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Ms. Cindy Bailey
Chief, RADB
Office of Administration
Mail Stop TWB-05-B01M
U. S. Nuclear Regulatory Commission
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SUBJECT: Docket ID NRC-2012-0220

Consensus National Standard ANSI/ANS-8.1 includes a statement in Section 4.2.2 re the Double Contingency Principle (DCP). In NUREG -1520, the NRC erroneously interpreted the DCP. As a result, in the December 2009 issue of Nuclear News, the ANS Standards Committee issued a Clarification re the ANSI/ANS-8.1 DCP . The NRC staff failed to revise the erroneous interpretation of the DCP in NUREG 1520 or in the May 2010 NUREG 1520, Rev. 1.

National Standard ANSI/ANS-8.1 requires a process analysis to show that the process will be subcritical. It also recommends technical practices including consideration of the DCP. The DCP is in the form of a recommendation rather than a requirement because some rare facility safety conditions cannot conform to the DCP . NOTE: *If one erroneously claims to implement a national standard recommendation, but* actually fails to do so, one is exposed to increased risk as well as the equally dangerous perception of risk reduction. It is difficult to quantify the risk reduction by the proper implementation of the ANSI/ANS-8.1 DCP. However, the sharp decline in the frequency of nuclear criticality accidents in the US and in the former Soviet Union with the establishment of ANSI/ANS-8.1 and its international equivalent standard, including the DCP, is apparent.

NATIONAL STANDARD ANSI/ANS-8.1

The DCP in Section 4.2.2 of ANSI/ANS-8.1-1998 reads "Process designs should incorporate sufficient factors of safety to require at least two unlikely, independent, and concurrent changes in process conditions before a criticality accident is possible." The 2009 Clarification states that the DCP " applies only to changes in process conditions, not to controls or failure of controls." The 2009 Clarification also states that "Appendix A provides typical examples of contingencies, i.e., changes in process conditions. Finally, the 2009 Clarification states that ANSI/ANS-8.1 Section 4.2.2 as written says nothing about controls.

It is important to note that National Standard ANSI/ANS-8.1, Section 4.2.2 deals with sufficient factors of safety to require at least two changes in process conditions before a criticality accident is possible. The 2009 Clarification states that the DCP applies to changes in process conditions (contingencies) and not to controls.

NUREG-1520, REV.1

NUREG-1520, Rev. 1 erroneously equates at least two controls to at least two process changes (contingencies). Beginning on page 5-A-8 of NUREG-1520, Rev. 1, specific examples focus on two or more controls rather than on two or more process changes (contingencies) even though the 2009 Clarification states that ANSI/ANS-8.1 Section 4.2.2 as written says nothing about controls.

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On pages 5-A-8 and 5-A-9, NUREG-1520, Rev. 1, specific examples for a variety of processes with two or more controls supposedly meeting the ANSI/ANS-8.1 DCP are given. In essentially all of the examples, two or three controls are identified for only one potential process change (contingency). These examples fail to satisfy the ANSI/ANS-8.1 DCP because only one process change (contingency) is controlled. NOTE: One example on page 5-A-9 for the powder handling glovebox identifies moderator and mass to prevent the two process changes (contingencies). This would be an acceptable example for LEU powder but not for HEU and Pu powder. For HEU and PU powders which can go critical without moisture, there is only one prevented process change and the example does not satisfy the ANSI/ANS-8.1 DCP.

A few examples are:

> Page 5-A-9 Tank with Raschig (sic raschig) rings, and one inline concentration monitor. Criticality could occur with one process change (contingency is loss of all concentration control.) ANSI/ANS-8.1-1998 DCP is not met; hence, increased risk and decreased perception of risk.
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> Page 5-A-9 Powder handling glovebox with moderator and mass control. This appears to provide for two process changes (two contingencies). However, fissile powder (HEU or Pu) could be made critical without any moderator. Hence criticality could occur with one process change (one contingency beings loss of mass control)). ANSI/ANS-8.1-1998 DCP is not demonstrated for all fissile powders; hence increased risk and decreased perception of risk prevail. NOTE: This example could be used to demonstrate the DCP if the process were limited to LEU powder.
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> Page 5-A-9 Solution transfer to unfavorable geometry via inline monitor after two operators sample concentration. Operation may be safely performed but the ANSI/ANS-8.1-1998 DCP is not met; hence perception of risk is decreased.

