

S-38 50-348/364-CIVP 2/19/92

88. 03/23 15:14 P02 *

Staff Exh. 38

JOSEPH M. FARLEY NUCLEAR UNIT
NURC 55.0

DOCKETED
USNRC

ENVIRONMENTAL QUALIFICATION REPORT EVALUATION # 296

Equipment Description Raychem/CHICO Equipment Entrance Seal (See Note 4) Attachment 13 thru 15
 Manufacturer Raychem and Crouse-Hinds Model/Serial No. Raychem NCE with CHICO-A
 Qualifier (Test Lab) Raychem/Bechtel/SvRI Note 2 (S-492-2) (C03-4974-001)
 Reported by Robert A. Frink Report No. (S-15W) (E) EDR-504C
 Title Senior Engineer Date 9/8/87

Page 1 of 7

003479
Remarks

NUREG 5888 Requirements	Report Evaluation		Test Report Section or Para	Remarks
	Acceptable	Yes		
1.0 ESTABLISHMENT OF THE QUALIFICATION PARAMETERS FOR DEE			(A) Sec 3.4	(A) Max Temp 390°F Max Press 66 psig (80.7 p)
1.1 Temperature and Pressure Conditions Inside Containment - LOCA			(E) App B Test log	(E) Max Temp 310°F Max Press 60 psig (74.7 p) See Note 3 & Attachment 1
a. Does time dependent test profile envelop plant specific temperature and pressure profiles in PSAAT?	✓			
1.2 Temperature and Pressure Conditions Inside Containment - MELB			(A) Sec 3.4 (E) App B Test log	See Note 3 and Attachment 1
a. Does time dependent test profile envelop plant specific temperature and pressure profiles in PSAAT?	✓			
b. If LOCA conditions used, were MELB conditions developed?	✓		(E) Sec 3.4 (E) App B	See Note 4
1.3 Effects of Chemical Spray			(A) Sec 3.4	The CHICO Sealing Compound is Co by the NCB, Keeper Sleeve & Condu assembly and is not exposed to S. NCBK was tested for chemical z consisting of Boron, hydrogen, & sodium phosphate, pH 10.5. See Att.
a. Was the concentration of caustic used equal to or more severe than those in the containment spray system?	✓			
1.4 Radiation Conditions Inside and Outside Containment			(A) Sec 2.5 APP A (C) p.1	(A) 2.0 x 10 ⁸ Rads gamma (C) 1.02 x 10 ⁸ Rads gamma Note 5.
a. Is radiation qualification based on equipment qualified life plus most severe DPA and post DPA for which equipment must remain functional?	✓			
b. Has beta radiation been addressed?	✓		-	See A-506150, Rev. 1
c. Have components outside the containment exposed to pump recirculation been addressed?	✓		(A) Sec 3.4 (E) APP E	The inside containment conductor envelop the outside condition
1.5 Environmental Conditions for Outside Containment			(A) Sec 3.4 (E) APP E (B) MSVR	The inside containment envelop the outside conditions. Attachment 5 Addendum, CHICO Not required for
a. Does time dependent test profile envelop temperature and pressure profiles analyzed in the PSAAT for MELB areas?	✓			
2.0 QUALIFICATION METHODS			(A) Sec 1.0 (B) (C) (E)	Testing performed in Ref (A) and supplemented by Refs (E), (C) and (B)
2.1 Selection of Methods			(E) All (E)	Testing was performed. See Note 1 and Attachment 4 for Anal
a. Do qualification methods conform to IEEE 323-1971?	✓			
b. If analysis was performed in lieu of testing, was justification provided?	✓			
c. If analysis was performed in lieu of testing, was partial type test data provided to support analytical assumptions and conclusions?	✓		(E) All (E)	Testing was performed. See Note 1 & Attachment 4 for Anal

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NUCLEAR REGULATORY COMMISSION

Docket No. D-348/94-CV Official File No. 38

In the matter of Alabama Power Company

Staff _____ IDENTIFIED 12:19 p.m. 2/11/92

Applicant _____ RECEIVED 12:23 p.m. 2/19/92

Intervenor _____ REJECTED _____

Cont'g Off'r _____

Contractor _____ DATE 2/19/92

Other _____ Witness _____

Report S Etp

2557

LATCHER NCB NUREG 0588 Requirements	Report Evaluation		Test Report Section or Para	REC # 29G Remarks
	Acceptable			
	Yes	No		
d. If testing was performed, did the test demonstrate the operability of the equipment for the time required in the environmental conditions resulting from the accident?	✓		(A) Sec 3.0 (B) App B	Voltage and leakage test were done
e. For equipment that need not function to mitigate any accident, was it demonstrated that the equipment could not fail in a manner detrimental to plant safety?	N/A			Equipment Required to mitigate accident
1.2 Qualification by Test			(A) Sec 2.0 (B) App A Sec II	
a. Was failure criteria established before the test?	✓			
b. Did test profile envelop a composite LOGA/WLB profile inside containment?		✓	(A) Sec 4.4 (B) App B	See Section 1.2b, Note 3 & Attachment 1
c. If equipment could become submerged due to flooding, has the ability or necessity for submerged operation been demonstrated?	✓		(A) Sec 3.1.2	Chico A sealing compound is inside the NCBK assembly.
d. Was simulated accident temperature defined by thermocouples on or near the equipment?	✓		(A) App D (B) App B	
e. Were performance characteristics demonstrated before, during and after the test?	✓		(A) Sec 3.0 (B) App B	Measurement for the NCB supplemented by Ref (C) Test
f. Was acoustic spray of the proper concentration employed at the proper time and duration during the test?	✓		(A) Sec 3.4	See Section 1.3
g. Was Cobalt-60 employed for the gamma irradiation of the equipment?	✓		(A) Sec 3.3 (B) Item 5	
2.3 Test Sequence			(A) Sec 3.0 (B) All	065480
a. Was the adequacy of the test sequence selected justified?	✓			
b. Did the test simulate as closely as practical the postulated environment?	✓		(A) Sec 3.4 (B) App B	
c. Did the test procedures conform to the guidelines of Section 5 of IEEE 323-1971?	✓		(B) Sec 1.0	
3.0 MARGINS			(A) Sec 3.0 (B) All	See Attachment 2
a. Were quantified margins applied to design parameters to assure enveloping of accident conditions?	✓			
b. Was equipment demonstrated to remain functional in the accident environment for at least one hour in excess of the time assumed in the accident environment?	✓		(A) Sec 3.0 (B) All	The DBE ended at 30 day additional tests were done while submerged.
4.0 AGING				Equipment is not a valve or motor.
a. Does qualification program conform to requirements of IEEE 382-1972 for valve operators and IEEE 336-1971 for meters? Are aging effects considered?	N/A			
b. For equipment other than valve operators or meters, has equipment been assessed for materials which are susceptible to aging effects?	✓		(A) Sec 3.2 (B) All	NOTE 7
c. Has an acceptable accelerated thermal aging method been incorporated in the qualification program to establish qualified life?	✓		(A) Sec 3.2 (B) All	NOTE 7

