RAI Volume 2, Chapter 2.1.1.2, First Set, Number 11:

> Provide technical basis for DOE's assertion in Section 2.3.11.4 of BSC 2008b, that installing a Criticality Accident Alarm System (CAAS) could have adverse effects on safety and operations.

1. RESPONSE

The risk of false alarms and potential injury due to unnecessary evacuations or evacuation drills is acknowledged in the industry. Because there is no credible potential of a criticality accident, and there are acknowledged risks associated with false detection and evacuation, a criticality accident alarm system (CAAS) is considered to have net adverse effects on worker safety and operations, and is not considered a defense-in-depth feature. *Preclosure Criticality Safety Analysis* (BSC 2008), Section 2.3.11.4 provides a qualitative evaluation of whether a CAAS could be considered a defense-in-depth feature. The qualitative evaluation presented in this section concludes that a CAAS is not needed as a defense-in-depth feature for several reasons, one of which is that false alarms could have adverse effects on safety and operations.

National consensus standard ANSI/ANS-8.3-1997, *American National Standard Criticality Accident Alarm System*, states:

> **4.1.1** – Installation of an alarm system implies a nontrivial risk of criticality…
>
> **4.1.3** – The purpose of an alarm system is to reduce risk to personnel. Evaluation of the overall risk should recognize that hazards may result from false alarms and subsequent sudden interruption of operations and relocation of personnel.

The hazards that could result from false alarms include the potential injury to personnel during evacuation (e.g., slips, trips, and falls). In addition, sudden interruption of operations could leave spent nuclear fuel and high-level radioactive waste in an unsafe state with potential risks to workers during evacuation. Because event sequences important to criticality have been determined to be beyond Category 2 by greater than an order of magnitude (i.e., trivial risk) and because injury or increased exposure owing to false alarms is credible, a CAAS will not be deployed.

ANSI/ANS-8.23-2007, *American National Standard, Nuclear Criticality Accident Emergency Planning and Response*, includes many attributes including those described in Section 8.3, "Evacuation Drills," which acknowledge the potential for risk and injury due to evacuation drills, as well as the possibility of false alarms.

The frequencies of event sequences important to criticality are greater than an order of magnitude below the Category 2 event sequence threshold and are less than 1×10^{-7} per year (See the response to RAI 2.2.1.1.7-7-003). Event sequences with end states labeled "Important to Criticality" conservatively indicate the frequency of a potential impact to a criticality control parameter, but do not indicate a postulated criticality accident or an end state whose k_{eff} exceeds

the upper subcritical limit. For a CAAS to produce a net reduction in risk to personnel, exposure of personnel to hazards from CAAS deployment should be less than without a CAAS, which is not the case. As shown below, there is a history of criticality false alarms:

- BWXT Technologies, Inc., Lynchburg, Virginia (May 25, 2002) - False CAAS alarm due to an electrical power supply fault caused by leaking water resulted in evacuation of personnel (NRC 2002, Enclosure P).

- Nuclear Fuel Services, Inc. facility in Erwin, Tennessee (July 14, 2004) - False CAAS alarm due to lightning strike resulted in evacuation of personnel (NRC 2004, Section 3.0).

- BWXT Technologies, Inc., Lynchburg, Virginia (July 13, 2005) - False CAAS alarm due to a lightning strike, which induced damage to electric components within the alarm system, resulted in evacuation of personnel (NRC 2008).

These events demonstrate that false alarms have occurred with a frequency significantly greater than the frequency of event sequences important to criticality for geologic repository operations.

In summary, because preclosure criticality events have been quantitatively demonstrated to be not credible, and there are credible risks associated with CAAS false alarms, a CAAS does not result in a net reduction in total risk, and is not considered an effective defense-in-depth feature.

2. COMMITMENTS TO NRC

None.

3. DESCRIPTION OF PROPOSED LA CHANGE

None.

4. REFERENCES

ANSI/ANS-8.3-1997. 2003. *American National Standard Criticality Accident Alarm System*. La Grange Park, Illinois: American Nuclear Society. TIC: 258157.

ANSI/ANS-8.23-2007. *American National Standard, Nuclear Criticality Accident Emergency Planning and Response*. La Grange Park, Illinois: American Nuclear Society. TIC: 259669.

BSC (Bechtel SAIC Company) 2008. *Preclosure Criticality Safety Analysis*. TDR-MGR-NU-000002 REV 01. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20080307.0007.

NRC (U.S. Nuclear Regulatory Commission) 2002. *Weekly Information Report—Week Ending 05/31/02*. SECY-02-0097. Washington, D.C.: U.S. Nuclear Regulatory Commission.

NRC 2004. "Nuclear Fuel Services, Inc. NRC Inspection Report No. 70-143/2004-204." Letter Report from M. A. Galloway (NRC), July 26-30, 2004. Accessed September 16, 2009. URL: http://adamswebsearch2.nrc.gov/idmws/doccontent.dll?library=PU_ADAMS^PBNTAD01&ID=081480177.

NRC 2008. "Emergency Declared Due to Criticality Alarms." Event Notification Report. May 12, 2008. Event Number 41841. Accessed September 16, 2009. URL: http://www.nrc.gov/reading-rm/doc-collections/event-status/event/2008/20080512en.html#en41841.