CR: 1678709 **Revision: 4**

CR Title: NRC ISSUES POSITION ON MISSILE PROTECTION FOR G-01/2 EXHAUST

NOTE: To ensure a complete POD, each of the following items shall be addressed to a level of detail commensurate with the affected SSC safety significance.

Revision 4 of this POD supersedes the previous POD revisions and the associated Functionality Assessments (FAs). It now includes NRC guidance on acceptable methods for missile protection of equipment, an update to reflect the upgraded supporting of the stacks to survive high wind pressure loads, and recently developed information regarding the capability of the stacks to withstand missile impacts. Various other editorial corrections have also been made to improve flow and readability.

1. Describe affected SSC (System #/ Comp #, etc.):

   The G-01 and G-02 Emergency Diesel Generators (EDGs)

2. Describe degraded or nonconforming condition:

   PBNP GDC-2 requires that components "essential to the prevention or to the mitigation of the consequences of nuclear accidents" be "designed, fabricated, and erected to performance standards that enable [them] to withstand… extraordinary natural phenomenon such as… tornado…". The emergency diesel generators (EDGs) are such components.

   The standard invoked by Point Beach and submitted to the AEC to demonstrate compliance with the GDC was B-TOP-3. This standard meets the intent of the GDC by enclosing such equipment in thick reinforced concrete structures. However, since the emergency diesel generator exhaust piping ("stacks") are located outside of Class I structures, they do not conform to B-TOP-3 and therefore are non-conforming to PBNP GDC-2.

3. Identify Current Licensing Basis function(s) and performance requirements, including Technical Specifications, FSAR, EOPs, NRC Commitments, or other appropriate information:

   Prior to identifying the Current Licensing Bases functions and performance requirements the usage of the terms "specified safety function" and "specified function", the relationship between General Design Criteria and Technical Specifications, and the underlying purpose of the Technical Specifications as established in Title 10 of the Code of Federal Regulations and in applicable Federal Register Notices will first be reviewed.

   USAGE OF "SPECIFIED SAFETY FUNCTION" vs. "SPECIFIED FUNCTION"

   The NRC Inspection Manual Part 9900 (Technical Guidance) under "Operability Determinations & Functionality Assessments for Resolution of Degraded or Nonconforming Conditions Adverse to Quality or Safety" uses these two terms to differentiate between functions performed by an SSC as described in the CLB ("specified functions"), and the smaller subset of functions described in Technical Specifications that is performed by a SSC ("specified safety function").

   Although the usage of the terms is consistent throughout the balance of the 9900 manual, the definition of these terms in section 3.10 of the Manual is ambiguous and does not make a distinction. This is because the update intended by RIS 2005-10 was omitted and the original language of GL 91-18 retained. This discrepancy has been identified to the NRC by the Technical Specifications Task Force, and a correction to the guidance requested (Reference TSTF-11-09 dated 5 July, 2011).

   RELATIONSHIP BETWEEN GENERAL DESIGN CRITERIA, TECHNICAL SPECIFICATIONS, and OPERABILITY

   The NRC Inspection Manual Part 9900 (Technical Guidance) under "Operability Determinations & Functionality Assessments for Resolution of Degraded or Nonconforming Conditions Adverse to Quality or Safety" discusses the relationship between General Design Criteria and Technical Specifications in Appendix C.1:

"The criteria in the GDC correspond both directly and indirectly to the operational requirements in the TSs. The GDC "establish the necessary design, fabrication, construction, testing, and performance requirements for SSCs important to safety." Thus, the GDC cover a broad spectrum of SSCs, not all of which are described as subject to the TSs. The GDC are reflected in the facility design as described in the UFSAR. The license includes TSs that are derived from the facility design requirements and from analyses that support the facility design as described in the UFSAR and NRC evaluations of the UFSAR analyses.

While a variety of features must be included in the design of a nuclear power reactor, the TSs need control only aspects of the design and plant conditions required to satisfy 10 CFR 50.36. As stated in 10 CFR 50.36, TSs are to be "derived from the analyses and evaluations included in the safety analysis report." The TSs establish, among other things, limiting conditions for operation which are "the lowest functional capability or performance levels of SSCs required for safe operation of the facility…

Failure to meet a GDC in the CLB should be treated as a degraded or nonconforming condition and, therefore, the technical guidance in this document is applicable."

Therefore, while the requirement to provide tornado missile protection for the EDG stacks is part of the license basis criteria for the design of the plant, it does not, in and of itself, constitute a necessary requirement for OPERABILITY.

PURPOSE & EXTENT OF TECHNICAL SPECIFICATIONS

10 CFR 50.36 (Technical Specifications)

This section of the Code of Federal Regulations is relevant because it describes what items are required to be included in the Technical Specifications and the criteria for their inclusion:

"(c) Technical specifications will include items in the following categories:

…(2) *Limiting conditions for operation…*

(ii) A technical specification limiting condition for operation of a nuclear reactor must be established for each item meeting one or more of the following criteria:

(A) *Criterion 1.* Installed instrumentation that is used to detect in the control room, a significant abnormal degradation of the reactor coolant boundary.

(B) *Criterion 2.* A process variable, design feature, or operating restriction that is an initial condition of a design basis accident or transient analysis that either assumes the failure of or presents a challenge to the integrity of a fission product barrier.

(C) *Criterion 3.* A structure, system, or component that is part of the primary success path and which functions or actuates to mitigate a design basis accident or transient that either assumes the failure of or presents a challenge to the integrity of a fission product barrier.

(D) *Criterion 4.* A structure, system, or component which operating experience or probabilistic risk assessment has shown to be significant to public health and safety…

(4) *Design features.* Design features to be included are those features of the facility such as materials of construction and geometric arrangements, which, if altered or modified, would have a significant effect on safety and are not covered in categories described in paragraphs (c)(1), (2), and (3) of this section."

NRC Statements of Consideration for Technical Specifications (10 CFR 50.36)

These SOCs were noticed in the Federal Register on 7/19/1995 (60FR36953). A copy of the notice was appended to previous revisions of this POD, and is omitted here for brevity.

