Reference 2

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

OCT 0 1 1985

Docket No. 50-400

Team Leader
Ralph Architzel

Carolina Power and Light Company
ATTN: Mr. E. E. Utley
Executive Vice President
Power Supply and Engineering
and Construction
P.O. Box 1551
Raleigh, NC 27602

Gentlemen:

SUBJECT: INTEGRATED DESIGN INSPECTION 50-400/84-48, Supplement 1

The Office of Inspection and Enforcement conducted a follow-up reinspection to the Integrated Design Inspection at EBASCO offices from July 22-24, 1985. The reinspection team was composed of personnel from the Office of Inspection and Enforcement and consultants.

The purpose of the reinspection was to assess the adequacy and status of your actions in response to the Integrated Design Inspection report dated April 15, 1985. Our letter to you dated July 12, 1985, identified items to be addressed in the reinspection. These items were based on the IDI team's need for more information relative to your response to the IDI report dated June 13, 1985. During the reinspection, you agreed to take additional corrective actions; these actions and some clarifications and proposed FSAR revisions are documented in your letter dated August 6, 1985.

The enclosed report indicates IDI items which remain open. In addition, the Office of Inspection and Enforcement has identified potential enforcement findings which may result in enforcement action. These are listed in an attachment to the enclosed report. Resolution of these potential enforcement items will be handled by the Region II office. All other IDI items were closed out based on either the reinspection or the team's review of your June 13, 1985 letter. The report indicates that a significant percentage of the IDI items were resolved by the team's review of your June 13, 1985 letter and the reinspection. The NRC Region II Office and Vendor Program Branch may perform confirmatory inspections of certain items noted in the enclosed report.

8510070357 (5pp)

In accordance with 10 CFR 2.790(a), a copy of this letter and its enclosure will be placed in the NRC's Public Document Room.

Sincerely,

Brian K. Grimes, Director
Division of Quality Assurance, Vendor,
and Technical Training Center Programs
Office of Inspection and Enforcement

Enclosure:
Inspection Report 50-400/84-48,
Supplement 1

cc: See next page

over-conservative cross-referencing. The team agreed with this EBASCO comment, particularly since system level considerations need not be imposed on some vendors. EBASCO subsequently revised procedure E-35 to reflect those codes, standards, and NRC Regulatory Guides listed as requirements in the instrumentation specifications. The team reviewed the changes made in this revised procedure and considered them acceptable.

(Closed) Deficiency D6.1-10, Incomplete and Unissued Drafting Manual

At the Shearon Harris site, the team noted that issued instrumentation and control drawings were being modified without a drafting manual for the instrumentation and control discipline. The team reviewed the Carolina Power and Light electrical and instrumentation and control drafting manual issued as revision 1 on July 3, 1985, and determined that it provided appropriate drawing format and content guidance. The team also reviewed a recently prepared Carolina Power and Light instrumentation and control design guide that provides detailed instructions on a number of instrumentation and control topics for use by both engineering and drafting personnel. The team anticipates that this design guide will expand over time as additional instructions are prepared. In addition, the team reviewed a quality assurance audit report of the Harris plant engineering section dated May 13, 1985. Revision of the drafting manual and development of the design guide for the instrumentation and control discipline resolved the team's concerns in this area.

(Closed) Deficiency D6.3-2, Conduit Separation

During the inspection of main control room panels at the plant, the team noted numerous instances of redundant flexible conduits that were in direct contact with one another, and expressed a concern about conformance with electrical separation criteria provided in IEEE Std. 384-1974 and NRC Regulatory Guide 1.75. Separation distances less than those prescribed in these documents may be justified by an analysis of the particular installation. The team reviewed a Westinghouse analysis of their panels dated May 10, 1985, and a corresponding EBASCO analysis of their panels dated May 20, 1985. Each of these analyses used a technical basis of wire size, control circuit fusing, voltage level separation, and control wiring insulation characteristics. These actions satisfactorily resolve the team's concern.

(Closed) Unresolved Item U6.3-3, Instrument Impulse Line Separation Distance

The team determined that a Carolina Power and Light field change request had been issued and subsequently revised to permit reduced separation distances between redundant safety-related instrument impulse lines as well as between safety and non-safety-related instrument impulse lines. This field change request had been designated as a minor change not subject to design verification. An extensive discussion of the separation distance requirements in EBASCO's design criteria and other minimum values used to accept the instrument tubing installation was conducted with Carolina Power and Light and EBASCO personnel during the reinspection. The team reviewed seismic walkdown procedures and the corresponding EBASCO acceptance criteria for the walkdown. Telephone discussions were held with EBASCO plant site personnel regarding the

Reference 3

CQL-8787

Westinghouse Electric Corporation

Water Reactor Divisions

Nuclear Operations Division

Box 355
Pittsburgh Pennsylvania 15230

May 13, 1985

Ref: Telecon

Mr. L. I. Loflin, Manager
Harris Project Engineering
Carolina Power & Light Company
P.O. Box 101
New Hill, NC 27562

CAROLINA POWER & LIGHT COMPANY
SHEARON HARRIS NUCLEAR POWER PLANT
MCB - CONDUIT AIR GAP ANALYSIS

Dear Mr. Loflin:

Attached please find the requested analysis/backup information to support the Westinghouse position that a one inch air gap is not necessary to prevent heat propagation to wires which may be in contact with the flexible conduit wall for the Main Control Board.

