

September 16, 2003

Joseph D. Ziegler, Acting Director  
Office of License Application and Strategy  
U.S. Department of Energy  
Office of Repository Development  
P.O. Box 364629 M/S 523  
North Las Vegas, NV 89036-8629

SUBJECT: COMMENTS REGARDING IDENTIFICATION AND ESTIMATION OF  
AIRCRAFT HAZARDS FOR THE LICENSE APPLICATION OF THE  
PROPOSED REPOSITORY AT YUCCA MOUNTAIN RELATED TO KEY  
TECHNICAL ISSUE (KTI) AGREEMENT PRECLOSURE 3.01

Dear Mr. Ziegler:

The U.S. Nuclear Regulatory Commission (NRC) staff is reviewing the U.S. Department of Energy's (DOE's) July 16, 2003, Key Technical Issue (KTI) agreement response related to preclosure (PRE) 3.01. DOE submitted two reports, "The Identification of Aircraft Hazards" and "Frequency Analysis of Aircraft Hazards for License Application," for NRC staff review to address PRE 3.01. The July 16, 2003, letter recategorized the "Identification of Aircraft Hazards," TDR-WHS-RL-000001, Revision 00, report from "Official Use Only" to "Unclassified - Approved for Public Release." During the review of the hazards report, NRC staff identified specific concerns that may need to be addressed within DOE's license application for the proposed repository at Yucca Mountain. Comments related to the NRC staff concerns are enclosed. This information is also being provided in advance of the Technical Exchange on Aircraft Hazards on September 30, 2003, to enhance the interaction between our staffs.

NRC has not completed its review of the frequency analysis report, however, we will provide any comments on the report to DOE prior to the technical exchange. Based on discussions that NRC has had with representatives from DOE, to the extent practicable, NRC comments on the reports will be incorporated into the technical exchange discussions. The NRC staff will complete its review and status agreement PRE 3.01 following the technical exchange. If you have any questions regarding the NRC comments, please contact Mr. Greg Hatchett of my staff at 301-415-3315.

Sincerely,

**/RA/**

Janet R. Schlueter, Chief  
High-Level Waste Branch  
Division of Waste Management  
Office of Nuclear Material Safety  
and Safeguards

Enclosure: As stated

cc: See attached list

Letter to J. Ziegler from J. Schlueter dated: September 16, 2003

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NUCLEAR REGULATORY COMMISSION COMMENTS RELATED TO  
THE DEPARTMENT OF ENERGY'S KEY TECHNICAL ISSUE AGREEMENT PRECLOSURE  
3.01 RESPONSE RELATED TO THE IDENTIFICATION OF AIRCRAFT HAZARDS AT THE  
PROPOSED REPOSITORY AT YUCCA MOUNTAIN, NEVADA

The NRC staff is reviewing the Department of Energy's agreement response to preclosure (PRE) 3.01 of July 16, 2003. During the review the NRC identified potential issues related to the identification of aircraft hazards that may need to be addressed in a license application. The following comments are provided by the NRC staff for further consideration by the DOE as it relates to aircraft hazards associated with the proposed repository facilities. The NRC staff's comments or information needs in a potential repository license application are as follows:

1. A significant portion of the information regarding the Nevada Test and Training Range (NTTR) and associated activities has been acquired from the U.S. Air Force (1996, 1999). Therefore, information presented is at least 4 years old. Some information, such as the number and type of aircraft flown and mode of flight, may be time-dependent. Hence, it is important to use the latest data available. Projected estimates also are needed in cases where there is evidence of data trending, because current conditions may not be applicable at the end of the facility license. DOE should consider updating the available information used in aircraft crash hazard analysis in a license application.
2. Section 5.1.4, "Ordnance Used at the Nevada Test and Training Range," states, "the range operating agency must ensure that weapon safety footprints exist for all aircraft, weapons, and tactics authorized for a given target and event on the range." A similar and more detailed discussion of safety footprints is provided in Section 6.2.1.3, Ordnance Fired from Aircraft. DOE should determine how this information translates into the probability of ordnance impacting the North Portal. For example, Section 6.2.1.3 indicates there are procedures for dealing with safety footprints that may extend beyond the boundaries of the range to be employed. In the event that an off-range hazard cannot be eliminated, the procedure is for the range operating agency to assess the hazard and "make an informed decision" on its acceptability. DOE should demonstrate that any structures, systems, and components important to safety would not be affected by an ordnance accidentally delivered outside the intended region. The information should include the safety footprint information superimposed on these locations of the target sites. An alternate approach is to map historical data of actual off-range ordnance deliveries and use the data to estimate the probability of an ordnance impacting the North Portal.
3. The DOE report did not provide information regarding the number of each type of weapon used annually, safety precautions taken to ensure that weapons do not fly, or impact outside the intended region(s) of discharge and impact. In addition, Section 6.2.1.3, "Ordnance Fired from Aircraft," did not provide any information on testing cruise missiles, including the tests performed at Tonopah Test Range. DOE should provide information regarding the number of each type of weapon used annually. The information should include the flight paths for air-to-ground ordnance (rockets and cruise missiles) with respect to the proposed repository location.

