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EXHIBIT 2

June 3, 1999

RISK ASSESSMENT

OF

CREDIBLE AIRCRAFT OR MISSILE ACCIDENTS

IMPACTING

PRIVATE FUEL STORAGE LLC

INDEPENDENT SPENT FUEL STORAGE INSTALLATION

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INTRODUCTION

Any risk assessment of aircraft or missile accidents impacting a proposed Independent Spent (Nuclear) Fuel Storage Installation (ISFSI) located at 40°24'50"N and 112°47'37"W involves multiple aspects and many phases of flight operations and aerial maneuvers.

This assessment will examine all operations and activities, no matter how infrequent or remote, that could threaten the safety and security of such a facility. By exploring every possibility of even the most unlikely accident, we can identify and assess any relevant risks and make informed decisions. Aircraft operations, missile operations, routes, and procedures will all be carefully examined and assessed to ensure every possible aspect and angle is thoroughly covered

With regard to aircraft, an impact frequency evaluation is useful to determine the anticipated likelihood or frequency of an aircraft impacting a specific location or facility during a given period of time. The ISFSI site covers 820 acres, but the actual restricted area containing the spent nuclear fuel is only 99 acres. Aircraft operations must be specifically analyzed with respect to the airport environment, since arrivals and departures, to include takeoffs and landings, at airports have historically produced a higher rate of mishaps than other phases of flight. Aircraft operations should also be evaluated by category and type, since accident rates are generally lower for civilian and military large multi-engine aircraft such as commercial airliners, cargo aircraft, bombers and tankers, than smaller aircraft such as fighters, attack aircraft, trainers, and general aviation aircraft.

Weapons and ordnance such as bombs, missiles, and ammunition add an additional consideration to any risk assessment. In the event of a crash, the explosive impact of an aircraft with weapons or ordnance aboard can be significantly greater. In the event of an error or malfunction, an errant bomb or missile adds a new dimension to a risk assessment. Unmanned cruise missiles which are launched from aircraft or surface platforms merit special consideration as well, since they are dependent upon electronic guidance systems after launch rather than direct human control inputs. Risk is commonly defined as the product of the probability or likelihood of an event and the consequence or magnitude of that event integrated over all events being considered.

This risk assessment will be confined to determining the likelihood or probability of an aircraft or missile accident impacting the proposed Independent Spent (Nuclear) Fuel Storage Installation (ISFSI). Any evaluation of crash impact effects to the proposed facility are beyond the scope of this assessment.

ISSUE ONE: Heavy Jet Commercial Passenger or Transport Aircraft

Issue: Consideration of the probability of heavy-jet commercial passenger or transport aircraft crashing into an Independent Spent Fuel Storage Installation (ISFSI) located at 40°24'50"N and 112° 47'37"W.

Assessment: The Air Transport industry has steadily decreased both risk and accidents over time through improved modern equipment, better selection and training of personnel, and data collection and analysis. Despite growth of air traffic volume, studies show an "improving world trend in the fatal accident rate... for western built jet aircraft operations."[1] The United States' record is even better. From 1959 to 1996, there were 577 hull losses worldwide, of which only 154 were U.S. operations. In the last ten years there were 205 hull losses, of which only 41 were U.S. operations.[2] The United States National Transportation Safety Board (NTSB) has publicly cited "the advances we've made in transportation safety over the past few decades".[3]

In 1996 there were only 38 large air carrier "accidents" in the entire United States with an accident rate of only .28 per 100,000 flight hours.[4] (1996 investigations/data final) An aircraft accident as defined by the NTSB is an occurrence associated with the operation of an aircraft that takes place between the time any person boards the aircraft with the intention of flight until such time as all such persons have disembarked, and in which any person suffers a fatal or serious injury as a result of being in or upon the aircraft or by direct contact with the aircraft or anything attached thereto, or in which the aircraft receives substantial damage.[5] An "accident" would not necessarily even be of sufficient magnitude to pose a risk to an ISFSI. The NTSB further defines a "major" accident as one where the aircraft was destroyed or there were multiple fatalities, or there was one fatality and the aircraft was substantially damaged.[6] "Hull losses" with fatalities, which usually involve an aircraft impacting the ground and being damaged beyond repair or totally destroyed, really represent the only potential threat to the proposed ISFSI. A study by the Boeing Company concluded that the probability of a third party fatality, or an individual on the ground being killed by an airplane falling from the sky, is about one in a hundred million per year.[7] Of the 38 large air carrier accidents which occurred in the United States during 1996, only three were hull losses with fatalities. Three over the total territory (3,787,319 square miles) of the United States in a year, or one in approximately every 1,262,439 square miles, pose an inconsequential probability of a specific point impact, i.e. the proposed ISFSI site. In addition, only three hull losses with fatalities for over 12 million flying hours and over 550 billion revenue passenger miles by U.S. commercial air carriers in 1996 underscores the high level of safety and the low level of risk.[8] "In short, compared to other national aviation systems or to the world's safest road system, U.S. commercial aviation is remarkably safe."[9] In addition, our government strives for even greater improvements in the future by continually identifying potential problem areas and proactively reducing major risks that can lead to accidents, fatalities, and associated economic costs. The U.S. Department of Transportation's number one management issue is aviation safety and promoting public health and safety by working toward the elimination of transportation related deaths, injuries and property damage.[10]

There are three main flight phases which merit careful consideration. The takeoff phase includes the takeoff roll and initial climb. The in-flight phase includes the climb to cruise, cruise/in-flight, and the descent from cruise. The landing phase includes the landing approach and landing roll.

The proposed ISFSI facility location is not situated under the takeoff and departure corridor nor the approach and landing corridor of any airport. This is important since the majority of Hull Loss aircraft accidents, 23.7% and 44.6% respectively, occur during these phases of flight.[11] Climbs and descents account for only 7.3% and 6.4% respectively, while only 4.7% occur during cruise.

