U.S. NUCLEAR REGULATORY COMMISSION

STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

3.5.1.4 MISSILES GENERATED BY NATURAL PHENOMENA

REVIEW RESPONSIBILITIES

Primary - Plant Systems Branch (SPLB)[1] ~~Auxiliary Systems Branch (ASB)~~

Secondary - None

I. AREAS OF REVIEW

The applicant's assessment of possible hazards due to missiles generated by the design basis tornado, flood, and any other natural phenomena identified in Section 3.5 of the safety analysis report (SAR) is reviewed and evaluated by ~~the~~ SPLB[2] ~~ASB~~ to assure that appropriate design basis missiles have been chosen and properly characterized, and to assure that the effects caused by these missiles are acceptable. Currently, only missiles from the design basis tornado are consistently considered in the plant design bases. Missiles from other phenomena are considered on a case-by-case basis when they are identified.

Review Interfaces:[3]

SPLB also performs the following review under the SRP section indicated:[4]

> The SPLB[5] ~~ASB~~ also reviews the identification of those structures, systems and components (SSC)[6] that should be protected against missile impact under Standard Review Plan (SRP) Section 3.5.2.

In addition, the SPLB will coordinate with other branches' evaluations and reviews that interface with the overall review of this area as follows:[7]

1. The Civil Engineering and Geosciences Branch (ECGB)[8] ~~Structural Engineering Branch (SEB)~~ determines the acceptability of the design analysis, procedures and criteria used to establish the ability of seismic Category I structures and/or missile barriers to withstand the effects of tornado missiles as part of its primary review responsibility for SRP

Section 3.5.3. ~~The acceptance criteria and their methods of application are combined in that SRP section.~~[9]

2. The Emergency Preparedness and Radiation Protection Branch (PERB) determines the acceptability of the design basis tornado parameters, including maximum wind speed, as part of its primary review responsibility for SRP Section 2.3.1.[10]

For those areas of review identified above as being part of the review under other SRP sections, the acceptance criteria and their methods of application are contained in the referenced SRP sections.[11]

II. ACCEPTANCE CRITERIA[12]

The acceptability of the assessment as described in the applicant's Safety Analysis Report (SAR) is based on compliance with:

General Design Criteria 2 and 4 as ~~it relates~~they relate[13] to the capability of ~~structures, systems, and components~~SSC[14] important to safety to withstand the effects of tornado~~es~~[15] and other natural phenomena. Acceptance is based on meeting the guidelines of Regulatory Guide 1.76 and 1.117. New applications may utilize a maximum tornado wind speed, used in the evaluation of missiles generated by the design-basis tornado, of at least 482 km/hr (300 mph) in lieu of the guidance on tornado wind speeds contained in Regulatory Guide 1.76 (see References 7 and 8).[16]

The methodology of identification of appropriate design basis missiles generated by natural phenomena shall be consistent with the acceptance criteria defined for the evaluation of potential accidents from external sources in SRP Section 2.2.3.

Technical Rationale:[17]

The technical rationale for application of the above acceptance criteria to missiles generated by natural phenomena is discussed in the following paragraphs.

1. GDC 2 establishes requirements regarding the ability of SSC important to safety to withstand natural phenomena, including a tornado, without the loss of capability to perform their safety functions. Application of GDC 2 ensures that the chosen design basis reflects the most severe of the natural phenomena historically reported for the site and surrounding region. Regulatory Guide 1.76 describes a design-basis tornado based upon WASH-1300, "Technical Basis for Interim Regional Tornado Criteria" (Reference 6) that is acceptable to the NRC staff. A nuclear power plant must remain in a safe condition in the event of the most severe tornado that can reasonably be predicted. Essentially all conclusions concerning tornado properties are based upon indirect observations rather than directly sensing tornado properties. However, it is possible to characterize a set of properties that are significant and can be used to develop a definition for a design-basis tornado. Designing a nuclear plant to withstand the design-basis tornado characteristics of Regulatory Guide 1.76 ensures that there will be no undue risk to the health and safety of the public in the event of the most severe tornado conditions. Evolutionary reactors have the option of using a maximum tornado wind speed of at least 482 km/hr (300 mph) in the design-basis tornado. In SECY 93-087 and its associated Staff Requirements Memorandum (SRM) (References 7 and 8), the NRC staff found acceptable and the Commission approved, for evolutionary reactors, a departure from Regulatory Guide 1.76 guidance regarding tornado design-basis maximum wind speed. This change in tornado design-basis maximum wind speed for the evolutionary reactors is based upon updated tornado data from the National Severe Storm Forecast Center covering a 30 year period and the analysis of this data provided by NUREG/CR-4461