The analysis provides backup information as requested by CP&L per a recent telecon. If any additional information is required, please give us a call.

Very truly yours,

WESTINGHOUSE ELECTRIC CORPORATION

A. T. Parker, Manager
Carolina Power & Light Project

ARB/bdm/4945d:1

Attachment

cc:	M. F. Thompson, CP&L Site	2L, 2A
	L. I. Loflin, CP&L Site	2L, 2A
	R. A. Watson, CP&L Site	1L, 1A
	J. R. Santosuosso, Ebasco	3L, 3A
	W. C. Arent, Ebasco	1L
	J. L. Willis, Plant General Manager, CP&L Site	1L, 1A
	N. J. Chiangi, CP&L Site	1L, 1A
	G. S. Cashell, CP&L	1L, 1A
	R. E. Lumsden, CP&L	1L, 1A
	L. H. Martin, CP&L	1L, 1A
	R. M. Parsons, CP&L Site	1L, 1A
	G. L. Forehand, CP&L Site	1L, 1A
	R. S. Pollock, W Raleigh	1L
	B. J. Mandaglio, W Sales (Hillside)	1L

SHEARON-HARRIS

MAIN CONTROL BOARD

CONDUIT

AIR GAP ANALYSIS

Written: NM Kraynek, PI&CS

Approved: JB Reid, Manager PI&CS 5/10/85

Reviewed: L. Gingerich, Quality Assurance 5/11/85

Date: May 10, 1985

SHEARON HARRIS
MAIN CONTROL BOARD
CONDUIT
AIR GAP ANALYSIS

PURPOSE

The purpose of this analysis is to show that a one-inch air gap is not necessary to prevent heat propagation to wires which may be in contact with the flexible conduit wall.

BACKGROUND

When current flows through a conductor, heat is generated in that conductor due to inherent resistance. Since the heat generated is dependent upon the amount of current flowing (I^2R losses), the larger the current flow, the more heat is generated. Thus the temperature rating of the insulation and the size of the conductor dictate the maximum current that a conductor can handle safely.

ASSUMPTIONS

For clarification, the following assumptions are stated here:

- All wiring to be considered as 1/c, #16 AWG teflon type TFE, 600V. (Ref 1)
- The maximum teperature of TFE is 250C--for conservatism 200C will be used. (Ref 2)
- The control board ambient temperature range is 40-120F. Worse case will be assumed--120F (50C). (Ref 1)
- All voltages to be 120 VAC or 125 VDC.
- All conduit to be 1/2" flexible metallic conduit.
- All conduit is to be considered grounded to the control board.
- The average OD of the cable is considered to be .083" or .0054 sq in, giving a maximum number of 22 conductors per conduit.
- The cross-sectional area for # 16 AWG wire is 2580 cir mils. (Ref 3)
- Power supplies are to be considered unlimited.

NORMAL CIRCUIT CURRENT

The maximum current of a # 16 AWG conductor with 200C insulation rating in free 30C ambient air is 32 amps. Correcting this current for 50C, a bundling factor for 22 conductorsand a conduit factor, the maximum current is given by:

32 Amps x .95 (50C Amb Temp) x .7 (Bund. Fact) x .73 (Cond. factor)= 15.5 Amps (Ref 4)

To determine the maximum fuse size to be used with this size conductor, a factor of 1.25 is applied to 15 amps to give a fuse size of 12 Amps. A review of the control circuit fusing by Ebasco shows the maximum fusing for the different control circuits given below:

o 120 Solenoid Circuits	6 Amps
o Main Termination Cab.	3 Amps
o 480V MCC	10 Amps
o Reactor Trip Switchgear	10 Amps
o 6.9 Kv Swtchgr-Closing Ckt	3.2 Amps
o 6.9 Kv Swtchgr-Trip Ckt	35 Amps
o 480V Loadcenter-Closing	30 Amps
o 480V Loadcenter-Trip Ckt	35 Amps

Although the switchgear and loadcenter fuses are quite a bit larger than the rating of the wire, a review of the circuit and switchgear specifications shows that the circuits involved intermittently operate only the close and trip coils. The total current for these items, again according to Ebasco,is 9.6 amps maximum. This is within the calculated range of the wire.