The SOCs provide clarification of the intent, scope, and limitations of Standard Technical Specifications (STS), and in particular, how STS conforms to the requirements of 10 CFR 50.36. PBNP subsequently submitted a license amendment request and obtained NRC approval via Amendments 201/206 to transition to a site specific form of STS (termed "Improved Technical Specifications" or "ITS").

Of particular note in the Background discussion of the SOCs is that development of STS had been pursued because there had "been a trend toward including in technical specifications not only those requirements derived from the analyses and evaluation in the safety analyses report but also essentially all other Commission requirements governing the operation of nuclear power reactors... [T]his use [had] contributed to the volume of technical specifications... [and had] diverted both NRC and licensee attention from the more important requirements in these documents to the extent that it has resulted in an adverse but unquantifiable impact on safety".

In another section of the SOCs appears the following:

"The criteria of Sec. 50.36(c)(2) apply to safety functions. Therefore, the Commission does not believe that these criteria can be appropriately applied to the types of requirements found in the "design features" and "administrative controls" sections of the technical specifications..."

NRC Final Policy Statement on Technical Specifications Improvements

The SOCs formally noticed the Commission's published "Final Policy Statement on Technical Specifications Improvements for Nuclear Power Reactors" (final policy statement) by reference. A copy of the final policy statement was appended to previous revisions of this POD, and is omitted here for brevity.

The Policy Statement elaborates on the four criteria of 10 CFR 50.36. The following excerpts are relevant to the condition of concern:

> "Discussion of Criterion 2: Another basic concept in the adequate protection of the public health and safety is that the plant shall be operated within the bounds of the initial conditions assumed in the existing Design Basis Accident and Transient analyses and that the plant will be operated to preclude unanalyzed transients and accidents. These analyses consist of postulated events, analyzed in the FSAR, for which a structure, system, or component must meet specified functional goals. These analyses are contained in Chapters 6 and 15 of the FSAR (or equivalent chapters)[1] and are identified as Condition II, III, or IV events (ANSI N 18.2) (or equivalent) that either assume the failure of or present a challenge to the integrity of a fission product barrier...
>
> Discussion of Criterion 3: A third concept in the adequate protection of the public health and safety is that in the event that a postulated Design Basis Accident or Transient should occur, structures, systems, and components are available to function or to actuate in order to mitigate the consequence of the Design Basis Accident or Transient. Safety sequence analyses or their equivalent have been performed in recent years and provide a method of presenting the plant response to an accident. These can be used to define the primary success paths.
>
> A safety sequence analysis is a systematic examination of the actions required to mitigate the consequences of events considered in the plant's Design Basis Accident and Transient analyses, as presented in Chapters 6 and 15 of the plant's FSAR (or equivalent chapters)[1]. Such a safety sequence

[1] The equivalent chapters in the PBNP FSAR are 6 (Engineered Safety Features) and 14 (Safety Analysis; reference Reg Guide 1.70, "Standard Format and Content of Safety Analysis Reports")

analysis considers all applicable events, whether explicitly or implicitly presented. The primary success path of a safety sequence analysis consists of the combination and sequences of equipment needed to operate (including consideration of the single failure criteria), so that the plant response to Design Basis Accidents and Transients limits the consequences of these events to within the appropriate acceptance criteria.

It is the intent of this criterion to capture into Technical Specifications only those structures, systems, and components that are part of the primary success path of a safety sequence analysis…

Discussion of Criterion 4: It is the Commission policy that licensees retain in their Technical Specifications LCOs, action statements and Surveillance Requirements for the following systems (as applicable), which operating experience and PSA have generally shown to be significant to public health and safety and any other structures, systems, or components that meet this criterion:

° Reactor Core Isolation Cooling/Isolation Condenser,

° Residual Heat Removal,

° Standby Liquid Control, and

° Recirculation Pump Trip.

The Commission recognizes that other structures, systems, or components may meet this criterion."

Criterion 1 of 10 CFR 50.36 pertains to RCS leakage instrumentation, and is therefore not applicable to the EDG exhaust stacks.

Tornados and tornado protection are not included in the Chapter 6 or 14 analysis contained in the FSAR. Tornados and tornado protection are not a condition II, III, or IV event per ANSI 18.2. Therefore, Criterion 2 and 3 are not applicable to the tornado event.

Criterion 4 is limited (for PWRs) to residual heat removal (RHR) and any other SSCs specifically identified for inclusion in the TS based on their PRA significance, but otherwise not included under the other three criteria. EDGs are already included in the TS under criterion 3 (albeit to the exclusion of a tornado event), and have not been shown in the license bases to be risk significant for the mitigation of a tornado event.

If a SSC's only function was an initial condition or mitigation assumed for a tornado or tornado missile, that SSC would not be included as an LCO in the Technical Specifications. A function that would not result in an SSC being included in an LCO cannot result in an LCO not being met. A function required for Operability must, by definition, satisfy the criteria for inclusion in the Technical Specifications.

Therefore, unless a tornado protection is a function that satisfies Criterion 2, 3, or 4, it is not subject to Technical Specification OPERABILITY requirements.

POINT BEACH LICENSING BASES

Technical Specifications

3.8.1 AC Sources—Operating

LCO 3.8.1 The following AC electrical power sources shall be OPERABLE:

…

c. One standby emergency power source capable of supplying each 4.16 kV/480 V Class 1E safeguards bus.

APPLICABILITY: MODES 1, 2, 3, and 4.

3.8.2 AC Sources—Shutdown

LCO 3.8.2 The following AC electrical power sources shall be OPERABLE:

...

b. One standby emergency power source capable of supplying one of the associated unit's 480 V Class 1E safeguards bus(es) B03 or B04, required by LCO 3.8.10.

APPLICABILITY: MODES 5 and 6

4.0 Design Features

This section includes site location, reactor core, and fuel storage. There is no mention of tornado and tornado missile resistant structures or components in this section.

TS Bases

B 3.8.1

BACKGROUND

"The unit Class 1E AC Electrical Power Distribution System AC sources consist of; ...the onsite standby emergency power sources..."