(Reference 9). The design-basis maximum wind speed for evolutionary reactors, although lower in some cases than Regulatory Guide 1.76 tornado wind speeds, is based upon methodology that has been shown to be appropriate and is conservative. Designing a nuclear power plant to withstand the design-basis maximum tornado wind speed ensures that SSC important to safety will be capable of performing their safety functions and that there will be no undue risk to the health and safety of the public in the event of tornado conditions.

2. GDC 4 establishes requirements regarding the ability of SSC important to safety to be protected from dynamic effects, including the effects of missiles, from events and conditions outside the nuclear unit. Natural phenomena such as tornados are dynamic events originating outside the nuclear unit, therefore, this criterion applies directly to the assessment of any missiles generated by such events. The selection of SSC to be protected is based upon the methods of Regulatory Guide 1.117 and maintaining offsite exposures below an appropriate fraction of the offsite dose guidelines of 10 CFR Part 100. Basing the limits upon an appropriate fraction ensures protection for those tornado events that are not as severe as the design-basis tornado but have a higher probability of occurrence. The application of Regulatory Guide 1.117 provides a method for defining those SSC that should be protected from the effects of a design-basis tornado without losing the capability to perform their safety functions. Protecting SSC important to safety from missiles generated by natural phenomena will ensure that they will be capable of performing their safety functions under severe dynamic conditions and ensuring there will be no undue risk to the health and safety of the public in the event of such conditions.

III. REVIEW PROCEDURES

The procedures below are used during the construction permit (CP) review to determine that the design criteria and bases and the preliminary design as set forth in the preliminary safety analysis report meet the acceptance criteria given in subsection II. For review of operating license (OL) applications, the procedures are utilized to verify that the initial design criteria and bases have been appropriately implemented in the final design as set forth in the final safety analysis report.

Upon request from the primary reviewer, ECGB[18] ~~SEB~~ will provide input for the areas of review stated in subsection I. The primary reviewer obtains and uses such input as required to assure that this review procedure is complete.

The reviewer will select and emphasize material from this SRP section, as may be appropriate for a particular case.

The judgment on areas to be given attention and emphasis in the review is to be based on an inspection of the material presented to see whether it is similar to that recently reviewed on other plants and whether items of special safety significance are involved.

1. The SAR is reviewed for the identification of the design basis natural phenomena which could possibly generate missiles. Postulated missiles are reviewed for proper characterization.

2. Regulatory Guide 1.76 provides guidance on the definition and characterization of the design-basis tornado reviewed by the PERB as discussed in subsection II.[19]

3. For new applications, the design-basis maximum tornado wind speed should be at least 482 km/hr (300 mph). Information regarding the use of this maximum wind speed in

lieu of the guidance contained in Regulatory Guide 1.76 is documented in NUREG/CR-4461 and SECY 93-087 and its associated SRM.[20]

~~4~~2.[21] The probability per year of damage to the total of all ~~important structures, systems, and components~~ SSC important to safety, ~~(~~as discussed in Regulatory Guide 1.117~~)~~,[22] due to a specific design basis natural phenomena capable of generating missiles is estimated. If this probability is greater than the acceptable probability stated in Regulatory Guide 1.117, then specific design provisions must be provided to reduce the estimate of damage probability to an allowable level.[23]

