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November 25, 1996
6730-96-2336

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

Gentlemen:

Subject: Oyster Creek Nuclear Generating Station (OCNGS)
Docket No. 50-219
Facility Operating License No. DPR-16
Response to Request for Additional Information Regarding Thermo-Lag Related Ampacity Derating Issues

NRC letter dated August 26, 1996 (6730-96-3276) requested additional information regarding Thermo-Lag related ampacity issues.

The attachment provides an itemized response to each of the NRC questions. If any additional information is required, please contact Mr. David J. Distel, GPU Nuclear Regulatory Affairs at (201) 316-7955.

Very truly yours,

Michael B Roche

Michael B. Roche
Vice President & Director,
Oyster Creek Nuclear Generating Station



DJD/plp
Enclosures

cc: Administrator, Region I
OCNGS NRC Resident Inspector
OCNGS NRC Project Manager

A029

# Attachment

**NRC 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.

**Response:**

OCNGS has utilized only the 3-hour test results from the TVA ampacity test program. OCNGS ampacity derating values for 1-hour barriers are derived from Texas Utilities (TU) test results for 1-hour barriers.

It is noted 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 state that the enclosure for the conduit was constructed from nominal 1-1/4 inch thick preformed conduit sections which were dry fit to the conduit and secured with stainless steel bands. Therefore, the presence or lack of an air gap can be considered not applicable since both OCNGS and TVA 3-hour barrier base Thermo-Lag test barrier construction are comparable as both were dry fit around the conduit. Additionally, it is noted that TVA's 3-hour test barriers employ additional mats and trowel grade material providing an additional insulating effect as indicated in our previous response letter (C321-95-2350) dated December 8, 1995. Based on the above, the TVA 3-hour test results are considered to be representative of OCNGS 3-hour installations for the purpose of bounding ampacity derating values applied to the OCNGS 3-hour barrier configurations.

**NRC 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.

## Attachment

**Response:**

Attachment A provides specific circuit examples of the OCNGS derating calculation approach for typical 1-hour conduits, typical 3-hour conduits, and typical air drops. Baseline ampacity (rated amps) and derating values for ambient temperatures and the number of conductors in the raceway are based on National Electric Code specifications, as shown in Attachment A. Cable and conduit characteristics are also identified in the Attachment A. Additional calculation assumptions and conservatisms were previously described in GPU Nuclear letter C321-95-2350, dated December 8, 1995.

**NRC 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.

**Response:**

The OCNGS ambient temperature cable deratings based on 30°C, as previously submitted, have been revised to incorporate more conservative deratings based on an ambient temperature of 40°C. The revised derated amperage values are shown on the attached revised Table 1. This Table indicates that the existing OCNGS Thermo-Lag protected Appendix R circuits are adequate for the revised design ampacity derating factors.

**NRC 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.

**Response:**

OCNGS Circuits 62-93 and 62-100 contain 1-hour fire wraps for an air drop configuration. These two circuit air drop configurations are each approximately 2 to 3 feet in length. The total length of each respective circuit is over 500 feet. National Electric Code 310-15(c) specifies that no additional derating factor need be applied for circuits which are less than 10% of the total length of circuit or a maximum of 10 feet. Based on the above, OCNGS has determined that the 11% bounding ADF is applicable for the air drops associated with these two (2) circuits.

## Attachment

However, it should be noted that the maximum available ADF for Circuit 62-93 is 48.7%, and the maximum available ADF for Circuit 62-100 is 19% using an actual maximum circuit loading based on the existing breaker rating. However for Circuit 62-100, the ADF is 97% based on calculated circuit load. These values are shown on the attached Table 1.

**NRC 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.

**Response:**

During normal plant operation the station battery chargers carry the load for the normal DC load on Bus "C" and the float current for battery "C". The load is approximately 10 amps. The OCNGS station batteries are discharged and charged only during the performance and service tests which are performed during each refueling outage (2 year interval). Under normal plant operating conditions the battery is on float. Battery current is monitored once per shift in accordance with Plant Procedure 106, and corrective action is taken if required. Therefore, no credible scenario exists within the existing design basis which would require these circuits to be derated due to current flow to a fully discharged battery.

