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SUBJECT: Provides results of study amacity rating of cables at H.B. Robinson Steam Electric Plant,Unit 2.

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H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2  
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CABLE AMPACITY STUDY

Gentlemen:

The purpose of this letter is to provide the results of the study of ampacity rating of cables at the H. B. Robinson Steam Electric Plant, Unit No. 2 (HBR2) as discussed by Carolina Power & Light Company (CP&L) in our July 2, 1991 letter.

In support of the Design Basis Reconstitution effort in progress for HBR2, a study of power cables was conducted to confirm that the power cables, located in the Reactor Auxiliary Building and the Containment Building, have adequate ampacity ratings to carry their required loads. The enclosure to this letter provides the detailed results of this study.

The study identified 608 power cables as requiring evaluation. This study concluded that all of the 608 cables analyzed have adequate ampacity ratings to carry their required loads. This conclusion is based on the application of the design basis standard in place at the time of plant construction, Insulated Power Cable Engineers Association (IPCEA) standard P-46-426 and P-54-440, the standard which superseded the sections of P-46-426 for cables in tray (see enclosure A).

The calculations demonstrating cable adequacy are dynamic in that updates will be required as modifications and/or other changes occur in the plant. The studies will be revised as required to demonstrate cable adequacy if additional cables are identified.

In general, it is CP&L's intent not to add additional power cables to the trays installed during plant construction. New trays or conduits will be used for such installations. For trays installed since early 1988, sizing for cables has been based on CP&L calculation RNP-E-5.001, which establishes the cable size based on the more limiting of the IPCEA P-46-426 or P-54-440 criteria. However, for these new installations, the newer standard IPCEA P-54-440 is considered more appropriate for assessing cable adequacy. Therefore, a FSAR change will be submitted to reflect only the use of IPCEA P-54-440 for future trays and trays in which all cables were sized in accordance with RNP-E-5.001.

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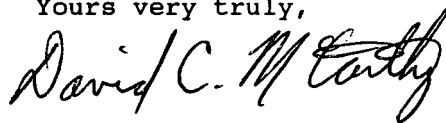
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The studies discussed above were based on an ambient temperature of 50°C inside the Containment Building and 40°C in the Reactor Auxiliary Building. As discussed in the NRC Inspection Report Nos. 50-261/91-21 and 50-261/92-32, the temperature and temperature impact on equipment in the E1/E2 switchgear room are currently under review. Should the evaluation of the ampacity ratings on any of the cables under study result in a less-than-adequate ampacity rating, the NRC shall be notified as a follow-up to this report.

Please refer any questions regarding this submittal to Mr. R. W. Prunty at (919) 546-7318.

Yours very truly,

A handwritten signature in black ink, appearing to read "David C. McCarthy". The signature is fluid and cursive, with the first name "David" and last name "McCarthy" clearly distinguishable.

David C. McCarthy  
Manager

Nuclear Licensing Section

RES/jbw

Enclosure

cc: Mr. S. D. Ebnetter  
Mr. L. W. Garner  
Ms. B. L. Mozafari

## VERIFICATION OF POWER CABLE ADEQUACY

### Purpose

A study was undertaken to demonstrate that power cables in the Reactor Auxiliary and Containment Buildings (areas containing safety-related cables) have adequate ampacity ratings to carry their required loads.

### Background

Power cables installed at H. B. Robinson Steam Electric Plant, Unit No. 2 (HBR2) for systems less than 600 volts are installed in open-top trays with "random fill." In addition to power cables, control cables may also be installed in the same trays. Further, safety and non-safety cables may be installed in the same trays.

