CHAPTER 3

DESIGN OF STRUCTURES, COMPONENTS, EQUIPMENT, AND SYSTEMS

TABLE OF CONTENTS

Section	Title	Page
3.5.1.6	Aircraft Hazards	3.5-1
3.5.1.6.1	Airports	3.5-1
3.5.1.6.2	Military Airports and Routes	3.5-1
3.5.1.6.3	Airways	3.5-2
3.5.1.6.4	References	3.5-4

LIST OF TABLES

Number	Title
3.5-1	Comparison of Projected Operations to Screening Limit for Nearby Airports
3.5-2	Two-Mile Screening of Airways from the PSEG Site
3.5-3	DOE Input Values for CONUS Average
3.5-4	Calculated Effective Areas
3.5-5	Probability per Year of an Aircraft Crash for Each Reactor Technology
3.5-6	Small Aircraft Resultant Probability Determination
3.5-7	Five-Mile Screening of Low-Level Military Training Routes from PSEG Site
3.5-8	Flight Traffic per Year on the Low-Level Military Training Routes near the PSEG Site

LIST OF FIGURES

Number	Title
None	

CHAPTER 3

DESIGN OF STRUCTURES, COMPONENTS, EQUIPMENT, AND SYSTEMS

3.5.1.6 Aircraft Hazards

Airports and airways near the PSEG Site are discussed in Subsection 2.2.2 and shown in Figure 2.2-2. Aircraft hazards related to these airports and airways are evaluated in this section in accordance with NUREG-0800, *Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plant: LWR Edition*, to show that the hazards do not meet the NUREG-0800 Section 3.5.1.6 criteria and are not incorporated into the plant design basis.

3.5.1.6.1 Airports

Plant-to-airport distance (D) is evaluated for each airport or helipad against its projected annual number of operations for distances between five and ten statute miles and distances greater than ten statute miles to determine whether the hazard probability requires further evaluation.

There are eight airports and helipads within five to ten miles of the new plant. Additionally, the Salem/Hope Creek helipad is located within five miles of the new plant and exists for corporate and emergency use. These facilities are listed in Table 2.2-11. The annual number of operations for each of these is described as sporadic. Due to the infrequent nature of these operations, these facilities do not present a safety hazard to the PSEG Site. There are no airports within five miles of the PSEG Site.

Table 2.2-11 lists six airports ten to thirty miles from the new plant along with the projected number of annual operations for the year 2025, where available. The hazard probability for these airports is considered acceptable if the projected annual number of operation is less than 1000 D^2. The screening limits are listed in Table 3.5-1. None of these airports require additional hazard probability evaluations, as the projected number of operations for each airport does not exceed the respective screening limit.

3.5.1.6.2 Military Airports and Routes

New Castle County Airport is the closest facility with military operations (Air National Guard), and it is located 14.5 mi. northeast of the site. The closest dedicated military facility is Dover Air Force Base, located 23.8 miles from the site. The method of calculating hazard probabilities of these facilities are discussed in Subsection 3.5.1.6.3.

The closest military training routes (MTRs) are six slow speed low-altitude MTRs (SR800, SR805, SR844, SR845, SR846, and SR847). These MTRs are used by the Delaware Air National Guard (DANG). The nearest edge of these MTRs is located within approximately five statute miles of the PSEG Site (see Table 3.5-7). The annual traffic for these six MTRs is provided by the DANG and shown in Table 3.5-8. Military training route VR1709 is located 37 miles from the plant. The flight data for this route is not available from the Federal Aviation Administration (FAA) to verify that the number of flights does not exceed 1000 per year.

However, the distance from the PSEG Site to the nearest edge of any military base and MTR VR1709 significantly exceeds the five statute miles stated in the NUREG-0800, Section 3.5.1.6, acceptance criteria. Therefore military flight operations on VR1709 do not present a safety hazard to the PSEG Site.

3.5.1.6.3 Airways

Any federal airway, holding pattern, or approach pattern with a nearest edge greater than 2 statute miles from the PSEG Site is screened out from requiring additional hazard probability evaluations per the NUREG-0800 Section 3.5.1.6, acceptance criteria.

A review of public airports within twenty miles of the PSEG Site indicates that there are no holding or approach patterns within two miles of the PSEG Site.

Figure 2.2-2 shows six airways (federal and jet) and their corresponding centerlines within ten miles of the PSEG Site center. Each airway is conservatively evaluated from its nearest edge to the edge of the PSEG Site, which is two-tenths of a mile from the PSEG Site center. As listed in Table 3.5-2, three of the identified airways (V123-312, V29 and J42-150) are within the two-mile screening criteria, thus a detailed review is performed.

NUREG-0800, Section 3.5.1.6, Item III.2 provides a method for estimating the probability per year of an aircraft crashing into the plant.