"The onsite standby emergency power system is comprised of four diesel generators that directly supply the 4.16 kV safeguards electrical distribution buses (A05 and A06). The two A train standby emergency power sources (G-01 and G-02) are normally aligned; G-01 to the Unit 1 A train 4.16 kV bus (1A05) and G-02 to the Unit 2 A train 4.16 kV bus (2A05)... Each emergency diesel generator is capable of starting and supplying the power requirement of one complete set of safeguards equipment for one reactor unit, while simultaneously providing sufficient power to allow the other unit to be placed in a safe shutdown condition (no accident is assumed in the second unit)."

"Each diesel generator will automatically start on an undervoltage signal from its associated 4.16 kV train in either unit, and will restore power on the bus(es) to which it is aligned (refer to LCO 3.3.5, "Loss of Power (LOP) Diesel Generator (standby emergency power source) Start Instrumentation")..."

APPLICABLE SAFETY ANALYSIS

The applicable safety analyses pertain to various Chapter 14 events and make no mention of tornado events.

B 3.8.2

The bases for LCO 3.8.2 refer back to the Bases for 3.8.1, and are largely identical in content with the exception of explaining reduced requirements for redundancy during the shutdown modes of operation.

FSAR

While there are pending FSAR changes associated with recent plant modifications, the specified safety functions of the G-01 and G-02 EDGs have not changed.

Chapter 1.3

"All systems and components designated Seismic Class I are designed so that there is no loss of function in the event of the maximum hypothetical ground acceleration acting in the horizontal and vertical directions simultaneously. The working stress for both Seismic Class I and Seismic Class II items is kept within code

allowable values for the design earthquake. Similarly, measures are taken in the plant design to protect against high winds, flooding, and other natural phenomena."

"Performance Standards

"2. Those systems and components of reactor facilities which are essential to the prevention or to the mitigation of the consequences of nuclear accidents which could cause undue risk to the health and safety of the public shall be designed, fabricated, and erected to performance standards that enable such systems and components to withstand, without undue risk to the health and safety of the public, the forces that might reasonably be imposed by the occurrence of an extraordinary natural phenomenon such as earthquake, tornado, flooding condition, high wind, or heavy ice. The design bases so established shall reflect: (a) appropriate consideration of the most severe of these natural phenomena that have been officially recorded for the site and the surrounding area and (b) an appropriate margin for withstanding forces greater than those recorded to reflect uncertainties about the historical data and their suitability as a basis for design." (PBNP FSAR GDC-2)

"The containments and Seismic Class I portions of the Auxiliary Building, the turbine hall, the pumphouse, and the diesel generator building are designed to withstand the effects of a tornado. The design criteria of the containment and the Class I portions of the auxiliary and turbine buildings to withstand the effects of a tornado, including wind force, pressure differential, and missile impingement are described in Bechtel Topical Report B-TOP-3, "Design Criteria for Nuclear Power Plants Against Tornadoes." (March 12, 1970)

B-TOP-3 states in part, "2.3 A missile impingement equivalent to:

1. A 4"x12"x12' long wood board (108 pounds) traveling end on at 300 mph and striking at any elevation on the structure.
2. A 3"x10' long (ASA Schedule 40) pipe (75.8 pounds) traveling end on at 100 mph at any elevation on the structure.
3. A passenger auto (4,000 pounds) impact velocity of 50 mph not more than 25 feet above grade with a contact area of 20 square feet"

The Foreword for B-TOP-3 states, "When the three criteria are considered simultaneously, the resulting design parameters describe a tough, tornado-resistant structure. The application of the criteria results in a building with energy absorption characteristics much higher than those of buildings that have withstood tornados.

Additionally, B-TOP-3 states: "The following tornado effects should be considered to assure the ability to shut down the reactor and to maintain integrity of containment and essential decay heat removal systems during and following a tornado which may traverse the site. This criterion applies to all Class I structures. The effects of the criteria 2.1 through 2.3 are combined to produce the most critical loading."

The design criteria used for the construction of Class I structures at PBNP is clearly only applicable to the structures and is silent on the components attached to those structures.

Chapter 5.1, Containment System Structure

This chapter provides the design bases missiles specifically ascribed to the design of the containment.

> "Tornado driven missiles equivalent to an airborne 4 in. by 12 in. by 12 ft. plank traveling end on at 300 mph (440 fps) or a 4000 lb. automobile flying through the air at 50 mph (74 fps) and at not more than 25 feet above the ground, are assumed."

Chapter 8.8 Diesel Generator (DG) System

A review of this chapter found that the relevant information duplicates what was already cited above under the applicable Technical Specifications.

Chapter 14.0 Safety Analysis

Chapter 14.0 describes in a general sense the factors and considerations used when performing specific Safety Analyses contained in the balance of Chapter 14. The coincidence of external events and analyzed Anticipated Operational Occurrences (AOOs) and Accidents is not explicitly discussed in the FSAR. Two analyzed AOOs are discussed as potential dual-unit events in the context of shared systems:

> "The two units are connected to the same external electrical grid, and it is therefore possible that the following transients could affect both units simultaneously:
>
> 1. Loss of external electrical load (Section 14.1.9)
>
> 2. Loss of all AC power to the station auxiliaries (Section 14.1.11)"

However, the occurrence of an external event such as a tornado is not discussed or described as an initiating event for these AOOs.

A review of Sections 14.1 (Core and Coolant Boundary Protection Analysis), 14.2 (Standby Safety Features Analysis) and 14.3 (Primary System Pipe Ruptures) found that external events (and specifically tornados) are not analyzed accidents or transients.

RELEVANT LICENSING CORRESPONDENCE

During the initial licensing of Point Beach, the Atomic Energy Commission (AEC) issued a series of questions on specific topics. The responses to the questions became a part of the license bases for Point Beach. The responses were incorporated into the text of the Final Facility Description and Safety Analysis Report (FFDSAR), and subsequent revisions of the site Safety Analyses Report retained the information, though often in abridged form.