Salt Lake City International Airport is located 50 statute miles northeast of the proposed ISFSI site. Major runways at Salt Lake City International Airport include 16 Right/ 34 Left, 16 Left/34 Right and 17/35. The north/south alignment of the runways places the proposed ISFSI location well away from the takeoff and landing segments of flights departing and arriving Salt Lake City International Airport. The Standard Instrument Departure (SID) routes are Jazz One, Oquirrh One, Milford Two, and Fairfield Three. All three SIDs avoid the proposed ISFSI site, and departing aircraft are tracked by radar as well. Of the nation's 22 Air Route Traffic Control Centers, Salt Lake City Center ranked only number 19 of 22 for 1998 in number of aircraft handled. In 1998, the Salt Lake City International Airport Traffic Control tower logged 365,000 total (takeoffs and landings) operations. Of the 50 busiest FAA Airport Traffic Control Towers in the nation, Salt Lake City International Airport ranked only number 27 in 1998.[12]

Provo Municipal Airport is located 55 statute miles east by southeast of the proposed ISFSI site and its main runway 13/31 also places takeoff and landing traffic well away from the proposed ISFSI site.

As noted previously, only 4.7% of Hull Loss accidents occur during the cruise portion of flight. High altitude Jet Route 56 with a minimum en route altitude of 33,000 feet MSL has a designated route which passes 10 nautical miles (11.5 statute miles) north of the proposed ISFSI site. However, as with all designated high altitude jet routes, it has no specified width. For analysis purposes, it is reasonable to assume a width on the order of eight nautical miles (9.2 statute miles) given the practice of pilots to follow and track the designated course. Low Altitude Route Victor 257 runs north/south with a minimum en route altitude of 12,300 feet MSL and a width of 12 nautical miles (13.8 statute miles). It passes 17 nautical miles (19.5 statute miles) east of the proposed ISFSI site. Taking the 4.7% figure together with the distance of the ISFSI from these airways makes the odds of an aircraft falling out of the sky and crashing on the proposed ISFSI site too small to compute and so highly improbable as to even contemplate.

Conclusion: The probability of a heavy jet commercial passenger or transport aircraft crashing into an ISFSI at the proposed site is extremely remote.

ISSUE TWO: Turbine Powered Business Aviation Aircraft or General Aviation Aircraft

Issue: Consideration of the probability of a Turbine Powered Business Aviation Aircraft or General Aviation aircraft crashing into an Independent Spent Fuel Storage Installation (ISFSI) located at 40°24'50"N and 112 47'37"W.

Assessment: The proposed ISFSI site is located in a Military Operating Area (MOA), SEVIER B, which is adjacent to the airspace of Restricted Areas R6406 and R6402. Sevier B airspace extends up to 9,500' altitude. Civilian aircraft are prohibited from operating in the Restricted Areas and generally avoid flying in Military Operating Areas. R6406 and R6402 airspace both extend up to 58,000' (FL580) and both are listed as being in continuous use. The proximity of the SEVIER B MOA to the Restricted Areas makes it unlikely that Turbine Powered Business Aviation Aircraft would even transit the area and be anywhere near the proposed ISFSI site. Turbine Powered Business Aviation Aircraft generally range from the six-seat 10,400-lb. gross weight Cessna Citation jet to the dozen-seat 90,900-lb. gross weight Gulfstream V. They can also include smaller turbo prop aircraft. However, business aircraft pilots who do wish to transit the Sevier B MOA are instructed to contact Clover Control on 134.1 for range activity status. In 1996, these aircraft had 20 accidents nationwide for a fatal accident rate of .34 per 100,000 flight hours which is comparable to the 38 accidents and a rate of .28 per 100,000 flight hours for large air carriers that same year.[13]

General Aviation aircraft can, and do, occasionally transit the MOA, but records of volume of civilian aircraft flying around the Utah Test and Training Range (UTTR) are not recorded by the U.S. Air Force. The Cessna 172, a four-seat 2,500 lb. gross weight reciprocating engine-powered aircraft typifies the General Aviation category of aircraft, although some types are somewhat larger and heavier. Because of their relatively slow speed and light weight, crashes of small aircraft would not pose a significant hazard to the PFSF, in that the structures, systems, and components important to safety at the PFSF are designed so that they can withstand the impact of such aircraft. PFS has demonstrated that the PFSF can withstand Spectrum I missiles that would be produced by the design basis tornado. PFS SAR § 8.2.2.2 Such missiles include a 3,960 lb. (1,800 kilogram) automobile impacting the facility at 126 m.p.h. Id. at 8.2-17. Light aircraft, such as the Cessna 172, typically weigh about 2,500 lbs. In a crash, such aircraft typically impact the ground at 100 knots (114 mph) or less, in that the pilot is often attempting to fly the aircraft or land without engine power. Because the typical light aircraft is less massive and would impact the ground at a lower velocity than the design basis automobile in a tornado, the aircraft will impact with less energy and less momentum and hence will cause less damage than the automobile. Thus, because the PFSF is designed to withstand such an automobile impact, it can also withstand the aircraft impact.

Further, according to the NTSB, a breakdown of the 2,078 total and 419 fatal General Aviation accidents nationwide in 1995, indicates that 85 fatal accidents occurred during the cruise phase of flight, or 4.1% of the total General Aviation accidents.[14] This correlates closely to the 4.7% cruise hull loss rate of accidents experienced by large air carriers as well as their single hull loss with fatalities experienced in 1995. High risk General Aviation takeoff and landing at Salt Lake City International Airport is located far from the proposed ISFSI site. Other airports in the region at which such aircraft could land are also located far from the proposed ISFSI site. Tooele Airport is 26 statute miles east by northeast of the proposed ISFSI site; Bolinder/Tooele Valley Airport (Private) is 27 statute miles northeast of the proposed ISFSI site; Cedar Valley Airport (Private) is 40 statute miles east of the proposed ISFSI site; and Salt Lake City No.2 Airport is 45 statute miles east by northeast of the proposed site. Consequently, crashes of General Aviation aircraft will pose no significant risk to the proposed ISFSI site.

Conclusion: The probability of a Turbine Powered Business Aviation Aircraft or a General Aviation aircraft crashing into an ISFSI at the proposed site is extremely remote.