At the time of construction of HBR2, Insulated Power Cable Engineers Association (IPCEA) standard P-46-426 (IEEE S-135), "Power Cable Ampacities," was used for defining cable ampacities in trays. Ampacity of cables was derated based on the number of power conductors in the tray. Subsequently, IPCEA standard P-54-440, "Ampacities - Cables in Open-Top Cable Trays," was developed. This standard recognized that instead of the number of conductors in the tray, the "depth of fill" of the cables and the ratio of insulating material to current carrying material are the critical parameters in determining cable ampacity.\* As a conservative approach to this study, both standards were used in reviewing and determining the long-term acceptability of the HBR2 power cables.

### Scope

The scope of the study consisted of safety-related power cables and non-safety-related power cables which could be routed with safety-related cables. Cables for systems rated 480 volts and below were reviewed. Non-heat generating cables (e.g., valve circuits and control cables) were not analyzed. Power cables in recently installed trays are separately controlled and were not included in this study. Six hundred eight (608) cables were identified as requiring evaluation.

\*In general, IPCEA P-46-426 is more limiting for larger cables, while P-54-440 is more limiting for small ones.

### Methodology

To accurately assess the adequacy of the power cables, evaluations were conducted using IPCEA standards P-46-426 and P-54-440.

Both standards were utilized making conservative assumptions. The required cable data were obtained from:

- The plant cable and conduit list,
- As-built data sheets, and
- Plant walkdown.

### IPCEA P-46-426

The calculation was made in three iterations:

#### Iteration 1

In Iteration 1, conservative assumptions were made in determining both the allowable ampacity value of the power cable and the required current which the cable must carry. To calculate the allowable ampacity value, the maximum derating factor of 50 percent was used, based on the tray containing more than 43 power conductors, as required by the standard. In establishing the required ampacity, equipment nameplate ratings were used, with appropriate multipliers to account for factors, such as operation at voltages other than nominal and motors with 1.15 service factors. Ambient temperatures were considered as 40°C outside containment and 50°C inside. The cable was considered to pass Iteration 1 if the allowable ampacity exceeded the required ampacity. Five hundred fifty-six (556) of the cables were found to be acceptable.

#### Iteration 2

Iteration 2 includes those 52 cables that did not pass Iteration 1. In this iteration, the loads were reviewed to determine the actual expected current (bhp data, field-measured data, etc.). Then a multiplier of 1.1 was applied to account for operation at voltages other than nominal. This required ampacity value was compared to the allowable ampacity value derived in Iteration 1. Thirty-nine (39) of the 52 cables were found to be acceptable in Iteration 2.

#### Iteration 3

Iteration 3 includes the 13 cables that did not pass Iteration 2. In this iteration, a plant walkdown of the trays containing the 13 cables was conducted; and the actual number of the power conductors in the tray was used to determine the ampacity derating factor (vs. the 50 percent factor used in Iterations 1 and 2). The revised allowable ampacity value determined was then compared to the required ampacity value derived in Iteration 2. All cables were found to be acceptable.

IPCEA P-54-440

The calculation was made in two iterations:

Iteration 1

Conservative assumptions were made in determining both the allowable ampacity value of a power cable and the required current which the cable must carry. In determining the allowable ampacity, all power cable trays were assumed to be filled to the top of the side rail, which derates the cable ampacity to values equivalent to the 1.5" depth of fill tables in the standard. The required ampacity was determined as shown under Iteration 1 of IPCEA standard P-46-426. The cable was considered to pass Iteration 1 if the allowable ampacity exceeded the required ampacity. Five hundred forty-three (543) of the cables were found to be acceptable.

Iteration 2

Iteration 2 includes those 65 cables that did not pass Iteration 1. In this iteration, the loads were reviewed to determine the actual expected current (bhp data, field-measured data, etc.). Then a multiplier of 1.1 was applied to account for operation at voltages other than nominal. In determining the allowable cable ampacity, the actual tray fill, determined by physical inspection of the trays, was used. All of the subject cables were found to be acceptable in Iteration 2.

Conclusion

All 608 cables analyzed were determined to have adequate ampacity ratings to carry their required loads. This conclusion is based on the application of both IPCEA standards P-46-426 and P-54-440.