~~3. If this probability is greater than the acceptable probability stated in Regulatory Guide 1.117, then specific design provisions must be provided to reduce the estimate of damage probability to an allowable level.~~

5. For new applications, the statistical significance of an identified missile due to the design basis natural phenomena can be evaluated utilizing a probability analysis. Once a potential missile is identified, its statistical significance is determined by calculating the probability of missile occurrence. If this probability is less than 10^{-7} per year, the missile is not considered significant. If the probability of occurrence is greater than 10^{-7} per year, then the probability that it will impact a significant target is determined. If the product of these two probabilities is less than 10^{-7} per year, the missile is not considered significant. If the above product is greater than 10^{-7} per year, the probability of significant damage is determined. If the combined probability (product of all three) is less than 10^{-7} per year, the missile is not considered significant. If the combined probability is greater than 10^{-7} per year missile protection of SSC important to safety should be provided.[24]

~~6~~4.[25] All plants are required to be designed to protect safety-related equipment against damage from missiles which might be generated by the design basis tornado for that plant. The reviewer verifies that the applicant has postulated missiles that include at least three objects: a massive high kinetic energy missile which deforms on impact, a rigid missile to test penetration resistance, and a small rigid missile of a size sufficient to just pass through any openings in protective barriers. Until more definitive guidelines are established, these missiles may be assumed to be an 1800 Kg (4000 lb)[26] automobile, a 125 Kg (280 lb) 20 cm (8" in.)[27] armor piercing artillery shell, and a 2.54 cm (1" in.)[28] solid steel sphere, all impacting at 35% of the maximum horizontal windspeed of the design basis tornado. The first two missiles are assumed to impact at normal incidence, the last two[29] impinge upon barrier openings in the most damaging directions. These missiles are identified as Spectrum I.

Alternately, the missiles selected by the National Bureau of Standards as representative of construction site debris in report NBSIR 76-1050 (Reference 5)[30] may be used. These are identified as Spectrum II missiles. Tornado regions are defined in WASH-1300.

SPECTRUM II[31] Velocity ~~(~~m/sec~~)~~ (ft/sec)[32]

MISSILE	~~Mass(Kg)~~	~~Dimensions(m)~~	Region I	Region II	Region III
A. Wood Plank, mass 52 kg (115 lb), .092 m x .289 m x 3.66 m (3.62 in. x 11.38 in. x 12.0 ft)			83 (272)	70 (230)	58 (190)

B. 15 cm (6" in.) Sch 40 pipe, mass 130 kg (287 lb), .168 m Dia. x 4.58 m (6.62 in. Dia. x 15.0 ft) 52 (171) 42 (138) 10 (33)

C. 2.54 cm (1" in.) Steel rod, mass 4 kg (9 lb), .0254 m Dia. x .915 m (1 in. Dia. x 3.0 ft) 51 (167) 40 (131) 8 (26)

D. Utility pole, mass 510 kg (1124 lb), .343 m Dia. x 10.6 m (13.5 in. Dia. x 35.0 ft) 55 (180) 48 (157) 26 (85)

E. 30 cm (12" in.) Sch 40 pipe, mass 340 kg (750 lb), .32 m Dia. x 4.58 m (12.6 in. Dia. x 15.0 ft) 47 (154) 28 (92) 7 (23)

F. Automobile, mass 1810 kg (4000 lb), 5 m x 2 m x 1.3 m (16.4 ft x 6.6 ft x 4.3 ft) 59 (193) 52 (171) 41 (134)

Vertical velocities of 70% of the postulated horizontal velocities are acceptable in both spectra except for the small missile in Spectrum I or missile C above. These missiles, which are used to test barrier openings, should be assumed to have the same velocity in all directions. Missiles A, B, C, and E are to be considered at all elevations and missiles D and F at elevations up to 9.2 m (30 ~~Feet~~ft)[33] above all grade levels within 0.81 km (½ mile)[34] of the facility structures.

