A27 830228 031

400 Chestnut Street Tower II

February 28, 1983

BLRD-50-438/82-27
BLRD-50-439/82-24

U.S. Nuclear Regulatory Commission
Region II
Attn: Mr. James P. O'Reilly, Regional Administrator
101 Marietta Street, Suite 2900
Atlanta, Georgia 30303

Dear Mr. O'Reilly:

BELLEFONTE NUCLEAR PLANT UNITS 1 AND 2 - INSOLUBLE GLUE USED FOR PURGE DAMS IN STAINLESS STEEL PIPING - BLRD-50-438/82-27, BLRD-50-439/82-24 - SUPPLEMENTAL REPORT

The subject deficiency was initially reported to NRC-OIE Inspector R. V. Crlenjak on March 22, 1982 in accordance with 10 CFR 50.55(e) as NCR 1725. This was followed by our interim reports dated April 22 and June 18, 1982 and our final report dated September 28, 1982. In our January 24, 1983 meeting with NRC-OIE Region II representatives at Bellefonte Nuclear Plant, TVA provided justification for the position taken in our final report on this nonconformance. As requested by Region II officials, we are providing those documents used in support of our position as presented in the January 24 meeting.

If you have any questions, please get in touch with R. H. Shell at FTS 858-2688.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

L. M. Mills, Manager
Nuclear Licensing

RHS:WTW:LHB
Enclosure
cc: Mr. Richard C. DeYoung, Director (Enclosure)
Office of Inspection and Enforcement
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555
cc (Enclosure):
ARMS, 640 CST2-C
J. W. Anderson, 902 HBB-K
L. S. Cox, Bellefonte
H. N. Culver, 249A HBB-K
H. J. Green, 1750 CST2-C
R. L. Lumpkin, 401 UBB-C (2)
J. A. Raulston, W10C126 C-K
H. S. Sanger, Jr., E11B33 C-K
F. A. Szczepanski, 417 UBB-C
J. D. Wilcox, Bellefonte-NRC

8304270016 830418
PDR ADOCK 05000438
S PDR

ENCLOSURE

ATTACHMENT A

NCR 835; REJECTION OF DISSOLVO TAPE;
SELECTION OF ELMER'S SCHOOL GLUE
FOR PURGE DAM USE

BNP-QCP-10.4 [illegible]
Attachment A

DIVISION OF CONSTRUCTION

NONCONFORMING CONDITION REPORT

BLN '78 0315 111

1. Nuclear Project: Bellefonte Nuclear Plant	Unit 1 & 2	NCR: 835.
2. Area: ☐ Civil ☐ Electrical ☐ Mechanical ☐ Instrumentation ☒ Welding		ASME ☒ Yes ☐ No
3. Activity: ☐ Receiving ☐ Storage ☒ Fabricating ☐ Installing ☐ Testing		Contract No. N/A

4. Type: ☐ Damage ☐ Failure ☐ Defect ☐ Documentation ☒ Other Procedure Deviation

5. Item Description: Stainless steel pipe butt welds made on: (1) Decay Heat Removal System (1KD)-54 welds. (2) Waste Disposal System (0WD)-6 welds. (3) Chemical Addition and Boron Recovery (1KB, 2KB, 0KB)-11 welds. (4) Spent Fuel Cooling & Cleaning (1KM, 2KM, 0KM)-46 welds (5) Reactor Building Spray (1KS)-4 welds. (6) Essential Raw Cooling Water (1KK & 2KK) - 4 welds.

6. Nonconformance Description: Soluble paper purge blocks and tape used on stainless steel piping systems was not approved by G-39 10.1.7.1 and G-29 4.M.1.1 (b) prior to its use.

Recommended Disposition ☐ Rework ☐ Reject ☐ Repair ☒ Use-As-Is ☐ Hold-For-Documentation

Perform hydrostatic flush of systems and visually exam to verify the paper purge block and tape dissolution.

Action Required to Prevent Recurrence: Revise G-29 to allow use of "Dissolve" purge paper and Elmer's water soluble school paste.
Engineering to assure that only approved fabricating materials are released for construction.

NCR Initiator: Hugh C Johnson Date 3-14-78 QCIR# 145

7. Referred to Design: ☒ Yes ☐ No Significant Condition: ☐ Yes ☒ No
Disposition: ☒ As Recommended ☐ Other (Describe)

Approved by Construction Engineer: [illegible] Date 3-14-78

8. EN DES Disposition: ☐ As Recommended ☐ Other (Describe)

Approved by Design Project Manager: _____ Date _____

9. Disposition Inspection and Release from Nonconforming Status: ☐ Yes ☐ No

Inspected by: _____ Date _____

10. Action Required to Prevent Recurrence Complete: ☐ Yes ☐ No

Verified by Construction Engineer: _____ Date _____

DISTRIBUTION:
NCR Initiator and his Unit Supervisor
Site QA Records File
Construction Engineer
Site QA Unit
OEDC QA Manager
Design Project Manager (Items for his action only)
Authorized Nuclear Inspector (Code items only)
EN DES QA Staff Chief (Significant NCR's only)
B&W Site Rep. (Items under Cont. 54114-2 only)

Disposition Reviewed and Accepted By:

_____ Authorized Nuclear Inspector _____ Date

TVA 64 (08-6-68)

UNITED STATES GOVERNMENT

Memorandum

CSB 780331 055

TENNESSEE VALLEY AUTHORITY

780403C0056 ②

TO : D. R. Patterson, Chief, Mechanical Engineering Branch, W10C126 C-K

FROM : Gene Parmer, Chief, Construction Services Branch , E6B39 C-K

DATE : March 30, 1978

SUBJECT: BELLEFONTE NUCLEAR PLANT - PURGE DAM REMOVAL FROM WELDED PIPE

Samples of Dissolve Tape and five adhesives were submitted to EML Laboratory to determine the solubility of the glue on the tape or of other adhesives in the system flush water. Chloride and fluoride contents of these substances and their effect on the prolonged contact with stainless steel piping were also to be determined.

The tape was attached to two 1-foot by 3-inch stainless steel pipes using:

1. Adhesive back on tape only
2. Elmer's Glue-All
3. Elmer's School Glue
4. Le Page's White Glue
5. Flour paste

After drying for three days the stainless pipes and tape were placed in demineralized water at 180°F. The tapes and adhesives applied with Le Page's White Glue and the flour paste come off in less than 1 minute. The samples attached with the adhesive back, Elmer's Glue-All, and Elmer's School Glue, adhered to the stainless steel pipes for 5 to 6 minutes before releasing. It was noted, however, that the adhesives remained on the pipes. After 30 minutes at 180°F the Elmer's School Glue dissolved from the pipes. After 2-1/2 hours the adhesive back material and the Elmer's Glue-All adhered to the stainless steel pipes.

All five samples were then tested for chloride and fluoride contents in accordance with ASTM D 512 for chlorides. Fluorides were tested by the Orion specific ion electrode method.

		Cl^- ppm	F^- ppm
1.	adhesive back	124	<0.1
2.	Elmer's Glue-All	<0.1	<0.1
3.	Elmer's School Glue	<0.1	<0.1
4.	Le Page's White Glue	216	<0.1
5.	Flour paste	210	<0.1

Buy U.S. Savings Bonds Regularly on the Payroll Savings Plan

D. R. Patterson
March 30, 1978

BELLEFONTE NUCLEAR PLANT - PURGE DAM REMOVAL FROM WELDED PIPE

Prolonged exposure of the stainless steel to the five adhesives had no ill effect.

A retest of the solubility of the Disolve Tape was requested to determine if the tape could be removed by a hot water flush.

The Disolve Tape was applied to the inside surface of three sections of 1-inch stainless pipe and allowed to dry for 24 hours. Water at a temperature of 140°F was passed through the pipes at a velocity of 4 ft/sec and 5 ft/sec. In both instances the tape released from the pipe in less than 2 minutes. Although the Disolve Tape was released from the pipes, the adhesive material remained insoluble in the hot water flush.

Original signed by
Gene Farmer

Gene Farmer

LHH:BCJ
cc: R. R. Dunham, W11A9 C-K
L. R. Edwards, W12D131 C-K
R. M. Hodges, W7C126 C-K
R. O. Lane, SBB-K
M. M. Mull, K7B24 C-K
MEDS, E4B37 C-K

TVA 64 (08-6-65)

UNITED STATES GOVERNMENT

Memorandum

CSB 780419 052

TENNESSEE VALLEY AUTHORITY

780419B0584 (1)

TO : D. R. Patterson, Chief, Mechanical Engineering Branch, W10C126 C-K

FROM : Gene Farmer, Chief, Construction Services Branch, K6B39 C-K

DATE : April 18, 1978

SUBJECT: KELLEPONTE NUCLEAR PLANT - PURGE DAM REMOVAL FROM WELDED PIPE - ADDITIONAL TESTING

Elmer's Sno-Drift Paste adhesive and previously tested Elmer's School Glue were compared to determine the solubility of the two adhesives when used on Dissolve tape material applied to stainless steel piping.