Of particular interest is a portion of a question requesting additional information pertaining to design features to withstand a tornado:

> "Structures which should be included and discussed individually are the containment building, the primary auxiliary building, including that portion enclosing the spent fuel storage pit and the control room, the diesel generator housing, the intake structure and pump house and any other equipment or structure *required for safe shutdown of the units*." (emphasis added)

This established safe shutdown as the criterion needed to be supported following a tornado, and does not discuss supporting a DBA event. The focus of the question is on "equipment or structure[s] required for safe shutdown". Protection of equipment necessary to mitigate the consequences of design basis accidents (as might be implied by the general wording of the PBNP GDC) was not in question.

The response did not contain information on the diesel generator exhaust stacks, and the response was accepted as-written as evidenced by the issuance of the plant operating license with no further clarifying questions or changes. The specific mention of the EDG "housing", with an accompanying lack of any mention or information on EDG exhaust components is evidence that tornado missile protection for these components was not considered under the original licensing of the facility. Similarly, there was no request for, nor response pertaining to, other passive conduits that could have been considered necessary for reaching and achieving safe shutdown condition (e.g. Service Water piping that might be exposed to a postulated missile). Rather, the focus was on providing missile protection for active components (e.g. Service Water pumps and EDGs) that needed to perform an active function to achieve safe shutdown. This may have been because (as will be demonstrated later in this POD), the piping components of the exhaust stacks are inherently rugged and capable of sustaining considerable damage without a

loss of function, and did not rise to the level for inclusion in Technical Specifications required by 10 CFR 50.36(c)(2)(ii).

Conclusion of CLB Review

- The occurrence of a tornado is not postulated or analyzed in Chapters 6 or 14 of the FSAR
  - The ANSI 18.2 definitions of Condition II, III, and IV do not include external events
  - This is an intentional omission. External events ("Environmental Conditions") are discussed in Section 2.1.5 of the ANSI standard
- Ability of EDGs to withstand tornados does not meet criteria for inclusion in Technical Specifications
- Criterion 4 is limited (for PWRs) to residual heat removal (RHR) and other SSCs identified by PRA but not included under the other three criteria.
  - EDGs are already included in the TS under criterion 3, and have not been shown in the license bases to be risk significant for the mitigation of a tornado event.

Therefore, since tornados do not fall under Criteria 1, 2, 3, or 4 of 10 CFR 50.36, capability to withstand them is not a subject of Technical Specifications. OPERABILITY is a concept that exists only within Technical Specifications. Requirements of the License Bases that are not contained within Technical Specifications are not subject to Operability requirements.

NRC GUIDANCE ON TORNADO MISSILE DESIGN

The balance of this POD evaluates the safety significance of the acknowledged non-conformance. Two NRC documents will be helpful in assessing the significance by providing a useful standard of acceptable practices for providing tornado missile protection.

Regulatory Guide 1.117 ("Tornado Design Classification", Rev. 0 dated 1976; current revision is dated 1978)

This guidance was first issued several years after the design and licensing of Point Beach. However, it provides a useful standard for assessing both the scope of SSCs that should be missile protected, particularly when used in conjunction with applicable Point Beach design basis documents.

The Regulatory Position established in RG 1.117 establishes three categories of SSCs important to safety that should be protected from the effects of a Design Basis Tornado:

1. "Those necessary to ensure the integrity of the reactor coolant pressure boundary;
2. Those necessary to ensure the capability to shut down the reactor and maintain it in safe shutdown condition (this includes both hot standby and cold shutdown capability); and
3. Those whose failure could lead to radioactive releases resulting in calculated offsite exposures greater than 25% of the guideline exposures of 10 CFR Part 100 using appropriately conservative analytical methods and assumptions."

An appendix to the RG enumerates the SSCs that should be protected from the effects of a tornado. In general, the as-built Point Beach configuration conforms to that guidance. One is relevant to this Operability Determination.

Item #13

"The Class 1E electric systems, including the auxiliary systems for the onsite electric power supplies, that provide the emergency electrical power needed for the functioning of plant features included… above."

The EDGs, their fuel supplies, radiators (in the case of G-03 and G-04), etc. are fully enclosed in missile protective Class I structures. The identified potential vulnerability is limited to the G-01 & G-02 EDG exhaust stacks.

NUREG-0800 3.5.2 Revision 3, "Structures, Systems, and Components to be Protected from Externally-Generated Missiles" [ML070460362]

Section IV:

> "The applicant has met the requirements of GDCs 2 and 4 for protection of important safety-related SSCs against the effects of externally-generated missiles by…
>
> 4. Meeting regulatory Positions C.1, C.2, and C.3 of the Appendix to RG 1.117, "Tornado Design Classification," so that important safety-related SSCs are protected from the effects of missiles generated… *by location of independent redundant systems or components in missile-protected structures…*"(emphasis added)

4. Identify the established minimum design basis values necessary to satisfy the SSC design basis safety and quality function(s):

The specified safety function of the emergency diesel generators (for which the exhaust stacks are supporting equipment) are to start, automatically load safe shutdown and/or emergency loads, and to continue to supply those loads as long as necessary to maintain safe shutdown or mitigate the consequences of analyzed accidents and transients described in Chapter 14 of the FSAR.

However, a postulated external event (including a tornado) is not a specified event in Chapters 6 or 14 of the FSAR, and therefore not a "specified safety function". Rather, the functioning of the EDGs in support of a tornado event is a function implied by PBNP GDC 2 and is therefore a "specified function". As described in the correspondence with the AEC pertaining to tornado protection, and consistent with later approved regulatory guidance, the specified function of the EDGs in the event of a tornado is to support reaching "safe shutdown" conditions.

Therefore, the **specified function** of the EDGs in the context of this concern is to automatically start and carry the connected loads. Although not specified in the Current License Bases, the design bases includes the loads necessary to mitigate a tornado induced steam line break (i.e. a break occurring outside of the containment). These are bounded by the maximum load required to be carried in the event of a combination DBA LOCA on one unit, and hot shutdown loads on the other unit, with only one EDG in operation. From Calculation 2004-0002 Revision 4, this is 2718 KW.

5. Evaluate effects of condition, including potential failure modes, on the ability of the SSC to perform its specified TS, or safety support, function(s). The following items shall be covered in the Evaluation:

A. Identify the Mode or other specified conditions of Operability when the specified TS function(s) for the affected SSCs are required;

MODES 1-6 per Technical Specifications.