Applicants who were required at the construction permit stage to design to one of the missile spectra (A or B) of the November 24, 1975 version of this SRP section (or a review modification such as a 61 cm (24" in.)[35] vertical and 53 cm (21" in.)[36] horizontal wall thickness commitment in Region I), shall have the option at the OL stage of showing conformance with either their original commitment or Rev. 2 (same as Rev. 1) to this SRP section. Partial compliance with each is not acceptable.

SRP Section 3.5.1.4, November 24, 1975 MISSILE SPECTRUM A[37]

		Fraction of total tornado velocity
A.	Wood plank, 10 cm x 30 cm x 3.7 m (4 in. x 12 in. x 12 ft), ~~weight~~mass 90.7 kg (200 lb~~.~~).	0.8
B.	Steel pipe, 8 cm (3 in.) diameter, schedule 40, 3 m (10 ft) long, ~~weight~~mass 35.4 kg (78 lb)	0.4
C.	Steel rod, 2.54 cm (1 in.) diameter x 0.9 m (3 ft) long, ~~weight~~mass 3.6 kg (8 lb).	0.6
D.	Steel pipe, 15 cm (6 in.) diameter, schedule 40, 4.6 m (15 ft) long, ~~weight~~mass 129.3 kg (285 lb).	0.4
E.	Steel pipe, 30 cm (12 in.) diameter, schedule 40, 4.6 m (15 ft) long, ~~weight~~mass 337 kg (743 lb).	0.4

F.	Utility pole, 34.3 cm (13.5~~-1/2~~ in.) diameter, 10.7 m (35 ft) long, ~~weight~~mass 675.9 kg (1490 lb).	0.4
G.	Automobile, frontal area 1.86 m^2 (20 ft^{2}~~**2~~), ~~weight~~mass 1814 kg (4000 lb).	0.2

SRP Section 3.5.1.4, November 24, 1975 "NO TUMBLING" MISSILE SPECTRUM B[38]

		Horizontal Velocity[39] m/sec (ft/sec)
A.	Wood plank, 10 cm x 30 cm x 3.7 m (4 in. x 12 in. x 12 ft), ~~weight~~mass 90.7 kg (200 lb).	112.2 (368)
B.	Steel pipe, 8 cm (3 in.) diameter, schedule 40, 4.6 m (15 ft) long, ~~weight~~mass 52.2 kg (115 lb).	81.7 (268)
C.	Steel Rod, 2.54 cm (1 in.) diameter x 0.9 m (3 ft) long, ~~weight~~mass 3.6 kg (8 lb).	79 (259)
D.	Steel pipe, 15 cm (6 in.) diameter, schedule 40, 4.6 m (15 ft) long, ~~weight~~mass 129.3 kg (285 lb).	70.1 (230)
E.	Steel pipe, 30 cm (12 in.) diameter, schedule 40, 9.1 m (30 ft) long, ~~weight~~mass 680.4 kg (1500 lb).	62.5 (205)
F.	Utility pole, 36 cm (14 in.) diameter, 10.7 m (35 ft) long, ~~weight~~mass 680.4 kg (1500 lb).	73.5 (241)
G.	Automobile, frontal area 1.86 m^2 (20 ft^{2}~~**2~~), ~~weight~~mass 1814 kg (4000 lb).	30.5 (100)

These missiles are considered to be capable of striking in all directions with vertical velocities equal to 80% of the acceptable horizontal velocities. Missiles A, B, C, D, and E are to be considered at all elevations and missiles F and G at elevations up to 9.2 m (30 ~~Feet~~ft)[40] above all grade levels within 0.81 km (½ mile),[41] of the facility structures.