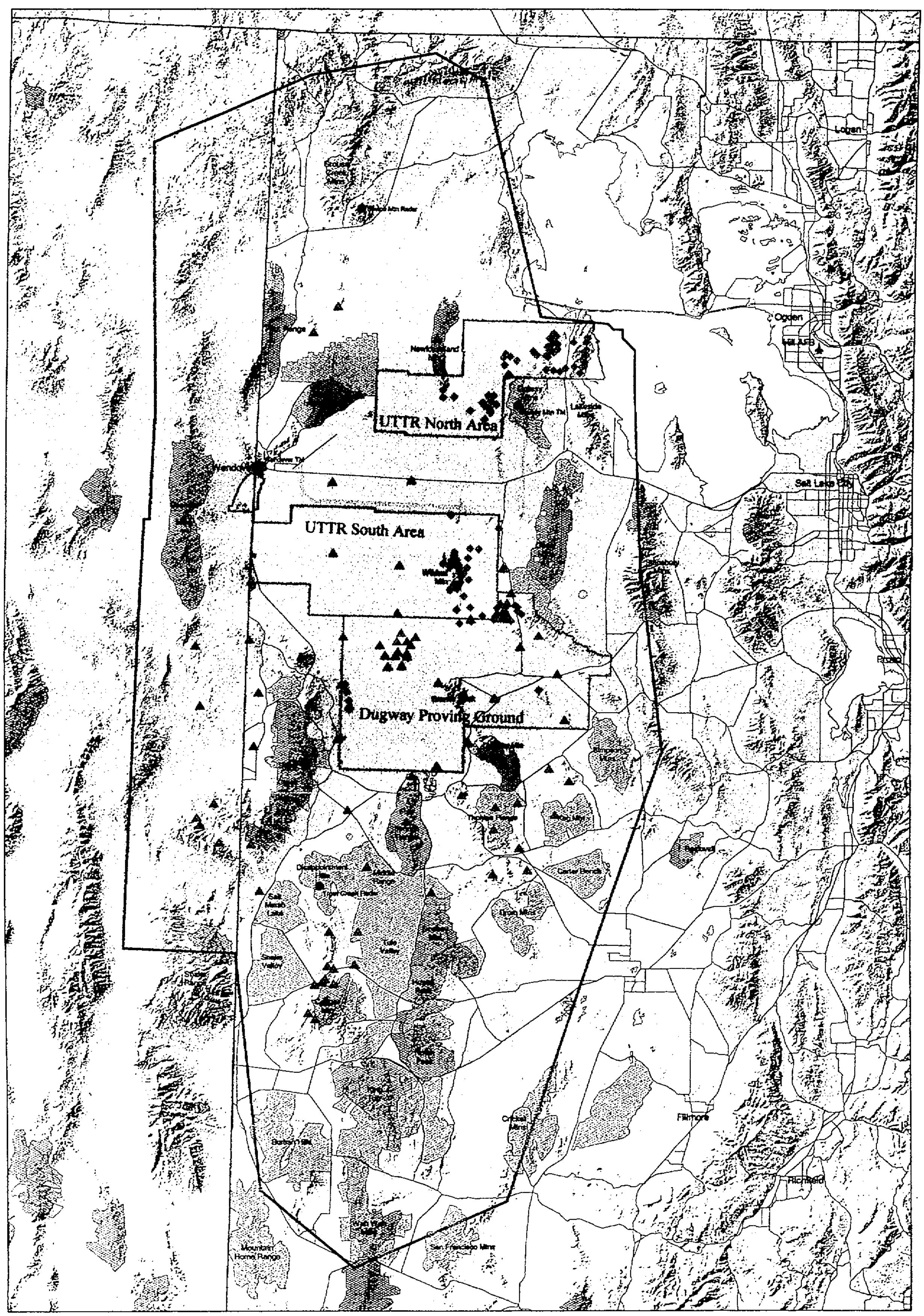
ISSUE THREE: Military Jet Fighter or Other Military Aircraft

Issue: Consideration of the probability of military jet fighter aircraft or other types of military aircraft crashing into an Independent Spent Fuel Storage Installation (ISFSI) located at 40°24' 50"N and 112°47' 37" W.

Assessment: The UTTR is used by the U.S. Air Force as a training area for simulated air-to-air combat, air-to-ground attack missions using live munitions, and testing of military ordnance. The UTTR was established in January 1979 and is located in northwestern Utah and eastern Nevada, within the Great Salt Lake Desert, approximately 70 miles west of Salt Lake City, Utah. (See map following page.) High country desert, sand dunes, mountains, and rolling hills characterize the landscape. The ever-changing seasons and the 2,800 square miles of landmass make the UTTR an ideal choice for testing airborne, air-to-ground, and ground-to-air weapon systems. The UTTR also

UTTR Military Airspace

Western Utah and Eastern Nevada



supports the Ogden Air Logistics Center shelf-life testing program for conventional munitions and provides an unparalleled arena for combat training units. Many types of Department of Defense (DOD) aircraft use the UTTR, and there are thousands of training sorties flown there each year. The proposed ISFSI site is located within the Sevier B MOA and two statute miles outside the edge of R 6402B airspace and 9 statute miles from the closest boundary of DOD owned land space.

Hill Air Force Base (AFB) is located 65 statute miles northeast of the proposed ISFSI site. An Air Operations Center (AOC) at Hill AFB is the central air traffic control and weapons control facility for the UTTR. All air traffic control radar data is displayed on the Fleet Area Control and Surveillance Facility Air Tracking System (FACTS), and all weapons control radar data is displayed on the AN/UPA-62C analog radar scope at the Hill AFB AOC. Radar data is provided at three long-range radar sites and three short-range radar sites. Radio coverage is provided at six remote sites. All data from remote sites is brought into the AOC by landline, microwave, or fiber optics. All operations in the UTTR are positively controlled and carefully monitored.[15]

F-16 fighter aircraft depart Hill AFB under positive Radar Departure Control en route to the UTTR. They are handed off to Clover Control (Range Control) and fly south passing west of Desert Peak (11,031' elevation) near the Stansbury Mountains to practice terrain masking to evade radar, approximately five miles east of the proposed ISFSI site. Clover Control is a certified air traffic control facility augmented by the 729th Air Control Squadron, with three ASR-9 short-range radar sites (Bovine Mountain, Cedar Mountain, and Trout Creek) in the UTTR. Long range radars (200 nautical miles) are located at

Francis Peak, Battle Mountain, and Cedar City. F-16's fly no lower than 1,000' Above Ground Level (AGL) as they transit Skull Valley and are normally at 3,000' to 4,000' AGL. During this phase of flight, the aircraft are not engaging in any threat reaction or tactical maneuvering but rather are simply transiting the area. There is no aggressive maneuvering until they are well south of Dugway, 15 miles south of the proposed ISFSI site.

