**Department of Energy**
Office of Civilian Radioactive Waste Management
Office of Repository Development
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QA: N/A
Project No. WM-00011

AUG 31 2004

OVERNIGHT MAIL

**ATTN: Document Control Desk**
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TRANSMITTAL OF COMPLETION OF RESPONSE TO KEY TECHNICAL ISSUE (KTI) AGREEMENT ITEM PRECLOSURE (PRE) 3.01

References: (1) Identification of Aircraft Hazards, TDR-WHS-RL-000001, Rev. 00
(2) Frequency Analysis of Aircraft Hazards for Licensing Application, CAL-WHS-RL-000001, Rev. 00B
(3) Ltr, Schlueter to Ziegler, dtd 9/16/03 (Comments regarding Identification and Estimation of Aircraft Hazards for LA)
(4) Ltr, Schlueter to Ziegler, dtd 9/17/03 (Comments regarding Frequency Analysis of Aircraft Hazards for LA)
(5) Ltr, Schlueter to Ziegler, dtd 10/7/03 (NRC/DOE Technical Exchange on Aircraft Hazard Analysis)

This letter provides the status of work that has been done to date in response to KTI Agreement PRE 3.01. The KTI agreement is as follows:

> "Provide a plan for identification and estimation of aircraft hazards for the license application. This plan should be consistent with the guidelines in NUREG-0800 and other applicable DOE standards, as appropriate, to a nuclear waste repository. Provide a map delineating the vicinity to be considered in the detailed analysis, taking into consideration available information for civilian and military aircraft, including information from federal and local agencies concerning how such activities may reasonably change. Participate in an Appendix 7 meeting to discuss the aircraft hazards plan, initial data collection and analysis, development of the vicinity map, and the appropriate level of detail for analyses to be presented in the license application assessment.

UMSSO7

DOE agrees with the request and will provide the plan and map in June 2002. DOE agrees to participate in an Appendix 7 meeting which will be scheduled after the plan and map are provided."

In response to the above agreement, the U.S. Department of Energy (DOE) provided two reports (References 1 and 2), on which the U.S. Nuclear Regulatory Commission (NRC) provided comments (References 3 and 4). A technical exchange was conducted on September 30, 2003, as documented in Reference 5. At the conclusion of the technical exchange, DOE agreed to proceed with items listed in Enclosure 1.

As documented in the technical exchange meeting summary (Reference 5), the NRC generally concluded that more current information was needed in support of the aircraft hazard identification and in support of the aircraft crash frequency analysis. The DOE agreed to update the reports addressing the NRC's comments from References 3 and 4 as applicable. Revisions to these reports are currently pending. Enclosure 1 provides the implementation status of agreements reached during the technical exchange meeting.

DOE has evaluated the comments and will address the NRC's comments in the pending updates to the report on Identification of Aircraft Hazards, and the Frequency Analysis of Aircraft Hazards for License Application. The disposition of NRC's comments is tabulated in Enclosure 2.

This analysis is ongoing and will be presented as part of the License Application (LA). Pending revisions to References 1 and 2 will be available at the Yucca Mountain Project offices when they are approved.

The original aircraft hazard reports and the pending revisions addressing NRC comments fulfill KTI agreement PRE 3.01 and the agreements reached in the September 30, 2003, technical exchange, with the exception of the follow-up meeting (Item 3 in Enclosure 1). Pending further review by the NRC, DOE believes that an additional meeting with the NRC is not necessary. The information provided adequately reflects the DOE approach to identification and estimation of aircraft hazards for the LA.

DOE considers KTI Agreement PRE 3.01 to be fully addressed and pending review and acceptance by the NRC, it should be closed. DOE believes that this response and NRC's eventual review of the revised reports and the LA obviate the need for the Appendix 7 meeting per the agreement. DOE therefore recommends that further exchanges on this matter occur with the LA review framework.

There are no new regulatory commitments in the body or the enclosures to this letter. If you have any questions or require additional information, please contact David C. Haught at (702) 794-5474 or e-mail david_haught@ymp.gov, or Paul G. Harrington at (702) 794-5415 or e-mail paul_harrington@ymp.gov.