For standard design certification reviews under 10 CFR Part 52, the procedures above should be followed, as modified by the procedures in SRP Section 14.3 (proposed), to verify that the design set forth in the standard safety analysis report, including inspections, tests, analysis, and acceptance criteria (ITAAC), site interface requirements and combined license action items, meet the acceptance criteria given in subsection II. SRP Section 14.3 (proposed) contains procedures for the review of certified design material (CDM) for the standard design, including the site parameters, interface criteria, and ITAAC.[42]

IV. EVALUATION FINDINGS

The reviewer verifies that sufficient information has been provided and the review and calculations support conclusions of the following type, to be included in the staff's safety evaluation report:

Structures, systems and components (SSC)[43] important to safety are designed to withstand the effects of natural phenomena without loss of capability to perform their safety functions.

The basis for acceptance in the staff review is the conformance of the applicants' design and design criteria for the protection from the effects of natural phenomena to the Commission's regulations as set forth in the General Design Criteria, and to applicable Regulatory Guides and National Standards.

The staff concludes that the assessment of possible hazards due to missiles generated by the design basis tornado, flood, and other natural phenomena is acceptable and conforms to the requirements of General Design Criterion 2 and General Design Criterion 4 as they relate to tornado-generated missiles. This conclusion is based on the applicant having met the requirements of General Design Criteria 2 and 4 by: (a) meeting Regulatory Guide 1.76 Positions~~s~~ C-1 or[44] ~~and~~ C-2 and (b) meeting Regulatory Guide 1.117 Positions C-1 through[45] ~~thru~~ C-3.

The staff concludes for new applications that, if the positions of Regulatory Guide 1.76 are not fully applied, a maximum tornado wind speed of at least 482 km/hr (300 mph) is utilized.[46]

For design certification reviews, the findings will also summarize, to the extent that the review is not discussed in other safety evaluation report sections, the staff's evaluation of inspections, tests, analyses, and acceptance criteria (ITAAC), including design acceptance criteria (DAC), site interface requirements, and combined license action items that are relevant to this SRP section.[47]

V. IMPLEMENTATION

The following is intended to provide guidance to applicants and licensees regarding the NRC staff's plans for using this SRP section.

This SRP section will be used by the staff when performing safety evaluations of license applications submitted by applicants pursuant to 10 CFR 50 or 10 CFR 52.[48] Except in those cases in which the applicant proposes an acceptable alternative method for complying with specified portions of the Commission's regulations, the method described herein will be used by the staff in its evaluation of conformance with Commission regulations.

The provisions of this SRP section apply to reviews of applications docketed six months or more after the date of issuance of this SRP section.[49]

Implementation schedules for conformance to parts of the method discussed herein are contained in the referenced regulatory guides.

VI. REFERENCES

1. 10 CFR Part 50, Appendix A, General Design Criterion 2, "Design Basis for Protection Against Natural Phenomena."

2. 10 CFR Part 50, Appendix A, General Design Criterion 4, "Environmental and Dynamic Effects[50] ~~Missile Design~~ Basis."

3. Regulatory Guide 1.76, "Design Basis Tornado for Nuclear Power Plants."

4. Regulatory Guide 1.117, "Tornado Design Classification."

5. NBSIR 76-1050, "Tornado-Borne Missile Speeds," National Bureau of Standards (April 1976).

6. WASH-1300, "Technical Basis for Interim Regional Tornado Criteria," U.S. Atomic Energy Commission (May 1974).

7. SECY 93-087, "Policy, Technical, and Licensing Issues Pertaining to Evolutionary and Advanced Light-Water Reactor (ALWR) Designs," April 2, 1993.[51]

8. Staff Requirements Memorandum for SECY 93-087, Memorandum for J. M. Taylor from S. J. Chilk, dated July 21, 1993.[52]

9. NUREG/CR-4461, J. V. Ramsdell, G. L. Andrews, "Tornado Climatology of the Contiguous United States."[53]

SRP Draft Section 3.5.1.4
Attachment A - Proposed Changes in Order of Occurrence

Item numbers in the following table correspond to superscript numbers in the redline/strikeout copy of the draft SRP section.