The Dissolve Tape and adhesives were applied to the inside surface of two sections of 1-inch stainless pipe and allowed to dry for three days. The tape using Elmer's School Glue was removed with a water flush at 140°F in 1-1/2 to 2 minutes. The tape using Elmer's Sno-Drift Paste was removed in less than 30 seconds.

Although the Sno-Drift Paste appears to have the desirable poor adhesion qualities, it should be noted that air bubbles readily formed under the tape which could cause the tape not to hold the purge gas for welding.

Chemical testing for chloride and fluoride contents gave the following results:

	Cl^-, ppm	F^-, ppm
Sno-Drift	423	<0.1
Elmer's School Glue	<0.1	<0.1

Original signed by
Gene Farmer

Gene Farmer

LHH:BCJ

cc: R. M. Hodges, W7C126 C-K
R. O. Lane, SBE-K
H. H. Mull, K7B24 C-K
MEDS, K4B37 C-K

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(109-9-65)

ED STATES GOVERNMENT

emorandum

MEB 790626 371

TENNESSEE VALLEY AUTHORITY

: W. R. Dahnke, Project Manager, Bellefonte Nuclear Plant, CONST (2)

M : R. M. Hodges, Bellefonte Design Project Manager, W7C126 C-K

79070300181 (2)

TE : JUN 25 1979

BJECT: BELLEFONTE NUCLEAR PLANT - NONCONFORMANCE REPORT NO. 835

DISSOLVO TAPE AND DISSOLVO PAPER PURGE DAMS

References:

1. Memorandum from F. E. Gilbert to me dated March 15, 1978 (BLN 780315 111), Bellefonte Nuclear Plant - Nonconformance Report No. 835.

2. Memorandum from Gene Farmer to D. R. Patterson dated March 30, 1978 (CSB 780331 055), Bellefonte Nuclear Plant - Purge Dam Removal from Welded Pipe.

3. Memorandum from Gene Farmer to D. R. Patterson dated April 18, 1978 (CSB 780419 052), Bellefonte Purge Dam Removal from Welded Pipe - Additional Testing.

Reference 1 transmitted the nonconforming condition report to me concerning the use of water-soluble purge dams and tape at various stainless steel pipe welds.

We have investigated the properties of the Dissolvo paper and tape as well as various other glues and pastes (references 2 and 3) and the areas of use of the purge dams and have determined that no damage results from the use of the Dissolvo paper. The tape and tape residuals can be removed by proper cleaning and flushing of the affected lines. The chemical cleaning of the system will completely clean the areas where the purge dams and purge dam tape were used. We foresee no lasting problems from the use of these materials and the nonconformance should remain classified as not significant.

Construction specification G-29 was revised following receipt of the Singleton Materials Laboratory reports (references 2 and 3) to allow the use of Dissolvo paper and Elmer's School Paste as purge dam materials. Elmer's School Paste is preferred to Dissolvo tape since it has lower residuals and is easier to remove. Therefore, Dissolvo tape should not be used. Concerned parties were notified by phone by D. A. Fraser on March 30, 1978.

School glue instead of paste in G-29.

R. M. Hodges

DRP:DAF:MMP

cc: Roy H. Dunham, W11A9 C-K
J. P. Knight, W12B30 C-K
~~WCDS, E4B37 C-K~~
~~H. H. Hull, E1B24 C-K~~
J. L. Parris, W11C126 C-K
D. R. Patterson, W10C126 C-K

577870/4 *Buy U.S. Savings Bonds Regularly on the Payroll Savings Plan*

TVA 64 (09-6-69)

UNITED STATES GOVERNMENT

Memorandum

MEB 790821 202

TENNESSEE VALLEY AUTHORITY

TO : W. R. Dahnke, Project Manager, Bellefonte Nuclear Plant, CONST (2)

FROM : R. M. Hodges, Bellefonte Design Project Manager, W7C126 C-K

DATE : AUG 20 1979

79082460255 (1)

SUBJECT: BELLEFONTE NUCLEAR PLANT - NONCONFORMANCE REPORT NO. 835

DISSOLVO TAPE AND DISSOLVO PAPER PURGE DRAINS

Please refer to my memo to you dated June 25, 1979 (MEB 790626 371), which discussed the subject NCR and recommended the use of Dissolvo Paper and Elmer's School Paste.

Please make a correction in the last paragraph of the reference. The recommended adhesive should be "Elmer's School Glue," as stated in Construction Specification G-29, not "Elmer's School Paste." Attached is a copy of the label on the desired glue.

If you have any questions, please have your staff contact Doug Fraser at extension 3214 in Knoxville.

R M Hodges

R. M. Hodges

CAC:DAF:SKZ
Attachment
cc: C. A. Chandley, W10D225 C-K
Roy H. Dunham, W11A9 C-K
J. P. Knight, W12B30 C-K
MEDS, E4B37 C-K
H. H. Mull, E7B24 C-K
J. L. Parris, W11C126 C-K
D. R. Patterson, W10C126 C-K

ATTACHMENT B

NCR 1725

BLN 82 0129 108

BNP-QCP-10.4 R8
Attachment A
Addendum No. 3

DIVISION OF CONSTRUCTION

LOP

NONCONFORMING CONDITION REPORT

QCFR 16199

1. Nuclear Project: Bellefonte | Unit 1 & 2 | NCR: 1725

2. Area: ☐ Civil ☐ Electrical ☒ Mechanical ☐ Instrumentation ☐ Welding | ASME Code Item ☒ Yes ☐ No

3. Activity ☐ Receiving ☐ Storage ☐ Fabricating ☐ Installing ☐ Other ☒ Testing | Contract No. N/A

4. Type: ☐ Damage ☐ Failure ☐ Defect ☐ Documentation ☒ Other System cleanliness

5. Item Description:
Stainless steel piping systems (Reference NCR No. 835, QCIRs 16077, 16175, and 16,199)

6. Nonconformance Description: (Include Apparent Cause)
Glue used in installation of purge dams has proved insoluble during flushing activities and minor glue residual remains in piping at purge dam locations.

Recommended Disposition: (Check Block and/or Detail Below) ☐ Rework ☐ Reject ☐ Repair ☐ Use-As-Is ☒ Other
Analyze glue residual discovered during flush NMFA to determine if there are any harmful elements to stainless steel in systems that must meet Class B or C cleanliness criteria and have EN DES evaluate acceptability of leaving residual in these systems or methods to be used for residual removal with resulting modifications to appropriate construction specifications.

Action Required to Prevent Recurrence: (Significant Conditions Only)

NCR Initiator: Thomas F. Newton Date 1/28/82 L. R. Willis

7. Referred to Design Project Organization (DPO): ☒ Yes ☐ No DPO Coordination Contact J. L. Gee
Disposition: ☒ As Recommended ☐ Other (Describe) Significant Condition ☐ Yes ☒ No

Approved by Construction Engineer: Danny P. Bridges for FEG Date 1/29/82

8. DPO Disposition: ☐ As Recommended ☐ Other (Describe)

Approved by Design Project Organization: _____ Date _____

9. Disposition Inspection and Release from Nonconforming Status: ☐ Yes ☐ No

Inspected by: _____ Date _____

10. Action Required to Prevent Recurrence Complete: ☐ Yes ☐ No

Verified by Construction Engineer: _____ Date _____

Distribution:
Site QA Records File MEDS, 100 LB-K
Construction Engineer
Site QA Unit
NCR Initiator
OEDC QA Manager
Site Proj. Train Officer (Items for his action only)
Design Proj. Organization (Items for his action only)
Authorized Nuclear Inspector (Code Items Only)
EN DES NUB-MLS (Significant NCR's only)
NORS (Significant NCR's only)
B&W Site Rep. (Items under Contract 51113-2 only)
Weld Engr. Staff (Only when Item #2, welding is checked)

Disposition Reviewed and Accepted By:

Authorized Nuclear Inspector _____ Date _____

ATTACHMENT C

METALLURGICAL ANALYSIS SHOWING
PURGE DAMS HAVE NO HARMFUL
EFFECTS ON MATERIALS

TVA 64 (03-9-65)

UNITED STATES GOVERNMENT

Memorandum

SME 820830 001

TENNESSEE VALLEY AUTHORITY

SEP 01 REC'D

TO : C. E. Roberts, Supervisor, Codes, Standards, and Materials Section, W3D190 C-K

FROM : R. O. Lane, Supervisor, Singleton Materials Engineering Laboratory, SME-K

DATE : August 30, 1982

SUBJECT: BELLEFONTE NUCLEAR PLANT - EFFECTS OF LEACHABLE CHLORIDES PRESENT IN PURGE DAM MATERIAL IN CONTACT WITH STAINLESS STEEL AT 150°F AND 550°F IN BORATED WATER

In response to TR 7-28-82-3, immersion tests with stainless steel pipe samples (Ht No. M4563) in 13,000 ppm boric acid solution have been performed at 150°F and 550°F. Four sample groups were involved: pipe samples with Elmer's School Glue; glue and purge dam paper; glue containing 500 ppm (wt Cl/wt undried glue) Cl; and control samples without glue.