F-16 traffic passing through Skull Valley varies, but averages approximately 10 aircraft daily. According to the U.S. Air Force, there were 3,871 Skull Valley transits in 1998, and they were almost entirely F-16 flights originating from Hill AFB. Of those, less than a quarter were actually carrying live ordnance. No combat maneuvers are performed, but clearing turns (looking for other aircraft) and "G" awareness maneuvers (range warm-up) are conducted on a routine basis. No aircraft over-flying Skull Valley are allowed to have their armament switches in a release capable mode, and all switches are "safe" until inside DOD land boundaries, which are 9 statute miles to the southwest at the closest point. The UTTR has not experienced an unintended munitions release outside of designated launch/drop/shoot boxes.[16] The boxes are at least 30 statute miles from the proposed ISFSI site. The F16's work in the south ranges. Wildcat Range is the range closest to the proposed ISFSI site where live ordnance is expended, and it is 30 statute miles west by northwest of the proposed site. No run-in headings for weapons delivery currently transit over the Skull Valley area. When the F-16's complete their work on the range, they fly north to return to Hill AFB and do not pass near the proposed ISFSI site. F-16's that work in the northern ranges are not a factor since during ingress, range work, and egress they do not pass near the proposed ISFSI site. Both Hill AFB and Michael

Army Air Field (AAF) are available for hung live ordnance recovery. Michael AAF is located 15 nautical miles (17.25 statute miles) south by southwest of the proposed ISFSI site. The F-16's use it as an emergency landing field, when required, and a recovery field for landing with a "hung bomb", i.e. live ordnance that did not release and failed to drop from the aircraft on the range. The main runway (12/30) at Michael AAF is 13,125' long and aligned southeast and northwest. Approaches and landings are usually made from the northwest to land to the southeast (Runway 12). There is also an aircraft-arresting barrier at the end of Runway 12. Consequently, there is no overflight or directional vector risk to the proposed ISFSI site with respect to emergency landings or hung ordnance recoveries at Michael AAF. Even a MK84 GP 2000 lb. Bomb (Net Explosive Weight: 945 lb.), the largest carried by the F-16, would not pose an explosive threat to the proposed ISFSI site at a distance of 15 nautical miles (17.25 statute miles) from the airfield. F-16 jettison and controlled bailout areas (Hill AFB Tactical Air Navigation/TACAN-channel 49 - 242° radial/53 nautical mile fix) are well to the west and north,45 statute miles from the proposed ISFSI site, and also pose no hazard.

Other military aircraft use the UTTR for a wide variety of training missions to include B-52's, B-1's and B-2's dropping bombs or launching cruise missiles as well as A-10's, F-18's, F-117A's and A-6's. Their activities are generally confined to the northern and western portions of the UTTR and are approximately 30 miles away from the proposed ISFSI site. Run-ins, drops, and launches are normally done from north to south or east to west and are thus directed away from the proposed ISFSI site.

The UTTR reports aircraft activity status to the FAA on a regular basis. These reports include an extensive list of aircraft that could conceivably use or transit the UTTR. These reports indicate only possible use of the airspace by the cited aircraft, and as a practical matter, the aircraft flow through Skull Valley consists almost entirely of F-16 flights originating from Hill AFB.

In the past 28 years 50 USAF fixed-wing aircraft have crashed somewhere in the state of Utah (82,076 square miles). There have been five USAF and no Army, Navy, Marine Corps or foreign aircraft accidents on the Utah Test and Training Range in the past five years. The UTTR includes 17,000 square miles of airspace and 2,800 square miles of landmass. The USAF losses in the entire state include 34 F-16's, six F-4's*, four F-105's*, two F-5's*, and one each B-52, EB-57*, F-111*, and T-38. (Asterisked aircraft are no longer flown by the U.S. Air Force). The apparently high number of F-16 crashes is a reflection of their proportionately large numbers in the USAF inventory, since they constitute slightly over half of all USAF combat aircraft. F-16 mishap rates are actually comparable to those of other fighter aircraft. The F-16 Class A Mishap rate for fiscal year 1998 was 3.89 per 100,000 flight hours. The F-16 lifetime Class A Flight Mishap rate is 4.38 per 100,000 flight hours, while the lifetime rates of the F-15A, F-15C, F-111, and F-117 are 3.65, 2.42, 6.13, and 5.71 respectively. Older fighter aircraft such as the F-86, F-100, and F-105 experienced even higher mishap rates (see chart on next page), particularly when they first entered the USAF inventory.[17] The 50 crashes in Utah are classified as USAF Class A Flight Mishaps, which means there was a fatality, a destroyed aircraft, or damage in excess of $1 million. At least 17 of these occurred within 10 miles of an airfield, so they would have posed no threat to the proposed ISFSI site, since there are no airfields, military or otherwise, within 10 miles of the site. This leaves 33 crashes in the entire state of Utah (82,076 square miles) which represents 1.18 crashes per year in the entire state. This rate is a conservative number since it includes several older aircraft that were less reliable and had higher accident rates that are no longer flying. The five F-16's that crashed during the past five years all crashed within the UTTR.

Consequently, the probability of a specific impact on the proposed ISFSI site is extremely low. Although approximately 3,900 aircraft transit Skull Valley each year, given the current routes of flight and range procedures, there is no reason to presume any significant risk to the proposed ISFSI site from a military aircraft crash. The prevailing flight pattern is along the Stonsbury Mountain, five miles east of the proposed ISFSI. Given the lack of any aggressive training maneuvers, the only likely cause of crash would be mechanical, electrical or other equipment failure. At the low altitudes at which they transit the valley (3,000 ft. to 4,000 ft. AGL), if such a failure were to occur, however, it is highly unlikely that the crash would impact the site five miles away, particularly given their flight pattern along the Stansbury Mountains not directed toward the PFSF.

