



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

Enclosure 1

DEC 02 1982

COMMS

MEMORANDUM FOR: William R. Mills, Chief, Events Analysis Branch
Division of Engineering and Quality Assurance, IE *UIC EMER*

FROM: I. Villalva, Events Analysis Branch
Division of Engineering and Quality Assurance, IE

SUBJECT: MINUTES OF OUR NOVEMBER 30, 1982 MEETING WITH CP&L
ON THE USE OF RAYCHEM-FLAMTROL CABLES

The purpose of the subject meeting was to inform CP&L of NRC's new position regarding certain Raychem-Flamtrol cables. The meeting was attended by those listed in Enclosure 1. Copies of the slides used during our presentation are appended hereto as Enclosure 2.

The major thrust of the meeting was to inform CP&L that the NRC no longer considers all Raychem-Flamtrol cables as being qualified for Class 1E applications. In this regard, we informed CP&L that certain cables being used at Brunswick are now considered as not having been qualified for Class 1E applications. The non-qualified or suspect cables are limited to those unshielded, radiation cross-linked, polyethylene, multi-conductor Raychem-Flamtrol cables rated at 1000V and having a combined wire and jacket insulation thickness equal to or greater than 0.120 inch.

The bases for NRC's new position were stated to include the effects of a space charge phenomenon on the suspect cables. Said space charge effects can degrade the insulating qualities of the cable as described in a Raychem report and a Franklin Research Center report (Enclosure 3) entitled, "Investigation of Raychem Cable Installed in the Brunswick Plant, Phase 2 - Evaluation and Test Recommendation." (Copies of the Franklin report were distributed to the attendees during the course of the meeting for information purposes).

At or near the conclusion of the meeting, CP&L was informed that since the suspect cable is apparently being used only at the Brunswick facility, that we do not consider the problem to be generic. Finally, because of our revised position, CP&L was advised that they would have to demonstrate the cable's ability to perform its intended function when used in safety related circuits and that such demonstration would fall under the purview of our equipment qualification program.

I. Villalva

I. Villalva, Events Analysis Branch

Enclosures:

8302230082 830125
PDR COMMS NRCC
CORRESPONDENCE PDR

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

Enclosure 2

DEC 20 1982

Docket Nos. 50-325/
324

Mr. E. E. Utley
Executive Vice President
Carolina Power & Light Company
P. O. Box 1551
Raleigh, North Carolina 27602

EUT/CPL

Dear Mr. Utley:

SUBJECT: SAFETY EVALUATION FOR ENVIRONMENTAL QUALIFICATION OF
SAFETY-RELATED ELECTRICAL EQUIPMENT

Re: Brunswick Steam Electric Plant, Units 1 and 2

This letter transmits the Safety Evaluation for the Environmental Qualification of Safety-Related Electrical Equipment at your facility. This evaluation is based on your response to our previous Safety Evaluation Report, dated June 13, 1981, and subsequent submittals dated September 16, 1981, October 26, 1981, March 7, 1982, and July 14, 1982. This Safety Evaluation presents the results of the Environmental Qualification Review for safety-related electrical equipment, exposed to a harsh environment, in accordance with NRC requirements. We request that you provide your plans for qualification or replacement of any of the equipment in NRC categories I.b, II.a and II.b (presented in the Technical Evaluation Report) and the schedule for accomplishing your proposed corrective actions to us within ninety (90) days of the receipt of this letter.

As indicated in the conclusion section of the Safety Evaluation, we request that you reaffirm the justification for continued operation and within thirty (30) days of receipt of this letter, submit information for any items in NRC categories I.b, II.a and II.b (presented in the enclosed Technical Evaluation Report) for which justification for continued operation was not previously submitted to the NRC. We suggest that the clarification set forth in Item 8 of Generic Letter No. 82-09, "Clarification Questions and Answers on Environmental Qualification Requirements," should be considered in your justification for continued operation.

The Technical Evaluation Report contains certain identified information which you have previously claimed to be proprietary. We request that you inform us as indicated in the proprietary section of the Safety Evaluation whether any portions of the identified pages still require proprietary protection.

At your option, the staff will be available to discuss the findings in the Safety Evaluation as augmented by the Technical Evaluation Report. Questions regarding this letter should be directed through the NRC Project Manager for your plant.

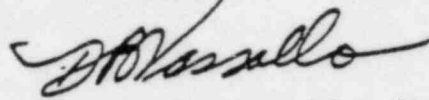
Attachment to be withheld from Public Disclosure

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Not attached to PDR copy

The reporting and/or recordkeeping requirements contained in this letter affect fewer than ten respondents; therefore, OMB clearance is not required under P.L. 96-511.

Sincerely,



Dominic B. Vassallo, Chief
Operating Reactors Branch #2
Division of Licensing

NAFLOR2

Enclosures:

1. Safety Evaluation
2. Technical Evaluation Report

cc w/o TER
See next page

Attachment to be Withheld from Public
Disclosure

*Not attached to
PDR copy*

Mr. E. E. Utley
Carolina Power & Light Company

cc:

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

SAFETY EVALUATION BY THE
OFFICE OF NUCLEAR REACTOR REGULATION
FOR CAROLINA POWER AND LIGHT COMPANY
BRUNSWICK STEAM ELECTRIC PLANT, UNITS 1 AND 2
DOCKET NOS. 50-325 AND 50-324

82122P
TRSER

ENVIRONMENTAL QUALIFICATION OF SAFETY-RELATED ELECTRIC EQUIPMENT

INTRODUCTION

General Design Criteria 1 and 4 specify that safety-related electrical equipment in nuclear facilities must be capable of performing its safety-related function under environmental conditions associated with all normal, abnormal, and accident plant operation. In order to ensure compliance with the criteria, the NRC staff required all licensees of operating reactors to submit a re-evaluation of the qualification of safety-related electrical equipment which may be exposed to a harsh environment.

BACKGROUND

On February 8, 1979, the NRC Office of Inspection and Enforcement (IE) issued to all licensees of operating plants (except those included in the systematic evaluation program (SEP)) IE Bulletin (IEB) 79-01, "Environmental Qualification of Class IE Equipment." This Bulletin, together with IE Circular 78-08 (issued on May 31, 1978), required the licensees to perform reviews to assess the adequacy of their environmental qualification programs.

