
G. O. Udent  
M. Dunn  
A. N. Ellis  
L. Scott

## **Response to CSSG Tasking 2014-05**

### ***CSSG Position on Evacuation and Criticality Safety***

November 17, 2014

#### **Executive Summary**

In Tasking 2014-05 (attachment 1) the CSSG was requested to look at how the CSSG had previously addressed the applicability of crediting evacuation after some initiating event to then require a less robust justification for the prevention of an accidental criticality. Three previous Taskings (2010-01, 2011-04 and 2013-01) were identified that addressed this issue.

ANSI/ANS-8.1-2014 requires an evaluation that demonstrates subcriticality of the operation, and ANSI/ANS-8.10-1983 provides the allowance for reduced conservatism under specified criteria. In DOE Order 420.1C this has been modified somewhat to state the evaluation must demonstrate subcriticality under all normal and credible abnormal conditions, including design bases events.

The consensus of the telecon participants was that the three referenced tasking responses are consistent in the application of the referenced ANSI/ANS-8 standards, and are clearly within the identified scope/applicability of the standards. They were also judged by the CSSG to be consistent in the application of evacuation in the prevention of dose to workers. The question of whether evacuation during an event is equivalent to the “distance may replace shielding” statement in ANS 8.10 was felt by the CSSG as more appropriately directed to the ANS Standards group for a formal clarification or interpretation.

A minority opinion on this matter by a CSSG member is attached to this report as Attachment 2.

#### **Discussion**

A telecon was held on 10/21/2014 to ‘kick-off’ the tasking and identify the path forward. The following were the CSSG participants in the call: D. Erickson (Team Lead), D. Hayes, D. Heinrichs, T. McLaughlin, J. Morman, F. Trumble and R. Wilson. M. Dunn, and I. Fergus participated as Ex-officio members.

Based on the telecon the writing team members were identified as D. Erickson, D. Hayes, J. Morman and F. Trumble.

In Tasking 2010-01 the concern was a seismic event, the resulting consequences, and what the appropriate resulting Seismic Design Criteria (SDC) level should be. In this tasking the wording is clear that the intent is to analyze all credible events, including design basis events (DBEs), and to prevent criticality accidents via design and crediting of vessels to the DBE. There are statements that if failure of a component could cause an

immediate criticality, the SDC may need to be increased (pg. 6.) This tasking response goes on to say that systems should be designed to remain subcritical for earthquakes that are within a specified design basis, but not for events that exceed design basis. This is important as the CSSG further amplifies this in 2011-04.

In Tasking 2011-04 the tasking was an evaluation of the fire and seismic criticality safety strategies as specifically applied to the UPF. In this tasking response the CSSG found that the UPF design prevented criticalities up to the design basis for both fire and seismic (pg. 3, 4) and noted that cost savings may be found by arguing specific configurations may be shown subcritical even with some limited facility/vessel degradation/failure in such an event. There are statements that for the fire event, "... a disruptive facility fire-caused criticality accident, regardless of likelihood, would not put emergency personnel at risk since they would have promptly evacuated the area" [again based on the safety design strategy which provided for vessels to retain their integrity as a result of the DBE]. For the beyond design basis event, during which subcriticality cannot be assured, the risk to personnel is low based on the evacuation (repeated also on pg. 7.) The statement is also made in this tasking that "When personnel are not at risk due to the inherent shielding of the facility, then ANS-8.10 may provide additional guidance." (pg. 5) The tasking states that the criticality safety evaluations do identify those controls that require seismic qualification to preclude a criticality accident under these contingency scenarios (including seismic events and secondary fires with resulting sprinkler activation).

Finally, Tasking 2013-01 addressed the use of water for firefighting in light of criticality safety constraints. In this tasking it is stated that all sources of fire-fighting water must be considered in the evaluations (pg. 8) while also acknowledging that "some guidance should be provided to the criticality safety analyst to define 'credible' since manual firefighting is much more likely to lead to dispersal rather than collection of loose fissile material." Once those credible arrangements are determined, the tasking goes on to state "...the evaluation should document that, due to the water, the critical state would or would not be exceeded." In this case ANSI/ANS 8.22-1997 provides guidance for the fire-fighting plans (pg. 11). The question of shielding is also broached on pg. 11 of the tasking with the following statement "The primary goal of the criticality safety program ... is the protection of people from exposures to significant doses of radiation, preferably by prevention of the accident. If this can be accomplished by shielding inherent to the system, for example via ANS 8.10, then the CSE may be somewhat less rigorous in documenting subcriticality under extreme conditions." It then states the relationship to ANS 8.1 "...systems should be designed to remain subcritical for fires that are within a specified design basis, but not necessarily for events that exceed the design basis." (aligning with the words in DOE O420.1C).

## **Summary**

To clarify and summarize the CSSG's positions taken previously on the interplay between ANS-8.1 and ANS-8.10:

The CSSG's response to relevant taskings does not indicate any conflict or changing position as regards ANS-8.1, ANS-8.10, or the interplay between those standards. The CSSG affirms the ANS-8.1 requirement for process analysis to include credible abnormal conditions (e.g., fires and firefighting where appropriate). The CSSG affirms application of 8.10 to shielded facilities. None of the taskings indicate it is acceptable to credit evacuation as providing distance/shielding equivalent to that 'inherent' for ANS-8.10 application.