Further, aircraft flying through Skull Valley will not interfere with the ISFSI communications and security systems, nor will those systems interfere with the aircraft. There is a list of specific systems and requirements for noninterference specifications used by the Department of Defense and Department of Energy. As long as systems from this list are installed in the ISFSI, there will be no interference problems with the site and aircraft in transit through Skull Valley.

Conclusion: The probability of an F-16 or other military aircraft crashing into an ISFSI at the proposed site is extremely low.

ISSUE FOUR: Michael AAF

Issue: Consideration of the probability of aircraft operating to and from Michael AAF crashing into an Independent Spent Fuel Storage Facility located at 40°24'50" North and 112°47'37" West.

Assessment: Runway designations at airports are determined by their directional alignment with respect to magnetic north. At Michael AAF, the main runways are 12 and 30. This means an aircraft approaching to land on runway 12 will be heading approximately 120° (east by southeast), and an aircraft taking off and departing will also be heading approximately 120° (east by southeast). The primary runway for instrument approaches and landings and emergency recoveries at Michael AAF is Runway 12. Runway 12, as well as Runway 30, is 13,125' long and 200' wide.

Approaches and landings for military aircraft often involve an initial approach to the runway, aligned with the landing runway, and then a turn to a downwind leg which is parallel to the runway and on a reciprocal heading from the runway direction. The aircraft then makes a descending turn to a base leg, which is 90° to the runway heading, followed by a descending turn to final approach which is aligned with the runway heading and places the aircraft in a position to land. The initial approach, downwind leg, base leg, final approach sequence is normally performed on a specified side of the landing runway, either right or left. If no side is specified the sequence is normally executed to the left. Normally known as the pattern side, any local operations such as touch-and-go practice landings are flown on that side of the runway. Since there is a concentration of traffic on one side of the runway, this would influence crash probabilities and risk assessments for the area on that side of the runway.

Crash probabilities for near airport operations at Michael AAF represent an important consideration for any risk assessment of credible aircraft accidents impacting the proposed ISFSI site, which is located 15 nautical miles (17.25 statute miles) north by northeast of Michael AAF. The Department of Energy Analysis for Aircraft Crashes into Hazardous Facilities provides useful information regarding near airport operations as they apply to Michael AAF.[18] The analysis uses the Cartesian coordinate convention with the origin at the center of the runway and the X-axis along the runway extended centerline and the positive direction being the direction of flight. The Y-axis is perpendicular to the X axis with the positive direction created by a 90° counterclockwise rotation of the positive X-axis.

The location of a facility is expressed in terms of distance (R) and bearing (θ) from the facility to the airfield. The X,Y values of the facility in the specified coordinate system are determined in the following manner:

$$X = -R\cos(\theta - \phi)$$

$$Y = R\sin(\theta - \phi)$$

Where:

R= distance from the facility

θ = bearing from the facility to the airport

ϕ= runway bearing as an angle with respect to magnetic north (runway number times ten)

Tables were prepared for the following cases:

Commercial Aircraft – Takeoff

Commercial Aircraft – Landing

General Aviation Aircraft – Takeoff

General Aviation Aircraft – Landing

Large Military Aircraft – Takeoff – Pattern side Left and Right

Large Military Airport – Landing – Pattern side Left and Right

Small Military Aircraft – Takeoff- Pattern side Left and Right

Small Military Aircraft – Landing – Pattern side Left and Right

The DOE analysis found some significant differences between where takeoff and landing crashes are expected to occur. In commercial aviation, landing crashes extend out only a mile from the end of the runway, while military landing crashes are more widespread and can occur up to 10 miles beyond the end of the runway. Takeoff crashes for military aircraft are concentrated along the extended centerline of the runway. Landing crashes for military aircraft are more spread out, simply because an aircraft that experiences difficulties and turns back to attempt recovery on the landing runway and then crashes would be considered a landing crash. Hence, military landing crashes extend up to 10 miles from the runway. It is important to note that current published instrument approach procedures for Michael AAF include a TACAN to Runway 12, Global Positioning

System (GPS) to Runway 12, Copter Non-directional Beacon (NDB) 080°, and NDB or GPS A. None of these approaches involves overflight nor directional vector risk to the proposed ISFSI site.

The most important conclusion from this portion of the DOE analysis is that the proposed ISFSI site, located 17.25 statute miles away on a magnetic bearing of 315° is outside the crash risk area of near-airport operations and at right angles (90°) from the direction of flow for takeoff and landing traffic at Michael AAF. Consequently, the proposed ISFSI site is located under neither the takeoff nor landing flight paths of the airfield, the historical location for over half of all crashes that occur. Consequently, the risk to the proposed ISFSI site by departure(takeoff) and arrival(landing) traffic at Michael AAF is minimal.

The airspace over the Dugway Proving Ground is restricted and flights into Michael AAF are on a Prior Permission Required (PPR) basis only. A military airway, IR-420, which is 10 nautical miles (11.5 statute miles) wide, passes over the proposed ISFSI site. Traffic to and from Michael AAF use this airway. IR-420 is classified as a Military Training Route and extends from 100' Above Ground Level (AGL) to 8,000'.

A safety analysis using the methods of NUREG-0800 was conducted to determine the risk and probability of an aircraft using IR-420 impacting the proposed ISFSI site. The methodology is as follows:[19]

$P = C \times N \times A/W$ where

P= Probability per year of an aircraft crashing into the proposed ISFSI site.

C= In-flight crash rate per mile

N= Number of flights per year along the airway

A= Effective area of the ISFSI site in square miles

W= Width of airway in miles

Using an in-flight crash rate of 4E-10 per mile and the number of flights per year (414) along with the area of the proposed site (0.1546 square miles) and the width of the airway 10 nautical miles (11.5 statute miles) the probability of an aircraft crashing into the proposed ISFSI site was computed to be 2.23 E-9 per year.[20] This is an extremely low probability of occurrence, well below the NUREG-0800 standard of acceptable risk, which is 1E-7 per year. Consequently, there is very low risk and a very low probability of a crash into the proposed ISFSI site by aircraft using IR-420. Based on information provided by Dugway Proving Grounds, there are currently approximately 414 flights annually at Michael AAF.[21] These include C-5's, C-141's, C-17's, C-130's, C-12's, C-21's and others. For the probability of an aircraft crash at the proposed ISFSI site to reach the minimum level of concern, the number of flights per year would have to greatly increase far above the current level. Military security, cargo airlift, and other related flights currently operating to and from Michael AAF should remain at approximately the same level with no appreciable increase in risk.