On January 14, 1980, NRC issued IE Bulletin 79-01B which included the DOR guidelines and NUREG-0588 as attachments 4 and 5, respectively. Subsequently, on May 23, 1980, Commission Memorandum and Order CLI-80-21 was issued and stated the DOR guidelines and portions of NUREG-0588 form the requirements that licensees must meet regarding environmental

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qualification of safety-related electrical equipment in order to satisfy those aspects of 10 CFR 50, Appendix A, General Design Criterion (GDC) 4. Supplements to IEB 79-01B were issued for further clarification and definition of the staff's needs. These supplements were issued on February 29, September 30, and October 24, 1980.

In addition, the staff issued orders dated August 29, 1980 (amended in September 1980) and October 24, 1980 to all licensees. The August order required that the licensees provide a report, by November 1, 1980, documenting the qualification of safety-related electrical equipment. The October order required the establishment of a central file location for the maintenance of all equipment qualification records. The central file was mandated to be established by December 1, 1980. The staff subsequently issued Safety Evaluation Reports (SERs) on environmental qualification of safety-related electrical equipment to licensees of all operating plants in mid-1981. These SERs directed licensees to "either provide documentation of the missing qualification information which demonstrates that safety-related equipment meets the DOR Guidelines or NUREG-0588 requirements or commit to a corrective action (re-qualification, replacement (etc.))." Licensees were required to respond to NRC within 90 days of receipt of the SER. In response to the staff SER issued June 3, 1981, the licensee submitted additional information regarding the qualification of safety-related electrical equipment.

EVALUATION

The acceptability of the licensee's equipment environmental qualification program was reviewed for the Division of Engineering by the Franklin Research Center (FRC) as part of the NRR Technical Assistance Program in support of NRC operating reactor licensing actions. The consultant's review is documented in the report "Review of Licensees Resolutions of Outstanding Issues from NRC Equipment Environmental Qualification Safety Evaluation Reports," which is attached.

We have reviewed the evaluation performed by our consultant contained in the enclosed Technical Evaluation Report (TER) and concur with its bases and findings. Our review has also revealed certain discrepancies in the TER which are being corrected by this SER as follows: -

- o Delete the third paragraph on page 1-9 of the TER.
- o Delete the second paragraph on page 1-10 of the TER.

The staff has also reviewed the licensee's justification for continued operation regarding each item of safety-related electrical equipment identified by the licensee as not being capable of meeting environmental qualification requirements for the service conditions intended.

CONCLUSIONS

Based on the staff's review of the enclosed Technical Evaluation Report and the licensee's justification for continued operation, the following conclusions are made regarding the qualification of safety-related electrical equipment.

Continued operation until completion of the licensee's environmental qualification program has been determined to not present undue risk to the public health and safety. Furthermore, the staff is continuing to review the licensee's environmental qualification program. If any additional qualification deficiencies were identified during the course of this review, the licensee would be required to reverify the justification for continued operation. The staff will review this information to ensure that continued operation until completion of the licensee's environmental qualification program will not present undue risk to the public health and safety.

The major qualification deficiencies that have been identified in the enclosed FRC TER (Tables 4-1, 4-2, 4-3 and 4-4) must be resolved by the licensee. Items requiring special attention by the licensee are summarized below:

- o Submission of information within thirty (30) days for any of the items in NRC categories I.a, II.a and II.b for which justification for continued operation was not previously submitted to NRC or FRC,
- o Resolution of completeness of safety-related equipment list,
- o Resolution of deficiencies associated with equipment items 46, 103 and 155,

- o Resolution of the concern identified on Page 5-1 of the FRC TER regarding the qualification by analysis of equipment items potentially exposed to LOCA and HELB environments.

The licensee must provide the plans for qualification or replacement of the unqualified equipment and the schedule for accomplishing its proposed correction action.

PROPRIETARY REVIEW

Enclosed in the FRC Technical Evaluation Report (TER) are certain identified pages on which the information is claimed to be proprietary.

During the preparation of the enclosed TER, FRC used test reports and other documents supplied by the licensee that included material claimed to be proprietary by their owners and originators. NRC is now preparing to publicly release the FRC TER and it is incumbent on the agency to seek review of all claimed proprietary material. As such, the licensee is requested to review the enclosed TER with their owner or originator and notify NRR within seven (7) days of receipt of this SER whether any portions of the identified pages still require proprietary protection. If so, the licensee must clearly identify this information and the specific rationale and justification for the protection from public disclosure, detailed in a written response within twenty (20) days of receipt of this SER. The level of specificity necessary for such continued protection should be consistent with the criteria enumerated in 10 CFR 2.790(b) of the Commission's regulations.

Principal Contributor: P. Shemanski

Date: DEC 20 1982

EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 164

EQUIPMENT ITEM NO. 164
 ELECTRICAL CONTROL CABLE LOCATED IN CONTAINMENT
 RAYCHEM MODEL FLAMTROL
 REQUIRED OPERATING TIME: LONG TERM
 TER CHECKSHEET NO. 164
 LICENSEE REFERENCE(S): 959
 FUNCTION (PLANT ID): CONTROL CABLE (NOTE 2)
 LICENSEE SUBMITTAL: FRC DESIGNATED SCEW(S): 421 [1]

DESIGNATION FOR DEFICIENCY IDENTIFIED BY THE NRC SER - CIRCLED ITEM(S) ONLY:
 (See Section 3 of this TER for Legend)

R, T, QT, RT, P, H, CS (A), S, (R), M, I, QM, RPN, EXN, SEN, QI, RPS, None,
 Not stated, Not applicable

LISTING OF APPLICABLE CHECKSHEETS:

<u>Contents</u>	<u>Checksheet Page No.</u>
Equipment Item	1a
Summary of Licensee Responses to the NRC SER	1b
Equipment Environmental Qualification Summary Forms	2
Licensee Response to NRC SER	3a, 3b, 3c, 3d
System Consideration Review	4a, 4b, 4c, 4d, 4e, 4f
Equipment Environmental Qualification Review	5a, 5b, 5c, 5d, 5e, 5f, 5g, 5h, 5i, 5j
Installed TMI Lessons Learned Implementation Equipment Summary	6a, 6b
Maintenance and Replacement Schedule Summary	7a, 7b, 7c



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 164

SUMMARY OF LICENSEE RESPONSES TO THE NRC SER - ONLY CHECKED ITEMS ARE APPLICABLE:

- The Licensee (has/~~has not~~) provided a response to the SER concerns.
- The Licensee (has/~~has not~~) specifically stated that the equipment is qualified and/or will function when exposed to the applicable DBE environmental service conditions.
- The Licensee has presented information which shows there are no outstanding qualification deficiencies.
- The Licensee (has/has not) proposed a corrective action for this equipment item whose qualification has not been fully established.
- Justification for interim operation (has/has not) been provided by the Licensee for this equipment item.
- Corrective action specified by the Licensee:
 - Equipment replacement with qualified equipment
 - Equipment modification
 - Equipment relocation above submergence level
 - Relocate or shield equipment from radiation source
 - Verify qualification by additional (testing/analysis)
 - Equipment relocation to a mild environment
 - Qualification testing of equipment in progress
 - Other (_____)
- The Licensee has provided other information for this equipment item that can be construed as a basis for justification for interim operation.
- The Licensee (has/has not) provided a schedule for the proposed corrective action. (Schedule for accomplishing the corrective action _____.)
- The Licensee states that the equipment item does not require qualification and/or should be exempted from environmental qualification.

DESIGNATION OF RESULTANT NRC QUALIFICATION EVALUATION CATEGORY BASED ON REVIEW - CIRCLED ITEM ONLY: (See Section 3 of this TER for Legend)

- | | |
|---|--------------------------------|
| I.a Qualified | II.c Qualified Life Deficiency |
| I.b Modification | III.a Exempt |
| <u>II.a Qualification Not Established</u> | III.b Not in Scope |
| II.b Not Qualified | IV Documentation Not Available |

EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 164

EQUIPMENT ENVIRONMENTAL QUALIFICATION SUMMARY FORM

NRC REQUIREMENTS

DESIGNATION:
 X = DEFICIENCY

Documented Evidence of Qualification Adequate	_____
Adequate Similarity Between Equipment and Test Specimen Established	_____ X
Aging Degradation Evaluated Adequately	_____ X
Qualified Life or Replacement Schedule Established (If Required)	_____ X
Program Established to Identify Aging Degradation	_____
Criteria Regarding Aging Simulation Satisfied (If Required)	_____
Criteria Regarding Temperature/Pressure Exposure:	_____
o Peak Temperature Adequate	_____
o Peak Pressure Adequate	_____
o Duration Adequate	_____
Required Profile Enveloped Adequately	_____
Steam Exposure (If Required) Adequate	_____
Criteria Regarding Spray Satisfied	_____
Criteria Regarding Submergence Satisfied	_____
Criteria Regarding Radiation Satisfied	_____
Criteria Regarding Test Sequence Satisfied	_____
Criteria Regarding Test Failures or Severe Anomalies (If Any) Satisfied	_____
Criteria Regarding Functional Testing Satisfied	_____
Criteria Regarding Instrument Accuracy Satisfied	_____
Test Duration Margin (1 hour + Function Time) Satisfied	_____
Criteria Regarding Margins Satisfied (NUREG-0588, Cat. I)	_____

NRC QUALIFICATION CATEGORY

DESIGNATION:
 X = CATEGORY

I.a	Equipment Qualified	_____
I.b	Equipment Qualification Pending Modification	_____
II.a	Equipment Qualification Not Established	_____ X
II.b	Equipment Not Qualified	_____
II.c	Equipment Satisfies All Requirements Except Qualified Life or Replacement Schedule Justified	_____
III.a	Equipment Exempt From Qualification	_____
III.b	Equipment Not in the Scope of the Qualification Review	_____
IV	Documentation Not Made Available	_____



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 164

EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW

Criteria: DOR Guidelines X; NUREG-0588, Cat. I ; NUREG-0588, Cat. II .

NRC REQUIREMENTS WITH SECTION REFERENCE (DOR/0588-I/0588-II)	LICENSEE SUBMITTAL	QUALIFICATION DOCUMENTATION	DEFICIENCY (X OR NOTE NO.)
<u>EQUIPMENT DESCRIPTION</u>			
Equipment Type	Electric Cable	Electrical Cable	
Manufacturer's Name (5.2.2/-/-)	Raychem	Raychem Corporation	
Model Number (5.2.2/-/-)	See Page 5g	Raychem Flamtrol	X Note 1
Serial Number	Not Stated	Not Applicable	
Features/Mounting (5.2.6/-/-)	Not Stated	On Mandrel In Autoclave	
Connections/Interfaces (5.2.6/-/-)	Not Stated	Test Item Is a Cable and Splice	
Location/Elevation	Inside & Outside Containment	Not Applicable	
Equipment ID No.		Not Applicable	
<u>QUALIFICATION REPORT</u> (8.0/5.0/5.0)			
Report ID Number	F-C4033-1	F-C4033-1	
Report Date	N/A	January 1975	
Issued by	N/A	Franklin Institute Research Laboratories	
Prepared for	N/A	Raychem Corporation	
Referenced Reports	N/A	Not Applicable	
Qualification Method (5.1, 5.3/2.1, 2.4/2.1, 2.4)	N/A	Simultaneous Test	
<u>QUALIFICATION TEST PROGRAM</u>			
Functional Test Description (5.2.5/2.2.9/2.2.9)	N/A	Insulation Resistance/ Current Carrying Capability, and HiPot	
Operating Conditions (-/2.2.10/2.2.10) Load/Cycles/Voltage/ Current/Freq.	Not Stated	See page 5i	