Joseph D. Ziegler, Director
Office of License Application & Strategy

OLA&S:DCH-1818

Enclosures:
1. Implementation Status of Agreement Reached During Technical Exchange of September 30, 2003, on Aircraft Hazards
2. Tabulation of NRC Comments and Disposition in Updated Reports

cc w/encls:
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**Enclosure 1**

Implementation Status of Agreement Reached During
Technical Exchange of September 30, 2003, on
Aircraft Hazards

| Item | Status |
|---|---|
| 1) DOE will review the 38 comments provided by the NRC in letters dated September 16 and 17 , 2003, and will consider them in its future updates to the documents discussed during the technical exchange, as necessary | DOE has reviewed the 16 comments relative to Identification of Aircraft Hazards for the License Application, and obtained additional (more current) data and information from the USAF.<br><br>DOE has reviewed the 22 comments relative to the frequency analysis of aircraft hazards and considered these in an update of the frequency analysis as noted in item 2 below. |
| 2) DOE will update the Frequency Analysis of Aircraft Hazards for License Application by March 2004 and, if necessary, revise the Identification of Aircraft Hazards for License Application, with updated flight and crash information. The update(s) will address the 38 comments provided by NRC as applicable | A revision to the report on Identification of Aircraft Hazards is pending and will include more current data and information from the U.S. Air Force.<br><br>A revision to the Frequency Analysis of Aircraft Hazards for License Application is pending and will address the 22 comments in the NRC's letter of September 17, 2003.<br><br>Enclosure 2 tabulates the disposition of NRC's comments. |
| 3) DOE will meet with NRC after it completes its updates to discuss new data and analysis used, and the extent to which the NRC comments were addressed | The need to hold such a meeting will be reassessed pending further consideration by the NRC. |

# Enclosure 2
# Tabulation of NRC Comments and Disposition in Updated Reports

| Comments and Responses on the Identification of Aircraft Hazards | | |
|---|---|---|
| **Comment No.** | **Comment** | **Response** |
| 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. | Updated information including aircraft types and estimates of numbers of sorties has been received from the U.S. Air Force in a letter from Major General Stephen J. Wood to John Arthur, dated May 21, 2004. The letter contains information on historical activity through 2003 and projected activities. This information will be incorporated into Tables 5-2 through 5-4 of the revised report. |
| 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. | Updated information including a discussion of the potential risks associated with ordnance deliveries has been received from the U.S. Air Force by letter from Major General Stephen J. Wood to John Arthur (dated May 21, 2004). The safety footprints are applicable to determining the probability of missing a properly identified intended target. The safety footprints do not address situations where ordnance is accidentally delivered to distant areas. A probabilistic calculation out to 20 or more miles based on the weapons footprints would not be appropriate and is not planned. The letter of May 21, 2004, states that there are no reports of ordnance deliveries off the NTTR or inside the NTS during the period they evaluated (1993-2003). All impacts were confined to the surface hazard areas. The hazard will be screened out in the revised report due to the great distance between the surface hazard areas and the repository site. |

## Enclosure 2
## Tabulation of NRC Comments and Disposition in Updated Reports

| Comments and Responses on the Identification of Aircraft Hazards | | |
|---|---|---|
| **Comment No.** | **Comment** | **Response** |
| 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. | The numbers and types of each weapon used annually and the flight paths of rockets fired from aircraft are not required to make the case for safety of the repository due to the great distance to the weapons testing areas, as discussed in the response to Comment 2. Safety precautions have been specified in U.S. Air Force instructions, of which the U.S. Air Force has provided copies (or website locations). The revised hazards identification report will make reference to the applicable U.S. Air Force instructions. Future revisions will consider cruise missile testing, if applicable. |
| 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. | The text in question will not be used in the revised report. Instead of relying on safety practices and other pilot actions, the revised approach, which will be reflected in the pending report, relies on establishment of a distance beyond which there is no significant hazard from flight-training activities. The distance is established based on flight characteristics after initiation of an accident. Flight activities within the established distance are considered in the crash-frequency analysis. Required safety practices are no longer credited, so the associated information is not provided. |
| 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. | Information regarding the two refueling routes within the 100-mile regional setting will be incorporated into the revised hazards identification report. Instead of relying on safety practices and other pilot actions, the revised approach, which will be reflected in the report, relies on establishment of a distance beyond which there is no significant hazard from flight activities. This distance will be established based on flight characteristics after initiation of an accident. Flight activities within the established distance will be considered in the crash-frequency analysis. Required safety practices are not credited, so the associated information will not be provided. |