RAYCHEM NCB CHICO DBE Requirements	Report Evaluation		Test Report Section or Page	REPRBC # 29 G Remarks
	Acceptable	Not		
d. Has mechanical (cyclic) aging (if applicable) been incorporated in the qualification program?	N/A		1	Non-cycling device
3.0 QUALIFICATION DOCUMENTATION				Notes 1, 3, 5, 7
a. Does the qualification documentation verify that the equipment is qualified for its application and meets its specified performance requirements?	✓		(1) All (2) All (3) All (4) All	
b. Is qualification data used to demonstrate equipment qualification organized in an accessible form?	✓		(1) All (2) All (3) All	Some data is raw test data which can be used to demonstrate acceptance
c. Does qualification documentation meet the guidelines of IEEE 323-1971?	✓		(1) All	
d. If a certificate of conformance is submitted, is it accompanied by test data and information concerning the test program?	N/A			Certificate of Conformance is not submitted

Maintenance Requirements none specified

Revision 3
 Reviewed By: G.M. Laxford Date 3-23-88
 Title Engineering Specialist
 Organization: Bechtel
 Approved by: Vance A. Sundberg Date 3/29/88
 Title: EQ Group Supervisor
 Organization: BEPC

Accepted by: Ralph Stewart
 Organization APCo
 Date 3/23/88

Evaluation Summary The Raychem/CHICO Equipment Entrance seal is considered qualified for use inside and outside containment at Farley Nuclear Plants for Units 1 and 2 for a qualified life of 40 years plus DBE.

005481

Revision _____
 Reviewed by: Sushant Kapur Date 11/24/87
 Title Engineer
 Organization: Bechtel
 Approved By: V.P. Sundberg Date 11/24/87
 Title: EQ Group Supervisor
 Organization: BEPC

Accepted by: Ralph Stewart
 Date 11/24/87
 Organization: APCo-APC

Revision 1
 Reviewed By: Robert O. Frink Date 9/9/87
 Title SR. ENGINEER
 Organization: Bechtel
 Approved By: Vance A. Sundberg Date 9/11/87
 Title: EQ Group Supervisor
 Organization: BEPC

Accepted by: Jim Bond
 Date 1/15/87
 Organization: APCo

NOTES:

1. Qualification of the Raychem/Crouse Hinds (CHICO) environmental seal is based on similarity to the NCBK (Fig. 1) by use of the NCB molded boot breakout with the WCSF insulated sleeve. This NCB molded boot is qualified with the WCSF insulating sleeve per Wyle Lab Test Report 5844. The Raychem/Chico environmental entrance seal is similar to the tested WCSF/NCB in that the WCSF sleeve is now surrounded by a 1/4 inch metal coupling. In addition, the NCB is attached to a 1 inch conduit nipple which is filled with CHICO sealing compound to provide structural support for harsh environment. Since the NCBK had been qualified previously Ref. (A) tested the CHICO environmental seal configuration (Fig. 2) for postulated Farley LOCA profile.