Additionally, it is noted that a maximum current of 153 amps, based on the battery charger nameplate rating plus a 10% overload current (battery chargers are current limited), would be expected if the battery is discharged. This conservative value remains bounded by the calculated derated value of 158 amps shown on Table 1.

**Example Item 19** (one hour fire wrap, air drop length 2 to 3 feet)

| | |
|---|---|
| · Circuit designation: | 62-100 |
| · Circuit description: | 125 VDC control power to 4160V SWGR 1D<br>2-1C #4 AWG, conduit 1¼" steel, portion of this cable is run in conduit with cable 62-93 (1½" conduit).<br>Conduit fill = 16%. |
| · Maximum cable load = | 56 Amps. (This is based on 70 Amps breaker and 80 % of the breaker rating. Calculated continuous load is about 2 Amps). |
| · Rated current at 30°C | = 95 Amps |
| · Rated current at 40°C | = 95 x 0.91 = 86.5 Amps |
| · Rating due to multiple conductors (greater than 3) in conduit | = 86.5 x 0.8 = 69.2 Amps |
| · Rated current due to TSI wrap | = 69.2 x 0.89 = 61.6 Amps |

· There is no derating required due to air drop because of very small length of air drop (2 to 3 feet) relative to the total length (about 500 feet). Reference National Electric Code Article 310-15(c).

· Since the maximum cable load (56 Amps, actual 2 Amps) is less than the derated current (61.6 Amps), circuit is acceptable.

· Maximum available derating based on a calculated load of 2 amps is 97 8%.

**Example Item 31** (3 hour fire wrap)

- Circuit designation: 86-71
- Circuit description: From 4160V SWGR EDG-2
  6-1/C, 500 MCM; 2 conduits 3½" / 4", transite/steel
  each conduit with 3 conductors.
  Conduit fill = 38%.
- Maximum load current = 543 Amps (Ref. B&R Calculation 3731-29-E007)
- Rated current at 30°C = 950 Amps (475 Amps x 2; because of 2 conductors/phase)
- Rated current at 40°C = 950 x 0.91 = 864.5 Amps
- Since there are 3 conductors per conduit, no derating is required per NEC.
- Rated current due to TSI wrap = 864.5 x 0.82 (18% derating)
  = 708.9
- Since the maximum load current (543 Amps) is less than the maximum derated current (708.9 Amps), circuit is acceptable.

**Example Item 15** (One hour fire wrap)

| | |
|---|---|
| · Circuit designation: | 14-25 |
| · Circuit description: | From 4160V Emergency Switchgear 1D to 460V Unit Substation 1B2 3-1/C, 500 MCM, 3½" steel conduit.<br>Conductor fill = 38%. |
| · Load current: | 281 Amps (Ref. GPUN TDR 1136, Rev. 0) |
| · Rated current at 30°C | = 475 Amps |
| · Rated current at 40°C | = 475 x 0.91 = 432 Amps |
| · No. of conductors in conduit | = 3 |

· No derating required per NEC for conductors 3 or less.

| | |
|---|---|
| · Rated current due to TSI wrap | = 432 x 0.89 (11% derating)<br>= 384 Amps |

· Since the maximum load current (281 Amps) is less than the maximum derated current (384 Amps), circuit is acceptable.

