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An Employee-Owned Company

Tooele Chemical Agent Disposal Facility Quantitative Risk Assessment

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.nodeling. Table 5-8 shows these combinations. The complete APET logic for seismic events is included in appendix L.

5.2 Site-Specific Aircraft Crash Frequency Estimate

Aircraft crashes at TOCDF or its chemical agent storage area could result in the release of large quantities of agent. These releases could pose significant hazards to the health of onsite (TOCDF) workers, depot workers, or the surrounding public population. To address the potential for agent release from an aircraft crash, accident sequences were defined and their initiating frequencies estimated.

5.2.1 Aircraft Hazards. Aircraft crashes into agent-containing structures pose a hazard due to the potential for agent release and dispersion that could result in health consequences for the public or site workers. Damage to agent-containing structures

Table 5-8. Seismic Structure Failure Combinations Modeled in the QRA

	Median Capacity Values (PGA)			
Failure Combination	CHB/UPA	CHB	MPF	LPG
CHB/UPA fails alone	0.26	—	—	—
CHB fails alone	—	0.49	—	—
MPF fails alone	—	—	0.40	
LPG tank fails alone	—	—	—	0.70
CHB/UPA and CHB both fail	0.26	0.49	—	—
CHB/UPA and MPF both fail	0.26	—	0.40	—
CHB/UPA and LPG both fail	0.26	—	—	0.70
CHB and MPF both fail	—	0.49	0.40	—
CHB and LPG both fail	—	0.49	—	0.70
CHB/UPA and CHB and MPF all fail	0.26	0.49	0.40	—
CHB/UPA and MPF and LPG all fail	0.26	—	0.40	0.70
CHB/UPA and CHB and LPG all fail	0.26	0.49	—	0.70

could result from the direct impact of the aircraft on the structure or from impacts of high speed missiles such as aircraft engines. Furthermore, fires could result from the large quantity of fuel potentially carried by the aircraft.

The analysis of aircraft risk at the TOCDF and its storage area was based on the U.S. Nuclear Regulatory Commission's *Standard Review Plan*, NUREG-0800 (USNRC, 1981) updated for the results of the draft DOE Aircraft Crash Risk Analysis Methodology (ACRAM) (DOE, 1996). Because greater potential for structural damage exists when larger aircraft are involved, aircraft statistics were gathered based on size. This allowed separate frequencies to be calculated for large (i.e., commercial air carriers and military bombers), medium (i.e., commercial air taxis, military attack planes, and general aviation jets), and small (i.e., other general aviation planes and helicopters) aircraft. Assignment of consequences appropriate to each aircraft size was then possible.

For commercial and military aviation, the in-flight portion of the crash frequency is calculated for each aircraft type using the following formula:

$$\frac{F_j}{A_j} = \frac{C_j N_j}{w} \quad \text{for } j = 1,\ldots,M \qquad (5\text{-}3)$$

where F_j/A_j = frequency per unit area for the j-th aircraft type, occurrences per year per square mile (yr^{-1}-mi^{-2})

M = number of types of aircraft

C_j = in-flight crash rate for aircraft type j, occurrences per mile

w = width of the airway in miles (twice the distance from the edge of the airway to the site is added when the site is located outside the airway)

N_j = number of flights of aircraft type j along the airway.

The value for C, the in-flight crash rate per mile, has been calculated for commercial and military aircraft based on actual crash data as part of the DOE ACRAM study (DOE, 1996). The values are presented in table 5-9. As discussed in the following paragraphs, the values for N and w were obtained from aviation maps and interviews with regional representatives from the Federal Aviation Administration (FAA). Values of A were based on physical sizes of the facility and storage area.

Table 5-9. In-Flight Crash Rates for Commercial and Military Aviation

Aviation Type	In-Flight Crash Rate, per mile (C_i)
Commercial Aviation	
Air Carriers	2.2×10^{-10}
Air Taxis	2.7×10^{-8}
Military Aviation	
Cargos, Bombers, etc.	1.9×10^{-9}
Attack Planes, Trainers, etc.	1.7×10^{-8}

For general aviation and helicopters, the DOE ACRAM study generated a computer program that accepts as input the latitude and longitude of the site and returns the frequency per unit area per year. The computer program represents a fit to actual crash locations for the continental United States.

Data for aircraft traffic near TOCDF was obtained from interviews with personnel at the Salt Lake City Air Traffic Control Tower (ATCT) (Hess, 1994; Bayley 1995) and from a survey of high- and low-altitude aeronautical charts (USGFIP, 1994a; NOAA, 1994a) (see figures 5-30 to 5-32).

Initial screening against the flight density criteria discussed in appendix I showed that aviation usage in the vicinity of TOCDF failed to satisfy one of the three screening

criteria. The in-flight proximity criterion is failed in two ways: 1) a low-altitude federal airway, V257, has its nearest edge within 2 miles of the site, and 2) Salt Lake City International Airport standard instrument departure (SID) and standard arrival routes (STAR) direct aircraft near TOCDF (see figure 5-30). These activities required that a more detailed analysis be performed.

5.2.1.1 Calculation of Aircraft Crash Frequency per Unit Area. This section discusses the use of site-specific data for in-flight operations, takeoffs and landings, and special use airspaces to evaluate aircraft crash frequencies per unit area.

5.2.1.1.1 In-Flight Operations. Survey of a 10-nautical-mile radius around TOCDF identified one route: V257. V257 is a low-altitude instrument flight rule (IFR) route with a width of 12 nautical miles (13.8 miles). Its nearest edge passes 2 miles west of TOCDF (see figure 5-31).

Although holding patterns do not bring aircraft close to the facility, Salt Lake City International Airport SIDs and STARs direct aircraft through Rush Valley and, therefore, over the TOCDF site. Due to these flight patterns, the FAA representative from the Salt Lake City control tower estimated that 15 percent of the total instrument operations at Salt Lake City International Airport pass over the site.

Visual flight rule (VFR) traffic near TOCDF is limited by a notice to pilots appearing on the VFR sectional map indicating the aircraft should stay clear of DCD. Rather than assume that all VFR traffic maintains an adequate distance from the site, an estimate for VFR traffic is made based on the computer program developed as part of the DOE ACRAM study. The program was run with the latitude and longitude coordinates of the TOCDF to obtain the crash frequency per unit area per year for general aviation aircraft and helicopters. The split between medium (i.e., jets) and small (i.e., all others) general aviation aircraft was assumed to be 20 percent medium to 80 percent small.

Aviation activity in the vicinity of the depot does not occur on well-defined airways. As a result, an equivalent airway width was defined. Aircraft flying under IFR on SIDs or