B. Identify assumptions used;

None

C. Discuss why the degraded or nonconforming condition does or does not prevent the SSC from performing its specified TS function(s). (Include known information that supports the specific evaluation, any adverse impact about the condition, or related analysis);

OPERABILITY

As established in Section 3 above, the ability to withstand a postulated tornado event is not a consideration for OPERABILITY. Therefore, without information to the contrary, it is reasonable to reassert their OPERABLE status per the Presumption of Operability discussed in section 4.3 of NRC Inspection Manual 9900.

CONFORMANCE to CLB

They are, however, non-conforming to the license basis because the stacks are not enclosed in missile resistant structures as described generally in B-TOP-3 and original license submittals for equipment important to safety.

10 CFR 50 Appendix B Criterion XVI requires that the non-conformance be resolved in a timely manner commensurate with the safety significance. Accordingly, corrective actions to resolve this non-conformance (analyses in support of a License Amendment Request, and development of the License Amendment Request itself) are continuing. In the interim, it is important to asses the safety significance of the non-conformance.

SAFETY SIGNIFICANCE CONSIDERATIONS

PLANT CONFIGURATION IS CONSISTENT WITH ESTABLISHED NRC ACCEPTANCE CRITERIA (REDUNDANT TRAIN OF EDGS ARE MISSILE PROTECTED)

In the mid-1990s, Point Beach installed two additional emergency diesel generators (G-03 and G-04), and re-trained the original two (G-01 and G-02). The current configuration has G-01 and G-02 as "A" train EDGs, and G-03 and G-04 as the redundant "B" train EDGs. Since any one of the installed EDGs can carry full accident loads on one unit and simultaneously carry the safe shutdown loads on the other unit, only one EDG per train is required to be OPERABLE by the Technical Specifications. The "B" train EDGs are considered completely missile protected.

This full missile protection of the redundant train EDGs conforms to the applicable approved regulatory guidance of RG 1.117 and NUREG-0800 3.5.2. Based on this, there is reasonable assurance that the specified function of the EDGs in support of safe shutdown following a loss of offsite power caused by a tornado is satisfied.

ABILITY TO WITHSTAND WIND PRESSURE LOADS

During the early review and evaluation efforts associated with this concern, it was determined that while the G-01 and G-02 EDG exhaust stacks themselves could withstand the high wind pressure loads associated with extreme wind events, their supports likely could not. Support failure during a postulated event would lead to simultaneous common-cause failure of both "A" train EDG stacks, and this was found to be a risk-significant concern.

Accordingly, the supports for both stacks and the supporting building structure were reinforced to be able to withstand the wind pressure load from 216 mph winds. This wind speed was selected based on approved NRC guidance in NUREG-4461 Revision 2, "Tornado Climatology of the Contiguous United States", February, 2007. That document establishes a frequency of exceedance of 1E-7/yr for winds of 216 mph. This is considered to be consistent with the requirements of PBNP GDC-2 to consider the highest winds officially recorded at the site and surrounding area plus margin for uncertainty.

This modification has eliminated the risk significant common cause failure mode of the G-01 and G-02 EDG exhaust stacks.

ABILITY OF EXHAUST STACKS TO WITHSTAND MISSILE STRIKES

A previous site specific study on the subject commissioned by the NRC (NUREG/CR-4458, "Shutdown Decay Heat Removal Analysis of a Westinghouse 2-Loop Pressurized Water Reactor", March 1987) identified two discrete hazards to the EDG stacks: wind pressure overload, and missile strike. The occurrence of either event was assumed to cause loss of function of the associated EDG(s), and failure of both EDGs was assumed to lead directly to core damage (no other EDGs were present at the time).

The study concluded that the risk of core damage due to simultaneous failure of both stacks was 6.5E-5/year prior to reinforcing the stack supports. However, after resolving the common mode failure due to wind overload (i.e. eliminating that failure mode), the likelihood of core damage due to stack failure (i.e. the probability of both stacks being struck in the same event) was less than 1E-8/yr (Reference Table 7-4).

That earlier NUREG study did not explicitly evaluate the likelihood of failure of a stack given that a missile strike occurs. However, a recently completed study on the subject (Belcan Project #348-1496, "Investigation of the Impact Response Behavior of PBNP EDG Exhaust Stack Subjected to Impact by a Wood Plank Missile Using the LS-DYNA Finite Element Program", October 20, 2011) reveals that a high speed end-on impact from the postulated plank would not result in significant deformation of the exhaust stacks. Rather, as the velocity of the missile is increased, only moderate deformation occurs until the kinetic energy of the missile is high enough to cause perforation of the stack wall. At that point, the missile may intrude and reduce the effective cross section of the stack by direct blockage. This area reduction is the bounding failure from a licensing basis missile strike.

EC275830 is a completed engineering evaluation that used the results from the Belcan study to determine the likely effects of a worst-case missile (high velocity plank impacting end-on) induced denting and/or perforation on the ability of an EDG to carry load. The evaluation concluded that in the event of such an impact, the EDG would continue to be capable of carrying at least 99.5% of its full rated load.

By comparison, the maximum load required to be carried in the event of a combination DBA LOCA on one unit, and hot shutdown loads on the other unit, with only one EDG in operation is 95.4% (2718 KW per Calculation 2004-0002 Revision 4).

While an automobile missile impact was not explicitly evaluated, the effects of such an impact on stack crushing or "crimping" is considered reasonably bounded by the plank analysis for 5 reasons:

- Automobiles and the types of missiles typified by automobiles are by design "crushable". With the exception of the engine block, they are fabricated from sheet steel that is significantly thinner than the 3/8" exhaust stack pipe wall that is designed to absorb and dissipate collision energy through progressive collapse of the structure. The engine block is fully surrounded by these energy absorbing structures.
- These larger missiles travel at the velocities that are significantly lower than the plank.
- The impact area of automobile typified missiles is substantially larger than the 4" x 12" area of a postulated end-on plank impact. This distributes the impact energy over a much larger impact area and reduces the specific impulse energy.
- Missiles typical of automobiles generally roll, tumble, and slide along the ground, rather than becoming airborne. The functional bottom of the exhaust stacks are ~14' above the surrounding grade

- The lowest extent of the EDG stacks is located between the adjacent missile barrier covering the EDG room intakes and a structural reinforced concrete pilaster that is part of the Class 1 structure. These adjacent structures would tend to fend off low altitude missiles, absorb much their impact energy, and limit the extent of crushing that could occur due to impact from large area, low altitude missiles.