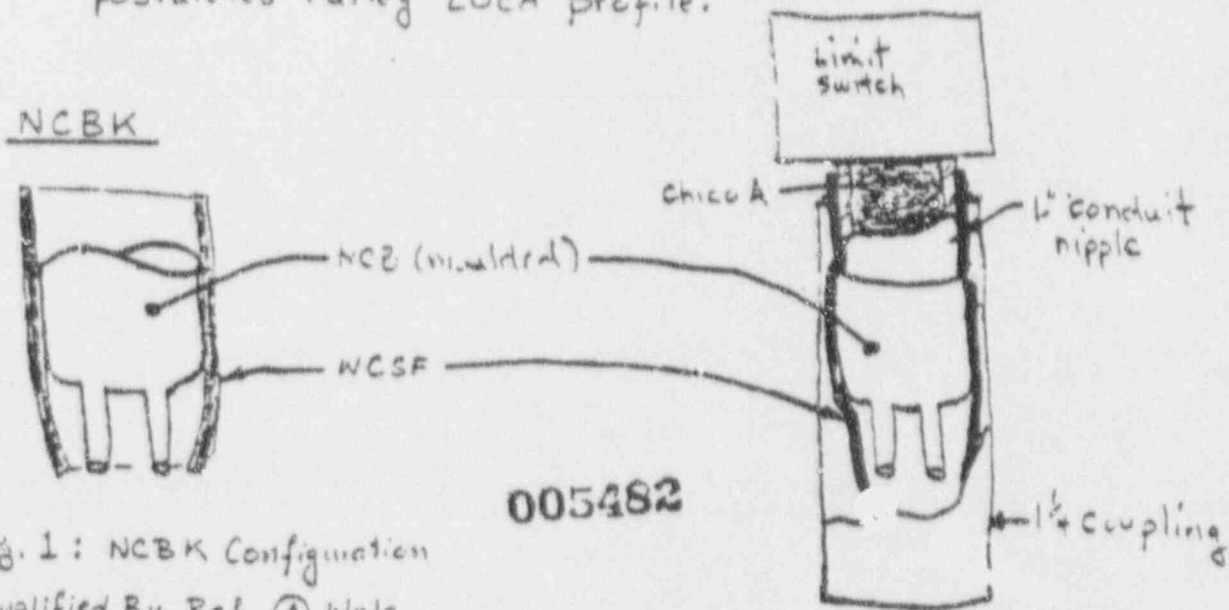


Fig. 1: NCBK Configuration
Qualified By Ref. (A) Wyle
Test Report 5844 2-2

Fig. 2: CHICO Seal Configuration
Qualified By Similarity to NCBK
Configuration and Ref. (E)

2. References:

- ① Wyle Laboratories test Report No. 58442-2. Environmental Qualification Test Report of Raychem Nuclear Cable Breakout and End Sealing Kits. Dated April 3, 1981

- ② Qualification Testing of Raychem Environmental Seals for Alabama Power Co, Joseph M. Farley Nuclear Plant
Appendix A. Test Procedure Limit Switch Cable Seal Test

Appendix B APCo QC Test Log
Dated 12/30/81

- ③ Southwest Research Institute, Bechtel P.O. 9645,
SWRI PROJECT No. 03-4974-001 Dated February 2, 1979.

- ④ Raychem Report No. EDR-5040. Analysis of Heat Aging Data on -52 Moulding Material to Determine Pre-aging conditions for Nuclear Qualification Testing, Dated 10/15/81

005483

Notes:

3. The ^{Raychem/}CHICO seal configuration (Note 1, Fig. 2) that was tested consisted of a 1" nipple (conduit), a 1/4" pipe coupling, a Raychem NCB, a Raychem WCSF sleeve and the CHICO AA (Ref. ② sec. V, App. A sec. III, IV & App. B). Testing per Ref. ② did not test to the extremes of the DBE (Specified 316°F, tested 310°F). However, the metal pipe will withstand the DBE extremes; the NCBK was tested to the DBE conditions (Ref. ②) and the CHICO is a cement mixture of calcium aluminate and gypsum cement (Attachment 2) inside the conduit (Note 1). In addition, the CHICO-A withstood the pressure test, via the NCBK, with 12 psig margin (Attachment 1 p. 2).
4. Testing was only for 24 hours but after 24 hours the pressure is approximately 0 psig. Therefore testing is adequate and the MSLE is enveloped.
5. A conduit assembly with CHICO-AOS sealing compound (Ref ②) was irradiated to a value of 1.02×10^8 rads. The only difference between CHICO-AOS that was irradiated and CHICO AA is the packing size (see Attachment 3, p. 2).

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6. Deleted

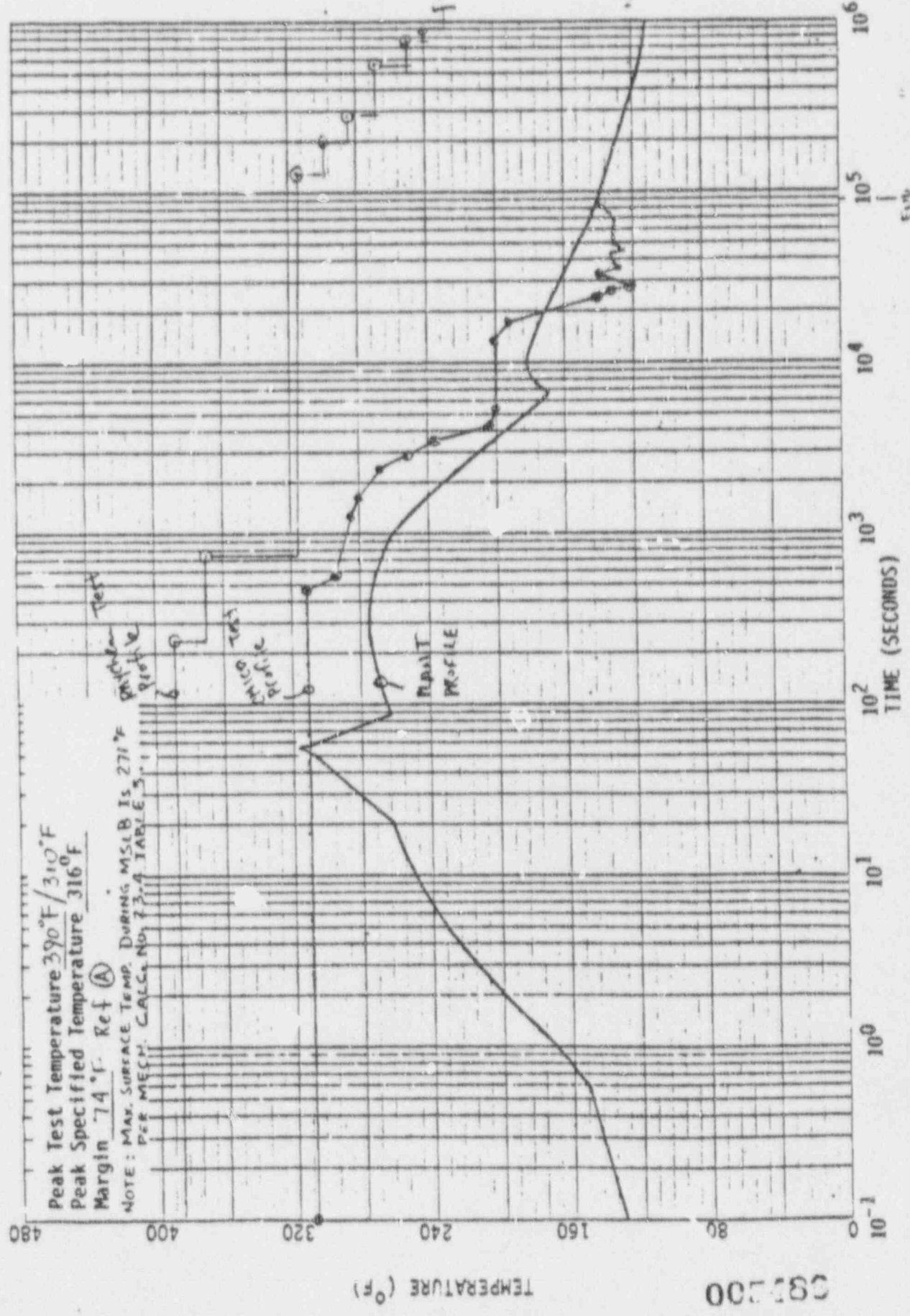
7. The CHICO configuration for testing was not thermally or radiation aged prior to DBE testing. However, the CHICO inorganic cement mixture (mixture of calcium aluminate and gypsum cement) will not be as susceptible to aging as the organic compounds which were tested in Ref A. Therefore the aging test in References A and D may be utilized for the entire assembly. Thus the testing provided by Ref A and supplemented by References B, C and D provide acceptable justification for aging.