# Table 1



| CALCULATION FOR THERMO-LAG AMPACITY DERATING FOR OCNGS | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | DERATED AMPS DUE TO: | | | |
| ITEM | CIRCUIT # | CIRCUIT DESCRIPTION | CABLE SIZE | CALCULATED ACTUAL LOAD AMPS | CABLE RATED AMPS @ 30°C | AMBIENT 40°C | MULTIPLE CONDUCTORS IN RACEWAY | FIRE WRAP (USING TSI DATA) | FIRE WRAP (USING TU/TVA DATA) |
| 1 | 11GP1402 | Inst. PNL 4C Feed to RSP | 2-1/C #8 | 24 | 55 | 50 | 40 | 36 | 35.6 |
| 2 | 11NP1403 | Inst. PNL 4C Feeder to Fire Det. Pnl. | 2-1/C #12 | 10 | 30 | 27.3 | 21.8 | 20 | 19.4 |
| 3 | 112P1406 | Halon Syst Protection | 2-1/C #12 | 5.5 | 30 | 27 | 19 | 17 | 16.9 |
| 4* | 11-861 | HVAC Control PNL | 2/C #10 | 20 | 40 | 36 | 25 | 23 | 22.3 |
| 5* | 12-600 | Battery Charger C1 | 3-1/C #2/0 | 12.5 Actual | 195 | 177.5 | 177.5 | 163 | 158 |
| 6* | 12-601 | Battery Charger C2 | 3-1/C #2/0 | 12.5 Actual | 195 | 177.5 | 177.5 | 163 | 158 |
| 7* | 12-602 | Battery Room C Ventilation Fan F1 | 1-3/C #10 | 4.3 | 40 | 36.4 | 36.4 | 33.5 | 32.4 |
| 8* | 12-603 | Battery Room C Ventilation Fan F2 | 1-3/C #10 | 4.3 | 40 | 36.4 | 36.4 | 33.5 | 32.4 |
| 9 | 12-604 | Battery Room C Vent Heater/Fan | 1-3/C #10 | 24 | 40 | 36.4 | 36.4 | 33.5 | 32.4 |
| 10* | 12NP0825 | "A" SWGR Rm HVAC Fan | 3-1/C #12 | 17.5 | 30 | 27.3 | 21.8 | 20 | 19.4 |
| 11* | 12NP0826 | "A" SWGR Rm HVAC Fan | 3-1/C #12 | 17.5 | 30 | 27.3 | 21.8 | 20 | 19.4 |
| 12* | 12GP0816 | Power to Valve V-14-37 | 4-1/C #10 | 10 | 40 | 36 | 25 | 23 | 22.3 |
| 13* | 12GP0817 | Power to Valve V-14-32 | 3-1/C #12 | 10.25 | 30 | 27.3 | 19.1 | 17 | 17 |
| 14 | 122PO845 | Refueling Platform | 3-1/C #6 | 30 | 75 | 68 | 48 | 44 | 42.7 |
| 15* | 14-25 | 460V USS 1B2 | 3-1/C 500 MCM | 281 | 475 | 432 | 432 | 397 | 384 |
| 16* | 14-28 | 460V USS 1B3 | 3-1/C 2/0 | 150 | 205 | 186.5 | 186.5 | 171.6 | 165.9 |
| 17 | 14-31 | 400 HP Emerg. Serv. Water Pump 1-3 | 3-1/C 2/0 1/C #6 | 67 | 205 | 186.5 | 186.5 | 171.6 | 165.9 |