Therefore, even with a maximally damaged stack from a postulated missile impact, there is a high degree of confidence that an EDG would remain capable of carrying the necessary connected loads.

POTENTIAL VULNERABILITY OF STACK SUPPORTS TO MISSILE STRIKES

Although the stacks themselves can withstand damaging missile strikes without a loss of function, this conclusion does not consider the effects of a missile strike directly on (or immediately adjacent to) a stack support, particularly in the presence of superimposed worst case wind loading. This issue requires additional evaluation prior to final resolution. There are two lateral and one deadweight support per stack, each with a characteristic dimension of ~2 ft, while the stacks themselves are ~100 ft in length. Therefore, these supports comprise a relatively small target cross section for missiles.

These results illustrate the resiliency of the installed stacks and EDGs, and their ability to accommodate a significant degree of damage and still carry their full design basis loads. This is due to the use of standard weight pipe rather than sheet metal ducting or similar lighter weight material in the design of the stacks.

SUMMARY

The G-01 and G-02 EDGs are OPERABLE but Non-Conforming pending modifications, a license amendment, or other actions to formally resolve the open concerns with their exhaust stacks.

Four elements contribute to assurance of OPERABILITY, and to safety and maintenance of the specified functions of the EDGs despite the non-conformance:

OPERABILITY

1. Non-conformance to a GDC does not, in and of itself, cause an SSC to be INOPERABLE. There is no connection between the requirements of 10 CFR 50.36 and the ability of the EDGs to withstand a tornado event. In particular, the specified function in support of a tornado is not a *specified safety function* (i.e. contained within the analyses of Chapter 6 or Chapter 14 of the FSAR), and is therefore not a factor in determining OPERABILITY.

SAFETY SIGNIFICANCE

2. Even if the G-01 and G-02 exhaust stacks do not conform to the current NRC application of the requirements of PBNP GDC 2, the overall EDG installation at the site conforms to the NRC's established acceptance criteria for tornado missile protection of emergency on-site power supplies by providing complete protection of the redundant independent train. This provides assurance that the specified function to support the connected loads is satisfied in the event of a tornado and even a tornado induced steam line break.
3. The dominant common failure mode (wind pressure overload) that previously drove a higher than desired probability of failure of the G-01 and G-02 EDGs has been eliminated.
4. The stacks themselves can withstand a strike from a worst-case postulated missile that causes maximum denting, perforation, and obstruction of the stack without loss of EDG load carrying function. The potential exception is a highly unlikely strike of a missile that causes structural failure of a stack support and subsequent collapse of the associated stack. In that case, since the two stacks are separated by ~30 feet (greater than the major dimension of credible

missiles), it is not credible that a single missile would strike and inflict incapacitating damage on both stacks.

D. Describe (for SSC not fully capable of performing its specified TS function(s)) compensatory actions (e.g., procedure changes, facility changes, or substitution of manual actions for automatic functions) taken to address the condition (compensatory actions must be reviewed under 10 CFR 50.59):

Because the EDGs are OPERABLE, no compensatory measures are required to maintain or restore OPERABILITY. However, to enhance the capability of the G-01 and G-02 EDGs to withstand a tornado event (a specified function), six compensatory actions shall be implemented:

1. Upgrade the existing EDG stack supports to withstand the maximum credible wind pressure force from a postulated tornado. This action has been completed.

2. During the months of April through September[2], if a site meteorological instrument indicates a valid wind speed in excess of the design bases 108 mph for general plant buildings, or in the event that a tornado is confirmed on site (within the owner controlled property), an orderly shutdown of both units shall be commenced within 1 hour and shall continue until a damage assessment has confirmed that the G-01 and/or G-02 emergency diesels have remained OPERABLE and the requirements of TS LCO 3.8.1 and/or 3.8.2 as applicable are met. This action shall not be construed as requiring precipitous maneuvering of the plant while simultaneously monitoring and coping with the immediate wind event.

   The immediate assessment shall consist of a walk down by Operations to visually check for indications of structural distress (i.e. denting, bending, twisting, cracking, etc.) of the stacks and supports (one deadweight support and two brackets per stack). If indications of structural distress are apparent, the associated EDG(s) shall be considered INOPERABLE until further evaluation is completed by Engineering.

   This compensatory measure shall be proceduralized by incorporation in station procedure AOP-13C (Severe Weather Conditions).

3. During the months of April through September, an exclusion area shall be maintained to the east of the turbine building. The exclusion area shall extend from the northern most extension of the north service building to the southern most extension of the Technical Support Center building, and from the east wall of the turbine building (or maintenance shop, north service building, or TSC as applicable) to the lakeshore. No outdoor storage or staging of materials is permitted in the exclusion area. No vehicles are permitted to remain unattended within the exclusion area. No dumpsters, bins, trash barrels, or other receptacles, whether empty or full are permitted within the exclusion area. Items and vehicles may transit the exclusion area while enroute to acceptable storage locations (e.g. inside the turbine building, pump house, maintenance shop, etc., or to acceptable outdoor locations outside the exclusion area). Exceptions to this exclusion area compensatory measure may be made on a case-by-case basis with prior evaluation from Engineering.

   This compensatory measure shall be implemented through NP 1.9.6 (Plant Cleanliness and Storage), and the exclusion area shall be verified free of disallowed material, equipment and vehicles at least once per day.

[2] The detailed bases for selection of this period for implementation was developed in Revision 0 of this POD, and is not reiterated here for the sake of brevity. At the Point Beach site and surrounding areas there have been no officially recorded instances of winds high enough to credibly inflict damage on the EDG stacks during the excluded months of October through March, including margin for uncertainty. This is consistent with PBNP GDC-2.