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 164

NRC REQUIREMENTS WITH SECTION REFERENCE (DOR/0588-I/0588-II)	LICENSEE SUBMITTAL	QUALIFICATION DOCUMENTATION	DEFICIENCY (X OR NOTE NO.)
Acceptance Criteria (5.2.5/2.2.1/2.2.1)	N/A	Not Stated	
Accuracy (5.2.5/-/-)	N/A	Not Applicable	
Number of Specimens	N/A	16	
Test Instruments Calibrated	N/A	Yes	
Safety Function (Active/ Passive) (-/2.1.3/2.1.3)	Passive	Active..Carry current	
Test Duration (5.2.1/-/-)	N/A	30 Days	
Accident Duration (Envir. Above Normal) (5.2.1/-/-)	more than 24 hrs	Not Applicable	
Required Function Time	Long Term	Not Applicable	
Test Sequence (General) (5.2.3/2.3.1/2.3.1)	N/A	Visual Inspection Insulation Resistance Thermal/Radiation Aging	
Test Sequence (NUREG-0588, Cat. I) (-/2.3.1/-)	N/A	Visual Inspection Insulation Resistance LOCA Simulation Visual Inspection/ Insulation Resistance/ HiPct	
1. Representative Sample			
2. Baseline Data			
3. Performance Extremes			
4. Thermal Aging			
5. Radiation Aging			
6. Wear Aging			
7. Vibration/Seismic			
8. DBE Exposure			
9. Post-DBE Exposure			
10. Inspection			
Aging (5.2.4, 7.0/4.0/4.0) Thermal Aging/Basis	Not Stated	7 Days @ 150°C Not Stated	X Note 2
Material Aging Evaluation (7.0/-/-)	Not Stated	Visual Inspection/ Insulation Resistance	
Materials Susceptible (Thermal) (5.2.4, 7.0/-/-)	Not Stated	Not Stated	
Radiation Aging, Type	Not Stated	Gamma	



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 164

NRC REQUIREMENTS WITH SECTION REFERENCE (DOR/0588-I/0588-II)	LICENSEE SUBMITTAL	QUALIFICATION DOCUMENTATION	DEFICIENCY (X OR NOTE NO.)
Radiation Aging, Dose (rd)	Not Stated	5x10 ⁷	
Radiation Aging, Dose Rate	Not Stated	Not Stated	
Radiation Aging, Method	N/A	Test	
Materials Susceptible (Radiation) (5.2.4, 7.0/-/-)	Not Stated	Not Stated	
Operational Aging (-/4.2/-)	N/A	Not Stated	
Other Age Conditioning (-/4.2/-)	N/A	Not Stated	
Qualified Life Claimed/ Established (5.2.4/4.10/-)	Not Stated	Not Stated in Test Report	X Note 2
Normal Ambient Temperature	135°F	Not Applicable	
Normal Ambient Radiation	Not Stated	Not Applicable	
Normal Ambient Humidity	Not Stated	Not Applicable	
On-Going Surveillance and Preventive Maintenance (7.0/-/-)	Brunswick Program	Not Applicable	
On-Going Analysis of Failures and Degradation (7.0/-/-)	Brunswick Program	Not Applicable	
Margin (General) (6.0/3.0/3.0)	N/A	Not Stated	
Margin (NUREG-0588, Cat. I) (-/3.2/-)	N/A	Not Stated	
1. Temperature (+15°F)			
2. Pressure (+10%, 10 psig max)			
3. Radiation (not required)			
4. Time (+10%, +1 hour + function time minimum)			

EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 164

NRC REQUIREMENTS WITH SECTION REFERENCE (DOR/0588-I/0588-II)	LICENSEE SUBMITTAL	QUALIFICATION DOCUMENTATION	DEFICIENCY (X OR NOTE NO.)
<u>ACCIDENT CONDITIONS</u>			
LOCA/MSLB/HELB/Uncontrolled (4.1, 4.2, 4.3.1, 4.3.3/ 1.1, 1.2, 1.5/1.1, 1.2, 1.5)	LOCA/HELB	LOCA/ MSLB	
Radiation Type	Gamma	Gamma	
Radiation Dose (rd) (4.1.2/1.4/1.4)	1.1x10 ⁸	197.7-209.8 Megarads	
Radiation Dose Rate (rd/hr) Radiation Qual. Method (5.3.1/-/-)	Not Stated N/A	Not Stated Test	
Proximity to Concentrated Radiation (4.1.2/1.4.6/1.4.6)	Not Stated	Not Applicable	
Equipment Susceptible to Beta Radiation (4.1.2/-/-)	Not Stated	Not Stated	
Radiation Dose (Normal + Accident) (4.1.2/-/-)	Not Stated	Not Applicable	
Plateout Dose Considered (-/1.48/1.48)	Not Stated	Not Applicable	
Gamma + Beta Dose (rd) (4.1.2/1.4.7/1.4.7)	Not Stated	Not Applicable	



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. LE4

NRC REQUIREMENTS WITH SECTION REFERENCE (DOR/0588-I/0588-II)	LICENSEE SUBMITTAL	QUALIFICATION DOCUMENTATION	DEFICIENCY (X OR NOTE No.)
<u>ENVIRONMENTAL PROFILE OF ACCIDENT CONDITIONS</u>			
Rate of Temp./Press. Increase	Not Stated	10°F; 7Psi/second	
Peak: °F/psig/RH/Time	See Profile	357/70/100%/10 hrs	
Decrease To: °F/psig/RH/Time	Page 5j	357-275/70-31/100%/2hrs	
Decrease To: °F/psig/RH/Time		275/31/100%/4days	
Decrease To: °F/psig/RH/Time		212/10/100%/26 days	
Equipment Surface Tempera- ture (MSLB) (-/1.2.5.C, 2.2.6/1.2.5.C, 2.2.6)	N/A	Not Applicable	
Spray Qualification Method (5.3.2/1.3, 2.2.8/1.3, 2.2.8)	N/A	Test	
Spray Composition (4.1.4/1.3, 2.2.8/ 1.3, 2.2.8)	Demin H ₂ O	3000 ppm Boron 0.064 Molar Na ₂ S ₂ O ₃ NaOH for pH of 10.5	
Spray Density (gpm/ft ²)	Not Stated	0.15	
Spray Duration	Not Stated	30 days	
Submergence Duration (4.1.3/2.2.5/2.2.5)	Not Stated	Not Applicable	
In-Leakage Considered (5.2.6, 5.3.2/-/-)	Not Stated	Not Applicable	
Time to Submergence	Not Stated	Not Applicable	
Dust Environment (-/2.2.11/2.2.11)	Not Stated	Not Applicable	

EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 164

NOTES: / -

The Licensee has not presented sufficient information to establish equivalence between the cable tested and the installed cable (see 5g. A51) as required by DOR Guidelines and/or IEEE-383-74

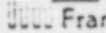
2. Test Specimen - The test specimen should be the same model as the equipment being qualified. The type test should only be considered valid for equipment identical in design and material construction to the test specimen. Any deviations should be evaluated as part of the qualification documentation (see also Section 8.0 below).