The samples were heated 1 h at 400°F, cooled, and immersed 24, 48, or 96 h. Sample weight changes were determined after immersion and after removal of glue/paper by sonication in acetone. The percent purge dam material (glue/paper) removed by immersion and sample weight changes after sonication are reported in the attached table.

Immersion at 150°F removed <5 percent of purge dam material while immersion at 550°F removed >85 percent. Sample weight changes (all <1 mg) are considered insignificant.

Visual and microscopic examination of each sample after immersion and after sonication showed no general or pitting corrosion. Photograph 1 shows sample 5 after heating 1 h at 400°F. The dark area is dried glue and the small dark spots are probably splattered glue. Photograph 2 shows sample 5 after 48 h immersion at 550°F and sonication. This picture is typical of sample surfaces observed microscopically. Chloride analysis of the solutions showed essentially all chloride leached into solution within 24 h.

R. O. Lane

LES:BCJ
Attachments
cc (Attachments):
MEDS, W5B63 C-K

Principally prepared by L. E. Smith, extension 2771.

CSM GROUP

Init.		Date
CER	CER	9/1/82
	WPJ	
	EAM	
	JDW	
	DJE	File
	HFP	
	AG	
	SAC	
	JAP	
	JBH	
	DMH	
	RG	
	ALL	
	BNS	

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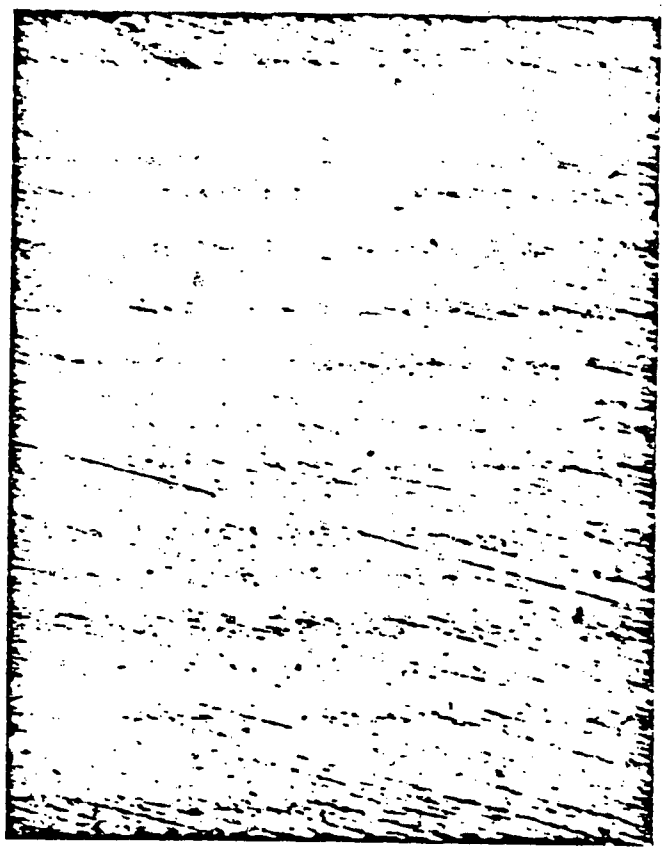
RESULTS FROM IMMERSION OF STAINLESS STEEL

(HT M4563) PIPE SAMPLES IN 13000 PPM BORIC ACID

Sample No.	Treatment 400°F, 1 h	Immersion Time h	Immersion Temp °F	% Purge Dam Material Removed	Sample Wt Change mg
78	Glue	22	150	2.9	-0.07
86		48		1.9	+0.02
90		48		1.3	+0.71
94		96		3.2	+0.30
98		96		2.5	+0.17
82		23	550	100	-0.19
11		48		88.5	+0.86
18		48		85.8	+0.98
1		96		99.9	+0.07
24		96		99.5	+0.26
79	Glue + Paper	22	150	15.3	+0.36
95		48		18.9	+0.25
99		48		20.4	+0.18
87		96		92.4	-0.41
91		96		82.6	-0.14
83		23	550	100	-0.47
3		48		98.8	+0.82
12		48		99.4	+0.24
19		96		99.7	+0.35
27		96		99.3	+0.63
80	Glue + Cl^-	22	150	4.0	+0.03
92		48		1.7	+0.29
100		48		1.7	-0.06
88		96		4.0	-0.28
96		96		4.0	-0.14
84		23	550	100	-0.55
5		48		91.3	+0.25
20		48		92.6	+0.25
14		96		100	-0.07
28		96		100	-0.32
81	Control	22	150		-0.19
89		48			-0.1
97		48			-0.02
85		96			-0.74
93		96			-0.16
66		23	550		+0.14
6		48			-0.13
15		48			+0.27
22		96			-0.38
29		96			-0.46

Photograph 1. Sample 5 (100X)
Before Immersion.



Photograph 2. Sample 5 (100X)
After Immersion and Sonication.

BLN 82 0308 046

TVA 64 (05-9-65)

UNITED STATES GOVERNMENT

Memorandum

TENNESSEE VALLEY AUTHORITY

TO : R. O. Lane, Supervisor, Singleton Materials Engineering Laboratory, SME-K

FROM : Walter R. Dahnke, Project Manager, Bellefonte Nuclear Plant

DATE : March 8, 1982

SUBJECT: BELLEFONTE NUCLEAR PLANT - TESTING OF PURGE DAM MATERIAL

We are forwarding under separate cover, samples of material as indicated below. It is requested that you perform an analysis of these samples to determine their contents with regard to whether they are injurious to stainless steel.

Sample #1 - Unit 2 ND System - Residual of intact purge dam approximately 12 inches from weld number 2ND-0032. Weld made April 9, 1981. Difficult to remove sample of purge paper saturated with glue as desired. Appearance of dam was normal.

Sample #2 - Unit 2 ND System - Residual of remains of purge dam approximately 3 inches from weld number 2ND-0032. Weld made April 9, 1981. Difficult to remove any large volume of purge paper and glue. Location exhibited scorched appearance as of burned glue and purge paper.

Sample #3 - Unit 2 ND System - Residual of purge paper and glue placed around edge of check valve flapper for purge dam purposes approximately 12 inches from weld number 2ND-0043. Weld made February 10, 1981. Good volume of sample obtained. Appearance of dam was normal.

Sample #4 - Unit 2 ND System - Residual of remains of purge dam approximately 6 inches from weld number 2ND-0046. Weld made January 2, 1981. Difficult to remove any sufficient volume of sample material. Appearance of remains was normal.

Sample #5 - Unit 2 NM System - Residual of intact purge dam. Positioned 4-3/4" from weld number 2NM-138-A. Weld made September, 1978. Appearance of purge dam normal except external environment very dirty.

Buy U.S. Savings Bonds Regularly on the Payroll Savings Plan

Those Listed
March 8, 1982

BELLEFONTE NUCLEAR PLANT - TESTING OF PURGE DAM MATERIAL

Sample #6 - Present glue utilized in installation of purge dams.

Sample #7 - Present purge paper utilized in purge dams.

NOTE: Photographs of all purge dam sample locations forwarded to D. Drouhard, MEB.

Please forward results of these analyses to Tom Newton of our Startup Testing and Coordination Unit and to C. Chandley of EN DES.

Walter R. Dahnke

TN:DN
cc: C. A. Chandley, W10D225 C-K
R. M. Hodges, 710 UB-K
J. A. Raulston, W10C128 C-K
QCRU, Bellefonte CONST
STCU, Bellefonte CONST
MEDS, 100 UB-K

Principally prepared by: T. F. Newton, ext. 288

ACTION → DJE/AG

SME '820323 001

Walter R. Dahnke, Project Manager, Bellefonte Nuclear Plant CONST

R. O. Lane, Supervisor, Singleton Materials Engineering Laboratory, SME-K

March 23, 1982

BELLEFONTE NUCLEAR PLANT - TESTING OF PURGE DAM MATERIAL

noted

In response to your memorandum, BLN S20308 046, the five residual samples of purge dam materials plus samples of glue and purge paper have been evaluated for total and leachable halogens, total sulfur, and other low melting contaminants in accordance with procedures specified by General Construction Specification G-29M. Where only small sample quantities existed, leachable halide determination preceded Parr bomb evaluation of the residue. The sum of the two values thus constituted the total halogen. Results are attached.