005485

The specified curve is based
on FSAR Curve, Figure 6.2-40

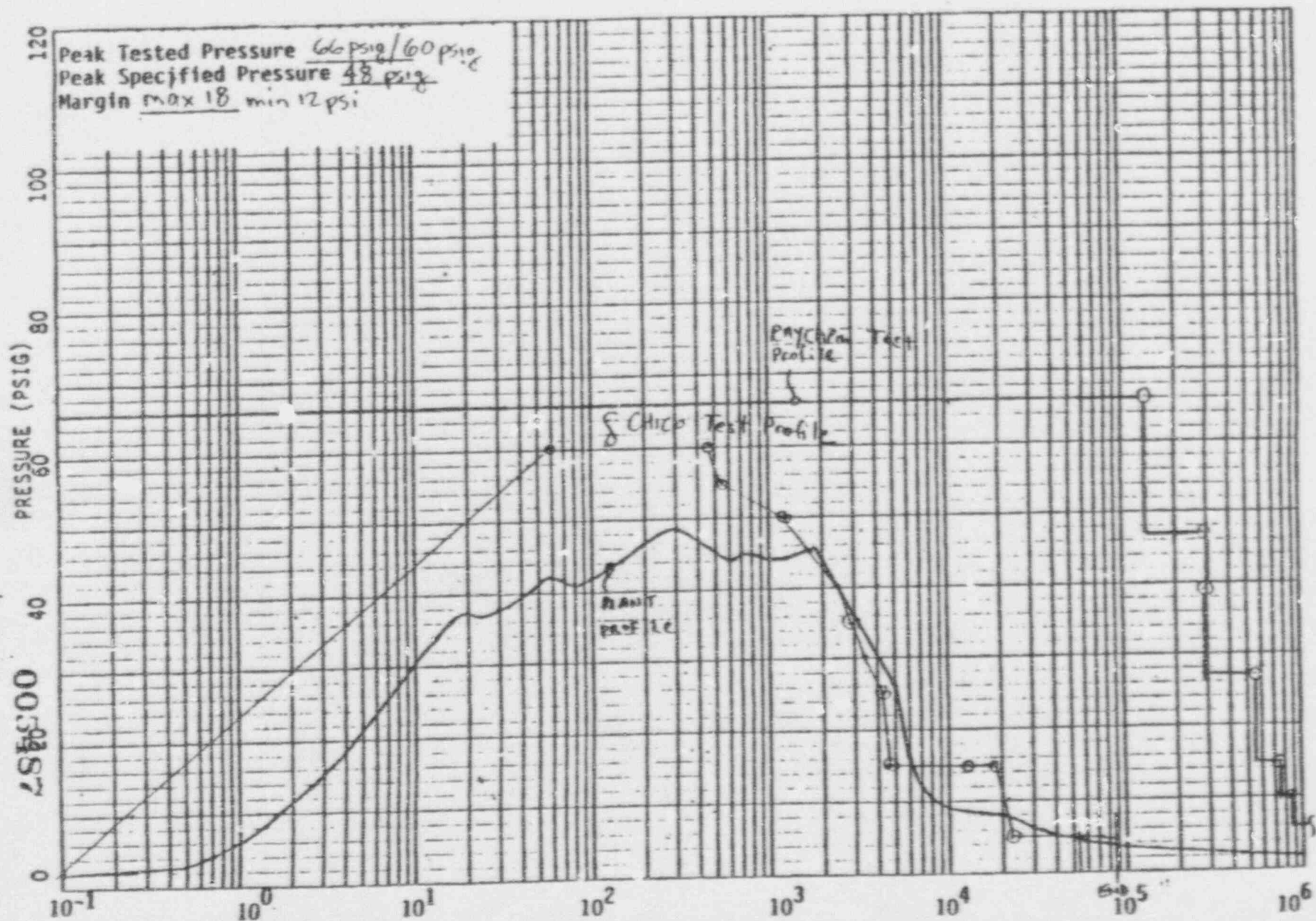
EQREC #296
LOCA INSIDE

CONTAINMENT TEMPERATURE ENVELOPE



The specified curve is based on FSAR curves, Figures 6.2-36 and 6.2-39

EQREC #296
COMPOSITE LOCA/MSLB
CONTAINMENT PRESSURE ENVELOPE



A

MARGINS

	FAULTY REQUIREMENT	QUALIFICATION	TOTAL MARGIN
TEMPERATURE	316 °F	Ⓐ 390 °F Ⓑ 310 °F See EDRECH Note 3	74 °F (23%)
PRESSURE	62.7 psia = 48.0 psig FOR APPROX. 60 SEC. (COMPOSITE PROFILE FOR LOCA & MSLB)	Ⓐ 60. psig Ⓑ 60 psig	Ⓐ 18 psig (37.5%) Note 1 Ⓑ 12 psig (25%)
RADIATION	5×10^7 rads (TID)	Ⓐ 20×10^7 rads Ⓑ 10.2×10^7 rads	Ⓐ 15×10^7 rads (300%) Ⓑ 5.2×10^7 rads (104%)
VOLTAGE	600 V	100 V rms	Ⓐ 400 V (66.7%)
FREQUENCY	N/A		Frequency variation will not affect function
OPERATING TIME + 1 HOUR	720 hrs + 1 hrs	Ⓐ 720 hrs + submergence test	

Note 1: The pressure margin exceeded the required 10 psi margin, but the test chamber maintained saturated conditions throughout the test.

SUMMARY: Margins are acceptable



**CROUSE-HINDS
ELECTRICAL
CONSTRUCTION
MATERIALS**



February 10, 1987

Mr. K. C. Gandhi
Bechtel Eastern Power Corp.
15740 Shady Grove Road
Gaithersburg, MD 20877-1454

Ref: Joseph M. Farley Nuclear Plant Unit 1 and 2
Bechtel Job 7597-042
CHICO-A4 Sealing Compound (ES86-769)
V-4302

Dear Mr. Gandhi,

In response to your request for information regarding the CHICO-A4 compound, we can verify:

- CHICO sealing compound is an expansive cement mixture consisting of calcium aluminate and gypsum cement.
- The same non-organic ingredients in the CHICO formulation have been used for over 15 years.
- There has been no change in the mixture that affects the intended application as a sealing compound in explosion-proof sealing fittings.
- The mechanical properties of currently manufactured CHICO cement are comparable to the previously supplied compound.

Sincerely,

S. A. Jeffrey

S. A. Jeffrey
Manager, Sales & Service
Eastern Region

BAJ/sek

ROLLERS #	
DATE	
NOTE	
PROJ. NO.	
ACCT. #	
OFFICE	
DEPARTMENT	
FUNCTION	
PLANT	
WORK SUBJECT	
RECORD NUMBER	7597
FILE	M-88

Crouse-Hinds

Chico A
Chico A-P
Chico X

For
Conduit
Seals

Application:

- Chico X is ceramic fiber used to make a dam in the space between the integral bushing of the seal fitting hub and the conduit end and around the electrical conductors prior to pouring Chico compound.