## Enclosure 2
## Tabulation of NRC Comments and Disposition in Updated Reports

| Comments and Responses on the Identification of Aircraft Hazards | | |
|---|---|---|
| **Comment No.** | **Comment** | **Response** |
| 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 in-flight 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. | Information regarding hung ordnance has been provided in the letter from the U.S. Air Force to DOE (May 21, 2004). U.S. Air Force procedures are in place to avoid sensitive areas when hung ordnance is encountered. DOE and the U.S. Air Force have discussed the establishment of a no-fly zone by MOU to preclude hazards from U.S. Air Force flight activity. Although the no-fly zone may have a cap, above which a certain number of flights may be permitted annually, aircraft with hung ordnance will be addressed. The specifics of the restricted airspace will be provided in forthcoming reports |
| 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. | The text in question will not be used in the revised report. Instead of relying on safety practices and other pilot actions, the revised approach, which will be reflected in the report, relies on establishment of a distance beyond which there is no significant hazard from flight-training activities. The distance will be established based on flight characteristics after initiation of an accident. Flight activities within the established distance will be considered in the crash-frequency analysis. |
| 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 in-flight emergencies have been considered. | The pending revision of the hazard identification report will not assume that the hazard from aircraft on the military training routes is negligible but will consider the hazard from these flights, in light of the possibility of zooming. New information on zooming and numbers of flights in the military training routes and LATN areas has been received in the May 21, 2004, letter from the U.S. Air Force to DOE. The sensitivity of the overall crash frequency to activities in the Beatty Corridor is very low owing to the distances involved. |
| 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. | The text in question will not be used in the revised report. The revised approach, which will be reflected in the report, relies on establishment of a distance beyond which there is no significant hazard from flight-training activities. The distance will be established based on flight characteristics after initiation of an accident. Flight activities within the established distance will be considered in the crash-frequency analysis. |

| Comments and Responses on the Identification of Aircraft Hazards | | |
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| **Comment No.** | **Comment** | **Response** |
| 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 In-flight emergencies that may place people, equipment, and systems at risks from aircraft hazards at the proposed repository at Yucca Mountain. | The text in question will not be used in the revised report. Instead of relying on safety practices and other pilot actions, the revised approach, which will be reflected in the report, relies on establishment of a distance beyond which there is no significant hazard from flight-training activities. The distance will be established based on flight characteristics after initiation of an accident. Flight activities within the established distance will be considered in the crash-frequency analysis. Expected pilot actions will no longer be credited, so the associated information is not provided. |
| 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. | Updated information including a discussion of the potential risks associated with ordnance deliveries has been received from the U.S. Air Force by letter from Major General Stephen J. Wood to John Arthur (dated May 21, 2004). Safety precautions have been specified in U.S. Air Force instructions, of which the U.S. Air Force has provided copies (or website locations). The hazards identification report will make reference to applicable U.S. Air Force instructions. |

## Enclosure 2
## Tabulation of NRC Comments and Disposition in Updated Reports

| Comments and Responses on the Identification of Aircraft Hazards | | |
|---|---|---|
| **Comment No.** | **Comment** | **Response** |
| 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. | The text in question will not be used in the revised report. Instead of relying on safety practices and other pilot actions, the revised approach, which will be reflected in the report, relies on establishment of a distance beyond which there is no significant hazard from flight-training activities. The distance will be established based on flight characteristics after initiation of an accident. Flight activities within the established distance will be considered in the crash-frequency analysis. The hazards identification report will not estimate frequency of occurrence of event sequences. This is reserved for the crash frequency analysis. The purpose of the hazards identification report is to narrow the scope of the crash frequency analysis to the significant hazards. Mode of flight is dealt with in the crash frequency analysis. |
| 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. | The potential for Kistler operations to impact the repository will no longer be considered in the aircraft report but in an analysis of nearby military and industrial hazards. The analysis "Industrial/Military Activity-Initiated Accident Screening Analysis", ANL-WHS-SE-000004, Rev. 1 concludes that the Kistler proposal is in incipient stages of development and that a flight hazard analysis would be conducted as part of a safety review under the auspices of the Federal Aviation Administration before a decision is made on whether to license any launch activities. The Kistler proposal has languished for some time and the company declared bankruptcy in July 2003. Therefore, no current or near-term hazard exists. Future revisions of the applicable analyses and reports will consider the hazard if it materializes. |