4. Prior to performing a planned activity that removes G-03 and/or G-04 from service during the months of April through September (e.g. monthly surveillance testing as required by Technical Specifications that results in brief periods of inoperability), a weather look-ahead shall be performed for the period of the planned activity. If the National Weather Service forecast for the Point Beach vicinity includes a chance of "high winds" during the scheduled activity, the activity shall be deferred until weather no longer threatens.

   This compensatory measure shall be implemented through the Work Management process as implemented by procedure FP-WM-SCH-01 (Online Scheduling Process).

5. During the months of April through September, elective maintenance shall not be performed on the G-03 and/or G-04 EDGs if it would result in a configuration that cannot be promptly restored to a functional condition. This shall not preclude the performance of routine and required surveillances (e.g., running of an EDG to comply with Technical Specification surveillance requirements), even if the EDG is rendered INOPERABLE for brief periods to permit manually barring over, etc.

   This compensatory measure shall be implemented through the Work Management process as implemented by procedure FP-WM-SCH-01 (Online Scheduling Process).

6. If, during the months of April through September, it becomes necessary to perform maintenance on either G-03 or G-04 that renders the EDG non-functional for an extended period, the remaining "B" train EDG and both turbine driven AFW pumps (1P-29 and 2P-29) shall be placed in "protected" status until the affected "B" train EDG has been restored to OPERABLE status.

   This compensatory measure shall be implemented through the Work Management process as implemented by procedure FP-WM-SCH-01 (Online Scheduling Process).

These measures improve the likelihood that at least two sources of motive power for auxiliary feedwater (the primary safe shutdown success path for decay heat removal) will remain available in the event that a tornado missile renders an A train EDG non-functional. Additionally, the protection of "B" train power will maximize the likelihood that power to a charging pump or high head safety injection pump will remain available (a longer term consideration for maintaining safe shutdown conditions).

Compensatory action 4 was established in a previous revisions of this POD. Subsequent to establishing that requirement, additional clarification was sought by site personnel on how to implement it. Specific guidance was provided via internal memorandum NPM 2012-2012. A copy of that memorandum has been attached to this revision of the POD.

E. Evaluate continued operation should the degraded condition degrade further and describe the method used to monitor the degraded condition until corrected (e.g., operator rounds, system health trending/walkdowns, CAP monitoring action) or provide justification why monitoring is not required. (The POD must be forward looking to assess conditions that may impact the SSC during the period of operation until the condition is corrected, especially for PODs that rely on equipment performance information):

This condition is not related to degradation. Although very unlikely, if an EDG were rendered INOPERABLE from the effects of a tornado, or for another reason, it would be declared INOPERABLE and the applicable Technical Specification action statement entered. Abnormal Operating Procedure AOP-13C ("Severe Weather Conditions") requires an assessment of damage caused by high winds and this would prompt an Operability determination if damage to the stack was identified.

F. Assess (for SSC not fully capable of performing its specified TS function(s)) the impact of Engineering Changes (e.g., modifications) scheduled for implementation over the duration of the POD and applicable open PODs and their cumulative impact on this POD (including a review of any related compensatory actions in place as a result of an open POD(s)):

F. Assess (for SSC not fully capable of performing its specified TS function(s)) the impact of Engineering Changes (e.g., modifications) scheduled for implementation over the duration of the POD and applicable open PODs and their cumulative impact on this POD (including a review of any related compensatory actions in place as a result of an open POD(s)):

NA

G. Conclusion:

- The G-01 and G-02 EDGs are OPERABLE but Non-Conforming pending modifications, a license amendment, or other actions to formally resolve the open concerns.
- Corrective actions to resolve the non-conformance should be addressed in accordance with the station corrective action program and in a timely manner commensurate with the safety significance of the non-conformance.

Because there is no category of "OPERABLE but NON-CONFORMING", the "Operable but degraded, and below Full Qualification" category is checked on the following page. It must be emphasized that no equipment is degraded according to the definition contained in RIS 2005-20. AR01685947 has been submitted on the matter of the deficiency in the pre-printed POD form.

6 References:

1. Point Beach Unit 1 and 2 Technical Specifications and Bases
2. Point Beach FSAR and Appendices
3. Question 1.1 of the FFDSAR, filed under correspondence as report "FFDSAR-Q1.1" and dated 1/16/1970.
4. NUREG-0800 (Standard Review Plan) 3.5.2, "Structures, Systems, and Components to be Protected from Externally-Generated Missiles", Revision 3 [ML070460362]
5. NRC Regulatory Guide 1.117, "Tornado Design Classification", Revision 1, April 1978 [ML7907110104]
6. Code of Federal Regulations, Title 10, Chapter 50, Section 36 (10 CFR 50.36).
7. Statements of Consideration for 10 CFR 50.36
8. NRC Final Policy on Technical Specifications Improvements
9. NRC Safety Evaluation Report (SER) dated 8/8/2001("Safety Evaluation By The Office of Nuclear Reactor Regulation Related to Amendment No. 201 to Facility Operating License No. DPR-24 and Amendment No. 206 to Facility Operating License No. DPR-27"), filed internally as SER 2001-0007.
10. NRC Task Interface Agreement, TIA 2011-011, dated August 16, 2011, "Evaluation of Point Beach Nuclear Plant Tornado Missile Protection Licensing Basis")
11. ANSI N18.2-1973, "Nuclear Safety Criteria for the Design of Stationary Pressurized Water Reactor Plants"
12. Bechtel Topical Report B-TOP-3, "Westinghouse Electric Corporation Wisconsin Michigan Power Company Point Beach Atomic Power Station Design Criteria for Nuclear Power Plants Against Tornados"
13. NRC Inspection Manual Part 9900 (Technical Guidance), "Operability Determinations & Functionality Assessments for Resolution of Degraded or Nonconforming Conditions Adverse to Quality or Safety"
14. Engineering Evaluation EC 275830, Effects Of Missile-Induced Crushing Of An EDG Exhaust Stack.
15. NUREG/CR-4458, "Shutdown Decay Heat Removal Analysis of a Westinghouse 2-Loop Pressurized Water Reactor", March 1987. Appendix G "Extreme Wind Analysis for the Point Beach Nuclear Power Plant"
16. NUREG/CR-4461 Rev 2, "Tornado Climatology of the Contiguous United States", February 2007
17. Calculation 2004-0002 Revision 4, "EC 262196 - AC Electrical System Analysis"
18. TSTF-11-09, "Request to Revise Part 9900 Technical Guidance, "Operability Determinations & Functionality Assessments for Resolution of Degraded or Nonconforming Conditions Adverse to Quality or Safety"", 5 July 2011