2.2 Type Test Samples. The samples tested should contain the conductor, insulation, fillers, jacket, binder tape, overall jacket, shielding, and field splices which are representative of the cable category being qualified. Table 1 lists sizes which have been considered representative of these categories. The sample lengths should be sufficient to permit reliable test readings and evaluation consistent with good testing practice.

ELECTRIC CABLES, FIELD SPLICES, AND CONNECTIONS IEEE Std 383-1974

Table 1
 Representative Cables for Type Tests

Type	Test	Specimen	Size
Up to 2000 V multiconductor control cable or four-wire multiconductor metal cable (see list below for individual components) or single conductor power cable	temperature and moisture resistance	2.3.1	1/C - 14 or 12 AWG
	thermal and radiation exposure	2.3.2	1/C or 1/C - 14 or 12 AWG
	charge back event simulation	2.4	1/C or 1/C - 14 or 12 AWG
	vertical flame test angles from cable assembly	2.5.6	1/C - 8, 4 or 2 AWG - 1/C - 14 or 12 AWG
Rounded pair, triple or quad (see multiconductor signal cable)	vertical tray flame test	2.5.4	7/C - 10, 14 or 12 AWG
	temperature and moisture resistance	2.3.1	1 only as shown
	thermal and radiation exposure	2.3.2	16 AWG or actual cable
	charge back event simulation	2.4	
General class of special instrument cable	vertical flame test	2.5.6	
	temperature and moisture resistance	2.3.1	actual size
	thermal and radiation exposure	2.3.2	
	charge back event simulation	2.4	
Single pair (interference free) telephone cable	vertical flame test angles from cable assembly	2.5.6	
	temperature and moisture resistance	2.3.1	2/C - 20 AWG or actual size if specified
	thermal and radiation exposure	2.3.2	
	charge back event simulation	2.4	
Vertical tray flame test	vertical flame test angles from cable assembly	2.5.6	
	vertical flame test angles from cable assembly	2.5.6	
	vertical tray flame test	2.5.4	
	vertical flame test angles from cable assembly	2.5.6	
1000-15 000 V power cable 1/C shielded and unshielded	vertical tray flame test	2.5.4	4 AWG (0.5kV) 2/C or 4/C or 4/C (2.5kV)



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 164/65

NOTES:

EQUIPMENT DESCRIPTION

SYSTEM: Common Components
 PLANT ID. NO. NA16, RC16, FA26, GA22,
 IA22
 COMPONENT: 1 Pair #16, 1 Triple #16,
 Triax, Coax, Coax
 MANUFACTURE: Raychem Corp.
 MODEL NO. Flamtrol
 FUNCTION: Instrument Cable (600v)

EQUIPMENT DESCRIPTION

SYSTEM: Common Components
 PLANT ID. NO. (SEE BELOW)
 COMPONENT: #8, #9, #10 & #12 AWG Cable
 MANUFACTURE: Raychem
 MODEL NO. Flamtrol
 FUNCTION: Control Cable



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 164

NOTES:

Note 1 (cont'd)

The licensee has not identified the cable characteristics (such as jacket and insulation thickness) which would establish the applicability of the referenced report to the installed cables. This is particularly important because certain 1000V multiconductor Flamtrol cables have been observed to have insulation properties significantly different than the cables tested in the referenced report (F-C4033-1). Of particular concern was a tendency of conductor insulation to experience dielectric breakdown at voltage levels considerably below those expected for polyethylene cable. Total insulation thickness (i.e. cable jacket plus conductor insulation) and cross linking electron beam energy used during fabrication are believed to be critical parameters.

The licensee should provide the information on the cable insulation thickness (jacket and conductor insulation) and any other characteristics which demonstrate that the installed cable is the same as the cable in the referenced test.

Note 2- the licensee has not provided an evaluation of aging degradation for the cable nor an estimated qualified life.



EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 164

Table 1 Test Specimens

Specimen Description	Number*	Length (in) [†]	Electrical Loading	
			Voltage (Vrms - 60 Hz)	Initial Current (A) [‡]
Raychem Flamtrol™ 1000 V insulated wire AWG 12, 45 mil nominal wall Part No. WITC12C10 #50C811-12 Run No. P7-10-1-72-4	1 1X	25	1000	25
Raychem Flamtrol™ 1000 V insulated wire AWG 8, 45 mil nominal wall Part No. WITC8W #50C811-8 Run No. P-7-9-23-71-4	2	23	1000	45
Raychem Flamtrol™ 1000 V insulated and jacketed cable, 7 conductor, AWG 12 20 mil nominal wall insulation 50 mil nominal jacket wall Part No. J7TC12C10 Run No. P7-23-74-7	3 3X	24 23	1000	17.5
Raychem Flamtrol™ 600 V insulated and jacketed cable, 2 conductor, AWG 18 Aluminum-polyester shield wrap with AWG 18 drain wire 20 mil nominal wall insulation 45 mil nominal jacket wall Part No. F2TC18C4-C1 Run No. J14-13-4-74-4	4A 4AX	27 23	600	8
Raychem Adverse Service Coastal Cable AWG 22 conductor 1st insulation layer - 8 mil wall of silicone-oxide polymer 2nd insulation layer - 49 mil wall of Rayolon K™ radiation cross-linked polyolefin Braided copper shield Raychem Flamtrol™ jacket - 34 mil nominal wall Part No. 10482 Run No. J7-5-10-72-4	5 5X	25 25	800	9
Raychem Adverse Service Trossal Cable AWG 22 conductor 1st insulation layer - 4 mil wall of silicone-oxide polymer 2nd insulation layer - 129 mil wall of Rayfoam Y™ radiation cross-linked cellular polyolefin Braided copper shield 1st jacket - 22 mils of Raychem Flamtrol™ Braided copper shield 2nd jacket - 22 mils of Raychem Flamtrol™ Part No. 10435 Run No. J7-3-1-73-4	6 6X	25 23	600	9
Coaxial Cable Splice Same cable as Specimen Number 5 with splice covered with Thermoid® WDFP-M heat-shrinkable tubing splice cover (splice illustrated in Figure 1)	7X	25	600	9
Raychem Flamtrol™ 1000 V insulated wire AWG 12, 45 mil nominal wall Part No. WITC12C10 (Note 2) Run No. P-11-7-12-74-4	10 10X	27 18	1000	25
Same as Specimen Number 10 except preaged before test begins at 150° C (320° F) for 25 days (Notes 2 and 3)	11	26	600 (Note 4)	25
Same as Specimen Number 10 except preaged before test begins at 150° C (320° F) for 10 days (Notes 2 and 3)	12 12X	27 22	1000	25