- Chico A is a water soluble powder that after mixing with water, can be poured to effect a seal that hardens and is suitable for use in hazardous areas.

- Chico A-P Intrapak® is an easy pour, two compartment plastic mixing pouch containing Chico sealing compound and the precise amount of water for mixing. No mixing or measuring implements are required. A hard squeeze of the water compartment releases the water into the Chico compound compartment. Mixing is completed by kneading the transparent pouch for one minute. The mixture is then poured directly into the sealing fitting—no funnel is required. The package label indicates the number and size of sealing fittings that can be made with each pouch.

- UL listings of Crouse-Hinds seal fittings are contingent upon their use with Chico A and X, the materials with which they are tested.

Features:

- Chico compound is unusually dense.
- Expands slightly on hardening, bonding to inner walls of sealing fitting.
- Chico A hardens in 60-70 minutes.

- Chico A-P hardens in 26-30 minutes.

Options:

Description
 Extra fast setting Chico compound—Chico FS (26 to 30 minutes) information on request

Size Ranges:

- Chico A compound—9 oz. to 10 lb. (13-230 cu. in.)
- Chico X fiber—1 oz. to 1 lb.
- Chico A-P cartons—25 and 55 cu. in.



Chico A Sealing Compound

Net Weight	Vol. Cu. In.†	Cat. #
9 oz.	13	Chico A2
1 lb.	23	Chico A3
1 lb.‡	26	Chico A4
2 lb.	46	Chico A23
2 lb.‡	46	Chico A24
5 lb.	115	Chico A05
10 lb.	230	Chico A5



Chico A-P Intrapak®

Sealing Compound and Water in Plastic Mixing Pouch

Cu. In. FBI per Pouch†	No. of Pouches per Carton	Carton Cat. #
5	5	Chico A19-PX*
11	5	Chico A39-PX*

Chico X Fiber

Net Weight	Cat. #
1 oz.	Chico X3
2 oz.	Chico X4
4 oz.	Chico X5
8 oz.	Chico X6
1 lb.	Chico X7

Chart for Approximate Amount of Fiber Per Hub

Hub Size	Ozs. Required	Hub Size	Ozs. Required
1/2	1/32	2 1/2	1 1/2
3/4	1/16	3	2
1	1/8	3 1/2	3
1 1/4	1/4	4	4 1/2
1 1/2	1/2	5	7
2	1	6	10

005490

*Dontex revision
 †A slash mark, containing an appropriate quantity of Chico X fiber, is included in these cartons.
 ‡Number of cubic inches this amount will fill when set. See internal volume requirements for EYS, EYS, EYD and EZD sealing fittings (8F-6 to 8F-9).
 §Includes 1 oz. Chico X fiber.
 ¶Includes 2 oz. Chico X fiber.