Item	Source	Description
1.	Current PRB names and abbreviations.	Editorial change made to reflect current PRB names and responsibilities for this SRP section.
2.	Current PRB names and abbreviations.	Editorial change made to reflect current PRB names and responsibilities for this SRP section.
3.	SRP-UDP format item.	Revised review interface section of Areas of Review to be consistent with SRP-UDP required format that uses a number/paragraph format to distinguish individual reviews and supporting reviews performed by other PRBs.
4.	Editorial.	Added an introductory sentence for the reviews performed by the SPLB under the SRP sections indicated. This Review Interface format is consistent with the format presented by the SRP-UDP procedures.
5.	Current PRB names and abbreviations.	Editorial change made to reflect current PRB names and responsibilities for this SRP section.
6.	Editorial.	Added the acronym SSC after the first use of the term structures, systems and components.
7.	Editorial.	Added an introductory sentence for the reviews of other branches' coordinated by the SPLB under the SRP sections indicated. This Review Interface format is consistent with the format presented by the SRP-UDP procedures.
8.	Current PRB names and abbreviations.	Editorial change made to reflect current PRB names and responsibilities for SRP section 3.5.3.
9.	Editorial.	This last sentence was deleted because of the use of the standard concluding statement for the Review Interfaces (see item 11.) which satisfies the intent of this sentence.
10.	**Integrated Impact #279.**	Added a review interface to SRP section 2.3.1 to clarify the interface between PERB and SPLB in regard to the review of design basis tornado parameters. The review interface is consistent with the reviews defined in SRP section 2.3.1.

Item	Source	Description
11.	Editorial.	Add a concluding paragraph for the review interfaces addressing the reviews and acceptance criteria contained in other referenced SRP sections. This conclusion statement for the Review Interfaces is consistent with the SRP-UDP approach.
12.	Editorial.	Minor editorial changes were made to divide the Acceptance Criteria section into several paragraphs rather than one long paragraph.
13.	Editorial.	To make this sentence grammatically correct "it relates" (singular) should be replaced with "they relate" (plural).
14.	Editorial.	Substituted the acronym SSC for Structures, Systems and Components as is consistent with the remainder of the section.
15.	Editorial.	The word "tornadoes" was replaced with the word "tornados" to standardize the spelling throughout the section.
16.	**Integrated Impact # 278.**	New acceptance criterion was added for new applications regarding the maximum tornado wind speed used in the design basis. In the SRM for SECY 93-087 dated July 21, 1993, the Commission approved the Staff's position that a maximum wind speed of 482 km/hr (300 mph) be used in the design-basis tornado employed in the design of evolutionary plants.
17.	SRP-UDP format item, adding technical rationale.	Technical Rationale were developed and added for the Acceptance Criteria. The SRP-UDP requires that technical rationale be developed for each of the Acceptance Criteria.
18.	Current PRB names and abbreviations.	Editorial change made to reflect current PRB names and responsibilities for SRP section 3.5.3.
19.	**Integrated Impact # 279.**	Added a new review procedure addressing the use of Regulatory Guide 1.76 for the definition and characterization of the design-basis tornado which could potentially generate missiles.
20.	**Integrated Impact #278.**	Added a new review procedure to address the maximum tornado wind speed of 482 km/hr (300 mph) used for new applications. This review procedure is consistent with staff positions documented in SECY 93-087 and its associated SRM.