SHORT CIRCUIT CURRENT

The maximum short circuit current that this wire will be required to carry will be supplied by the 35 amp fuse in the switchgear tripping circuits.. These fuses are Gould-Shamut One-Time fuses 250V, Cat. # OT35. According to the manufacturer's characteristic curves, the OT35 will melt and open the circuit after allowing a current of 750 Amps for .01 sec.

The equation that relates current and time to temperature is given as:

(Ref 5) $$\left[\frac{I}{A}\right]^2 t = .0297 \log\left[\frac{T2 + 234}{T1 + 234}\right]$$

Where: I = Short Circuit Current
A = Cross-sectional area in Mils
t = Time in seconds
T2= Maximum insulation temperature
T1= Ambient temperature

Solving for I, the maximum short circuit current that this cable can handle for .01 seconds is:

$$I=(2580)^2\sqrt{\frac{.0297\log((434)/(284))}{.01}}$$

or:

I = 1908 Amps

This is considerably more than the maximum forced short circuit current.

HIGH CURRENT CONSIDERATIONS

While the normal and short circuit currents are within the range of the # 16 wire, high impedance shorts must now be reviewed. Due to the characteristics of the 30 and 35 amp fuses protecting the control circuits in the switchgear, a current can flow that would not be considered a short circuit for the fuses, but could certainly cause strain on the conductor insulation. Interpolating the fuse characteristic curves, the currents given below will pass through the fuse for the time shown, after which the fuse will melt.

373 Amps	@	.1 seconds
210 Amps	@	1.0 second
110 Amps	@	10 seconds
64 Amps	@	100 seconds
52 Amps	@	1000 seconds

Using the short circuit equation from the last section, the maximum current the cable can carry for the same time periods is given as:

603 Amps	@	0.1 sec
191 Amps	@	1.0 sec
60 Amps	@	10 sec
19 Amps	@	100 sec
6 Amps	@	1000 sec

Comparing the two sets of data reveals a problem in the high impedance short circuit current for "long" time periods. However, in analyzing the Ebasco Control Wiring Diagrams for the switchgear involved, it would be necessary for the high impedance short to occur in the close or the trip coils, switch or lockout relay contacts, light bulbs or the corresponding resistors.

Analysis of the closing coil circuit shows that the high impedance short would have to occur after the control board switches, since any shorts prior to the wire entering the control board would be an instantaneous short. If the problem occurred in the closing circuit (closing coil windings shorting), not only would the closing coil not close the breaker (indicating trouble), but, the anti-pumping circuit would remove the closing coil from the circuit, even if the auto circuits were made up. The higher resistance anti-pumping relay coil would then limit the current in the control circuitry.

If the problem occurred in the trip circuit, it must occur in three elements--the trip coil and the indicating light bulb and indicating light resistors. Because of the trip circuit design, three sets of indicating lights and resistors are in series with the trip coil. If one of the lamps or the resistors were to short, the load would be governed by the trip coil, limiting current to 5 amps. If the trip coil windings were to short, the indicating lamps would then be the main load for the circuit, limiting the current, in general, to 50 mA. However, if the trip coil windings were to short, the higher current caused by this shorting would be present when the control board switch was activated to trip the breaker. This current would be limited to the trip operating time of the breaker, however, if the magnetic strength of the coil was weakened such that the breaker did not trip, the length of time the current flowed would be determined by the amount of time the operator held the control board switch in the trip position.

It can be seen from the above analysis, that, in general, the high impedance short should not be considered a problem in the switchgear control circuits. However, in a certain situation, a high impedance short could cause overheating of the control wiring in the control board conduits. The extent of this overheating would be determined by: 1. the amount of safety margin built into the temperature rating of the wire insulation and; 2. how long the operator held the switch in the trip position.

CONCLUSION

Due to the above analysis, in general, the requirement for the one inch air gap between conduits, to prevent heat propagation to wires which may be in contact with the flexible conduit wall, is not necessary. However, a potential problem exists in the control circuitry of the 6.9 kV switchgear and the 480 V loadcenter trip circuits protected by the 35 amp fuses. Ebasco would be prudent to analyze these control circuits to determine the probability of occurance of a high impedance short in the trip circuit and take effective action.

REFERENCES

1 Westinghouse E-spec
2 NATIONAL ELECTRIC CODE 1981, Table 310-13.
3 NATIONAL ELECTRIC CODE 1981, Chapter 9, table 8.
4 AIEE-IPCEA POWER CABLE AMPACITIES COPPER CONDUCTORS, Publication no. P-46-426, Aug. 1962.
5 ENGINEERING DATA FOR COPPER AND ALUMINUM CONDUCTOR ELECTRICAL CABLES, The Okonite Co., Bulletin EHB-78, Table 4-1, 1978.