The number of flights per year along airways centered within ten miles of the new plant and its breakdown into aircraft type was requested from the FAA to complete SRP Item III.2 methodology. The FAA response does not contain the number of flights per year from military aircraft and from non-military aircraft for each airway. The response contains radar hits on a 20-nautical mile grid centered on the site. This defeats the purpose of evaluating each airway separately, because several airways overlap in this grid area. The FAA also provided the flight plan data for each of the airways. However, a comparison of the flight plan data to the radar-hit data indicates that the flight plan data is incomplete. Discussions with the FAA confirm that the flight plan data is not complete and therefore is not used for the analysis.

Due to the unavailability of specific information required to perform the analysis using the NUREG-0800, Section 3.5.1.6, formula, an alternate methodology outlined in Department of Energy (DOE) Standard DOE-STD-3014-96 (Reference 3.5-1) utilizing crash rates for non-airport operations is used for each of the four reactor technologies under consideration.

The non-airport crash impact frequency evaluation is determined from Reference 3.5-1 using the following “four-factor formula”:

$$Fj = NjPjfj(x,y)Aj \qquad \text{(Equation 3.5-1)}$$

Where:

F_j = crash impact frequency
j = each type of aircraft suggested in the DOE Standard
N_jP_j = expected number of in-flight crashes per year
$f_j(x,y)$ = probability, given a crash, that the crash occurs in a 1-square-mile area surrounding the facility
A_j = effective plant area

Tables B-14 and B-15 of DOE-STD-3014-96 provide $N_jP_jf_j(x,y)$ values applicable for specific DOE sites. In addition, DOE-STD-3014-96 also includes crash probabilities for unspecified locations in the Continental United States (CONUS) in Tables B-14 and B-15 of that document. Therefore, CONUS Average values are used for the new plant and are listed in Table 3.5-3. (Reference 3.5-1)

The effective plant area (A_j) for the new plant depends on the length, width, and height of the facility, as well as the aircraft's wingspan, skid distance, and impact angle as explained below: (Reference 3.5-1)

$$A_j = A_f + A_s \qquad \text{(Equation 3.5-2)}$$

Where:

$$A_f = (WS + R) \cdot H \cdot \cot\Phi + (2 \cdot L \cdot W \cdot WS) / R + L \cdot W \qquad \text{(Equation 3.5-3)}$$

And:

$$A_s = (WS + R) \cdot S \qquad \text{(Equation 3.5-4)}$$

Where:

A_f = effective fly-in area
A_s = effective skid area
WS = aircraft wingspan (Table 3.5-3)
R = length of the diagonal of the facility = $(L^2 + W^2)^{0.5}$
H = facility height, facility-specific
$\cot\Phi$ = mean of the cotangent of the aircraft impact angle (Table 3.5-3)
L = length of facility, facility-specific
W = width of facility, facility-specific
S = aircraft skid distance (mean value) (Table 3.5-3)

The total effective areas for each reactor technology are provided in Table 3.5-4.

Crash impact probabilities for the five aircraft types are added to determine the overall probability for small and large aircraft. Small aircraft consist of air taxis, general aviation and small military. Large aircraft consist of air carriers and large military. Results of this analysis are listed in Table 3.5-5 for small and large aircraft.

The NUREG-0800, Section 3.5.1.6, acceptance criteria for aircraft accident probability of occurrence that could lead to radiological consequences in excess of 10 CFR 100 exposure guidelines is less than an order of magnitude of 1E-07 per year. The analysis determined that large aircraft meet the NUREG-0800, Section 3.5.1.6, acceptance criteria. The calculated crash probability for large aircraft is less than 1E-07 for all reactor technologies.

The calculated crash probability for small aircraft alone does not meet the NUREG-0800, Section 3.5.1.6, acceptance criteria for each of the reactor technologies. However, the potential for a small aircraft crash to cause a radiological release is much less than for large aircraft. The crash probabilities for each reactor technology are used to conservatively determine the core damage frequency (CDF) caused by a small aircraft crash. The resultant CDFs (Table 3.5-6) for each of the reactor technologies meet the NUREG-0800, Section 3.5.1.6 acceptance criteria of less than 1E-07.

3.5.1.6.4 References

3.5-1 DOE-STD-3014-96, “Accident Analysis for Aircraft Crash into Hazardous Facilities,” U.S. Department of Energy, October 1996, Reaffirmed May, 2006

Table 3.5-1
Comparison of Projected Operations to Screening Limit for Nearby Airports

Airport	Listed Distance (miles)	Number of Operations (Year 2025)	Screening Limit = 1000*D^2
Summit Airport	10.4	77,819	108,160
New Castle Airport	14.5	108,881	210,250
Delaware Airpark	17.2	53,697	295,840
Dover Air Force Base	23.8	123,735 [(a)]	566,440
Millville Airport	25.4	42,610	645,160
Philadelphia International Airport	32.2	696,178	1,036,840

a) Number of operations is provided for the year 2007.