The safety analysis using the methodology of NUREG-0800 confirms the conclusions of the DOE analysis, in that the airport to proposed ISFSI distance (D=17.25 statute miles) exceeds 10 statute miles, and the number of annual flights (414) is less than 1,000 D^2

squared. Consequently, takeoff and landing traffic at Michael AAF as well as aircraft using IR-420 pose minimal risk to the proposed ISFSI site.

Conclusion: The probability of aircraft operating to and from Michael AAF crashing into an ISFSI at the proposed site is extremely low.

ISSUE FIVE: Hung Ordnance

Issue: Consideration of the probability of "hung ordnance" unintentionally or inadvertently releasing and impacting an independent spent fuel storage facility (ISFSI) located at 40°24'50" North and 112°47'37"West.

Assessment: The probability of a "hung ordnance" situation is relatively low since most aircraft do not actually carry live ordnance but instead carry training ordnance such as Bomb Dummy Units (BDU) or inert filled or empty MK82 500lb bombs. Consequently, training ordnance is not considered live ordnance. The weight of these bombs absent explosive charges pose little risk to the proposed ISFSI site. BDU-33's have ballistic characteristics similar to MK 82 bombs and carry only a small smoke charge for marking purposes. They weigh 25 pounds and are often termed the weapon of choice for training missions. According to the U.S. Air Force, only approximately 15% of the 8,711 sorties flown in Fiscal Year 1998 actually carried live ordnance. Michael AAF is the designated primary airfield for aircraft landing with live hung ordnance that has failed to release. According to the U.S. Army, there were only five hung ordnance aircraft diversions/recoveries into Michael AAF during 1998.[22] Since only approximately 15% of the aircraft sorties carry live ordnance, a total of only five hung ordnance recoveries in

1998 for a total of about 1,300 sorties (approximately 15% of 8,711) produces a probability for failing to release of approximately one in two-hundred and fifty. A failure to release does not mean there will necessarily be an inadvertent release or an inadvertent release and explosion. The UTTR has not experienced an unintended munitions release outside of designated launch/drop/ shoot boxes.[23] All of these are obviously within the UTTR and at least 30 statute miles from the proposed ISFSI site.

In the event of hung ordnance, according to the U.S. Air Force, the first priority is to maintain aircraft control and then assess the situation and take appropriate action. Pilots contact Clover Control Air Traffic Control Facility and advise them of the situation. When hung ordnance is encountered, the pilot has the option of either jettisoning the rack and munitions on the range, if able, or recovering to base. Michael AAF is the designated primary recovery base for hung ordnance, although Hill AFB is available as well. Pilots request clearance to Michael AAF for a hung ordnance recovery/landing. Pilots maintain a stable flight path and remain in Visual Meteorological Conditions by avoiding clouds. Clover Control provides assistance as required and ensures Michael AAF is prepared to receive the aircraft to include fire fighting equipment and medical personnel standing by. The pilot maneuvers the aircraft to the northwest, approximately 20 statute miles from the proposed ISFSI site, and proceeds to Michael AAF, avoiding rapid or steep turns and abrupt climbs or descents. Test facilities or any populated areas are avoided. A long straight-in approach with a shallow rate of descent is established to a full stop landing on runway 12 (to the southeast). Runway 12 is 13,125' long and 200' wide with a barrier cable at the end. After landing, Dugway Proving Ground Explosive Ordnance Disposal personnel inspect and safe the bombs.

Based on information provided by the U.S. Air Force, the UTTR has not experienced an unintended munitions release outside the designated launch/drop/shoot boxes within the UTTR. In addition, aircraft overflying the Skull Valley are not allowed to have their armament switches in a release capable mode. All switches are "Safe" until inside Department of Defense (DOD) land boundaries within the UTTR. Master Arm switches are not actually armed until the aircraft are on the ranges within the UTTR where the bombs are to be dropped.[24] In addition, each weapon tested on the UTTR has a run-in heading established during the safety review process. Footprints, time of fall, altitude at release and release airspeed dictate the headings allowed. No run-in headings are currently over the Skull Valley area.

Conclusion: Since there have not been any unintentional releases of live ordnance in Skull Valley or at the Skull Valley reservation, and technological improvements, weapons reliability and training have improved over time and will continue to do so, the probability of either event occurring is extremely low.

ISSUE SIX: Missiles

Issue: Consideration of the probability of a missile impacting an Independent Spent Fuel Storage Installation (ISFSI) located at 40°24'50"North and 112°47'37"West.

Assessment: Since January 1, 1983, 21 missiles have been lost in class A mishaps in the state of Utah (89,904 square miles). These included 12 AGM-86's (conventional air launched cruise missile), 4 BGM-109's* and 4 AGM-124's (advanced cruise missile).

(Asterisked missiles are no longer used.) One LGM-30 (Minuteman ICBM) was damaged during ground movement.[25]

At least 10 of these missiles impacted within the confines of the Utah Test and Training Range and four crashed within three minutes of launch. Of the five missiles lost over the past five years, only one carried a live warhead. None impacted anywhere near the proposed ISFSI site. There are approximately six cruise missile launches per year. Missile launches are generally confined to the northern and western portions of the UTTR and are at least 30 statute miles away from the proposed ISFSI site. Run-ins, drops, and launches are normally done from north to south or east to west and are thus directed away from the proposed ISFSI site.

Weapon systems that have a capability of exceeding range boundaries are required to have a Flight Termination System (FTS) installed prior to testing on the UTTR. The FTS systems are designed to destruct the weapons and terminate the weapon flight path, on command, in the event of a weapon anomaly. Before a bomber launches a test cruise missile, the Mission Control Center verifies that the missile's remote control and flight control systems are working properly. At all times throughout the flight the cruise missile FTS must detect a signal that in effect permits the missile to keep flying. If the missile does not detect the signal for a preset time, the FTS activates. Safety officers can also activate the FTS, if required, at any time. The Range Safety Officer at Mission Control and the Airborne Range Instrumentation Aircraft are also both capable of terminating missile flight almost immediately. The UTTR has never experienced a FTS failure.[26]

Conclusion: The probability of a missile crashing into an ISFSI site at the proposed site is extremely low.