Item	Source	Description
21.	Editorial.	Renumbered the review procedure steps to accommodate the addition of four new review procedures.
22.	Editorial.	The phrase "important structures, systems and components" was changed to the broader term "SSC important to safety". The parenthetical reference to Regulatory Guide 1.117 was changed to a phrase using commas (instead of the parentheses) as this phrase is important to the definition of those SSC to be protected.
23.	Editorial.	The review information and instructions provided by the original steps 2 and 3 are closely allied, therefore, the two steps were combined into one new step. Combining these two steps will also highlight the differences between the original staff review guidance on this subject and the review guidance provided for Evolutionary reactors in the new review procedure step concerning the determination of the statistical significance of identified missiles.
24.	**Integrated Impact # 280.**	A new step was added to the review procedures to address the application of probability calculations used to evaluate the statistical significance of identified missiles. Because this change is based upon reviews documented in the ABWR FSER, the applicability of this new review procedure was limited to new applications. The review procedure is consistent with the staff positions documented in section 3.5.1 of the ABWR FSER.
25.	Editorial.	Renumbered the review procedure steps to accommodate the addition of four new review procedures.

Item	Source	Description
26.	Metric Conversion.	Converted 1800 kg to 4000 lb to allow for presentation in dual units. Note that there appears to be a contradiction between the various spectra (I,II,A and B) regarding the mass of the automobile missile. However, there is no real conflict here because this object is relatively massive and the minor differences in mass occurring as a result of the rounding rules for conversions, and because of the restrictions on changing established staff guidance without supporting information, are insignificant. For example: in spectra A and B the staff originally specified 4000 lb which must be converted and rounded to 1814 kg to respect the limit (a lighter missile of 1800 or 1810 would imply non-conservative rounding methods) which then apparently conflicts with the two original values of 1800 kg (for spectrum I) and 1810 kg (for spectrum II) which can be conservatively converted and rounded to 4000 lb.
27.	Metric Conversion and Editorial.	Converted 125 kg to 280 lb and 8" to 20 cm to allow for presentation in dual units. Presented the inch (") indicator as (in.) to be consistent with the remainder of the document.
28.	Metric Conversion and Editorial.	Converted 1" to 2.54 cm to allow for presentation in dual units. Presented the inch (") indicator as (in.) to be consistent with the remainder of the document.
29.	Editorial.	Grammar correction "to" should be "two".
30.	Editorial, verification of references.	A parenthetical reference was added for the citation of NBSIR 76-1050, "Tornado-Borne Missile Speeds," National Bureau of Standards.
31.	Metric Conversion and Editorial.	Converted mass and dimension parameters from metric to english to allow for presentation in dual units. Editorial changes were made to the table format to allow for presentation of dual units.
32.	Metric Conversion and Editorial.	Converted velocity parameters from metric (m/sec) to english (ft/sec) to allow for presentation in dual units. Editorial changes were made to the table format to allow for presentation of the dual units. The values in ft/sec are consistent with the values documented in NBSIR 76-1050 "Tornado-Borne Missile Speeds"
33.	Metric Conversion and Editorial.	Converted 30 feet to 9.2 m and presented feet as ft to be consistent with the remainder of the document.

Item	Source	Description
34.	Metric Conversion.	Converted ½ mile to 0.81 km to allow for presentation in dual units.
35.	Metric Conversion and Editorial.	Converted 24" to 61 cm and presented the " indicator as in. to be consistent with the remainder of the document.
36.	Metric Conversion and Editorial.	Converted 21" to 53 cm and presented the " indicator as in. to be consistent with the remainder of the document.
37.	Metric Conversion and Editorial.	Converted mass and dimension parameters from english to metric to allow for presentation in dual units. Editorial changes were made to the table format to allow for presentation of dual units. When the term weight was used it was converted to the term mass which is technically correct when presenting these parameters in dual units (weight in the metric system is measured in Newtons (N) and is equal to the mass of an object times the acceleration of gravity).
38.	Metric Conversion and Editorial.	Converted mass and dimension parameters from english to metric to allow for presentation in dual units. Editorial changes were made to the table format to allow for presentation of dual units. When the term weight was used it was converted to the term mass which is technically correct when presenting these parameters in dual units (weight in the metric system is measured in Newtons (N) and is equal to the mass of an object times the acceleration of gravity).
39.	Metric Conversion.	Converted horizontal velocity parameters from english (ft/sec) to metric (m/sec) to allow for presentation in dual units.
40.	Metric Conversion and Editorial.	Converted 30 feet to 9.2 m and presented feet as ft to be consistent with the remainder of the document.
41.	Metric Conversion.	Converted ½ mile to 0.81 km to allow for presentation in dual units.
42.	SRP-UDP Guidance, Implementation of 10 CFR 52	Added standard paragraph to address application of Review Procedures in design certification reviews.
43.	Editorial.	Added the acronym SSC for Structures, systems and components as is consistent with the remainder of the section.