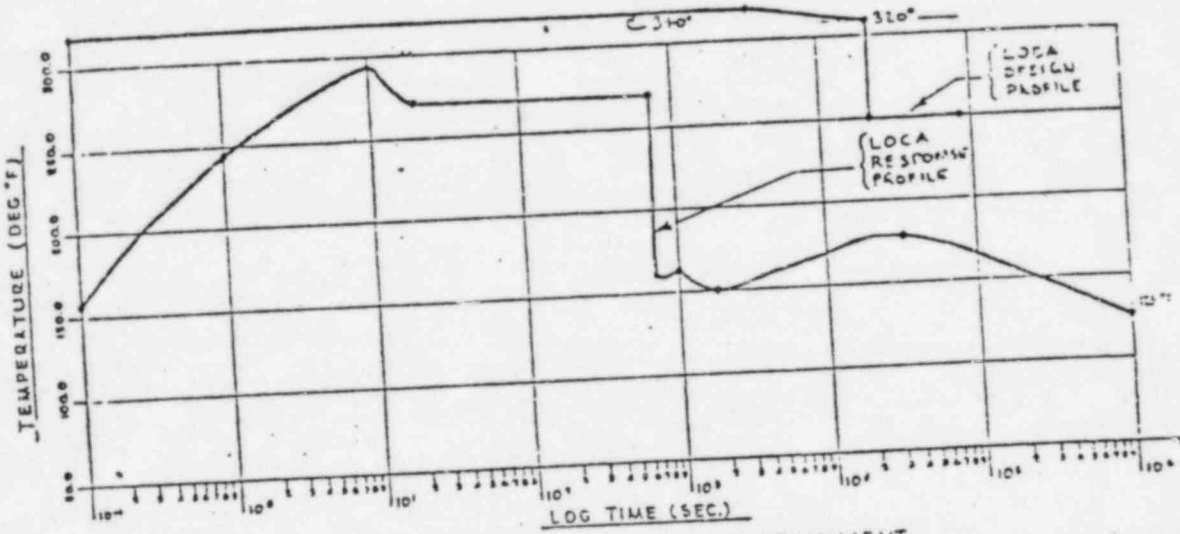
* Cables with suffix "X" were mounted on the outer cable manifold. See Section 4.4.
[†] Specimens cut to lengths shown. Approximately 4 ft of the length extended outside of the test vessel
 (2 ft on each end of the specimens).
[‡] Initial currents were applied at room temperature, and allowed to drop to a lower level during simulated
 radiative and thermal aging and simultaneous LOCA-stimulation testing. See text for discussion.
 Note 1: Specimens 7 and 8 were Raychem Solan™, test results are presented in report number Z-C4023-2.
 Note 2: Specimens 10, 11, and 12 were an experiment to determine the effect of additional preaging.
 Specimen 10 was the control for the other two specimens.
 Note 3: Information on preaging provided by Raychem.
 Note 4: Raychem specified 100V rms. Actual voltage used was 400V rms.
[†] and [‡] Trademarks of Raychem Corporation



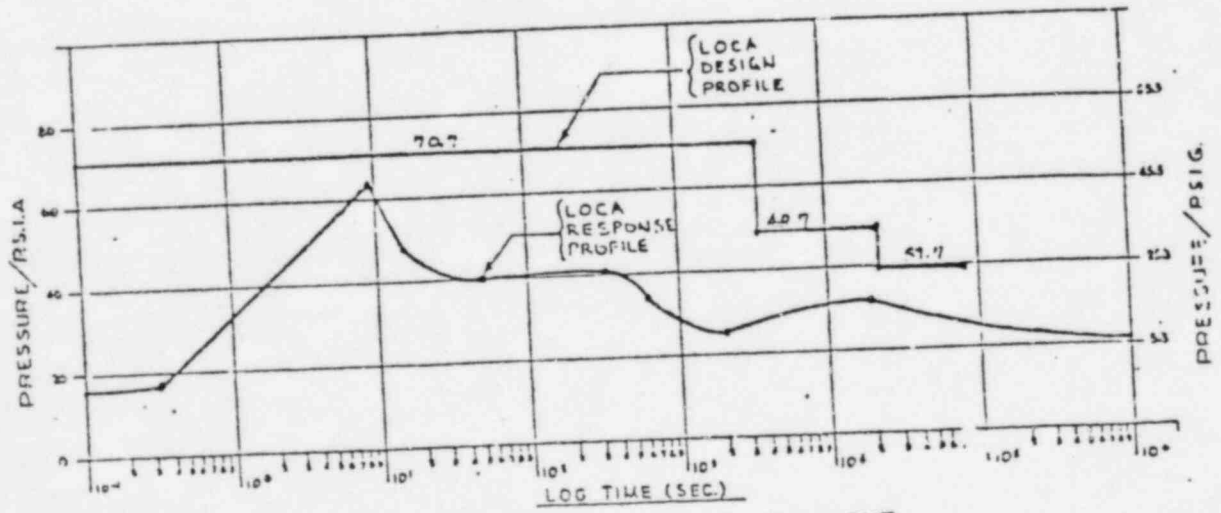
EQUIPMENT ENVIRONMENTAL QUALIFICATION REVIEW OF EQUIPMENT ITEM NO. 164

NOTES:

THE TEST PROFILE ENVELOPES THE ACCIDENT PROFILE BY A WIDE MARGIN



TEMPERATURE TRANSIENT INSIDE CONTAINMENT PROFILE "A"



PRESSURE TRANSIENT INSIDE CONTAINMENT PROFILE "B"



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

Enclosure 4

DEC 23 1982

Docket Nos. 50-325/
324

Mr. E. E. Utley
Executive Vice President
Carolina Power & Light Company
P. O. Box 1551
Raleigh, North Carolina 27602

Dear Mr. Utley:

SUBJECT: SAFETY EVALUATION FOR ENVIRONMENTAL QUALIFICATION OF
SAFETY-RELATED ELECTRICAL EQUIPMENT

Re: Brunswick Steam Electric Plant, Units 1 and 2

This letter transmits two reports on the investigation of Raychem cable installed at your Brunswick Plant Units 1 and 2. These reports were prepared by the Franklin Research Center (FRC) and supplement the August 8, 1982 FRC report on the environmental qualification of safety-related electrical equipment that was forwarded to you on December 20, 1982, together with our Safety Evaluation.

We have reviewed the enclosed reports and we have no information at this time that indicates that the "space charges phenomenon" is not a valid concern. Therefore, the status of the qualification of Raychem cables at the Brunswick Plant remains as stated in the August 8, 1982 FRC Report, that is, that the qualification of this cable has not been established.

Consideration of the enclosed reports should be included in your reaffirmation of justification for continued operation that you will submit in response to our December 20, 1982 letter transmitting the Safety Evaluation for environmental qualification of safety-related electrical equipment. In response to our request, made in a telephone discussion with members of your staff on December 17, 1982, it was indicated that a response reaffirming justification for continued operation with respect to the environmental qualification of Raychem cable, would be submitted by January 4, 1983.

Dupe 8212300145

Mr. E. E. Utley
Carolina Power & Light Company

cc:

Richard E. Jones, Esquire
Carolina Power & Light Company
336 Fayetteville Street
Raleigh, North Carolina 27602

George F. Trowbridge, Esquire
Shaw, Pittman, Potts & Trowbridge
1800 M Street, N. W.
Washington, D. C. 20036

Mr. Charles R. Dietz
Plant Manager
P. O. Box 458
Southport, North Carolina 28461

Mr. Franky Thomas, Chairman
Board of Commissioners
P. O. Box 249
Bolivia, North Carolina 28422

Mrs. Chrys Baggett
State Clearinghouse
Budget & Management
116 West Jones Street
Raleigh, North Carolina 27603

U. S. Environmental Protection Agency
Region IV Office
Regional Radiation Representative
345 Courtland Street, N. W.
Atlanta, Georgia 30308

Resident Inspector
U. S. Nuclear Regulatory Commission
P. O. Box 1057
Southport, North Carolina 28461

James P. O'Reilly
Regional Administrator, Region II
U.S. Nuclear Regulatory Commission
101 Marietta Street, Suite 3100
Atlanta, Georgia 30303

CP&L

Carolina Power & Light Company

December 31, 1982

Office of Nuclear Reactor Regulation
ATTN: Mr. D. B. Vassallo, Chief
Operating Reactors Branch No. 2
United States Nuclear Regulatory Commission
Washington, DC 20555

BRUNSWICK STEAM ELECTRIC PLANT, UNIT NOS. 1 AND 2
DOCKET NOS. 50-325 AND 50-224
LICENSE NOS. DPR-71 AND DPR-62
ENVIRONMENTAL QUALIFICATION

Dear Mr. Vassallo:

On November 30, 1982, a meeting was held with representatives from Carolina Power & Light Company (CP&L), Raychem Corporation, and the Nuclear Regulatory Commission (NRC) concerning the use of certain Raychem/Flamtrol cable at the Brunswick Steam Electric Plant, Unit Nos. 1 and 2. Specifically, the Raychem cable in question is unshielded multiconductor cable rated at 1000 V having a combined insulation thickness of 120 mils or greater.

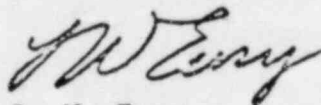
As outlined by our December 15, 1982 letter, CP&L is committed to the performance of qualification testing for the Raychem cable that is on question and in use at the Brunswick Plant. We would like to meet with the Staff in January 1983 to review and discuss our proposed cable qualification test program. In addition, CP&L will provide the Staff with periodic updates of the progress of the cable qualification test program.

On December 15, 1982, the NRC transmitted to CP&L Technical Evaluation Report (TER) Items 164 and 165 on Raychem cable. TER Item 165 does not refer to the cable type in question; thus, CP&L considers the cable covered by TER Item 165 to be qualified based on previously referenced and supplied Raychem test reports. TER Item 164 discusses the cable types in question, and these cable types are listed in Enclosure 1. Based on the technical justifications provided in Enclosure 2 and our commitment to perform qualification testing as described in our December 15, 1982 letter, CP&L believes that continued operation of the Brunswick Plant is justified.

Dupe ~~8301046220~~

If you should have any questions on this response, please contact our staff.