ISSUE SEVEN: X-33

Issue: Consideration of the probability of the X-33, a suborbital prototype for a single stage-to-orbit launch vehicle space plane, utilizing Michael AAF, crashing into an Independent Spent Fuel Storage Installation (ISFSI) located at 40°24'50"North and 112°47'37"West.

Assessment: The X-33 is an unmanned half-scale demonstrator launch vehicle planned to test critical components for the next generation space transport system. The planned test program consists of five flights during a six-month time period starting in December 1999. The flights will originate from Edwards AFB, CA, and land at Michael AAF. X-33 Gross Lift Off Weight (GLOW) is estimated to be 285,000lbs and empty weight, 75,000 lbs or 26% of GLOW. The planned approach is to enter the UTTR airspace R 6402 at 60,000' from the southwest. Once overhead Michael AAF it will initiate a descent turning north and continue turning until lined up on Runway 12 which is 13,125' long. Turn radius is estimated at 4-6 miles.[27] The X-33 will not fly over Skull Valley. Therefore, the approach pattern and landing would pose no overflight nor directional vector risk to the proposed ISFSI site. Most fuel would be expended by the time of landing. Once on the ground, the X-33 will be purged of any remaining fuels and oxidizers and readied for truck transport back to Edwards AFB, CA. Once these five flights are completed, the second phase consists of two flights from Edwards AFB to Malmstrom AFB, MT.

Conclusion: The probability of the X-33 crashing into an ISFSI at the proposed site is extremely low.

SUMMARY CONCLUSION

Since 1960, the annual accident rate for U.S. air carriers has decreased from 1.84 accidents per100,000 flight hours to less than 0.39, yet over the same period, total scheduled airline departures have increased from 3.9 million per year to 11.7 million per year and the number of passengers has increased from 62 million per year to 605 million per year.[28] Airline travel in the United States is the safest in the world, and it has been getting safer over the years. Stated another way, the National Safety Council cites a death rate of 0.04 per hundred million passenger miles in 1994, the most recent year for which the Council has published this calculation. The same rate for passenger automobiles was 0.86, over 21 times greater.[29] U.S. major air carriers completed 1998 by flying over 615 million passengers with no hull loss accidents and not a single passenger fatality. More specifically, no passenger died in an accident involving any type of U.S. commercial airplane anywhere in the world...this appears to be the first year since the dawn of commercial aviation for such an achievement.[30]

The Federal Aviation Administration's preliminary 1998 civil aviation accident statistics reflect remarkable achievements as well as promising trends. There were 48 Federal Aviation Regulation (FAR) Part 121 Accidents, (domestic, flag, and supplemental air carriers and commercial operators of large aircraft) in 1998, down from 49 in 1997. Only one of these accidents was fatal, down from four in 1997. There were no passenger fatalities in 1998, although one ramp worker was killed. There were a total of eight fatalities in 1997.

There were 8 FAR Part 135 Commuter Accidents in 1998, down from 17 in 1997. None of the accidents in 1998 were fatal; there were 5 fatal accidents in 1997 with 46 fatalities. All of the commuter accidents in 1998 occurred in Alaska. There were 79 FAR, Part 135 Air Taxi Accidents in 1998, down from 1997 when there were 82 accidents. Seventeen of the 1998 accidents were fatal, two more than in 1997. Fatalities were up slightly from 39 in 1997 to 45 in 1998. Thirty-four of these accidents occurred in Alaska. [31] This constitutes an amazing achievement and a tribute to the impressive advances in aviation technology and reliability as well as the recruitment of top quality aviation professionals and vastly improved training.

General Aviation has also made remarkable improvements in safety. Accidents and fatal accidents have declined for the past two years while General Aviation hours flown have increased.[32] 1998 statistics are not yet totally complete, but in 1997 General Aviation had the lowest accident rate for fatal accidents since 1982.[33] In addition, the number of fatalities has also decreased from 660 in 1997 to 621 in 1998.

The U.S. Air Force finished 1998 with the second safest year in their history. Their 1991 mishap rate of 1.11 Class A Flight Mishaps per 100,000 flight hours has been the best year in Air Force history, but there were actually more Class A Flight Mishaps (41) in that year than in 1998 (24). The high number of flight hours associated with Desert Shield/Storm drove the 1991 mishap rate down. With significantly less flight hours in

1998, that year's rate exceeded the 1.11 rate even though the number of mishaps was significantly less. The Class A Flight Mishap rate for the U.S. Air Force for 1998 was 1.14 per 100,000 flight hours.[34]

To underscore the impressiveness of this achievement, the U.S. Air Force Class A Flight Mishap rate was 10.4 in 1958, 3.9 in 1968, 2.93 in 1978 and 1.64 in 1988.[35] The numbers and the trend speak for themselves. This is an amazing achievement and indicative of remarkable technology and reliability advances in equipment and improved human performance due to selection and training.

The U.S. Army had a Class A Flight Mishap rate of 1.63 for 1998.[36] The U.S. Navy Class A Flight Mishap rate for 1998 was 2.32. The U.S. Marine Corps Class A Flight Mishap rate for 1998 was 2.52, which was their second best year ever.[37] The entire Department of Defense, considered in total, finished 1998 with a Class A Flight Mishap rate of 1.6 mishaps per 100,000 flight hours, which makes 1998 the fourth safest year in DOD's history.

Historically, about two thirds of aircraft fatal and hull loss accidents occur near airports, mostly during approach and landing, while less than 5 percent of hull loss accidents happen during cruise.[38] In addition, landing accidents account for over half of the total number of accidents.[39] Because of the proposed ISFSI site distance from airports, only the cruise risk applies, and that is minimal. Careful planning, positive control procedures, and Flight Termination Systems minimize the missile risk as well. Considered individually and in total the risk and probability of an aircraft or missile accident impacting the proposed ISFSI site are minimal. The phenomenal advances in technology and great improvements in training across the board in civilian and military aviation have significantly decreased risk and the probability of accidents across the entire spectrum of aviation. The future promises even greater improvements, which should continue to drive down risk and decrease the probability of accidents.