| Comments and Responses on the Identification of Aircraft Hazards | | |
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| **Comment No.** | **Comment** | **Response** |
| 14 | Many statements in Appendix G are not substantiated by rationale, bases, or historical data.<br>For example, Appendix G states:<br><br>"...it is expected that in a controllable situation. at high altitudes, the pilot would eject between 10,000 and 15,000 ft 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.<br><br>"...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.<br><br>"...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.<br><br>"... [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.<br><br>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.<br><br>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. | The text in question will not be used in the revised report. Instead of relying on safety practices and other pilot actions, the revised approach, which will be reflected in the report, relies on establishment of a distance beyond which there is no significant hazard from flight-training activities. The distance will be established based on flight characteristics after initiation of an accident. Flight activities within the established distance will be considered in the crash-frequency analysis. Required safety practices will no longer be credited, so the associated information is not provided. |

## Enclosure 2
## Tabulation of NRC Comments and Disposition in Updated Reports

| Comments and Responses on the Identification of Aircraft Hazards | | |
|---|---|---|
| **Comment No.** | **Comment** | **Response** |
| 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. | The report will be revised and updated to clearly indicate the source and date of flight information used. For example, the information in Table 1 will be contained in Table 5-3, and the source will be identified as the May 21, 2004 letter from the U.S. Air Force to DOE. |
| 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. | The report will be revised to provide high quality, legible figures. |

## Tabulation of NRC Comments and Disposition in Updated Reports

| Comments and Responses on the Frequency Analysis of Aircraft Hazards for License Application | | |
|---|---|---|
| Item No. | Comment | Response |
| | **Topic: Crash Estimation Methodology** | |
| 1 | Clarify what events have been considered as "crash-initiation" events for military aircraft flying in Nevada Test and Training Range. | The crash rates to be used for military aircraft in the crash frequency analysis will be based on a historical study of aircraft crashes, as cited in the pending revision to the crash-frequency analysis. All crash-initiation events that correspond to the applicable mode of flight and resulted in crashes that were included in the historical study will be included in the crash frequency analysis. |
| 2 | Justify why crash-initiation rate (rate of crash-initiation events, as assumed in Assumption 3.1 and used in developing the crash frequency estimation methodologies in Section 2) should be the same as the crash rate (number of crashes per flight mile), as used in NUREG—0800 and Kimura et al. (2002) and developed in Kimura et at. (1996). Provide plans that are in place to gather actuarial information of spatial distribution of crash-initiation events to be used in estimating the frequency of aircraft crashing onto a given facility. | A crash-initiating event is an event that results in the accidental crash of the aircraft. By definition, every crash-initiation event results in a crash. Therefore, the rate of crash initiation is the same as the rate of crash. The text of Assumption 5.1.1 will be clarified. The spatial distribution of crash-initiation events is uniform given the assumption that the distribution of flights is uniform and the use of a crash rate per unit distance flown in a particular flight mode. Therefore, no plans are in place to gather information on the spatial distribution of crash-initiation events. |
| 3 | Provide a basis, using historical data, to justify Assumption 3.1 that crash-initiation events are uniformly distributed throughout the flight area, defined as the area where an aircraft crash could originate. For example, the crash initiation event density has been assumed to be uniform in the airspace above the Nevada Test Site with perimeter 213 km [133 mi] and above the region surrounding the North Portal with perimeter 41 km [25.6 mi] (Section 5.5.1). | The pending revision to the frequency analysis will use aircraft-incursion data from concentric circles to demonstrate air traffic uniformity near the North Portal with increasing density deeper into the NTS. Thus, the assumption of uniformity is conservative. |
| 4 | Clarify whether aircraft drifting out the fixed airway boundaries have been considered in deriving the methodology in Section 2.2. Flight path records in Figure IV-1 in Appendix IV show that even in one week of information, aircraft do violate these boundaries. | Such movements are not violations, but are legitimate uses of the restricted airspace by military or DOE aircraft. Such aircraft will be conservatively double counted in the frequency analysis. |