The first two examples on page 5-A--10 do not assure criticality safety. In the first example, to assume that operators will limit stacking drum to not more than four high because the drums are heavy is laughable. If operators can lift heavy drums four high, operators will find a way to lift them higher. Stacking four high is not a credible control unless a barrier such as a ceiling prevents stacking more than four high. In the second example, loss of spacing for the mass-controlled is not evaluated. Loss of spacing is a process change that could lead to criticality.

HISTORY OF DCP

The ANSI/ANS-8.1-1998 DCP is based on experience over the last 60 years and should not be taken so lightly by the NRC staff. In the early years of the nuclear industry, processes were designed with many controls. The frequency of criticality accidents in the US and in the Soviet Union averaged one every few years. With the development of US and international standards for nuclear criticality safety, including recommendations for the DCP, the frequency of criticality accidents has dropped significantly. The accident frequency was much higher in the earlier years because the focus was on many controls on one process change (contingency). With the implementation of the DCP, the frequency of accidents has fallen close to zero. The last accident occurred in 1999.

Consider a few examples of this history:

1958 Y-12 Contractor. Many controls but one significant process change (contingency was loss of favorable geometry). Operators overexposed.

1958 LASL Contractor. Many controls but one significant process change (contingency was loss of safe mass). Operator killed.

1962 Hanford contractor. Many controls but one significant process change (contingency was loss of safe mass). No significant exposure.

1964 Wood River Junction Licensee. Many controls but one significant process change (contingency was loss of favorable geometry). Operator killed; supervisor overexposed.

1978 Tomsk-7 Russian Co. Many controls on glovebox for PU metal operations, but one process change (contingency was loss of mass control). One operator had arms amputated and impaired vision.

1991 Wilmington Licensee. Many controls on waste stream concentration, but one significant process change (contingency was loss of low concentration). No significant exposures occurred.

1999 Tokai-Mura.. Many controls and supervision on conversion process, but one significant process change (contingency was loss of mass control). Resulted in two deaths.

Additional examples involving both US and Soviet Union criticality accidents (resulting in deaths of operators) involved many controls but only one process change (contingency) in each accident. Critical examinations, i.e., lessons-learned, show that essentially all of the criticality accidents had multiple controls for each process, but not enough protection against multiple process changes (contingencies).

LOGIC TEST

The NRC interpretation of the DCP fails a simple logic test. Consider, for example:

An NRC standard, based on NUREG-1520, Rev.1, would read: Process designs SHALL require loss of at least two CONTROLS before a criticality accident is possible.

The ANSI/ANS-8.1 standard, in part, reads: Process designs SHOULD incorporate sufficient factors of safety to require at least two CHANGES IN PROCESS CONDITIONS before a criticality accident is possible.

The two verbs - SHOULD and SHALL - demonstrate that the two positions are LOGICALLY incompatible. The two required process changes - "CONTROLS" and " CHANGES IN PROCESS CONDITIONS "- are quite different. The 2009 ANS Clarification clearly shows that "contingencies" is equivalent to "changes in process conditions," not "controls". The NRC position does not represent the ANSI/ANS-8.1 position, hence, it allows increased risk of nuclear criticality accidents for the licensed nuclear fuel industry.

SUMMATION

History shows that the frequency of inadvertent nuclear criticalities decreased as the ANSI/ANS-8.1 DCP or its international equivalent were developed and implemented. The ANSI/ANS-8.1 national standard focuses on controlling "changes in process condition, i.e., contingencies" while the NRC's NUREG-1520 focuses on "controls". Lessons learned from criticality accidents are that each unsafe process had multiple controls but not multiple controlled process changes, i.e., contingencies. In addition, the NRC version of the DCP fails a simple logic test when compared to the ANSI/ANS-8.1 DCP. Simple logic shows that the ANSI/ANS-8.1 and NRC positions are incompatible.

To reduce risk as well as the perception of reduced risk in future operations, it is important that the NRC adapt the ANSI/ANS-8.1 definition of the DCP , including the 2009 Clarification. The NUREG-1520 section on the DCP needs extensive revision by experienced criticality safety staff so that risk and perception of risk are properly understood to prevent unnecessary deaths of operators as well as unnecessary amputations of operators' limbs. To be consistent with ANSI/ANS-8.1, the revision must focus on two or more process changes (contingencies) rather than on two controls for each operation. To do otherwise will allow licensees to repeat the high accident frequency of the early stages of the nuclear industry.

Respectfully,

George H Bidinger

George H. Bidinger
17016 Cashell Road
Rockville, MD 20853
301-774-6843