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4. Section 6.2.1.1, "Training More Than 30 Miles from the North Portal at Yucca Mountain," states, "... range safety practices will preclude the activities from having an adverse impact on Yucca Mountain Project (YMP) operations." However, DOE did not provide this information. DOE should provide information regarding the range safety practices that will preclude the activities from having an adverse impact on Yucca Mountain Project (YMP) operations.
5. DOE defined air refueling of aircraft as a routine operation and stated that required safety practices would prevent a crash. However, DOE did not provide data to support this. Although air refueling is routine, it is still a hazardous activity and has caused aircraft crashes (e.g., crash of an F-16 aircraft on January 23, 1992, that involved air refueling). DOE should provide any basis (e.g., historical crash data) that demonstrates that any damage to the fighter aircraft being refueled would be localized, and the aircraft could recover to a suitable airfield.
6. Ordnance is considered hung when it does not jettison when ordered. In addition, DOE should provide the flight paths for recovery to Nellis Air Force Base or Indian Springs Air Force Auxiliary Field in case of hung ordnance. DOE should also clarify what is meant by "critical inflight emergencies" that would allow an aircraft with hung ordnance to transit through restricted airspace/area R-4808N. DOE should specify the safety precautions and actions taken for hung ordnance, for aircraft carrying hung ordnance, in the vicinity of the repository location.
7. DOE should provide the basis for the statement in Section 6.2.1.5, "Large Multi-Engine Aircraft within the 30-Mile Criterion Zone," that aircraft with engine failure would still be able to return to the base. This assumption should be clarified to indicate it refers to multiengine aircraft. Furthermore, the likelihood of losing power to all engines should be stated to make the assumption valid.
8. Section 6.2.2.2, "Military Training Routes," concluded that aircraft flying on military training routes located more than 32 km [20 mi] from the North Portal at Yucca Mountain do not pose a hazard to that facility. DOE should provide information regarding whether zooming operations by pilots experiencing inflight emergencies have been considered.
9. Section 6.2.2.2, "Military Training Routes," argued that selection of the 32-km [20-mi] criterion zone is conservative when comparing it with proximity criterion (b) of NUREG-0800. However, the staff determined that comparison with this criterion is not appropriate because the three criteria in NUREG-0800 were established to determine if a detailed analysis is required for a facility (e.g., a nuclear power plant) to assess aircraft crash hazard. DOE should provide rationale for the assumption that the 32-km [20-mi] criterion zone is conservative.
10. Several sections of the DOE report (e.g., Appendix G; Section 6.3.1.1.2, "Desert MOA;" Section 6.3.1.1.3, "70 Series Ranges;" Section 6.3.1.1.4, "Electronic Combat Ranges;" and Section 6.3.1.1.6, "60 Series Ranges"), state that a pilot experiencing problems would direct the aircraft away from the Yucca Mountain site. For example, Section 6.3.1.1.2, Desert MOA, states, "... if the aircraft has glide capability and depending on

the altitude, the pilot will direct the aircraft away from the range boundaries to a suitable ejection area within one of the valleys located in the Coyote MOA; the pilot would eject and the aircraft would most likely crash into the surrounding mountains of the Coyote MOA.” Similarly, Section 6.3.1.1.4, “Electronic Combat Ranges,” states, “... pilots preparing to eject would avoid the mountainous western and southern areas resulting in the aircraft moving away from Yucca Mountain.” Section 6.3.1.1.3, 70 “Series Ranges,” states, “... range 75E/W has a mountain range that borders the eastern boundary and several radioactive contaminated areas adjacent to the southern border (Pahute Mesa) that make those areas unattractive for pilot ejection.” Section 6.3.1.1.6, “60 Series Ranges,” states that “if the aircraft has glide capability and depending on the altitude, the pilot will direct the aircraft away from mountainous terrain.” It also states, “... a suitable ejection area is within the flatter terrain found in Indian Springs Valley.”