| Comments and Responses on the Frequency Analysis of Aircraft Hazards for License Application | | |
|---|---|---|
| Item No. | Comment | Response |
| | **Topic: Mission Planning** | |
| 5 | Assumption 3.12 that states aircraft missions in EC South and in the Caesar Corridor are "an extension in space of the missions" over the Nevada Test Site. Provide a basis for the rationale that aircraft crossing the Nevada Test Site would also pass through EC South. For example, confirmatory information from the U.S. Air Force could be used to support the assumption that missions in EC South and in the Caesar Corridor are extensions of the airspace of the missions over the Nevada Test Site. | Due to recent changes in the rules governing the NTS airspace (described in the letter from the U.S. Air Force (Major General Stephen Wood) to DOE (John Arthur) dated May 21, 2004), Assumption 3.12 is no longer valid and will not be used in the revised analysis. The transitory nature of such flights will no longer be assumed. DOE and the U.S. Air Force have discussed imposing operational restrictions by a MOU. |
| 6 | Clarify whether actual operational planning of the U.S. Air Force has been checked to conclude in Assumption 3.5 "Flying the shortest distance between two points is the most efficient way to cross the NTS." The path taken by aircraft while flying in a restricted area depend on the mission with associated planning of the flight path(s). | Due to recent changes in the rules governing the NTS airspace (described in the letter from the U.S. Air Force (Major General Stephen Wood) to DOE (John Arthur) dated May 21, 2004), Assumption 3.12 is no longer valid and will not be used in the revised analysis. The transitory nature of such flights will no longer be assumed. DOE and the U.S. Air Force have discussed imposing operational restrictions by a MOU. |
| | **Topic: Flight Characteristics** | |
| 7 | Provide a basis for Assumption 3.5 that flight paths near the proposed repository will be straight lines. The proposed repository lies underneath the restricted airspace R-4808E. Additionally, the proposed repository is close to other restricted airspaces, such as Electronic Combat Range South. Aircraft are known to engage in different maneuvering activities inside a restricted airspace. Bechtel SAIC (2002) did not provide sufficient information to establish the possible flight paths and mode of flight in the airspaces near the proposed repository. Flying characteristics (mode and paths of flights) in an area would depend upon flight planners who develop the flight plans and pilots who fly through that area. Specific information (e.g., from U.S. Air Force records) is necessary to justify this assumption. | Due to recent changes in the rules governing the NTS airspace (described in the letter from the U.S. Air Force (Major General Stephen Wood) to DOE (John Arthur) dated May 21, 2004), Assumption 3.12 is no longer valid and will not be used in the revised analysis. The transitory nature of such flights will no longer be assumed. DOE and the U.S. Air Force have discussed imposing operational restrictions by a MOU. |
| 8 | Define what items are included in the "dropped objects" category in Section 2.4. If they include any objects that can explode (e.g., a bomb) or ignite (e.g., an external fuel tank), contribution of the air overpressure generated due to explosion and/or the thermal energy may need to be considered by appropriately enlarging the effective area of a ground structure. Clarify whether stressful activities such as maneuvers during combat training have been considered while making the assumption that the drop rate would be uniform along the flight path. | Information on the nature of dropped objects was provided in the May 21, 2004 letter from the U.S. Air Force (Major General Stephen Wood) to DOE (John Arthur). The new information will be incorporated into the revision of the crash frequency analysis and the assumptions inherent in the drop rate will be clarified. |