RAYCHEM/CHICO ENVIRONMENTAL SEAL FOR 005491
NAMCO LIMIT SWITCHES

The Raychem breakout kit for cables is environmentally qualified including thermal aging, irradiation, and LOCA testing (Reference Wyle Test Report No. 58442-2, dated 4/3/81). The Farley configuration uses a breakout at the end of a pipe nipple. Since the breakout had been qualified previously, Farley conducted a test on the Raychem/CHICO environmental seal configuration shown in Figure 1 for pressure and temperature conditions postulated during a LOCA (Reference Qualification Testing of Raychem Environmental Seals for Alabama Power Co., Joseph M. Farley Nuclear Plant, dated 12/30/81). The test did not include exposing the test specimen for chemical spray. The following paragraphs address the effect of chemical spray.

The environmental seals used with NAMCO EA-180 limit switches are composed of a Raychem WCSF breakout boot that has been shrunk onto a 1" pipe nipple attached to the limit switch (See Figure 1). The individual conductors connected to the switch pass through the breakout boot which forms a seal to the conductor insulation/jacket. To provide mechanical rigidity to the breakout boot, the nipple and the breakout boot are filled with Crucse-Hinds sealing compound (CHICO A) and allowed to cure. In addition to providing mechanical rigidity to the breakout boot crotch, the CHICO A provides an additional pressure tight barrier (seal) inside the pipe nipple which is environmentally qualified. CHICO A was qualified by test conducted by Southwest Research Institute (SWRI Project No. 03-4974-001) for use as drywell penetrations for Grand Gulf Nuclear Station. In addition, on the recommendation of Raychem, a keeper sleeve was installed over the breakout boot and the nipple to add rigidity to the boot, and to keep the boot in place during elevated accident temperatures when the adhesive softens.

In the final assembly, an appleton compression adapter is clamped over the keeper sleeve to provide support for the flexible conduit, and it also mechanically clamps the keeper sleeve to the pipe nipple.

The zinc coating on the galvanized steel nipple may react with the chemical spray during LOCA and form a grey product over the nipple. However, the chemical spray does not react with the Raychem S1119 adhesive (Reference Wyle Test Report no. 58442-2, Section 3.4, Page 9 and Section 3.4.2). In addition the duration of spray at Farley is only 87 minutes and the individual conductors will be effectively shielded from the spray.

Should there be a failure of the adhesive between the pipe nipple and the breakout boot, for whatever reason, the seal assembly would remain intact because of the keeper sleeve and the clamping action of the compression adapter. If it is postulated that the breakout boot, the keeper sleeve and the compression adapter clamp all fail, the internals of the NAMCO limit switch will still be protected by the approximately 3 inch long CHICO A seal.