LMH - did we cover
SFM

Reference 4

Transfer assigned to ...

Westinghouse Electric Corporation

Water Reactor Divisions

Nuclear Operations Division

Box 355
Pittsburgh Pennsylvania 15230

March 13, 1985

S.O. No: 395

CBD(85)-291

Ref: CQL-6900

Mr. L. I. Loflin, Manager
Harris Project Engineering
Carolina Power & Light Company
P.O. Box 101
New Hill, NC 27562

CAROLINA POWER & LIGHT COMPANY
SHEARON HARRIS NUCLEAR POWER PLANT

ONE INCH SEPARATION OF FLEXIBLE METALLIC CONDUIT (IN CQL BOARDS)

PER IEEE-384, 1974

Dear Mr. Loflin:

The 1" separation of flexible metallic conduit in the CQL boards is deemed unnecessary due to the following arguments:

1. The wire size was determined for the particular load per the National Electric Code.

2. All control circuits are fused effectively limiting the amount of overcurrent that the circuit would be forced to carry.

3. Separation by voltage level limits possible fault voltage to 140VDC or 118VAC.

4. The control wiring utilizes teflon insulation rated at 600V and 200C.

The combination of the wire sizing, fuse protection and insulation type precludes any possibility of a fire being generated or propagated between trains or between train and non-train conduits.

Due to the substantial conservatism in the above listed design criteria, further analysis and or testing was not deemed necessary.

REC'D MAR 21 1985

If you have any further comments or questions, please do not hesitate to call.

Very truly yours,

WESTINGHOUSE ELECTRIC CORPORATION

for A. T. Parker, Manager
Carolina Power & Light Project

N. M. Kraynek/sjp

Attachment

cc: L. I. Loflin, CP&L Site, 2L
R. A. Watson, CP&L Site, 1L
J. R. Santosuosso, Ebasco, 1L
W. C. Arent, Ebasco, 1L
J. L. Willis, Plant General Manager, CP&L Site, 1L
N. J. Chiangi, CP&L Site, 1L
G. S. Cashell, CP&L, 1L
R. E. Lumsden, CP&L, 1L
L. H. Martin, CP&L, 1L
R. M. Parsons, CP&L Site, 1L
G. L. Forehand, CP&L Site, 1L
R. S. Polluck, W Raleigh, 1L
B. J. Mandaglio, W Sales (Hillside), 1L

Reference 5

EBASCO

EBASCO SERVICES INCORPORATED

Two World Trade Center New York, N Y 10048

MAY 31 1985

EB-C-18950
File: L-1/2-L-1
RFT's affected: 16010.001
16011.002,
16020.001

Mr L I Loflin, Manager
Engineering - Harris Plant
Carolina Power & Light Commpany
P O Box 101
New Hill, North Carolina 27562

Dear Mr Loflin:

Subject: SHEARON HARRIS NUCLEAR POWER PLANT
INTEGRATED DESIGN INSPECTION (IDI)
MCB, AEP-1 & ACP - CONDUIT AIR GAP ANALYSIS

Reference: 1. CQL-8787 dated May 13, 1985

Ebasco has reviewed the Westinghouse MCB conduit air gap analysis attached to the referenced letter which was prepared in response to IDI Item 6.3-2. Ebasco's position is that a one inch air gap is not necessary to prevent heat propagation to wires which may be in contact with the flexible conduit wall for the Main Control Board, Auxiliary Control Panel or the Auxiliary Electrical Panel.

In accordance with the suggestion contained in the Westinghouse conclusion, an investigation was conducted in those circuits where the possibility of a high impedance short circuit exists. Ebasco concludes that due to the control circuit configuration, and the fact that the 125VDC supply is not grounded, there is no possibility for overheating for single failure occurrences (only one pole grounded).

Closing/tripping of 480 volt power center breakers and tripping of the 6.9Kv switchgear breakers is performed by control switches or auxiliary device contacts which will be closed only momentarily. The assumed excessive current would be removed within the allowed cable time-current capability.

RECD JUN 13 1985

We feel that the result of our investigation resolves the concern regarding the possible overheating of any conductor inside of a flexible conduit used in any of the subject control panels.

A copy of the referenced Westinghouse letter has been attached for your convenience. Please advise if you have any questions.