NEB's Codes, Standards, and Materials Section is being forwarded a copy of the results for their evaluation and disposition. SME has not attempted to establish accept/reject criteria for the results obtained.

Original Signed by
R. O. Lane

R. O. Lane

PVG:SML
Attachments
cc (Attachments):
Tom Newton, STCU, Bellefonte Nuclear Plant CONST
~~C. E. Roberts, W3D190 C-K (attn. Pete Etzler)~~
MEDS, 100 UB-K
C. A. Chandley, W10D225 C-K

ATTACHMENT 9
SME QCP-8
Rev 2

TENNESSEE VALLEY AUTHORITY

SINGLETON MATERIALS ENGINEERING LABORATORY

CHEMICAL ANALYSIS TEST REPORT

To: Walter R. Dahnke, Project Manager

From: R. O. Lane, SME-K

Project: Bellefonte Nuclear Plant

Date: 3-17-82

Report No.: B-206

Material Type Purge Dam Residual

Lot No., I.D. 1, Unit 2 ND System, 12 in. from weld #2ND-0032

Specification

Source Tom Newton

TOTAL HALOGENS, ppm

Chloride	248.5	Method	Parr Bomb - Specific Ion
Fluoride	40.7		Parr Bomb - Specific Ion

LEACHABLE HALIDES, ppm

Chloride	187.3	Method	24 h at 90° - 95° C - Specific Ion
Flouride	37.4		24 h at 90° - 95° C - Specific Ion

LOW MELTING ELEMENTS, ppm

Sulfur	Insufficient material	Method	Parr Bomb - Gravimetric
Copper	9.0		Atomic Absorption
Lead	<0.1		" "
Zinc	<0.1		" "
Mercury			

Accepted ☐ Rejected ☐

cc:

Dale O. Jeffers — Tested by — 3-23-82 Date

Wendell Keeling — Analytical Chemist — 3-23-82 Date

Paul V. Hutchins, Jr. — Unit Supervisor — 3-23-82 Date

TVA 22237 (CONST-12-80)

ATTACHMENT 9
SME QCP-8
Rev 2

TENNESSEE VALLEY AUTHORITY

SINGLETON MATERIALS ENGINEERING LABORATORY

CHEMICAL ANALYSIS TEST REPORT

To: Walter R. Dahnke, Project Manager

From: R. O. Lane, SME-K

Project: Bellefonte Nuclear Plant

Date: 3-17-82

Report No.: B-207

Material Type: Purge Dam Residual

Lot No., I.D.: #2; Unit 2 ND System, 3 inches from weld #2ND-0032

Specification:

Source: Tom Newton

TOTAL HALOGENS, ppm

Chloride	258.9	Method	Parr Bomb - Specific Ion
Fluoride	65.8		Parr Bomb - Specific Ion

LEACHABLE HALIDES, ppm

Chloride	242.6	Method	24 h at 90° - 95° C - Specific Ion
Flouride	56.1		24 h at 90° - 95° C - Specific Ion

LOW MELTING ELEMENTS, ppm

Sulfur	Insufficient material	Method	Parr Bomb - Gravimetric
Copper	53.0		Atomic Absorption
Lead	40.0		" "
Zinc	<0.1		" "
Mercury			" "

Comment: Small sample size. Difficult to remove from pipe

Accepted ☐ Rejected ☐

cc:

Dale O Jeffers — Tested by — 3-23-82 Date

Wendell Keeling — Analytical Chemist — 3-23-82 Date

Paul U. Huttis, Jr. — Unit Supervisor — 3-23-82 Date

TVA 22237 (CONST-12-80)

ATTACHMENT 9
SME QCP-8
Rev 2

TENNESSEE VALLEY AUTHORITY

SINGLETON MATERIALS ENGINEERING LABORATORY

CHEMICAL ANALYSIS TEST REPORT

To: Walter R. Dahnke, Project Manager

From: R. O. Lane, SME-K

Project: Bellefonte Nuclear Plant

Date: 3-17-82

Report No.: B-208

Material Type Purge Dam Residual

Lot No., I.D. #3, Unit 2 ND System, 12 inches from weld #2ND-0043

Specification

Source Tom Newton

TOTAL HALOGENS, ppm

Chloride	267.2	Method	Parr Bomb - Specific Ion
Fluoride	92.4		Parr Bomb - Specific Ion

LEACHABLE HALIDES, ppm

Chloride	151.8	Method	24 h at 90° - 95° C - Specific Ion
Flouride	66.5		24 h at 90° - 95° C - Specific Ion

LOW MELTING ELEMENTS, ppm

Sulfur	77.0	Method	Parr Bomb - Gravimetric
Copper	3.0		Atomic Absorption
Lead	0.3		" "
Zinc	<0.1		" "
Mercury			

Accepted ☐ Rejected ☐

cc:

Dale O Jeffers — Tested by — 3-23-82 Date

Wendell Keeling — Analytical Chemist — 3-23-82 Date

Paul U. Gutter Jr. — Unit Supervisor — 3-23-82 Date

TVA 22237 (CONST-12-80)

ATTACHMENT 9
SME QCP-8
Rev 2

TENNESSEE VALLEY AUTHORITY

SINGLETON MATERIALS ENGINEERING LABORATORY

CHEMICAL ANALYSIS TEST REPORT

To: Walter R. Dahnke, Project Manager

From: R. O. Lane, SME-K

Project: Bellefonte Nuclear Plant

Date: 3-17-82

Report No.: B-209

Material Type Purge Dam Residual

Lot No., I.D. #4; Unit 2 ND System; 6 inches from weld #2ND-0046

Specification

Source Tom Newton

TOTAL HALOGENS, ppm

Chloride	497.3	Method	Parr Bomb - Specific Ion
Fluoride	79.1		Parr Bomb - Specific Ion

LEACHABLE HALIDES, ppm

Chloride	458.9	Method	24 h at 90° - 95° C - Specific Ion
Flouride	53.2		24 h at 90° - 95° C - Specific Ion

LOW MELTING ELEMENTS, ppm

Sulfur	Insufficient material	Method	Parr Bomb - Gravimetric
Copper	82.6		Atomic Absorption
Lead	41.0		" "
Zinc	<0.1		" "
Mercury			

Comment: Small sample size. Difficult to remove from pipe.

Accepted ☐ Rejected ☐

cc:

Wade O Jeffers — Tested by — 3-23-82 Date

Wendell Keeling — Analytical Chemist — 3-23-82 Date

Paul V. Hutting, Jr. — Unit Supervisor — 3-23-82 Date

TVA 22237 (CONST-12-80)

ATTACHMENT 9
SME QCP-8
Rev 2

TENNESSEE VALLEY AUTHORITY

SINGLETON MATERIALS ENGINEERING LABORATORY

CHEMICAL ANALYSIS TEST REPORT

To: Walter R. Dahnke, Project Manager

From: R. O. Lane, SME-K

Project: Bellefonte Nuclear Plant

Date: 3-17-82

Report No.: B-210

Material Type Purge Dam Residual

Lot No., I.D. #5; Unit 2 NM System; 4-3/4 in. from weld #2 NM-138-A

Specification

Source Tom Newton

TOTAL HALOGENS, ppm

Chloride	233.2	Method	Parr Bomb - Specific Ion
Fluoride	164.7		Parr Bomb - Specific Ion

LEACHABLE HALIDES, ppm

Chloride	181.8	Method	24 h at 90° - 95° C - Specific Ion
Flouride	30.1		24 h at 90° - 95° C - Specific Ion

LOW MELTING ELEMENTS, ppm

Sulfur	45.0	Method	Parr Bomb - Gravimetric
Copper	2.8		Atomic Absorption
Lead	0.9		" "
Zinc	<0.1		" "
Mercury			

Accepted ☐ Rejected ☐

cc:

Dale O Jeffers — Tested by — 3-23-82 Date

Wendell Keeling — Analytical Chemist — 3-23-82 Date

Paul V Hutting, Jr — Unit Supervisor — 3-23-82 Date

TVA 22237 (CONST-12-80)

ATTACHMENT 9
SME QCP-8
Rev 2

TENNESSEE VALLEY AUTHORITY

SINGLETON MATERIALS ENGINEERING LABORATORY

CHEMICAL ANALYSIS TEST REPORT

To: Walter R. Dahnke, Project Manager

From: R. O. Lane, SME-K

Project: Bellefonte Nuclear Plant

Date: 3-17-82

Report No.: B-211

Material Type Glue

Lot No., I.D. #6; Elmers Glue used in installation of purge dams

Specification

Source Tom Newton

TOTAL HALOGENS, ppm

Chloride	49.6	Method	Parr Bomb - Specific Ion
Fluoride	4.4		Parr Bomb - Specific Ion