7. Attachments:

Memorandum NPM 2012-0072, "PPG Implementation of Compensatory Measures for Tornado PODs (2 pages)

8. MODE Restrictions (APPLICABILITY Restrictions for ISFSI Conditions):

None

CR: 1678709 Revision: 4

CHECK ONE	PROMPT OPERABILITY DETERMINATION
	Affected SSC should be considered Operable since it is fully qualified, meeting As-Built condition.
	Affected SSC should be considered Operable and above Full Qualification but with reduced margin below some FPL requirement. There is a high degree of confidence that the degraded SSC meets Full Qualification as described in the Current Licensing Basis. Action item _____ was initiated to notify the System Engineer of this item for potential System Health Report discussion.
X	Affected SSC should be considered Operable but degraded*, and below Full Qualification. Continued Operability is based on the provisions of RIS 2005-20. Action item 1678709-02 was initiated to administratively track resolution of this item.
	Affected SSC should be considered inoperable.

*Because there is no category of "OPERABLE but NON-CONFORMING", the "Operable but degraded, and below Full Qualification" category is checked on the following page. This form is deficient. As currently issued, the form does not provide a provision for an Operable But Non-Conforming condition. This form deficiency has been documented in AR 1685947 for resolution. The equipment is NOT degraded per the definition of RIS 2005-20

Prepared By: T. C. Kendall _____ Date 3/27/12
Print/Sign

Reviewed By: Chuck Richardson _____ Date: 3/27/12
Print/Sign

SM Approval: Steve Bowe _____ Date/Time: 3/27/12 1530
Print/Sign

Additional Reviews

Reviewed By: Patrick Wild / _____ Date: 3/27/12
Print/Sign

Reviewed By: C. Trezise / _____ Date: 3/27/12
Print/Sign

Reviewed By: Jim Costedio / _____ Date 3/27/12
Print/Sign

Distribution:

Responsible Supervisor
Responsible System Engineer

FPL Nuclear Station OPERABILITY Condition Model

Relative Level of SSC Degradation

Operable - Region

As-Built Condition as Described in FPL Drawings, Specifications, Procedures, etc.

Operable -
Above Full Qualification
(Reduced Margin)

Full Qualification as Described in the Current Licensing Basis

Operable - Degraded,
Below Full Qualification
(RIS 2005-20)

SSC Capable of Performing Required Safety Function(s)

Inoperable -
Technical Specifications/CLB
Action(s) as applicable

NEXTera ENERGY POINT BEACH

INTERNAL CORRESPONDENCE

NPM 2012-0072

To: Chuck McMillan and Gary Alkire

From: Tom Kendall and Chuck Richardson

Date: February 29, 2012

Subject: PPG implementation of Compensatory Measures for tornado PODs

Copy To: George Vickery, Rob Harrsch

ARs 1678709 and 1727221 each established compensatory measures intended to minimize the risk associated with tornado hazards on the site. The compensatory measures require that during the months of April through September, a "weather look-ahead" be performed prior to conducting planned activities that remove the P-53 pumps, the P-38 pumps, or the G-03/G-04 EDGs from Operable status. These compensatory measures state that "If the National Weather Service forecast for the Point Beach vicinity includes a chance of "severe thunderstorms" during the scheduled activity, the activity shall be deferred until weather no longer threatens".

This memorandum provides additional clarification on the intended implementation of these compensatory measures for the purposes of planning and scheduling necessary activities.

These are the steps for establishing whether high winds are forecast for the site:

1. Access the "Day 1 Convective Outlook" on the National Weather Service's Storm Prediction Center web site: www.spc.noaa.gov/products/outlook/day1otlk.html
2. Click on the dark "Wind" tab at the top of the map to pull up the graphic of high wind probabilities for the current day's outlook.
3. If the site is within any of the probability areas (5% or greater), then the work is to be deferred.
4. Check that the forecast is valid for the time of the planned activity (valid times are listed in the lower left of the map in GMT; CST = GMT - 6 hrs, CDT = GMT - 5 hrs)
5. IF the planned activity will extend beyond the valid time of the forecast, THEN:
    a. Go back to the previous page
    b. Click on "Day 2 Outlook" near the upper right of the screen
    c. Click on the "Probabilistic" tab to pull up the graphic of high wind probabilities for the next day's outlook.
    d. If the site is within any of the probability areas (5% or greater), then the work is to be deferred.

While this process could be pursued for work extending beyond the day 2 outlook window, the expanding areas due to prediction uncertainties make it improbable that work could be scheduled in compliance with the compensatory measures.

The phrase in the compensatory measures that states "during the scheduled activity" should be understood to mean during the period that the affected component would be inoperable (P-53 pumps and EDGs) or unavailable (P-38 pumps). It is recommended that for work expected to

exceed 50% of the forecast storm free window, the requirements of WM-AA-1000 for work exceeding 50% of a Technical Specification allowed outage time be applied to appropriately manage the risk.

Additionally, the compensatory measures require that "elective maintenance shall not be performed on the G-03 and/or G-04 EDGs if it would result in a configuration that cannot be promptly restored to a functional condition". For this requirement, "elective maintenance" means any maintenance that is not required to maintain the SSC Operable. For example, maintenance to correct a deficiency that has already rendered the SSC inoperable, or might cause it to become inoperable if left uncorrected is not elective. Conversely, maintenance that is performed for purely housekeeping purposes (e.g. to repair a leaking connection that does not challenge Operability) is elective.

Also as used in this context, "promptly restored" means within 50% of the available weather window discussed previously in this memorandum.

Prepared by: 2/29/12

Reviewed by: 3/1/12