Item	Source	Description
44.	**Integrated Impact #279.**	The evaluation findings were changed to state that the applicants should meet the guidelines of Regulatory Guide 1.76 position C-1 or C-2 not C-1 and C-2. These two positions contained in the regulatory guide are mutually exclusive, either C-1 or C-2 is acceptable, both C-1 and C-2 would not be requested.
45.	Editorial.	Grammar correction changed "thru" to "through".
46.	**Integrated Impact # 278**.	Added an evaluation findings paragraph to address findings for new applications in regard to the maximum tornado wind speed utilized for the design basis tornado.
47.	10 CFR 52 applicability issue.	An Evaluation Finding was added to address design certification and combined license reviews. The design certification and combined license evaluation finding statements are consistent with the SRP-UDP format and the documented findings in section 3.5.1.4 of the ABWR FSER and the ABB-CE FSER.
48.	SRP-UDP Guidance, Implementation of 10 CFR 52	Added standard sentence to address application of the SRP section to reviews of applications filed under 10 CFR Part 52, as well as Part 50.
49.	SRP-UDP Guidance	Added standard paragraph to indicate applicability of this section to reviews of future applications.
50.	Reference Verification and resolution of PI-21730.	The title of 10 CFR Part 50, Appendix A, GDC 4 was revised and now reads, "Environmental and Dynamic Effects" reference PI-21730.
51.	**Integrated Impact #278.**	Added a reference to SECY 93-087, "Policy, Technical, and Licensing Issues Pertaining to Evolutionary and Advanced Light-Water Reactor (ALWR) Designs," dated April 2, 1993.
52.	**Integrated Impact #278.**	Added a reference to the staff requirements memorandum for SECY 93-087, Memorandum for J.M. Taylor from S.J. Chilk, dated July 21, 1993.
53.	**Integrated Impact #278.**	Added a reference to NUREG/CR-4461, "Tornado Climatology of the Contiguous United States," this NUREG/CR documents the studies that set the basis for the new tornado wind speed values used for evolutionary and passive ALWRs.

SRP Draft Section 3.5.1.4
Attachment B - Cross Reference of Integrated Impacts

Integrated Impact No.	Issue	SRP Subsections Affected
278	Incorporate revised design-basis tornado wind speed for new applications. SECY 93-087 and its associated SRM document the Commission approved staff positions that a maximum wind speed of 482 km/hr(300 mph) be used for the design-basis tornado in the design of Evolutionary plants.	Subsection II: Acceptance criteria for new applications was added to the end of the first paragraph. Subsection III: Added two new review procedures (steps 3 and 7). Subsection IV: Added a new Evaluation Findings paragraph (paragraph 5). Subsection V: Added three new references (References 7, 8 and 9).
279	Incorporate use of Regulatory Guide 1.76 concerning the definition and characterization of the design-basis tornado.	Subsection III: Added a review procedure (step 2) to address the review of Regulatory Guide 1.76 in regard to the definition and characterization of the design-basis tornado. Subsection IV: Revised the evaluation findings (paragraph 4) to state that the applicants should meet the guidelines of Regulatory Guide 1.76 position C-1 or C-2 not C-1 and C-2.
280	Add a Review Procedure for new applications to address a method utilizing a combined probability to determine the statistical significance of an identified missile and evaluating the need to provide missile protection.	Subsection III: Added a review procedure (step 5) applicable to new applications.