LEACHABLE HALIDES, ppm

Chloride	7.3	Method	24 h at 90° - 95° C - Specific Ion
Flouride	0.2		24 h at 90° - 95° C - Specific Ion

LOW MELTING ELEMENTS, ppm

Sulfur	33.0	Method	Parr Bomb - Gravimetric
Copper	3.9		Atomic Absorption
Lead	0.7		Atomic Absorption
Zinc	<0.1		Atomic Absorption
Mercury			

Accepted ☐ Rejected ☐

cc:

Dale O. Jeffers — Tested by — 3-23-82 Date

Wendell Keeling — Analytical Chemist — 3-23-82 Date

Paul V. Guthrie, Jr. — Unit Supervisor — 3-23-82 Date

TVA 22237 (CONST-12-80)

ATTACHMENT 9
SME QCP-8
Rev 2

TENNESSEE VALLEY AUTHORITY

SINGLETON MATERIALS ENGINEERING LABORATORY

CHEMICAL ANALYSIS TEST REPORT

To: Walter R. Dahnke, Project Manager

From: R. O. Lane, SME-K

Project: Bellefonte Nuclear Plant

Date: 3-17-82

Report No.: B-212

Material Type Purge paper

Lot No., I.D. #7; Present purge paper utilized in purge dam

Specification ,

Source Tom Newton

TOTAL HALOGENS, ppm

Chloride	363.0	Method	Parr Bomb - Specific Ion
Fluoride	27.0		Parr Bomb - Specific Ion

LEACHABLE HALIDES, ppm

Chloride	206.0	Method	24 h at 90° - 95° C - Specific Ion
Flouride	1.0		24 h at 90° - 95° C - Specific Ion

LOW MELTING ELEMENTS, ppm

Sulfur	25.0	Method	Parr Bomb - Gravimetric
Copper	4.7		Atomic Absorption
Lead	1.2		" "
Zinc	<0.1		" "
Mercury			

Accepted ☐ Rejected ☐

cc:

Dale O Jeffers — Tested by — 3-23-82 Date

Wendell Keeling — Analytical Chemist — 3-23-82 Date

Paul U. Guthrie — Unit Supervisor — 3-23-82 Date

TVA 22237 (CONST-12-80)

ATTACHMENT D

JULY 12, 1982, TELECON WITH JACK HICKS,
CHAIRMAN OF AD HOC COMMITTEE ON CLEANING
OF FLUID SYSTEMS - ANSI N45.2.1

TVA 64 (08-8-68)

UNITED STATES GOVERNMENT

Memorandum

TENNESSEE VALLEY AUTHORITY

MEB 82 0714 009

TO : Mechanical Engineering Branch Files

FROM : Darrell T. Drouhard, Chemical Engineer, W7A64 C-K

DATE : JUL 12 1982

SUBJECT: BELLEFONTE NUCLEAR PLANT - BASIS FOR PARTICULATE CRITERIA IN ANSI STANDARD N45.2.1

On July 6, 1982, John Palatinus and I talked with Jack Hicks of Babcock and Wilcox (B&W). Jack Hicks is the chairman of the work group on ANSI N45.2.1.

According to Mr. Hicks, the 1/32-inch by 1/16-inch particulate criteria was chosen because the committee believed that particles larger than that were indicative of rust being present in the system.

When asked for his opinion on the acceptability of relaxing our acceptance criteria for glue and paper particulates, he said that we would have to make sure that the larger particles would not block openings of a strategic nature, such as pump seals.

Original Signed
By D. T. Drouhard
Darrell T. Drouhard

DTD:KJH
cc: C. A. Chandley, W7C126 C-K

CAC:KJH
cc: W. R. Brown, 102 ESTA-K
R. M. Hodges, 1117 IBM-K
M. N. Sprouse, W11A9 C-K
MEDS, W5B63 C-K
J. A. Raulston, W10C126 C-K

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ATTACHMENT E

NUCLEAR SYSTEMS ANALYSIS SHOWING
1/8" PURGE DAM PARTICULATE
ACCEPTANCE CRITERIA IS ACCEPTABLE
FROM A SAFETY STANDPOINT

ATTACHMENT 1

NSA REVIEW OF PURGE DAM PARTICULATE IN PRIMARY SYSTEMS

A. Background

Paper purge dams utilized during welding of stainless steel were located too close to the weld area, resulting in overheating of the glue used for attachment of the paper purge dams. This overheating has made removal (by system flushing) of the purge dam material difficult. NSA was requested to evaluate the seven systems listed to determine the effects of glue and paper purge dam particulate on the ability of the system perform its intended safety function.

The systems evaluated were:

a. Makeup and purification (MP) system
b. Decay heat removal (DHR) system
c. Waste disposal (WD) system
d. Reactor building spray (RBS) system
e. Spent fuel cooling (SFC) system
f. Chemical addition and boron recovery (CABR) system
g. Core flood (CF) system

B. Assumptions

The following assumptions were made to facilitate completeness of the review.

a. Glue and paper purge dam particulate will be limited to 1/8-inch or less.

b. The number of particles (quantity of particulate) in any given system or portion of a system at any given time will be small. The assumption was made as size alone did not appear to be the only criteria, especially since we were concerned about plugging of lines, etc.

c. Particulate in the reactor coolant (RC) system will be reviewed by others to determine impact, i.e., if the system dumps into the RC system, this is acceptable from the system standpoint.

d. Particulate was assumed to be soft and malleable.

e. Only systems or portions of systems which perform primary safety functions were analysed in detail. However, interfaces with systems that perform primary safety functions were reviewed.

NSA REVIEW OF PURGE DAM PARTICULATE IN PRIMARY SYSTEMS

C. Results of Evaluation

1. The following generally summarizes the results of the evaluation.

   a. No adverse safety effects on process piping. Justification: system piping is not small enough to be obstructed by 1/8-inch particulate.

   b. No adverse safety effects on system valves. Justification: purge dam particles are too small and not rigid enough to prevent valve opening or seating.

   c. No adverse safety effects on drain or vent lines. Justification: drain and vent lines serve no primary safety function.

   d. No adverse safety effects on instrument lines. Justification: instrument lines are 1/4-inch, and pass no flow that would cause entrainment of particulate.

   e. No adverse safety effeots on flow orifices or pressure limiters. Justification: flow orifices and pressure limiters are not small enough to be obstructed by 1/8-inch particulate.

   f. No adverse safety effect on heat exchangers. Justification: tubes in heat exchangers are too large to be obstructed by 1/8-inch particulate.

2. Specific results by system are summarized below:

   a. The MP system performs primary safety functions of high pressure injection (HPI) postaccident, and reactor coolant pump seal cooling and boration control during normal operation. The majority of this system is covered by general summary above. However, specific areas of concern include the lines to the reactor coolant pump seals, and the fact that the 1/8-inch particulate does not meet the minimum water chemistry standards per B&W equipment specification and water chemistry requirements of 0.1 ppm suspended solids.

   b. The DHR system performs primary safety function of low pressure injection (LPI) postaccident, and decay heat removal postaccident and normal shutdown. No specific areas of concern were uncovered for the DHR system. However, it should be noted that the DHR system interfaces directly with the RCS which was not covered in this evaluation (see assumption c).

NSA REVIEW OF PURGE DAM PARTICULATE IN PRIMARY SYSTEMS

c. The WD system performs no primary safety function that can be impeded by particulate. Its interfaces with other systems is such that it would not be excepted to be of concern for normal operation.

d. The RBS system performs the primary safety function of containment energy removal postaccident. The evaluation concluded no adverse effects in any areas.

e. The SFC system performs the primary safety function of spent fuel cooling. The evaluation included effects of of particulate on fuel cooling and flow blockage in the pool. The evaluation concluded no adverse effects in any area.

f. The CABR system performs no primary safety function that can be impeded by the particulate. Its interface with other systems that perform primary safety functions was evaluated and determined not to be a concern.

g. The CF system performs the primary safety function of emergency core cooling during a LOCA. However, the presence of particulate material will not prevent the system from performing its intended safety function.

Conclusion of Evaluation

The following conclusions are based on numerous conversations with MEB personnel and reflect NEB's understanding of what may be required to obtain a reasonable margin of confidence that piping systems have been adequately flushed.

a. With exceptions as noted, the 1/8-inch acceptance criteria for purge dam particulate will be acceptable from a safety standpoint.

b. Base on assumptions in part B. above (in particular a. and b.), NEB recommends that whatever flushing technique required be used to clean the piping. It is recommended that those portions of systems where areas of concern have been noted be flushed by that technique that provides the greatest confidence the piping system will meet the assumptions.

c. B&W and/or TVA must justify the acceptability of 1/8-inch particulate in the reactor coolant system.

d. Process pump seals and reactor coolant pump seals should be evaluated in more detail to determine the effect of particulate.