Raychem/CHICO Equip
Entrance Seal

005492

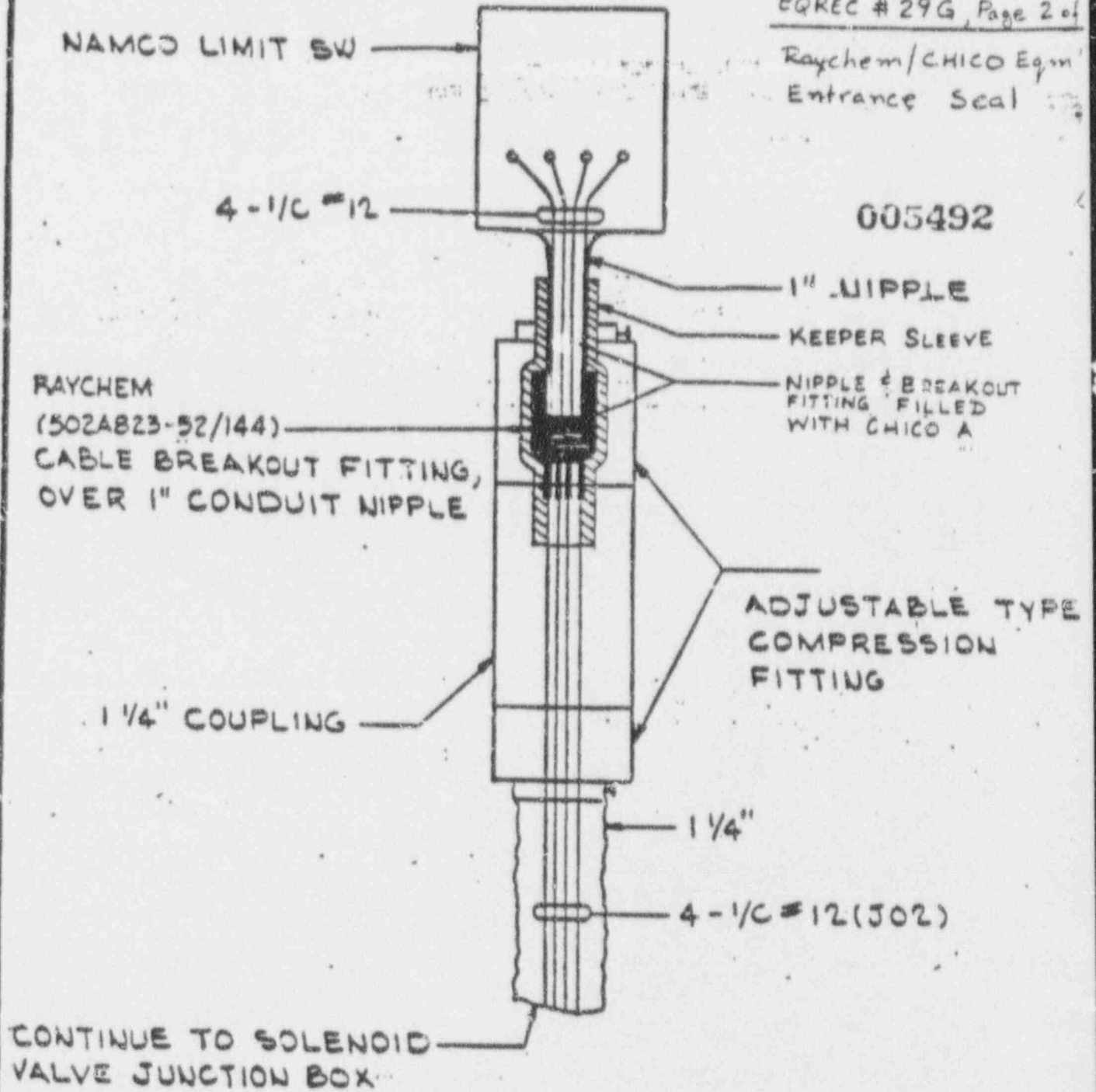


FIGURE 1

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MAIN STEAM VALVE ROOM. ADDENDUM

QUALIFICATION TESTING OF RAYCHEM ENVIRONMENTAL

SEALS FOR ALABAMA POWER COMPANY

JOSEPH M. FARLEY NUCLEAR PLANT

This addendum supports the switch seal configuration used in the main steam valve room. This configuration is identical to that used inside the containment, except that Chico A was not used as a mechanical support for the Raychem breakout.

The use of the Chico sealing compound is not required for use in the main steam valve room because of the low pressure peak (5.8 psig) and the short duration of the transient (1.5 sec). As can be seen from attachment 1, pages 1 and 2 of this addendum, the MSLB on the MSR accident profiles are enveloped with considerable margin.

005493

The test specimen consisted of a Raychem breakout boot, a keeper sleeve, and a compression fitting. The ends

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'sealed using solder-filled compression lugs with Raychem heat shrink sleeve sealing the lug barrel to the conductor insulation. Chico A was not used on this specimen.

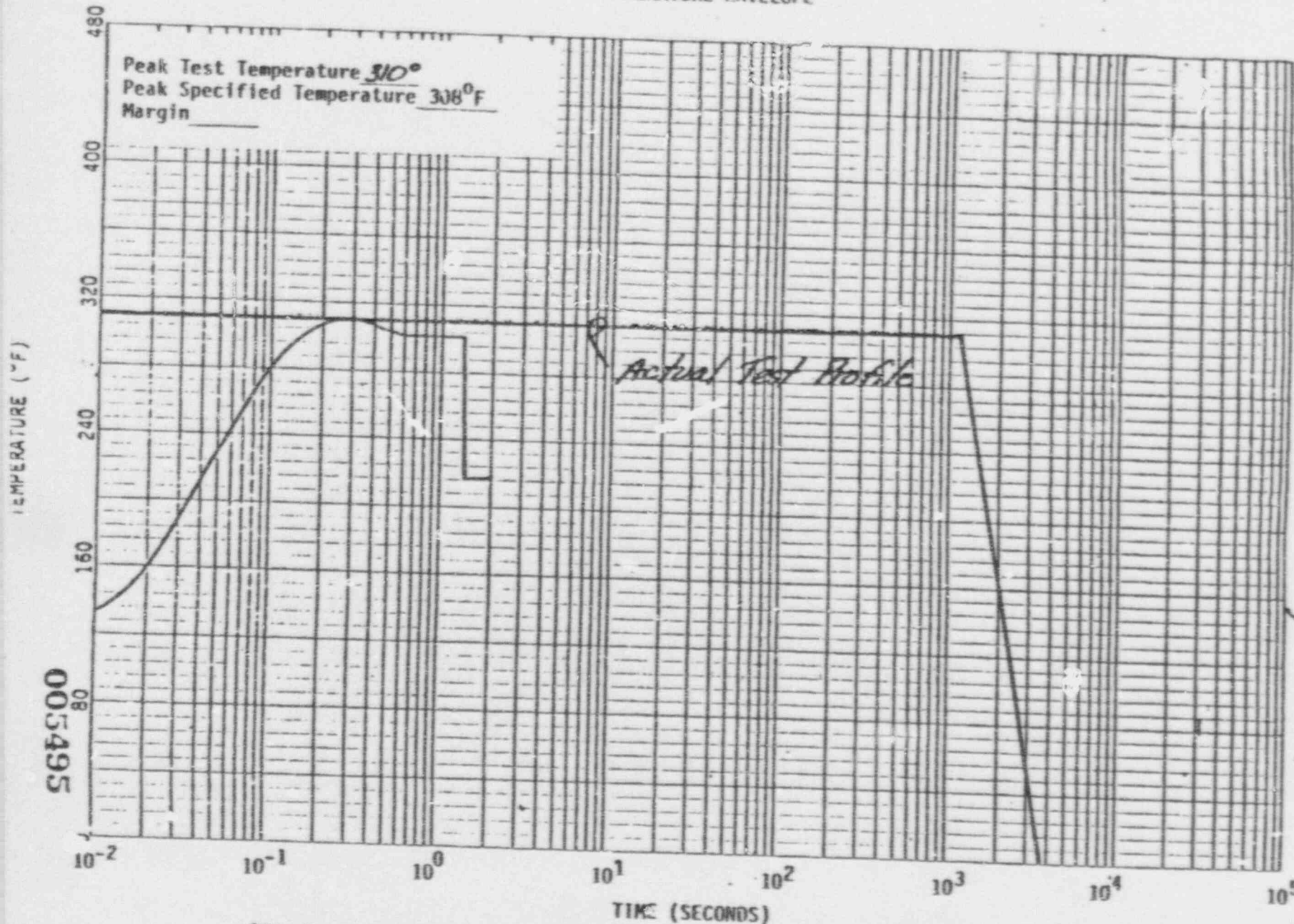
The actual test transient was started when the chamber temperature reached 310°F and the pressure quickly rained to 50 psig. After 7 minutes, the pressure was reduced to 45 psig. After 17 minutes into the test, the seal ruptured.