Very truly yours,

A C Anderson
Project Manager

SS/rtg
Attachment

cc: L I Loflin (1)
D McCarthy
L H Martin
J L Willis
C C Wagoner
Sheldon D Smith
G L Forehand
N J Chiangi
R E Lumsden

Reference 6

FORM NO. 86432
9/84

APF-001
REV. 24
9/84

KVH
9/18/84

CAROLINA POWER & LIGHT COMPANY
SHEARON HARRIS NUCLEAR POWER PLANT
FIELD CHANGE REQUEST/PERMANENT WAIVER
FCR/~~PW~~ -AS- 10,306

Exhibit 1

PAGE 1 OF 4

☐ Permanent Waiver
☒ Field Change
☒ Non-ASME
☐ ASME Sect. III Div. 1
☐ ASME Sect. III Div. 2
☐ ASME Sect. VIII Div. 1

ORIGINAL

☒ Q ☐ Non-Q ☐ Non-Q (Seismic)
☐ Radwaste-Q ☐ Fire Prot.-Q
Nonconformance NONE
Building RAB COMMON
Elevation 305'
Design Freeze Category II

RFT's 8320.006 1300.001

Instruments NA
Valves NA
Lines NA
Cables NA

List All Reference Documents (Drawings, Specs., FCR's, DCN's, Procedures, Etc.)
2166-G-324 REV.

Description CABLE SEPARATION IN SSP INPUT CABINETS - TRAIN A AND TRAIN B

Conflict/Condition

A BARRIER IS NEEDED FOR CABLE SEPARATION IN SSP INPUT CABINETS TRAIN A AND TRAIN B

Uncontrolled Copy
FOR INFORMATION ONLY

Recommended Action:

☐ Please Investigate/Resolve
☒ Please Resolve As Follows

INSTALL BARRIER AS SHOWN ON PAGE 3 AND 4

UNCONTROLLED COPY

DOCUMENT CONTROL
RECEIVED
DEC 13 1985
SHEARON HARRIS N. P. P

Requested By: DAVID DEGEROLAMO #210

David DeGerolamo — Discipline Engineer — Date 12/12/85

Site Approval: [signature] — Resident Engineer / HPES – Prin. Eng. Date 12-12-85

FORM NO. 80412 (Reverse)
9/84

APF – 001
REV. 24
9/84

KVKate
9/18/84

FCR/PW AS – 10,306

AP-IX-05
Exhibit 1

Authorization to Proceed: Work may proceed prior to final analysis ☐ ______ Discipline Engineer Date ______ MHPE or PPE Date

DESIGN ORGANIZATION APPROVAL

☐ APPROVED AS RECOMMENDED
☐ CONDITIONAL APPROVAL
☐ REJECTED

☑ NPED ONLY ☐ A/E ☐ NSSS ☐ OTHER
☐ YES ☑ NO TELEPHONE RESOLUTION
☐ YES ☑ NO DESIGN ORGANIZATION ATTACHMENT

COMMENTS:

Signature Title Date Signature Title Date

CP&L Harris Plant Engineering Approval

☐ Approved as Recommended
☑ Conditional Approval
☐ Rejected

HPES Attachments ☐ Yes ☑ No
ALARA Applicable ☐ Yes ☑ No

This change requires the following Document(s) to be revised:
Drawings, Specs., Instr. Iso's, Procedures, Etc.— 1364-00198 THRU 202.

Isometrics—

SEE HPES COMMENTS

MINOR CHANGE
DESIGN VERIFICATION
NOT REQUIRED

Ron Knott 12-13-85

S/ Julian A. Kachuck 12/13/85
Discipline Engineer Date

Bobby D Marlar 12/13/85
MHPE or PPE Date

Distribution: (Specify those to receive "prior to analysis" dist by ×)
(Copy) DON CAUSEY 332
(Copy) R. FUTCH 361
(Copy)
(Copy)
(Copy)
(Copy)

Implementation Completed As Approved ☐ Yes ☐ No
Comments:

Discipline Engineer Date

Final Distribution:
(Original) File in Doc. Control
(Copy)
(Copy)
(Copy)