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| 9 | Clarify what is meant by "preferred altitude of ejection" (below about 10,000 ft AGL) in Assumption 3.11. Provide documented evidences to establish whether this preferred altitude is recommended by the aircraft manufactures or U.S. Air Force for ejection, or only preferred by pilots for ejection. | Assumption 3.11 will not be used in the revised analysis, which will not take credit for a preferred altitude of ejection. The revised aircraft hazards identification report will rely upon the establishment of a distance beyond which there is no significant hazard from flight-training activities, regardless of pilot actions. Flight activities within the established distance are considered in the crash-frequency analysis. |
| | **Topic: Crash Frequency Estimation** | |
| 10 | Provide the rationale, taking into account information on flight characteristics of the aircraft flying in the vicinity of the proposed surface facilities, for considering crash rates limited to aircraft flying only in normal in-flight mode (Section 5.3). | The revised calculation will not make the claim that flights in the vicinity of the repository are normal in-flight mode. Instead it will use and provide a rationale for using the crash rate associated with special maneuvers. |
| 11 | Provide rationale for the statement in Assumption 3.12 that "because EC South is at least several miles from the North Portal, the aircraft crash hazard is insensitive to flight activity in EC South." Provide detailed information, at a minimum, on the flight activities, flight mode, and aircraft type(s) flying in EC South that have been considered to arrive at the assumption. Clarify whether crash range of each type of aircraft, type(s) of aircraft that fly in EC South, and missions conducted have been taken into account. | The statement in question will not be used in the revised analysis. The special-maneuver crash rate will be used for flights in the restricted airspace (NTS and NTTR), including EC South. The methods to be used in the calculation will not require the crash range to be known for aircraft in the proposed restricted airspace. The crash range cancels out of the equation for the conservatively applied special case of a facility far from the edge of the flight area. |
| 12 | Provide a basis for the assumption (Assumption 3.13) that a general aviation pilot would at all times steer away from the Yucca Mountain facilities. | This assumption will not be used in the revised analysis. No credit will be taken for pilot actions. |
| 13 | Provide basis for the statement in Assumption 3.14 that "an impact into a support area would not jeopardize the integrity of the process zone" and, therefore, the support areas of the buildings need not be considered in estimating the effective areas of the buildings. Information should include whether skid of the aircraft involving "ploughing" the support facilities was considered. | Support areas are included as part of the effective area in the revised analysis, so the statement will not be used in the revised analysis. Skidding into the building will be considered. |

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| 14 | Provide basis for neglecting the effective areas in Assumption 3.14 represented by the "transportation casks inside the Transporter Receipt Building or in transit between buildings, and waste packages in shielded transporters heading underground." Information should include whether frequency of shipment of waste packages for emplacement has been considered along with the skid of the aircraft. Additionally, information should clarify why the transportation casks inside the Transporter Receipt Building would provide insignificant effective area for estimation of the annual crash frequency when the Transporter Receipt Building itself was not considered. | These effective areas will be included in the revised analysis. Frequency of transport of waste packages will not be explicitly considered in the revised analysis. Instead, it will be conservatively assumed that two loaded waste-package, site specific casks, or transportation-cask transporters are always exposed on the surface and that the rail yard staging area for casks is always full to capacity. Transportation casks inside the Transportation Cask Receipt and Return Facility will be considered in the revised analysis. Skid distances will be considered. |
| 15 | Clarify whether the rail yard or the area used for casks waiting to be processed have been considered in estimating the annual crash frequency. | These areas will be included in the revised analysis. |
| 16 | Provide a basis for Assumption 3.15 that aircraft on Nevada Test and Training Range flying near the proposed surface facility would be represented by "small attack, fighter, trainer aircraft." Clarify whether trainer aircraft fly routinely near the proposed repository and identify their missions. Clarify also why the category "small military aircraft" (all small attack, fighter, and trainer aircraft) would be "more conservative" when crash rates for F-16s, all single-engine, and all attack and fighter aircraft are higher (Section 5.5.1). Clarify whether uncertainties associated with the determination of the aircraft type flying in the vicinity of the proposed surface facilities have been appropriately considered in estimating the effective area of the buildings and in selecting the appropriate crash rate for the aircraft in the analysis. | The higher crash rate for F-16s will be used in the revised analysis for conservatism. This will address uncertainty in the crash rate by application of a bounding crash rate. Uncertainty in the mix of aircraft will be addressed by the conservatism introduced by using F-16 crash rates. Using the characteristics of F-16s to calculate the effective areas in combination with the higher F-16 crash rates is conservative as will be explained in the assumption. |
| 17 | Provide a basis for using one week flight data (3/30/2002 through 4/5/2002, given in Table 9) to establish the annual number of flights and conclude that the restricted airspace R-4808S is not heavily used by civilian air traffic (Assumption 3.16). Moreover, justify how the average of one week flight data would be the representative of flights through this corridor (Assumption 3.19). Additionally, clarify whether uncertainties in flight information through this corridor have been appropriately considered in the analysis. | More FAA flight counts have been obtained and will be used in the revised analysis to more accurately estimate annual traffic. Uncertainty will be accounted for in the revised analysis by using an upper confidence bound. |