Yours very truly,



L. W. Eury
Senior Vice President
Power Supply

WRM/kjr (5896C10T2)
Enclosures

cc: Mr. S. D. MacKay
Mr. D. O. Myers (NRC-BSEP)
Mr. J. P. O'Reilly (NRC-RII)
Mr. J. A. Van Vliet (NRC)

ENCLOSURE 1

BURNSWICK STEAM ELECTRIC PLANT, UNIT NOS. 1 AND 2
RAYCHEM CABLE TYPES- IN QUESTION

1.	7	conductor	# 12	AWG
2.	10	conductor	# 12	AWG
3.	12	conductor	# 12	AWG
4.	2	conductor	# 2	AWG
5.	4	conductor	# 2	AWG
6.	2	conductor	# 6	AWG
7.	4	conductor	# 6	AWG
8.	4	conductor	# 4	AWG
9.	2	conductor	# 8	AWG

ENCLOSURE 2

JUSTIFICATION FOR CONTINUED OPERATION BRUNSWICK STEAM ELECTRIC PLANT

TER ITEM 164 — RAYCHEM/FLAMTROL CABLE

The cable in question is unshielded multiconductor Flamtrol control and power cable manufactured by Raychem Corporation, rated at 1000V with combined conductor and jacket insulation thickness of 0.12 inches or greater.

Flamtrol cable is a fire-retardant, radiation cross-linked cable utilized as control and power cable for certain safety-related electrical equipment at Carolina Power & Light Company's Brunswick Steam Electric Plant. It has been theorized that the use of an electron beam of insufficient energy by the manufacturer (References 1 and 2, hand delivered to Carolina Power & Light Company at the November 30, 1982 meeting with the Nuclear Regulatory Commission) resulted in inadequate penetration of the assembled cable to complete the cross-linking process and, as a direct consequence, caused a space charge buildup within some areas of the conductor insulation. The subsequent release of the space charge resulted in possible damage to the conductor insulation. (The space charge phenomenon and possible damage mechanism occurring in radiation cross-linked cable are discussed in detail in Appendix A to Reference 2).

The Franklin Research Center was tasked by the Nuclear Regulatory Commission to evaluate the possible detrimental effects of the space charge phenomenon (References 1 and 2). This evaluation resulted in a recommendation that Carolina Power & Light Company establish the functional capability of the suspect cable through applicable qualification testing.

This enclosure provides justification for continued operation until that functional capability has been established.

It should be noted that the suspect cable is not subject to immediate catastrophic failure when exposed to loss-of-coolant accident (LOCA) conditions. An increase in leakage current could be realized through the defective areas of the conductor insulation; however, IR measurements of the cable would have to decrease below 50K ohms resistance prior to possible failure of the cable's control and/or power function. Additionally, the cables are currently utilized at less than 50% rated voltage at the Brunswick Steam Electric Plant.

An extensive surveillance program was established by Carolina Power & Light Company in 1978 to monitor for degradation of the in-plant Flamtrol cable. This program consisted of making and recording annual IR measurements with a 1000 V dc megger on cable spares located throughout the Brunswick Steam Electric Plant. Each conductor was tested to all other conductors and ground. Investigation action was taken for any IR measurement less than 500 megohms.

From 1978 through 1980, there were a total of 12 cables with measured IR values less than 500 megohms. It was observed in each case that the conductors of these cables were wet or shorted together outside the jacket insulation, i.e. the bare ends of individual spare conductors were in contact. In 1981, all cables had IR values of 1000 megohms or greater.

An evaluation of this historical IR measurement test data on the 81 samples of spare Raychem Flamtrol cables indicate that no degradation in dielectric strength has occurred since program establishment. Additionally, a review of plant maintenance records revealed no failures attributable to cable insulation degradation.

The IR measurement program and maintenance record review confirms Franklin Research Center's "...engineering opinion that insulated Flamtrol cable having combined insulation thickness of 0.12 inches or greater can perform adequately under normal service conditions,..." (Reference 2).

For accident conditions, each Brunswick unit should be considered as having two separate areas, the reactor building and primary containment (drywell).

For LOCA conditions, Class 1E equipment within the reactor building would be subjected to an increase in radiation exposure only. The increase in radiation exposure without sustained high levels of moisture would not create the conditions necessary for cable failure through the suspected defect.

The LOCA conditions within the drywell could be contributory to cable degradation. The suspect cables used in safety related systems within the drywell are 7 conductor 12 AWG, 10 conductor 12 AWG, and 12 conductor 12 AWG only.

All Class 1E safety related equipment within the drywell serviced by the suspect cable has been reviewed with the following results:

1. None of the valves in the Automatic Depressurization System (ADS) are controlled or supplied power by the suspect cable and, therefore, can be considered continuously available for accident mitigation.
2. The components actually serviced by this cable perform their safety related function within a short time of sensing the accident parameter. There are 24 valves located within the drywell that are serviced by the suspect cable; all 24 of these are inboard isolation valves. Of the 24 valves four (4) have been rendered permanently inoperable and locked in position (due to other considerations), eight (8) are passive (not required to change position), and ten (10) valves actuate in less than 4 minutes after the accident is detected. The remaining two (2) valves (HPCI steam supply isolation inboard and RCIC steam supply isolation inboard) will stay open for accident mitigation (less than 12 hours) and then will be required to close. Failure of any of these 24 valves to operate upon demand will not adversely affect plant safety due to backup (outboard) isolation valves which would not be affected by these conditions.

Therefore, the suspect cable will not impede the mitigation of a loss-of-coolant accident at the Brunswick Steam Electric Plant.

In the event the plant is subjected to a high energy line break, only the equipment within the reactor building would be affected. The conditions would consist of a temperature peak of approximately 295°F decreasing rapidly to near normal conditions, a maximum pressure peak of 7 psig, and relative humidity of 100% for only a short period of time. The peak pressure and humidity combination are not sustained sufficiently to produce enough moisture intrusion through the cable insulation such that degradation of the insulation is significant.

Therefore, based upon the IR measurement program, maintenance record review, and evaluation of safety related functions, the suspect Raychem Flamtrol cable is justified for continued operation pending the establishment of the functional capability of the cable by qualification testing of representative specimens from the Brunswick plant.

REFERENCES

1. Investigation of Raychem Cable installed in the Brunswick Plant, Phase 1 - Preliminary Evaluation and Test Plan, Franklin Research Center Report No. 1-C-5260-3012-1 of October 23, 1981.
2. Investigation of Raychem Cable installed in the Brunswick Plant, Phase 2 - Evaluation and Test Recommendation, Franklin Research Center Report No. F-C-5569-3002 of June 30, 1982.