ATTACHMENT F

RESULTS OF STIRRED AUTOCLAVE TESTS

TECHNICAL REPORT

DIVISION OF POWER SYSTEM OPERATIONS

REPORT NO.:	M81-82-4184
SHEET NO.:	1 of 3 Sheets
DATE OF WORK:	
DATE OF REPORT:	9/24/82

LOCATION: Central Laboratories - PSC - Chattanooga

SUBJECT: BELLEFONTE NUCLEAR PLANT - TESTING THE SOLUBILITY OF GLUE USED IN PURGE DAMS

COPIES SENT TO: Darrell Drouhard, ARMS, Lab Files, Willene Robertson

PREPARED BY: Delsa Lindsey/RJS | CHECKED BY: Rebecca Stokes | APPROVED BY: Hillary A. Taff

Objective: To test the solubility of Elmer's Glue All versus the solubility of Elmer's School Glue (both products of the Borden Company) used in purge dams under specified laboratory conditions which approximate the conditions in a nuclear reactor and the interfacing piping system.

Introduction

On August 2, 1982, the Metallurgical Laboratory Section was requested to perform stirred autoclave tests at 200°F, 300°F, 400°F, and 500°F to determine the solubility of glue used in purge dams under conditions approximating those in a nuclear reactor and the interfacing piping systems. The two types of glue were placed on thirty-two stainless steel test coupons which underwent various baking, soaking, and drying procedures before being placed in the autoclave and tested at the specified temperatures. (See Table I.) The coupons were periodically removed from the autoclave and examined. Autoclave testing was continued until a solubility rate at each temperature could be determined. Percent weight loss was used to indicate the solubility rate.

Equipment

Various laboratory equipment was used to perform the tests under the conditions specified. A laboratory furnace and drying oven were used for the baking and drying procedures. The five percent acetic acid solution was heated in a beaker on a hot plate. An autoclave with a stirring head was used to approximate the conditions in a nuclear reactor and the interfacing piping system. All weights were determined by using a Gram-atic four place balance.

Test Procedure

The coupons were ground on 240 grit paper to give a smooth surface and then cleaned ultrasonically in acetone. A view of these coupons is shown in Figure 1A. Each sample was weighed and the results recorded. (See Table II.) Elmer's Glue All was applied to sixteen coupons and Elmer's School Glue to the remaining sixteen. The glue was allowed to cure for twenty-four hours at room temperature. A sample of each glue type after curing is shown in Figure 1B. The weights of the coupons were determined after curing and recorded. (See Table II.) Eight coupons each of both the Glue All and the School Glue were baked in a 400°F furnace for approximately two hours. A sample of each glue type after baking is shown in Figure 1C. The remaining eight coupons of each glue type were baked at 500°F for approximately two

hours. The 500°F baking temperature was used instead of 600°F - 700°F temperature originally requested because the glue charred and flaked off after baking at 650°F. (See Figure 1D.) After the coupons cooled, their weights were determined and recorded. (See Table II.) Four Glue All test coupons baked at 400°F and four baked at 500°F were soaked for twenty-four hours in five percent acetic acid solution heated to 145°F. The same soaking procedure was used for the School Glue test coupons baked at both temperatures. After soaking in acetic acid, the coupons were rinsed in running warm water and dried in a laboratory oven. After drying, they were weighed and the results recorded. (See Table II.)

At this point the test coupons were ready for autoclave testing at 200°F, 300°F, 400°F, and 500°F. The tests were performed using 6500 ppm boric acid buffered with lithium hydroxide to a pH between 5 and 6. After the solution was prepared and placed in the autoclave, coupons to be tested at a specific temperature were placed on the bottom of the autoclave bomb. The autoclave was heated to temperature and the stirring head was used to agitate the solution. The coupons were removed periodically, dried, and weighed. The pH of the solution was also checked periodically and adjusted or changed to maintain a pH between 5 and 6. Autoclave testing was continued until a solubility rate at each temperature could be determined.

Explanation of Results

Some experimental procedure and equipment problems were encountered. As was pointed out earlier, baking at 650°F caused the glue to char and chip off from the coupons. This baking temperature was lowered to 500°F. The glue curled up on coupon No. 11 during the acetic acid soak. (See Figure 1E.) Care was taken during soaking not to allow the glue surfaces to touch. Test coupons tested at 300°F had approximately half of their glue chipped off or curled up during testing (Figure 1F) possibly due to contact with the stirrers. The coupons affected were No. 11 and No. 7. Coupon No. 32 was also chipped upon completion of the second autoclave run at 200°F. These abnormalities are reflected in the Percent Weight Loss versus Time graphs. Glue curling and peeling off test coupons was also observed after the second autoclave run at 400°F. (See Figure 2A.) It was detected upon removal of the coupons from the autoclave. After drying the glue was still soft. Deposits of glue were found in the autoclave but could be easily removed. (See Figure 2B.) At 500°F testing the glue flaked off in the autoclave and care had to be taken not to remove the glue from the coupons when handling. (See Figure 2C.) Test coupons No. 9 and No. 17 (Figure 2D) had all of the glue removed except several spots. These weights were lower than the original weights recorded for the samples before glue was applied. The samples were cleaned and reweighed. These weights were taken as the original weights of the coupons and used in the weight loss percentage calculations.

Two sets of heaters in the autoclave had to be replaced and returned to the manufacturer for evaluation. When the second set of heaters burned out, a hole was also burned in the case so testing was continued at minimum pressure at each temperature. The building line voltage was reduced to ensure that the heater maximum voltage was not exceeded. A power outage

after hours caused an approximate test time to be set for the nonacetic acid soak test coupons at 400°F for the first autoclave run. This approximation was based on a straight line curve of a slope of 1 from the results of the second autoclave run. The approximation was seven hours. Test coupons affected were No. 6, No. 14, No. 22, and No. 30.

The coupons baked at 400°F generally had a slightly faster rate of glue removal (approximately 2 - 4 percent) than those baked at 500°F. This percentage did not include those test coupons whose glue curled or flaked off during testing. Those coupons were not representative of the group tested.

Soaking in acetic acid only increased the solubility from 1-3 percent in most cases. In Table II it is shown that the coupons experienced a slight weight gain after soaking in the 5 percent acetic acid solution. The glue weight after soaking was used as the total glue weight before autoclave testing and was used in calculating weight loss. (See Note 1 on Table II.) The glue weight after baking was used as the total glue weight for the coupons that did not undergo the soaking procedure. (See Note 2 on Table II.)

The pH was monitored during testing and a summary of the results are given in Table III. As necessary to maintain a pH between 5-6, the solution was buffered with lithium hydroxide or a new solution was prepared.

A summary of the data indicating autoclave testing temperature, time, and percent weight loss for each coupon is given in Table IV. Percent weight loss versus testing time graphs are given in Figures 3-10.

Conclusions

Based on the results given, temperatures of 400°F and above would adequately remove both glue types from the purge dams in less than 100 hours. The Elmer's Glue All was generally slightly more soluble at temperatures of 300°F and above than the School Glue. Baking the test coupons at 400°F produced a more soluble product for both glue types than baking at 500°F. Soaking in acetic acid increased the solubility slightly on both glue types.

DLL:RJS:SAV
Attachments

TABLE I
DESCRIPTION OF TEST COUPONS

Coupon No.	Glue Type	Baking Temp., °F	Acetic Acid Soak	Autoclave Testing Temp., °F
1	Glue All	400	Yes	500
2	Glue All	400	Yes	400
3	Glue All	400	Yes	300
4	Glue All	400	Yes	200
5	Glue All	400	No	500
6	Glue All	400	No	400
7	Glue All	400	No	300
8	Glue All	400	No	200
9	Glue All	500	Yes	500
10	Glue All	500	Yes	400
11	Glue All	500	Yes	300
12	Glue All	500	Yes	200
13	Glue All	500	No	500
14	Glue All	500	No	400
15	Glue All	500	No	300
16	Glue All	500	No	200
17	School Glue	400	Yes	500
18	School Glue	400	Yes	400
19	School Glue	400	Yes	300
20	School Glue	400	Yes	200
21	School Glue	400	No	500
22	School Glue	400	No	400
23	School Glue	400	No	300
24	School Glue	400	No	200
25	School Glue	500	Yes	500
26	School Glue	500	Yes	400
27	School Glue	500	Yes	300
28	School Glue	500	Yes	200
29	School Glue	500	No	500
30	School Glue	500	No	400
31	School Glue	500	No	300
32	School Glue	500	No	200