**CSSG TASKING 2014-05**  
Date Issued: October 16, 2014

**Task Title:**    *CSSG Position on Evacuation and Criticality Safety*

**Task Background:**

ANSI/ANS-8.1 requires that:

“Before a new operation is begun or an existing operation is changed, it shall be determined that the entire process will be subcritical under both normal and credible abnormal conditions.” Design Basis events (e.g., a seismic event with subsequent facility disruption) frequently pose the most significant, concurrent, consequences to evaluate.

ANSI/ANS-8.10 allows for reduced conservatism in the process analysis if the following criteria are met:

“The provisions of this standard may be applied only in those shielded facilities which meet the following criteria:

- a. All operations and manipulations involving fissile and fissionable materials are conducted remotely by persons located outside the shielded area, and
- b. Shielding and confinement provided are adequate to meet the radiation dose limits set forth in this section.”

The CSSG has addressed this topic previously; reference Tasking responses 2010-01, 2011-04 and 2013-01. However, it appears that some are trying to expand upon the prior CSSG position(s) and there seems to be some confusion relative to the application of 2011-04.

**Task Statement:**

The CSSG is being tasked with drafting a consensus position to clarify and summarize the CSSG’s positions taken previously where it touches on the interplay between these two Standards.

**Resources:**

CSSG Task 2014-05 Team Members:

- David Erickson (Team Leader)
- CSSG writing team members to be identified during kickoff telecom

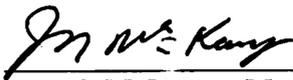
Contractor CSSG members of the team will use their FY14 NCSP CSSG support funding as appropriate; DOE CSSG members of the team will utilize support from their site offices. Emeritus CSSG members may participate on their own. No travel is necessary to support this tasking.

**Task Deliverables:**

1. CSSG to hold task ‘kickoff’ telecom by October 21, 2014

2. CSSG Team Lead to provide DRAFT position by October 22, 2014
3. Full CSSG to provide review of DRAFT position by October 24, 2014
4. CSSG Team Lead to provide draft FINAL position to full CSSG for consensus vote by October 27, 2014.
5. Full CSSG to provide vote on draft FINAL position by October 29, 2014.
6. CSSG Team Lead to provide results of vote and FINAL consensus position to NCSP Manager by October 30, 2014.

**Task Completion Date: October 30, 2014**

Signed:  10/15/2014  
**Jerry N. McKamy, Manager US DOE NCSP**  
**Director NA-00-10**

# MINORITY OPINION ON CSSG Tasking 2014-05

Thomas P. McLaughlin

## **INTRODUCTION**

The overarching philosophy of the ANS-8 standards is the protection of personnel from significant radiation exposures from a criticality accident. The standards make it clear that the preferred protection method is by preventing the accident, but they also state that economics should be a consideration. For this reason they provide guidance for situations when personnel are not at risk due to shielding, or equivalent distance. The graded approach, as endorsed by the ANS-8 standards and DOE regulations, must be applied in order that resources be used efficiently and that real safety not suffer.

## **DISCUSSION**

The Task Background, as stated, is misleading; not in what is stated, but in what is not stated. ANS-8.1 makes it clear that criticality accident control criteria may be different if personnel are not at risk of significant radiation exposure. The Task Background implies that the criterion from ANS-8.1 is to determine that the accident is incredible, with no exceptions. ANS-8.1 references ANS-8.10 for detailed guidance when personnel are not at risk. Again, the Task Background, quoting from ANS-8.10, is misleading in what is not stated. This standard makes it clear that distance that provides the same radiation protection as shielding may be considered (or any combination of shielding and distance) and that when personnel are not at risk then accident prevention criteria may be relaxed.

Consistent with ANS-8.10, CSSG Reports 2011-04 acknowledges that evacuation and emergency response measures may be credited in determining criticality accident risk acceptance criteria. Report 2013-01 only briefly mentions shielding and ANS-8.10, but not evacuation. Report 2010-01 does not mention either evacuation or ANS-8.10. From 2011-04:

*In ANS-8.1, it is recognized that the primary function of the ANS-8 criticality safety standards is to provide guidance for the protection of personnel and that*

*when personnel are not at risk from the consequences of a criticality accident requirements may be reduced somewhat. Consequently, immediate evacuation procedures and emergency response actions may be credited. It is also noted in ANS-8.1 that cost must be a consideration, but that the safety of personnel is paramount. When personnel are not at risk due to the inherent shielding of the facility, then ANS-8.10, Criteria for Nuclear Criticality Safety Controls in Operations with Shielding and Confinement, may provide additional guidance.*

Each fissile material operation is different and must be considered individually, but often there are bounding situations that have a common cause. One of these is a fire scenario that results in the activation of the commonly present, water-based, sprinkler system. Flooding of an enclosed space such as a glovebox will often provide both bounding reflection and moderation.

Significant water depth and volume, however, takes 10's of minutes or longer to accumulate and during this time personnel who might have been present would have evacuated the work site. While the fire likelihood itself makes this scenario inherently unlikely, spending resources to prevent a subsequent, highly judgmental, criticality accident condition that will not expose personnel may not be the most efficient use of resources. The graded approach and common sense must be applied.

The consensus CSSG position appears to be that since personnel protection gained by evacuation was not acknowledged to be within the scope of ANS-8.10 in the three reports under review, therefore it must not be. I disagree and am convinced that the intent of ANS-8.10 is to apply to any situation where shielding or distance protects personnel from significant radiation exposures. If there are disagreements as to the intent of the scope of ANS-8 standards, then these should be presented to ANSI for clarification.