Because the environmental parameters were exceeded for a time duration several orders of magnitude beyond the required time, the Raychem breakout seal configuration without Chico A is qualified for this application.

005494

This specified curve is from
Calculation No. 525-25-7597
Rev. 0 (Computer Run No. T10576)

MSLB INSIDE MAIN STEAM ROOM
TEMPERATURE ENVELOPE



005495

Attachment No. 1 to MSVR Attachment

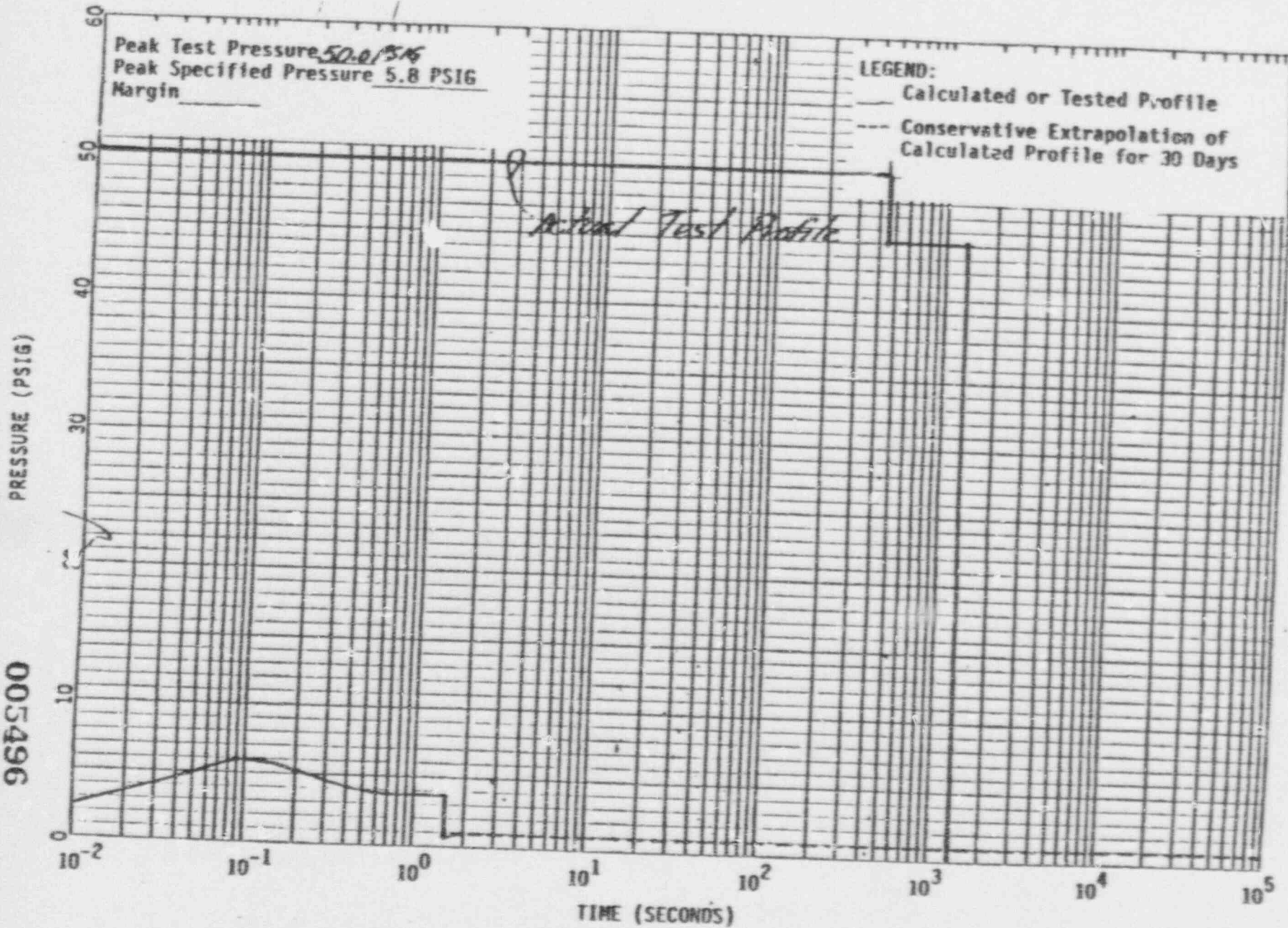
Attachment No 5 to EPRC #2
Page 3 of 4

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88.03/23 15:14 P07 *

The specified curve is from
Calculation No. 525-25-7597
Rev. 0 (Computer Run No. T10576)

MSLB INSIDE MAIN STEAM ROOM
PRESSURE ENVELOPE



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88.03/23 15:14 P08 *

Attachment No 5 to EOPREQ #2
Page 4 of 4