TABLE II
COUPON WEIGHT INFORMATION

Coupon No.	Original, grams	After Curing, grams	Glue Weight, grams	After Baking, grams	After Acetic Acid Soak, grams	Final, grams	Weight Loss, %
1	74.7241	74.9109	0.1868	74.8977	74.8895	74.7343	94.0
2	73.2292	73.4927	0.2635	73.4720	73.4736	73.2538	90.0
3	73.7741	73.9874	0.2464	73.9719	73.9738	73.9400	17.0
4	75.2413	74.4562	0.2149	75.4395	75.4358	75.4183	9.0
5	77.0026	77.2199	0.2173	77.2001	-	77.0073	98.0
6	75.1395	75.3126	0.1731	75.2996	-	75.1568	89.0
7	75.0144	74.1793	0.1649	74.1667	-	74.0368	85.0*
8	73.0487	73.2597	0.2110	73.2424	-	73.2251	9.0
9	74.7561	75.0074	0.2513	74.9794	74.9817	74.7603	98.0
10	75.8736	76.0855	0.2119	76.0620	76.0650	75.8956	88.5
11	72.6493	72.9544	0.3051	72.9260	72.9280	72.7715	56.0*
12	71.8378	72.1922	0.3544	72.1539	72.1638	72.1441	6.0
13	74.8839	75.1272	0.2433	75.0995	-	74.9021	92.0
14	74.5564	74.8564	0.3200	74.8252	-	74.5959	79.0
15	77.2217	77.4838	0.2621	77.4555	-	77.3936	26.5
16	75.4722	75.7613	0.2891	75.7322	-	75.7254	3.0
17	73.3290	73.4191	0.0901	73.4069	73.4079	73.3310	97.5
18	73.1474	73.3413	0.1939	73.3140	73.3260	73.1779	83.0
19	74.1186	74.2996	0.1810	74.2744	74.2830	74.2459	23.0
20	81.0809	81.3243	0.2433	81.2910	81.3047	81.2835	10.0
21	73.2422	73.4107	0.1685	73.3853	-	73.2475	96.0
22	74.7590	74.9092	0.1502	74.8887	-	74.7783	85.0
23	81.0906	81.2685	0.1779	81.2421	-	81.2162	17.0
24	79.5230	79.6673	0.1443	79.6478	-	79.6426	4.0
25	81.6176	81.8737	0.2561	81.8359	81.8446	81.6303	94.0
26	80.5823	80.7285	0.1462	80.7010	80.7055	80.6006	85.0
27	81.3655	81.5577	0.1922	81.5227	81.5297	81.5039	16.0
28	73.5074	73.6571	0.1497	73.6316	73.6367	73.6271	11.0
29	73.3776	73.5433	0.1657	73.5129	-	73.3927	89.0
30	78.7506	78.9143	0.1637	78.8825	-	78.7735	84.0
31	80.0651	80.2448	0.1797	80.2125	-	80.1926	13.5
32	75.8393	76.0255	0.1862	75.9971	-	75.9846	8.0

*Glue chipped off during testing.

To calculate weight loss percentage:

Note 1 - Acetic acid soaked coupons

$$\text{Weight Loss, \%} = \frac{\left(\text{Coupon wt. After Soak} - \text{Original Weight}\right) - \left(\text{Final Coupon wt.} - \text{Original Weight}\right)}{\left(\text{Coupon wt. After Soak} - \text{Original Weight}\right)} \times 100\%$$

Note 2 - Nonacetic acid soaked coupons

$$\text{Weight Loss, \%} = \frac{\left(\text{Coupon wt. After Baking} - \text{Original Weight}\right) - \left(\text{Final Coupon wt.} - \text{Original Weight}\right)}{\left(\text{Coupon wt. After Soak} - \text{Original Weight}\right)} \times 100\%$$

TABLE III
pH CHANGES DURING TESTING

Temperatures Tested, °F	1st Run Before/After	2nd Run Before/After	3rd Run Before/After
500*	5.5/5.1	5.7/5.9	5.4/4.9
500	5.5/5.1	5.7/5.9	5.4/4.9
400*	5.9/6.1**	5.3/4.3	-
400	5.6/5.5	5.9/6.1**	5.3/4.3
300*	5.2/4.6	-	-
300	5.2/5.5	5.2/4.6	-
200*	5.5/5.9	5.5/6.2**	-
200	5.5/5.9	5.5/6.2**	-

*Acetic Acid Soaked Coupons
**Solution Changed After Run

TABLE IV
DATA SUMMARY

Coupon No.	Autoclave Testing Temp., °F	Total Time, Hours	Weight Loss, %	Comments
Glue All - Baking Temperature 400°F - Acetic Acid Soak				
1	500	40	94.0	
2	400	44	90.0	Glue curled.
3	300	64	17.0	
4	200	90	9.0	
School Glue - Baking Temperature 400°F - Acetic Acid Soak				
17	500	40	97.5	Wt. lower than orig.
18	400	44	83.0	Glue curled.
19	300	64	23.0	
20	200	90	10.0	
Glue All - Baking Temperature 400°F - No Acetic Acid Soak				
5	500	40	98.0	
6	400	51	89.0	Glue curled.
7	300	78	85.0	Half glue flaked off.
8	200	90	9.0	
School Glue - Baking Temperature 400°F - No Acetic Acid Soak				
21	500	40	96.0	
22	400	51	85.0	Glue curled.
23	300	78	17.0	
24	200	90	4.0	
Glue All - Baking Temperature 500°F - Acetic Acid Soak				
9	500	40	98.0	
10	400	44	88.5	Glue curled.
11	300	64	56.0	Half glue flaked off
12	200	90	6.0	
School Glue - Baking Temperature 500°F - Acetic Acid Soak				
25	500	40	94.0	
26	400	44	85.0	Glue curled.
27	300	64	16.0	
28	200	90	11.0	

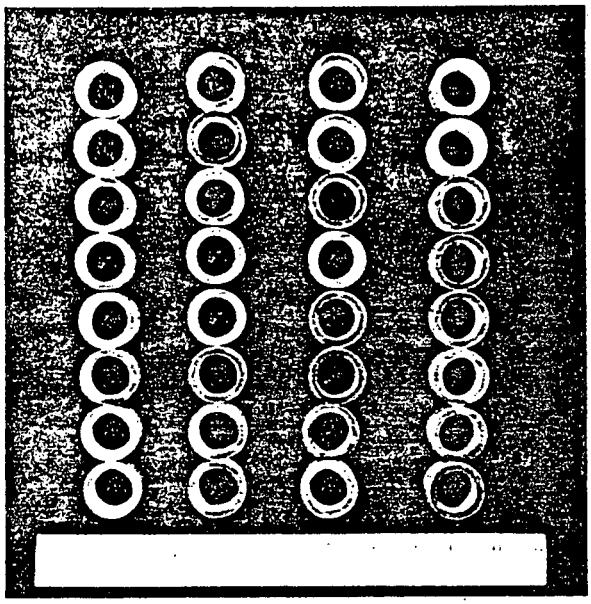
TABLE IV
DATA SUMMARY
(CONTINUED)

Glue All - Baking Temperature 500°F - No Acetic Acid Soak

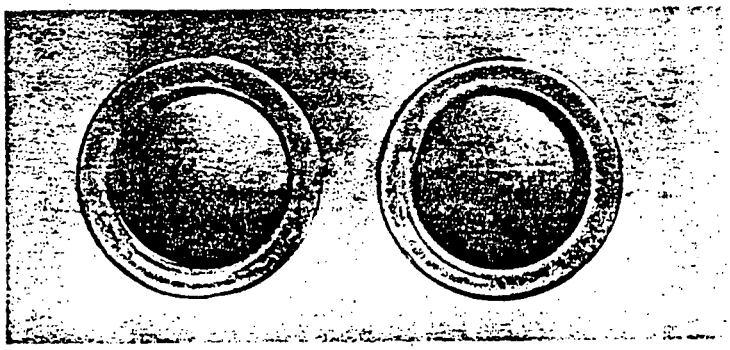
Coupon No.	Autoclave Testing Temp., %	Total Time, Hours	Weight Loss, %	Comments
13	500	40	92.0	
14	400	51	79.0	Glue cracked, stayed on.
15	300	78	26.5	
16	200	90	3.0	

School Glue - Baking Temperature 500°F - No Acetic Acid Soak

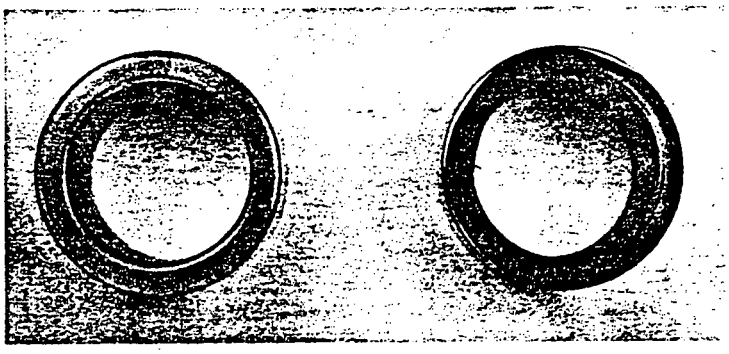
29	500	40	89.0	
30	400	51	84.0	Glue curled.
31	300	78	13.5	
32	200	90	8.0	Glue flaked in one area.