Careful examination of all air operations in the vicinity of the proposed ISFSI site has disclosed no significant risks that would preclude construction of such a site. Fully subscribing to the commendable goal of "Zero Accidents" means carefully examining every angle and every aspect of all operations and activities and identifying and assessing every possible risk. Only then can one discern any compelling arguments to recommend for or against a particular course of action. This assessment has done just that in the case of the proposed ISFSI site, and found no compelling argument to prohibit construction of such a facility on the selected location.

NOTES:

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[2] Statistical Summary of Commercial Jet Airplane Accidents, 1959-1996 Boeing Commercial Airplane Group. Seattle, Washington 98124, U.S.A. June 1997. Page11.

[3] We Are All Safer, National Transportation Safety Board, Washington, DC 20594, July 1998, page 3.

[4] FAA Administrator's Handbook. U.S. Department of Transportation. The Federal Aviation Administration, Washington, DC 20591, March 1999, Page 4.

[5] National Transportation Safety Board, Article 830, SUBPART A Definitions, page 865. National Transportation Safety Board, Washington, DC 20594

[6] National Transportation Safety Board Accident Classifications, WWW.NTSB.GOV.NTSB, Washington, DC 20594

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[10] Top Ten Management Issues, Office of the Inspector General, Department of Transportation, Report Number TW-1000-031, December 9, 1998 page 1-1.

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[12] FAA Administrator's Handbook, March 1999, page 12.

[13] "Turbine Powered Business Aviation Aircraft Accidents", Aviation Data Service, Wichita, Kansas, 67201. March 10, 1999.

[14] Annual Review of Aviation Accident Data. U.S. General Aviation, CY 1995 "Phases of Operation in all Accidents and Fatal Accidents." National Transportation Safety Board Report, NTSB, Washington, DC 20594, 1999.

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19. U.S. Nuclear Regulatory Commission Standard Review Plan, NUREG 0800, Office of Nuclear Reactor Regulation, Washington, DC 20555, pages 3.56-3-3.5.16-4.

20. Ibid.

21. Letter, Lt. Col. F. Gil Brunson, USA Command Judge Advocate, U.S. Army Dugway Proving Ground, Utah, to Mr. John Donnell, Project Manager, Stone & Webster Engineering Corp., April 2, 1997.

22. Letter, Lt. Col. F. Gil Brunson, U.S.A, Command Judge Advocate U.S. Army Dugway Proving Ground, Utah, to James L. Cole, Jr. Brig Gen., USAF, (Ret.), January 25, 1999.

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24. Ibid.

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27. "X-33 Contingency Operations Plan" Michael AAF, UT, provided by 388 Fighter Wing Hill AFB, UT 84056. Response to FOIA Request December 18, 1998.

28. Mission performance indicators, <u>Federal Aviation Administration Annual Report for 1996</u>, Federal Aviation Administration, Washington, DC 20591, page 7.

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30. "Airlines have 615 million passengers in 1998, no deaths," Washington Times, January 7, 1999.

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APPENDIX A

Extracted from Department of Energy Standard
Accident Analysis for Aircraft Crash Into Hazardous Facilities, October 1996, U.S. Department of Energy(DOE STD-3014-96, Appendix B) Washington, D.C. 20585

<u>Aircraft crash rates by category, subcategory and flight phase</u>

Aircraft	Crash Rate (P)	
	Takeoff (per takeoff)	Landing (per landing)
General Aviation		
1. Fixed Wing Single Engine Reciprocating	1.1E-5	2.0E-5
2. Fixed Wing Multiengine Reciprocating	9.3E-6	2.3E-5
3. Fixed Wing Turboprop	3.5E-6	8.3E-6
4. Fixed Wing Turbojet	1.4E-6	4.7E-6
Representative Fixed Wing	1.1E-5	2.0E-5
Representative Helicopter[1]	2.5E-5	See note 1
Commercial		
1. Air Carrier	1.9E-7	2.8E-7
2. Air Taxi	1.0E-6	2.3E-6
Military		
5. Large Aircraft[2]	5.7E-7	1.6E-6
6. Small Aircraft[3]	1.8E-6	3.3E-6

[1] Helicopter crashes are considered on a per-flight basis and are reported under takeoff for convenience.

[2] Large military aircraft includes bombers, cargo aircraft and tankers.

[3] Small military aircraft includes fighters, attack aircraft and trainers.

APPENDIX B

Extracted from Department of Energy Standard
Accident Analysis for Aircraft Crash into Hazardous Facilities, October, 1996
U.S. Department of Energy (DOE-STD-3014-96, Appendix B) Washington, DC 20585

Site	Air Carrier	Air Taxi	Large Military	Small Military
Maximum	2E-6	8E-6	7E-7	6E-6
Minimum	7E-8	4E-7	6E-8	4E-8
Average CONUS	4E-7	1E-6	2E-7	4E-6
Argonne National Laboratory	7E-7	4E-6	9E-8	8E-7
Brookhaven National Laboratory	2E-6	8E-6	7E-7	2E-7
Hanford	1E-7	1E-6	1E-7	4E-8
Idaho National Engineering Laboratory	7E-8	4E-7	9E-8	7E-7
Kansas City	4E-7[1]	1E-6[2]	2E-7	1E-6
Los Alamos National Laboratory	2E-7	3E-6	1E-7	5E-6
Lawrence Livermore National Laboratory	5E-7	2E-6	2E-7	3E-6
Mound	6E-7	3E-6	1E-7	2E-6
Nevada Test Site	5E-7	2E-6	2E-7	6E-6
Oak Ridge National Laboratory	6E-7	2E-6	1E-7	6E-7
Pantex	2E-7	3E-7	1E-7	5E-6
Pinellas	4E-7	1E-6	2E-7	4E-6
Rocky Flats	2E-7	6E-7	9E-8	9E-7
Sandia National Laboratories	2E-7	3E-7	1E-7	5E-6
Savannah River Site	6E-7	2E-6	1E-7	6E-7

[1] The Average CONUS was used for these sites.

[2] The Average CONUS was used for these sites.