UNITED STATES
NUCLEAR REGULATORY COMMISSION
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
AMPACITY DERATING ISSUES
GENERAL PUBLIC UTILITIES NUCLEAR CORPORATION
OYSTER CREEK NUCLEAR GENERATING STATION
DOCKET NO. 50-219

BACKGROUND

By letter dated November 25, 1996, General Public Utilities (GPU) Nuclear (the licensee) submitted a response to the NRC Request for Additional Information (RAI) related to Generic Letter (GL) 92-08, "Thermo-Lag 330-1 Fire Barriers," for the Oyster Creek Nuclear Generating Station (OCNGS).

The staff RAI dated August 26, 1996, had identified a number of open issues and concerns requiring clarification by the licensee. The subject licensee submittal contained the response to staff questions regarding its ampacity methodology. The staff evaluation of the ampacity derating methodology for OCNGS follows.

EVALUATION

After reviewing the licensee's submittals and Sandia National Laboratories (SNL) Technical Letter Report (see Attachment 2), the staff agrees with the SNL analyses and conclusions. The ampacity derating analysis questions, the licensee's response, SNL observations and the staff's evaluation of the responses follow.

Ampacity Derating Analysis Review

- Question 1

  The licensee stated that Thermo-Lag was installed on conduits using preformed sections and concludes that this would leave no air gaps. However, the staff agrees with its contractor that an air gap between the outer surface of the conduit and the inner surface of the barrier would be expected unless specific steps are taken to eliminate this gap. This may invalidate the licensee's comparison to the Tennessee Valley Authority (TVA) test results because TVA installation procedures for conduits specifically called for eliminating this air gap by "prebuttering" the entire inner surface of the barrier sections. The licensee must further assess the applicability of the TVA test results to its own installations recognizing this potential difference in installation procedures.

Enclosure 1

Licensee Response

In its submittal dated November 25, 1996, the licensee stated that the TVA 3-hour barrier test configurations were not prebuttered on the entire surface of the barrier sections. The Omega Point Laboratory Reports No. 11960-97337 and 97338, "Electrical Test to Determine the Ampacity Derating of an Electrical Raceway Fire Barrier System for Class IE Electrical Circuits," dated August 21, 1995, describe the test barrier material installation highlights and specifies that the enclosure for the conduit was constructed from nominal one and one-fourth inch thick preformed conduit sections which were dry fit to the conduit and secured with stainless steel bands. The licensee contends that the presence or lack of an air gap is not applicable because the subject OCNGS installed barriers and the tested TVA 3-hour barriers are comparable in terms of construction.

Staff Response

The information provided by the licensee fully resolves the staff's concerns.

- Question 2

The licensee needs to provide complete calculations in order to evaluate the appropriateness of its ampacity assessment approach and implementation. Otherwise, specific and complete examples of the ampacity derating calculations illustrating all aspects of those calculations in detail (baseline ampacity with source, cable characteristics, conduit size and type, percent fill, number of conductors, fire barrier rating, etc.) should be provided for typical 1-hour conduits, typical 3-hour conduits, and typical air drops. See attached SNL Report for details.

Licensee Response

In its submittal dated November 25, 1996, the licensee provided one example of the calculations in the following applications: (1) a conduit using a three-hour barrier; (2) a conduit using a one-hour barrier; and (3) an air drop barrier.

Staff Response

The information provided by the licensee fully resolves the staff's concerns.

- Question 3

It appears that the licensee has assumed an ambient temperature of 30°C for items 15, 16, 17, and 31. Ambient temperature of 30°C would not be expected to bound the environmental conditions in most typical plant areas. The licensee should review the assumed ambient temperatures used in the calculation and provide adequate justification for the assumptions.

Licensee Response

In its submittal dated November 25, 1996, the licensee stated that the OCNGS ambient cable deratings based on 30°C, as previously submitted to the staff have been revised to incorporate more conservative deratings based on an ambient temperature of 40°C.

Staff Response

The information provided by the licensee fully resolves the staff's concerns.

- Question 4

It appears that the licensee has assumed an 11% "bounding" ampacity derating factor (ADF) for 1-hour fire wraps including air drops. This value fails to bound the Texas Utilities (TU) results in which air drop ADF values in the range of 21.2% to 31.8% were reported. Ampacity assessments for cables involving air drop configurations should be performed using realistic estimate of the fire barrier ADF impact.