FORM NO. 8C971
REV. 8/83

CP&L – HPES

CALCULATION SHEET

SHT. ______ OF ______

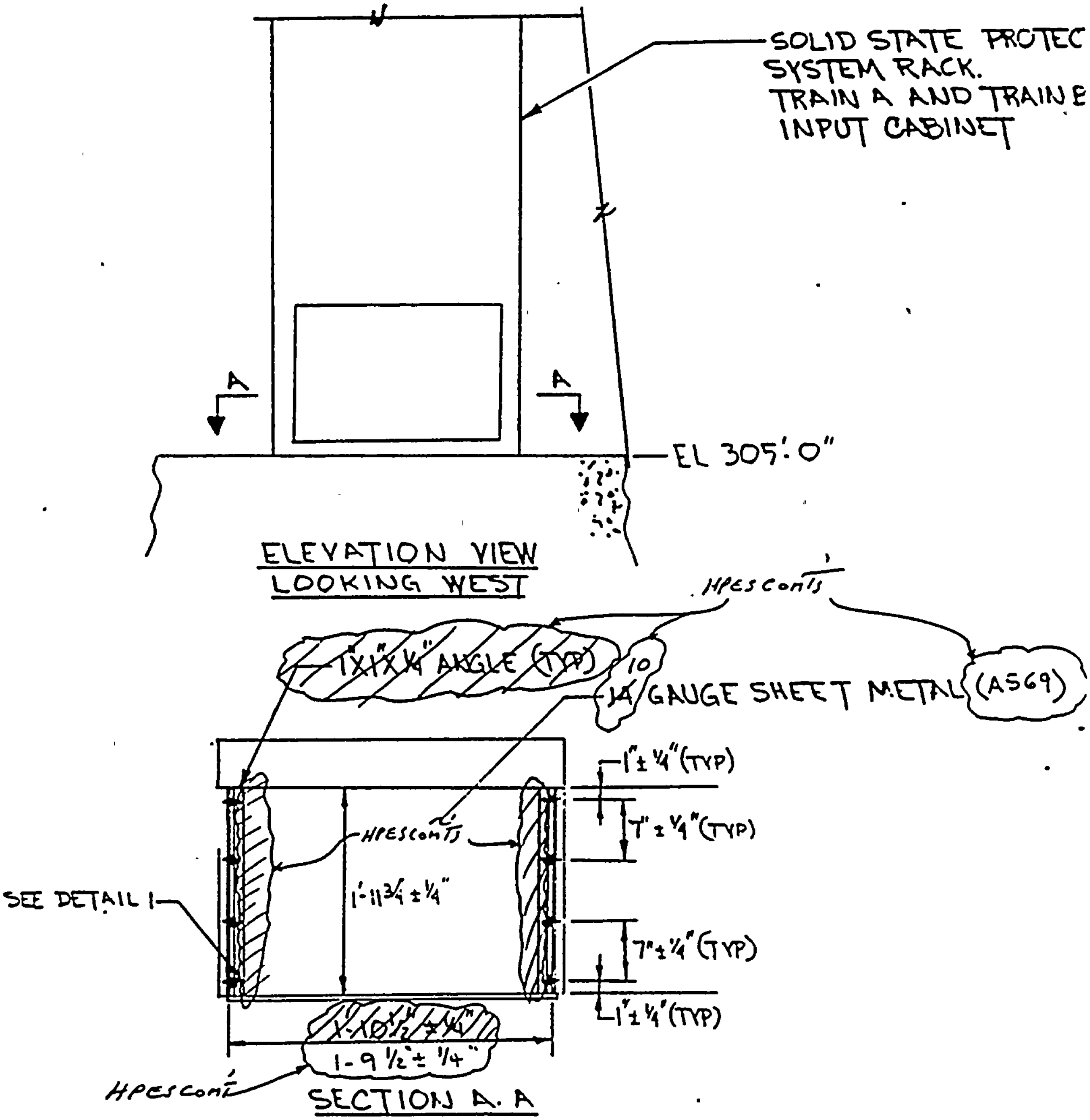
BY: ______ DATE: ______

CHK: ______ DATE: ______

FCR/PW/PHP NO. ______ DWNG. NO. ______ REV. ______

SUBJECT ______

FCR AS-10,306
PAGE 3 OF 4



FORM NO. 88871
REV. 6/83

CP&L — HPES

CALCULATION SHEET

SHT. ______ OF ______

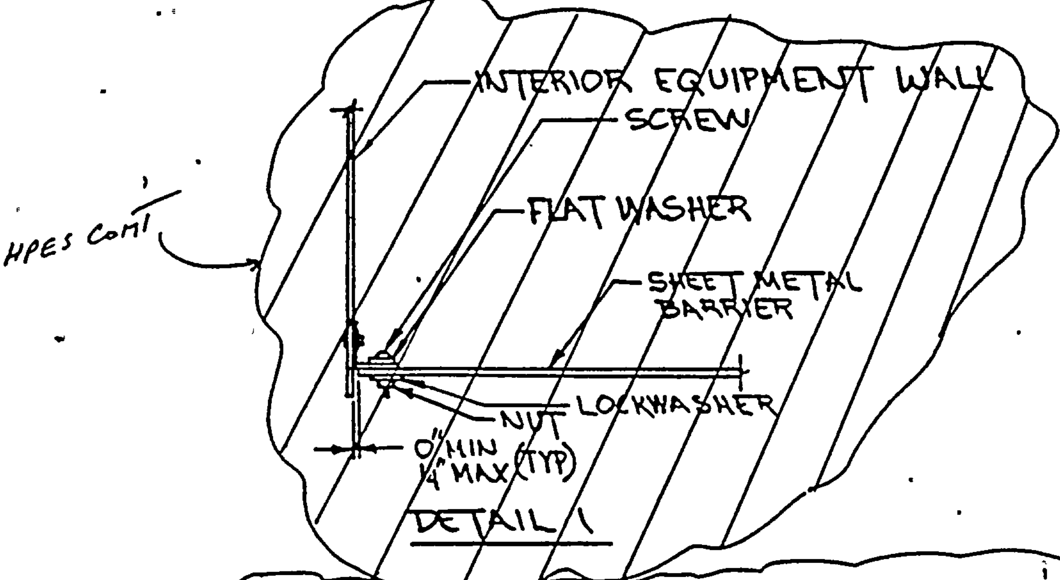
BY: ______ DATE: ______

CHK: ______ DATE: ______

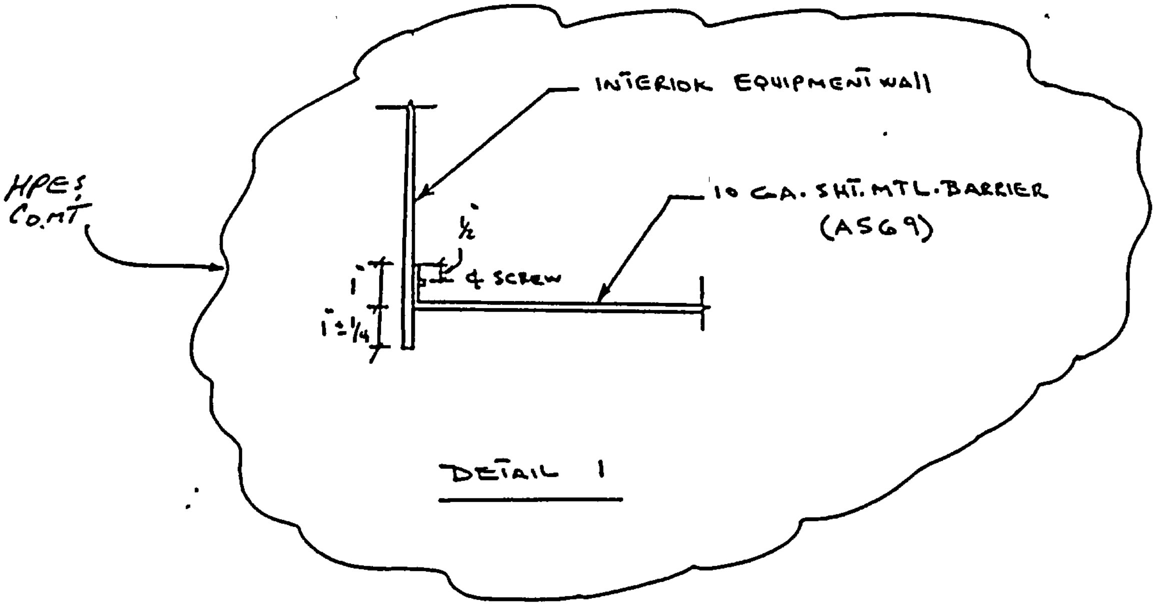
FCR/PW/PHP NO. ______ DWNG. NO. ______ REV. ______

SUBJECT ______

FCR AS-10,306
PAGE 4 OF 4



NOTES: 10 GAGE SHT. MTL. TO BE FABRICATED AS SHOWN BELOW & ~~2. 1"X1"X¼" ANGLE IRON TO~~ BE ATTACHED TO INTERIOR WALL BY DRILL AND TAPPING WALL AND USING #10-24 SILICON BRONZE SCREWS AND FLATWASHERS



APF-001 Rev. 24 9/84 KVH [illegible] 9/13/84

CAROLINA POWER & LIGHT COMPANY
SHEARON HARRIS NUCLEAR POWER PLANT
FIELD CHANGE REQUEST/PERMANENT WAIVER
FCR/PW I-3033

Reference 7

☐ Permanent Waiver	☒ Q ☐ Non-Q ☐ Non-Q (Seismic)
☒ Field Change	☐ Radwaste-Q ☐ Fire Prot.-Q
☒ Non-ASME	Nonconformance NONE
☐ ASME Sect. III Div. 1	Building RAB / FHB
☐ ASME Sect. III Div. 2	Elevation 236
☐ ASME Sect. VIII Div. 1	Design Freeze Category II

RFT's 1-1005.003

Instruments SEE PAGE 3 & 4 — Valves N/A

Lines N/A — Cables N/A

List All Reference Documents (Drawings, Specs., FCR's, DCN's, Procedures, Etc.)

2166 B431 SHEET X-67, X-67A

Description RVLIS RACK NAMEPLATE COLOR CODING.

Conflict / Condition

NAMEPLATES ON RVLIS RACKS A1-R45A & B ARE NOT CORRECTLY COLOR CODED.