# Table 1



| CALCULATION FOR THERMO-LAG AMPACITY DERATING FOR OCNGS | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | DERATED AMPS DUE TO: | | | |
| ITEM | CIRCUIT # | CIRCUIT DESCRIPTION | CABLE SIZE | CALCULATED ACTUAL LOAD AMPS | CABLE RATED AMPS @ 30°C | AMBIENT 40°C | MULTIPLE CONDUCTORS IN RACEWAY | FIRE WRAP (USING TSI DATA) | FIRE WRAP (USING TU/TVA DATA) |
| 18* | 62-93 | 125V DC to 460V SWGR 1B3 | 2-2/C #6 | 56 | 150 | 136.5 | 109.2 | 100.5 | 97.2 |
| 19* | 62-100 | 125V DC to 4160V SWGR 1D | 2-1/C #4 | 56 | 95 | 86.5 | 69.2 | 63.7 | 61.6 |
| 20* | 62-153 | 125V DC POWER to DC-2 PNL | 2-1/C 2/0 | 85 | 195 | 177 | 177 | 163 | 157 |
| 21* | 62-158 | 125V DC to 460V SWGR 1A2 | 2-1/C #2 | 56 | 130 | 118.3 | 118.3 | 108 | 105 |
| 22* | 62-161 | 125V DC Power to PNL F | 2-1/C 2/0 | 150 | 195 | 177 | 177 | 163 | 157 |
| 23 | 62-165 | DC Power to RPS PNL 6XR | 1-2/C #10 | 15 | 40 | 36.4 | 25.5 | 23.4 | 22.7 |
| 24 | 62-168 | DC Power to PNL 11F | 1-2/C #10 | 5 | 40 | 36.4 | 25.5 | 23.4 | 22.7 |
| 25 | 62-169 | DC Power to PNL 1F/2F | 1-2/C #12 | 14 | 30 | 27.3 | 19.1 | 17 | 17 |
| 26 | 62-170 | DC Power to PNL 3F | 1-2/C #10 | 10 | 40 | 36.4 | 25.5 | 23 | 22.7 |
| 27* | 62GP0229 | 125V DC Power to 460V SWGR 1B3 | 4-1/C #6 | 56 | 150 | 136.5 | 109.2 | 100 | 97 |
| 28* | 62GP0228 | DC Power to 4160V SWGR 1D | 2-1/C #4 | 56 | 95 | 86.5 | 69.2 | 63 | 61.6 |
| 29* | 62GP0225 | DC Power to V-16-2 | 11-1/C #8 | 18.5 | 55 | 50 | 35 | 32 | 31 |
| 30* | 62GP0226 | DC Power to V-16-14 | 11-1/C #8 | 18.5 | 55 | 50 | 35 | 32 | 31 |
| 31* | 86-71 3-Hour Wrap | 4160V SWGR 1D | 2 X 3-1/C 500 MCC | 543 | 950 | 864.5 | 864.5 | 769.4 | 708.9 |
| 32 | 21-2038 | Drywell Personnel | 2/C #12 | 6.25 | 30 | 27 | 13.5 | 12.4 | 12 |
| 33 | 12-317 | Valve NG02C | 4-1/C #12 | 6 | 30 | 27 | 13.5 | 12.4 | 12 |
| 34 | 12-318 | Valve NG02E | 4-1/C #12 | 6 | 30 | 27 | 13.5 | 12.4 | 12 |
| 35 | 12-320 | Valve NG03C | 4-1/C #12 | 6 | 30 | 27 | 13.5 | 12.4 | 12 |
| 36 | 12-321 | Valve NG03E | 3-1/C #12 | 6 | 30 | 27 | 13.5 | 12.4 | 12 |