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| 18 | Explain the rationale for assuming the width of the aviation corridor to the southwest of Yucca Mountain to be equal to 38.4 km [24 mi]. Clarify whether this assumed width belongs to federal airway V105-135, J86, J92, VR1214, or IR286 (see Figure 16 of Bechtel SAIC, 2002). Clarify whether the assumed width of the airway is same as used by the Federal Aviation Administration. The methodology presented in this report points to a scenario where the airway width is significantly larger than the crash range of an aircraft. Generally the width of federal flight corridors have a width smaller than the crash range used in this report (40 km [25 mi] for air carriers and 48 km [30 mi] for military aircraft in Assumption 3.17). | Written communication and data from the FAA provides the rationale for assuming that the entire corridor between the R-2508 complex and the NTTR is used as a flight corridor. This will be explained in the text of the revised analysis. The width will be determined by the actual width available between the R-2508 complex and the NTTR. Aircraft are not required to follow the federal airways. The methods to be used in the revised analysis will not assume specific crash ranges. |
| 19 | Provide the source of information presented in Assumption 3.16 that "air traffic near and with R-4808S tends toward the very high frequency omnidirectional range and tactical air navigation station (VORTAC) south of Beatty." | The revised analysis will not rely on the observation that air traffic tends toward the Beatty VORTAC. |
| 20 | Provide the basis for assuming that military aircraft flying on the military training routes and low-altitude tactical navigation areas pose a negligible hazard to proposed surface facilities (Assumption 3.20). Clarify whether the "zooming" maneuvers conducted by the military pilots facing in flight emergencies were considered in developing this assumption, which, by its very nature, takes the aircraft to a higher altitude before beginning the glide and results in a potentially larger crash range. | The revision of the frequency analysis will not assume that the hazard is negligible but will incorporate the hazard from these flights, with consideration of zooming. New information on zooming and numbers of flights in the military training routes and LATN areas has been received in the May 21, 2004, letter from the U.S. Air Force to DOE. The sensitivity of the overall crash frequency to activities in the Beatty Corridor is very low owing to the distances involved. |
| 21 | Provide the rationale for assuming civilian aircraft flying at [1,200 ft] above ground level (AGL) (Assumption 3.20) and below [10,000 ft] above mean sea level (MSL) (Assumption 3.21), irrespective of distance from the proposed surface facilities, will not pose a credible hazard to the proposed surface facilities. Additionally, provide the conversion from MSL to AGL for flights near the proposed repository. | Assumption 5.2.3 in the revised analysis will replace Assumptions 3.20 and 3.21. The analysis will include estimated number of flights below 10,000 ft in the crash frequency estimates. A general conversion of MSL to AGL is not practical because of the variations in ground elevation near the repository. |
| 22 | Provide the rationale why the average number of flights in years 1999 through 2002 would be representative for estimating the annual crash frequency onto the proposed surface facilities (Section 5.5.1). Clarify whether uncertainties in number of annual flights have been appropriately considered in the analysis. | Data collection is ongoing. The revised analysis will include data through June 2004. Restrictions on expansion of future activity may be imposed by memorandum of understanding between DOE and the U.S. Air Force. If so, the approved numbers of flights will be used in a future revision of the frequency analysis. Uncertainty will be considered. |