UNCONTROLLED

Recommended Action:

☐ Please Investigate / Resolve
☒ Please Resolve As Follows

COLOR CODE NAMEPLATES PER ATTACHED SHEET AND INSTALL ON RVLIS RACKS, PER INSTRUCTIONS ON PAGES 3 & 4 OF THIS FCR.

Requested By: VIC FREGONESE

[signature] 1/29/86
Discipline Engineer — Date

Site Approval:
[signature] 1/29/86
Resident Engineer / HPES — Prin. Eng. Date

I. A 2" x 10" NAMEPLATE SHALL BE ENGRAVED WITH THE RACK IDENTIFICATION NUMBER IN 1 1/2" HIGH LETTERS, AND FASTENED TO THE TOP FRONT CENTER OF EACH RACK WITH 2 STAINLESS STEEL SCREWS. THESE NAMEPLATES SHALL BE COLOR-CODED AS FOLLOWS:

RACK	COLOR-CODE	WITH	LETTERING
A1-R45A	ORANGE		WHITE
A1-R45B	GREEN		WHITE

II A 1" X 3" NAMEPLATE WITH 5/16" HIGH LETTERS ENGRAVED WITH THE INSTRUMENT IDENTIFICATION TAG NUMBER SHALL BE FASTENED WITH TWO STAINLESS STEEL SCREWS NEAR THE INSTRUMENT. THESE NAMEPLATES SHALL BE COLOR CODED AS FOLLOWS:

INSTRUMENT #	COLOR CODE	with	LETTERING
LT-1RC-1311 SAW	ORANGE		WHITE
LT-1RC-1312 SAW	↓		↓
LT-1RC-1310 SAW	↓		↓
LIS-1RC-1311 SAW	↓		↓
LIS-1RC-1312 SAW	↓		↓
LIS-1RC-1310 SAW	↓		↓

INSTRUMENT #	COLOR CODE	with	LETTERING
LT-1RC-1321 SBW	GREEN		WHITE
LT-1RC-1322 SBW	↓		↓
LT-1RC-1320 SBW	↓		↓
LIS-1RC-1321 SBW	↓		↓
LIS-1RC-1322 SBW	↓		↓
LIS-1RC-1320 SBW	↓		↓

INST. #	COLOR CODE	with	LETTERING
PT-1RC-0402 IW	RED		WHITE
PT-1RC-0403 IXW	YELLOW		BLACK

Reference 8

TEST REPORT ON ELECTRICAL SEPARATION VERIFICATION TESTING FOR THE CAROLINA POWER AND LIGHT COMPANY FOR USE IN THE SHEARON HARRIS NUCLEAR POWER PLANT

For

Carolina Power and Light Company
Shearon Harris Nuclear Power Plant
New Hill, North Carolina 27562

3.0 RESULTS

The five Control Cable Screening Tests were conducted per Paragraph 2.0 and successfully met the Acceptance Criteria of Paragraph 1.0. There was no visual evidence of damage to the Twisted Pair 16 AWG target cable inside the 1-inch rigid steel conduit, mounted 1 inch above the faulted cable, in any of these tests. In addition, the target cable did not exhibit electrical degradation as evidenced by the results of the Insulation Resistance and High Potential test results. There were no ignitions of the fault cable, in the test area, during the five Control Cable Screening Tests.

The results of the five individual tests are summarized in the following tables.

TABLE I. CURRENTS APPLIED AND TIME TO OPEN CIRCUIT

Test No.	Fault Cable Size	NEC Rated Current	Current at 90°C +5 Conductor Temperature	Test Current	Time to Open Circuit*
1	2/C 16 AWG	18A	25A	139A (1)	55.12 sec
2	2/C 12 AWG	30A	41A	180A	118.12 sec
3	2/C 10 AWG	40A	50A	180A	(2)
4	3-1/C 10 AWG	40A	50A	180A	324.4 sec
5	3-1/C 6 AWG	75A	75A	180A	(3)

* After application of test current.

Iotes: (1) The Multi-Amp CB8130 test set was not capable of delivering 180A to this cable due to the high impedance of the cable which increased as the conductors were brought to 90°C. The machine was capable of delivering this current on a cable at ambient temperature. However, this condition is judged to be representive of actual plant conditions.

(2) The fault cable did not open-circuit during this test. After approximately 358 seconds, at 180 amperes, the fault cable conductors shorted together which decreased the effective length of the cable as well as added an additional heat sink. Consequently, conductor temperature dropped from a maximum of 1464°F to 375°F over a period of approximately 6 minutes. At this point, the test was terminated. Based on the results of the previous tests which did open-circuit, the conductor temperatures recorded indicated that the fault cable was on the verge of open-circuiting.

(3) The fault cable did not open-circuit during this test. This test was terminated after 3 hours when the heat-up rate had decreased to approximately 0.5°F per minute (from a maximum rate of approximately 18°F per minute) indicating that steady-state conditions had been reached.

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