Table 3.5-2
Two-Mile Screening of Airways from the PSEG Site

Airway	Distance from Airway Centerline to PSEG Site Center	Distance from Airway Centerline to PSEG Site Edge	Airway Width	Distance from edge of airway to site edge
	miles[(a)]	miles[(a)]	miles[(a)]	miles[(a)]
V123-312	0.5	0.3	9.2	(b)
V29	1.1	0.9	9.2	(b)
V157	7.1	6.9	9.2	2.3
V213	9.4	9.2	9.2	4.6
J42-150	0.8	0.6	11.5	(b)
J191	9.7	9.5	11.5	3.8

a) statute miles
b) PSEG Site is within the airway width

Table 3.5-3
DOE Input Values for CONUS Average

$N_jP_jf_j(x,y)$ Values

	NjPjfj(x,y) Value[a] ($1/mi^2$)
Air Carrier	4E-7
Air Taxi	1E-6
General Aviation	2E-4
Small Military	4E-6
Large Military	2E-7

Effective Area Input Values

	WS[b] (ft.)	cotΦ[c]	S[d] (ft.)
Air Carrier	98	10.2	1440
Air Taxi	59	10.2	60
General Aviation	50	8.2	60
Small Military	110	10.4	447
Large Military	223	9.7	368

a) Reference 3.5-1, Tables B-14 and B-15
b) Reference 3.5-1, Table B-16
c) Reference 3.5-1, Table B-17
d) Reference 3.5-1, Table B-18

Table 3.5-4
Calculated Effective Areas (sq. mi.)

	AP1000	ABWR	US-APWR	U.S. EPR
Air Carrier	5.29E-02	1.05E-01	1.08E-01	1.48E-01
Air Taxi	2.86E-02	4.30E-02	6.04E-02	6.81E-02
General Aviation	2.27E-02	3.51E-02	4.88E-02	5.61E-02
Small Military	4.02E-02	6.75E-02	8.25E-02	1.01E-01
Large Military	4.89E-02	8.13E-02	9.86E-02	1.21E-01

Table 3.5-5
Probability per Year of an Aircraft Crash for Each Reactor Technology

AP1000[(a)]		ABWR		US-APWR		U.S. EPR	
Small Aircraft	Large Aircraft	Small Aircraft	Large Aircraft	Small Aircraft	Large Aircraft	Small Aircraft	Large Aircraft
4.74E-06	3.12E-08	7.33E-06	5.85E-08	1.01E-05	6.65E-08	1.17E-05	9.36E-08

a) For AP1000, calculated probability is for a single unit. PSEG is considering construction of dual units for this reactor technology at the PSEG Site.

Table 3.5-6
Small Aircraft Resultant Probability Determination

Reactor Technology	AP1000[(a)]	ABWR	US-APWR	U.S. EPR
Small Aircraft Crash Probability	4.74E-06	7.33E-06	1.01E-05	1.17E-05
CDF Probability	2.77E-13[(b)]	2.33E-08[(b)]	2.2E-08[(b)]	1.03E-08[(b)]

a) For AP1000, calculated probability is for a single unit. PSEG is considering construction of dual units for this reactor technology at the PSEG Site.
b) Less than NUREG-0800, Section 3.5.1.6 acceptance criteria of 1E-07.

Table 3.5-7
Five-Mile Screening of Low-Level Military Training Routes from PSEG Site

Low-Level Military Training Route (MTR)	Distance from MTR Centerline to PSEG Site Center (mi.)	Distance from MTR Centerline to PSEG Site Edge (mi.)	Distance from MTR Edge to MTR Centerline (mi.)	Distance from Edge of MTR to Site Edge (mi.)
SR800	7.75	7.55	3.45	4.10
SR805	5.90	5.70	3.45	2.25
SR844	6.62	6.42	4.6	1.82
SR845	4.84	4.64	4.6	0.04
SR846	6.62	6.42	4.6	1.82
SR847	5.27	5.07	5.75	(a)

Notes:
a) PSEG Site is within the airway width.

Table 3.5-8
Flight Traffic per Year on the Low-Level Military Training Routes near the PSEG Site

Low-Level Military Training Routes	Flights per Year
SR800	48
SR805[(a)]	48
SR844[(b)]	0
SR845[(b)]	0
SR846[(a)]	48
SR847	144

Notes:
a) The traffic on MTRs SR805 and SR846 is 8 flights per month. The DANG alternates the use of these routes. During the six months including the summer, MTR SR805 is used and during the six months including the winter, MTR SR846 is used. For the aircraft crash probability evaluation it was assumed that all 96 flights per year are on MTR SR846 since this MTR is closer to the PSEG site than MTR SR805.
b) This MTR is not used.