# Table 1



| CALCULATION FOR THERMO-LAG AMPACITY DERATING FOR OCNGS | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | DERATED AMPS DUE TO: | | | |
| ITEM | CIRCUIT # | CIRCUIT DESCRIPTION | CABLE SIZE | CALCULATED ACTUAL LOAD AMPS | CABLE RATED AMPS @ 30°C | AMBIENT 40°C | MULTIPLE CONDUCTORS IN RACEWAY | FIRE WRAP (USING TSI DATA) | FIRE WRAP (USING TU/TVA DATA) |
| 37 | 12-323 | Valve NG08-C | 4-1/C #12 | 0.91 | 30 | 27 | 13.5 | 12.4 | 12 |
| 38 | 12-324 | Valve NG08-E | 4-1/C #12 | 0.91 | 30 | 27 | 13.5 | 12.4 | 12 |
| 39 | 12GP0827 | Valve NG03-E | 4-1/C #12 | 10 | 30 | 27 | 14.0 | 13 | 12.4 |
| 40 | 12-328 | Valve NG02-B | 4-1/C #12 | 6 | 30 | 27 | 13.5 | 12.4 | 12 |
| 41 | 12-330 | Valve NG03-B | 4-1/C #12 | 6 | 30 | 27 | 13.5 | 12.4 | 12 |
| 42 | 12-332 | Valve NG08-B | 4-1/C #12 | 6 | 30 | 27 | 13.5 | 12.4 | 12 |
| 43 | 12-335 | Valve V-17-54 | 4-1/C #12 | 4.9 | 30 | 27 | 13.5 | 12.4 | 12 |
| 44 | 12-341A | Valve V-1-107 | 4-1/C #12 | 0.69 | 30 | 27 | 13.5 | 12.4 | 12 |
| 45 | 12-342 | Valve V-14-37 | 4-1/C #12 | 10.3 | 30 | 27 | 13.5 | 12.4 | 12 |
| 46 | 12-329 | Valve NG02-D | 4-1/C #12 | 6 | 30 | 27 | 13.5 | 12.4 | 12 |
| 47 | 12-331 | Valve NG-03-D | 4-1/C #12 | 6 | 30 | 27 | 13.5 | 12.4 | 12 |
| 48 | 12-333 | Valve NG-08D | 4-1/C #12 | 0.91 | 30 | 27 | 13.5 | 12.4 | 12 |
| 49 | 12-443 | Valve V-5-166 | 4-1/C #12 | 0.91 | 30 | 27 | 13.5 | 12.4 | 12 |
| 50 | 12-446 | Valve V-5-148 | 4-1/C #12 | 0.91 | 30 | 27 | 13.5 | 12.4 | 12 |
| 51 | 12-325 | Valve V-16-1 | 4-1/C #12 | 4.9 | 30 | 27 | 13.5 | 12.4 | 12 |
| 52 | 11-293 | SRM #1 Motor Feed | 3-1/C #16 | 0.29 | 18 | 16 | 8 | 7.3 | 7.1 |
| 53 | 11-294 | SRM #2 Motor Feed | 3-1/C #16 | 0.29 | 18 | 16 | 8 | 7.3 | 7.1 |
| 54 | 11-297 | IRM #1 Motor Feed | 3-1/C #16 | 0.29 | 18 | 16 | 8 | 7.3 | 7.1 |
| 55 | 11-298 | IRM #2 Motor Feed | 3-1/C #16 | 0.29 | 18 | 16 | 8 | 7.3 | 7.1 |
| 56 | 11-299 | IRM #3 Motor Feed | 3-1/C #16 | 0.29 | 18 | 16 | 8 | 7.3 | 7.1 |
| 57 | 11-300 | IRM #4 Motor Feed | 3-1/C #16 | 0.29 | 18 | 16 | 8 | 7.3 | 7.1 |
| 58 | 11-295 | SRM #3 Motor Feed | 3-1/C #16 | 0.29 | 18 | 16 | 8 | 7.3 | 7.1 |
| 59 | 11-296 | SRM #4 Motor Feed | 3-1/C #16 | 0.29 | 18 | 16 | 8 | 7.3 | 7.1 |

# Table 1



| CALCULATION FOR THERMO-LAG AMPACITY DERATING FOR OCNGS | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | DERATED AMPS DUE TO: | | | |
| ITEM | CIRCUIT # | CIRCUIT DESCRIPTION | CABLE SIZE | CALCULATED ACTUAL LOAD AMPS | CABLE RATED AMPS @ 30°C | AMBIENT 40°C | MULTIPLE CONDUCTORS IN RACEWAY | FIRE WRAP (USING TSI DATA) | FIRE WRAP (USING TU/TVA DATA) |
| 60 | 11-301 | IRM #5 Motor Feed | 3-1/C #16 | 0.29 | 18 | 16 | 8 | 7.3 | 7.1 |
| 61 | 11-302 | IRM #6 Motor Feed | 3-1/C #16 | 0.29 | 18 | 16 | 8 | 7.3 | 7.1 |
| 62 | 11-303 | IRM #7 Motor Feed | 3-1/C #16 | 0.29 | 18 | 16 | 8 | 7.3 | 7.1 |
| 63 | 11-304 | IRM #8 Motor Feed | 3-1/C #16 | 0.29 | 18 | 16 | 8 | 7.3 | 7.1 |
| 64* | 86-66 | EDG-2, Diff. Protn | 4-1/C 19/22 | 5 | 40 | 36 | 28.8 | 26.5 | 25.6 |
| 65* | 86GC0016 | EDG-2, Diff. Protn | 4-1/C #10 | 5 | 40 | 36 | 25.2 | 23.2 | 22.4 |