Licensee Response

In its submittal dated November 25, 1996, the licensee states that OCNGS Circuits 62-93 and 62-100 are enclosed by a 1-hour air drop fire barrier. The subject air drop configurations are each approximately 2 to 3 feet in length. The total length of each circuit is over 500 feet. The licensee contends based on the rationale provided by National Electric Code (NEC) 310-15(c) which allows that no additional derating factor need to be applied for circuits which are less than 10% of the total length of circuit or a maximum of 10 feet that no additional derating needs to be applied other than that for the conduit fire barrier (i.e., 11% ADF) since the air drop configuration length is so short

Staff Response

The information provided by the licensee adequately addresses the concern regarding a misapplication of Ampacity Correction Factor (ACF) values for air drop fire barriers. Instead the conduit derating value of 11% is expected to conservatively bound the very short air drop barrier length which should not experience significant localized heating effects. The licensee response fully resolves the staff's concerns.

- Question 5

The calculated load current for battery chargers (items 5 and 6) is shown as 12.5 amps (actual). This current could be much higher if the battery is discharged. Provide a technical basis for the acceptability of the cable during charging the fully discharged battery for the required duration.

Licensee Response

In its submittal dated November 25, 1996, the licensee cited that battery discharge conditions are only rarely experienced during a two year outage cycle. During such periods current loads are monitored by plant procedure. The licensee considered a

potential 10% overload condition on the maximum current load for the subject battery chargers.

Staff Response

The licensee response is adequate to resolve the identified concern. Specifically, the licensee has allowed for a 10% overload condition on the applicable circuit which is by design limited to its maximum rated current load. In addition, the licensee has cited existing plant procedures to identify and resolve any overload conditions.

- SNL Observations

During the review of the licensee submittal dated November 25, 1996, SNL identified the following observations of a minor nature:

1) SNL noted that the licensee adjusted all of the NEC tabulated values using an ACF of 0.91 to derate for a plant ambient of 40°C. Ampacity limits for the licensee's 5 kV cables appear to be have taken from NEC Table 310-73, and these table values are already based on 40°C ambient temperature.

Staff Comment: The apparent error results in additional conservatism to the ampacity derating assessment of the subject cables. Therefore, there is no material impact on the staff evaluation conclusions.

2) SNL notes that the application of the NEC conduit conductor count correction factors was unclear how the set of NEC values that was used in the subject analyses; either the pre-1990 values which are based on 50% load diversity assumptions or the post-1990 values which take no credit for loading diversity. This observation will impact cladded conduits with 10 or more conductors.

Staff Comment: Given the limited potential impact for conduits with 10 or more conductors and the available ampacity margin which should be sufficient to bound a change in the specific ACF value it is anticipated that this concern will have a material impact on the staff evaluation conclusions.

Application of Ampacity Derating Methodology

The licensee's analysis begins by utilizing the baseline ampacity limits for individual cables based on NEC Handbook values. Note that all of the installed Thermo-Lag fire barriers protecting electrical raceways are associated with conduits or air drop configurations only. For each baseline ampacity limit the value is adjusted for ambient temperature and the number of conductors in the conduits. Finally, the licensee applies an ACF value to reflect the impact of the fire barrier system. The final result is an estimate of the fully derated ampacity limit for the individual cables. Given these estimates the licensee then compares the actual installed service loading to the analyzed ampacity limits. The licensee has concluded that the estimated ampacity limits bound the installed service loads at OCNGS.

The staff finds that the SNL observations as previously discussed to be items for later onsite review and verification by the staff after they have been conveyed to the licensee for disposition. The apparent error involving the unnecessary ambient temperature correction results in a conservative treatment for the applicable 5 kV cables. This item can be addressed at the licensee's discretion. The potential concern pertaining to the application of the NEC conduit conductor count correction factors is limited in scope such that given the significant level of margin which has been demonstrated for most cables, it is not anticipated that it will have a material impact on the licensee's ampacity derating assessments. Therefore, both items are minor in nature and do not affect the overall staff conclusions regarding the licensee's ampacity derating methodology.

The licensee utilized in its assessment of the fire barrier impact, i.e., ACF values, the results from the Texas Utilities Electric (TUE) and Tennessee Valley Authority (TVA) ampacity derating tests. Given the licensee is now relying on industry ampacity derating test data (i.e., TUE test data) which has been reviewed and accepted by the staff for its ampacity derating assessment approach the staff finds that the actual operating conditions do not result in exceeding cable ampacity limits for the applicable electrical raceways protected by Thermo-Lag fire barriers at OCNGS.

The onsite review of the licensee implementation of its methodology is outside of the scope of this evaluation. The licensee revised calculations are available for onsite review and verification by the staff.

CONCLUSIONS

From the above evaluation, the staff concludes that no significant safety hazards are introduced through use of the licensee's ampacity derating methodology. Therefore, the application of Thermo-Lag fire barriers to enclose cables at Oyster Creek Nuclear Generating Station does not represent a safety concern with respect to ampacity. Given the licensee revision to its design calculation it is recommended, that the staff evaluation be used in a follow up site inspection to verify implementation of the licensee changes to its design documentation especially the potential concern regarding the application of the NEC conduit conductor count correction factors (see Section 2.5 of Attachment 2).