Pilot actions in ejection site selection and aircraft direction prior to ejection are achievable if there is sufficient time and control of the aircraft. Emergency procedures require pilots to perform numerous actions that may encroach on the pilot’s ability to exercise the appropriate ejection options. Even with sufficient time and control, other factors (e.g., weather, visibility, or ground feature recognition) may limit the ejection options available to the pilot. DOE should determine the likelihood of unwanted actions or inactions on the part of the pilot that arise from problems in sequencing, timing, knowledge, interfaces, and/or procedures that may result in deviations from what is expected of the pilot during inflight emergencies that may place people, equipment, and systems at risks from aircraft hazards at the proposed repository at Yucca Mountain.

11. Section 6.3.1.1.5, “Ordnance,” concluded that instructions from operating and controlling agencies of NTTR provide assurance that weapon training activities would not pose a credible hazard to the proposed repository operations. DOE should provide information regarding the safety instructions that would prohibit ordnance used in training activities from impacting any safety-related structures, systems, and components at the proposed repository.
12. Section 6.1, “Qualitative Approach to Hazard Screening,” states that the DOE “screened out event sequences considered not credible” using “criteria based on qualitative and quantitative bases that include distance, flight characteristics and pilot actions.” It is not clear to the staff what quantitative information has been used to characterize flight activities and pilot actions. No information has been presented on the mode of flight, which is an essential element of flight characteristics, used to determine the appropriate crash rate for a particular aircraft (DOE, 1996; Kimura et al., 1996). Additionally, no initiating events and event sequences have been identified in the report. Therefore, it is not clear how some event sequences were eliminated without information on the frequency of occurrence or estimated dose consequences.

DOE should identify the initiating events and event sequences and provide an analysis using Probabilistic Safety Assessment methodology, including the estimated frequency of occurrences and associated uncertainties, that have been used to eliminate potential event sequences. In addition, identify the qualitative (description and characteristics of the facilities and equipment, distance of the activity from the North Portal, identification of initiating events that could occur during the activity, identification of probable event

sequences following the initiating event, and determination of the credibility of these off-normal event sequences impacting the repository facilities and operations) and quantitative (distance, flight characteristics, and pilot action) parameters used in assessing potential hazards for each case. The response should include a definition of what is meant by off-normal events in the context of the preclosure performance objectives.

13. Section 5.8, "Commercial Rocket Launch and Retrieval," should be revised because Kistler Aerospace Corporation has received approval from the FAA for operations in Area 18 of the NTS. DOE should demonstrate that operations by Kistler Aerospace Corporation in Area 18 would not pose any undue hazard to the proposed repository.
14. Many statements in Appendix G are not substantiated by rationale, bases, or historical data. For example, Appendix G states:
  - "... it is expected that in a controllable situation at high altitudes, the pilot would eject between 10,000 and 15,000ft AMSL (approximately 5,000 and 10,000 feet AGL assuming a ground elevation of 5,000 feet) after unsuccessful restart." No basis for such expectation has been presented.
  - "... if the aircraft is at a high altitude and not in vertical descent, the pilot will regain control and a crash is averted." No basis for such an expectation has been presented.
  - "a disabling event at high altitudes would result in either immediate descent of the aircraft with pilot ejection or a controlled descent, providing time for pilot action prior to ejection." No basis has been provided.
  - "... [a]n engine fire could result in an immediate pilot ejection. It is expected that this would result in an in-flight explosion of the aircraft or a nearby crash of the aircraft depending on its altitude, speed, and direction." No actuarial information or rationale has been presented to justify such expectations.
  - In Appendix G it is stated pilot errors resulting in crashes are caused by midair collisions with other aircraft or collisions with the ground. In making this conclusion, DOE did not include crashes that originated because of pilots losing situational and/or positional awareness.

DOE should provide the supporting technical basis for the above statements in Appendix G of the report. Further, the technical bases should consider, as appropriate, that unwanted actions or inactions that arise from problems in sequencing, timing, knowledge, interfaces, and/or procedures that may result in deviations from the expected standards or norms that places people, equipment, and systems at risk from aircraft hazards at a potential repository at Yucca Mountain are adequately justified.

15. It is not clear to the staff for which year the flight information given in Table 1 of the report was compiled. DOE should clarify the year information and source of information



from which the number of flights in each military training route was estimated. Similarly, other information should be identified by year.

16. Several figures in this report, such as Figure 4 and Figure 7, are not legible. Some figures, such as Figure 2, lost detail when scanned from the original source. The report should be updated to provide legible, high-quality figures.