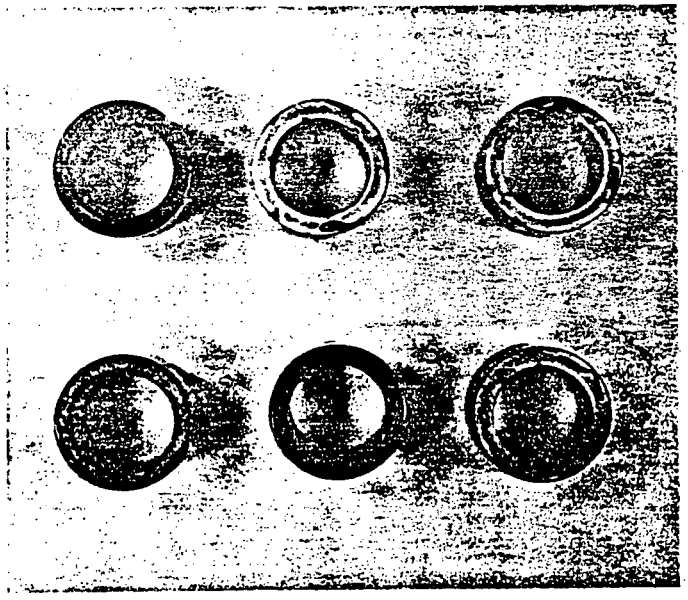
A. As received photograph.



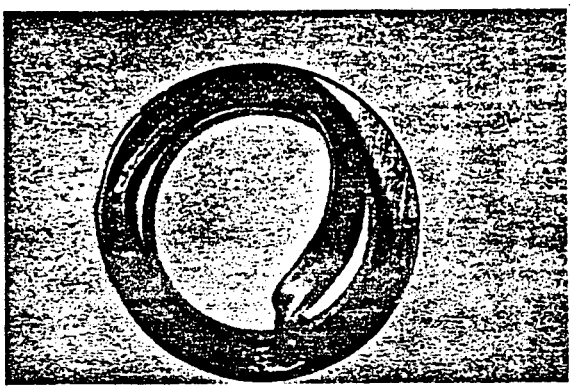
B. Appearance of School Glue (left) and Glue-all (right) after curing.



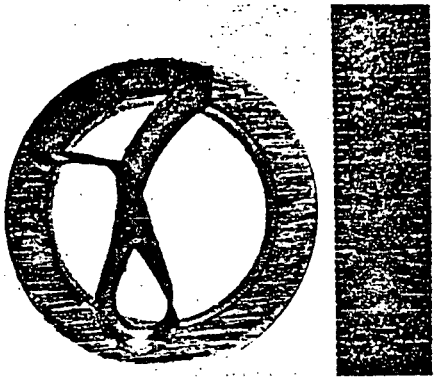
C. Glue-all (left) and School Glue (right) after curing and 400°F baking.



D. Chipping of glue after 650°F baking.

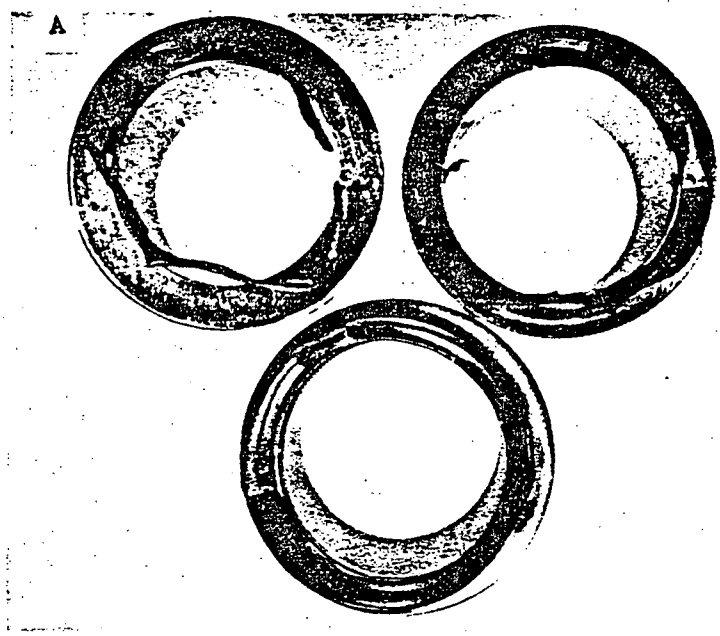


E. Test coupon No. 11 after acetic acid soak.

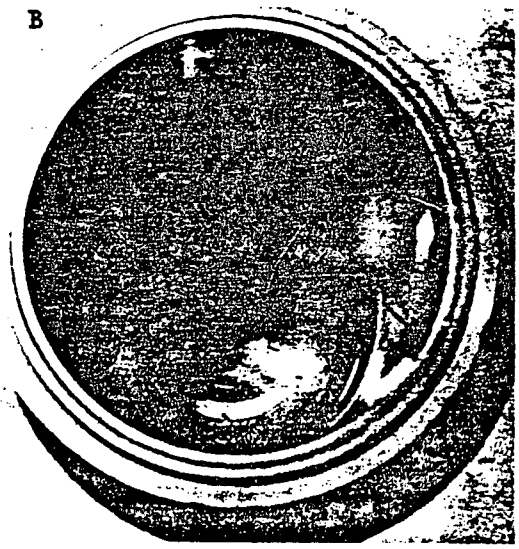


F. Coupon No. 7 after 300°F trial in autoclave.

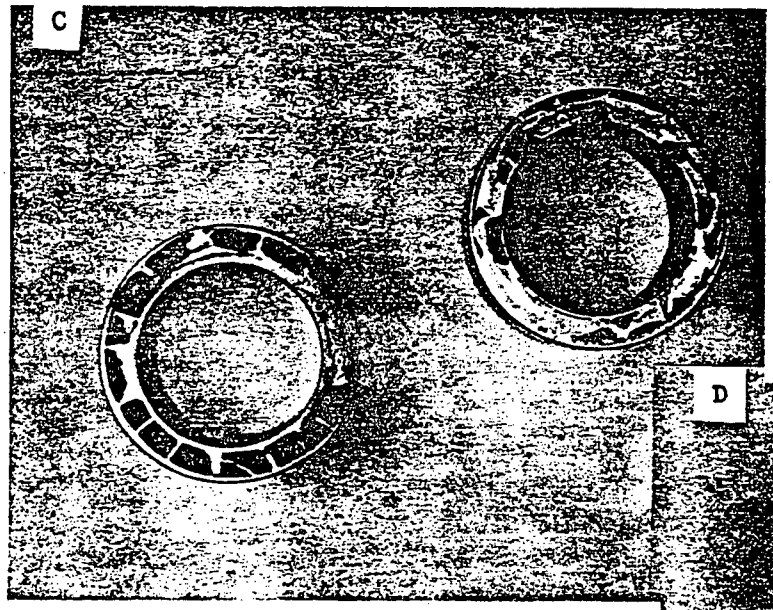
Figure 1 - Solubility of Glue in Purge Dam and Interfacing Piping System.



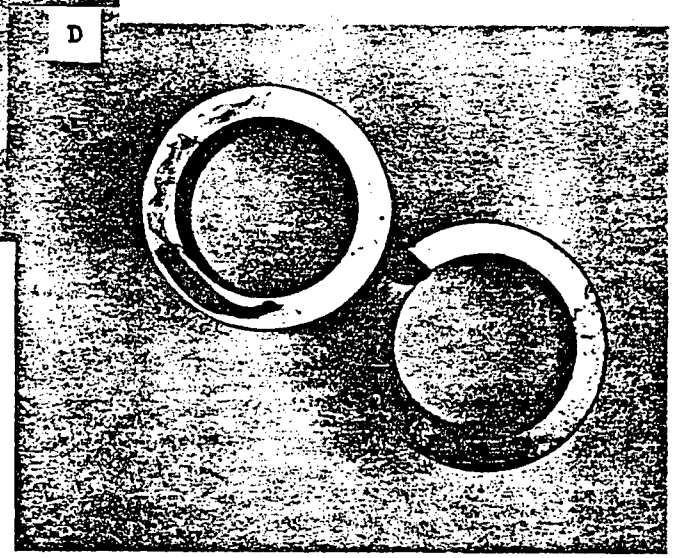
A. Glue after 400°F testing in autoclave.



B. Deposits on the bottom of autoclave after 400°F testing.



C. Flaking of glue after 500°F testing.



D. Coupons Nos. 9 and 17 after 500°F testing.

Figure 2 - Solubility of Glue in Purge Dam and Interfacing Piping System.

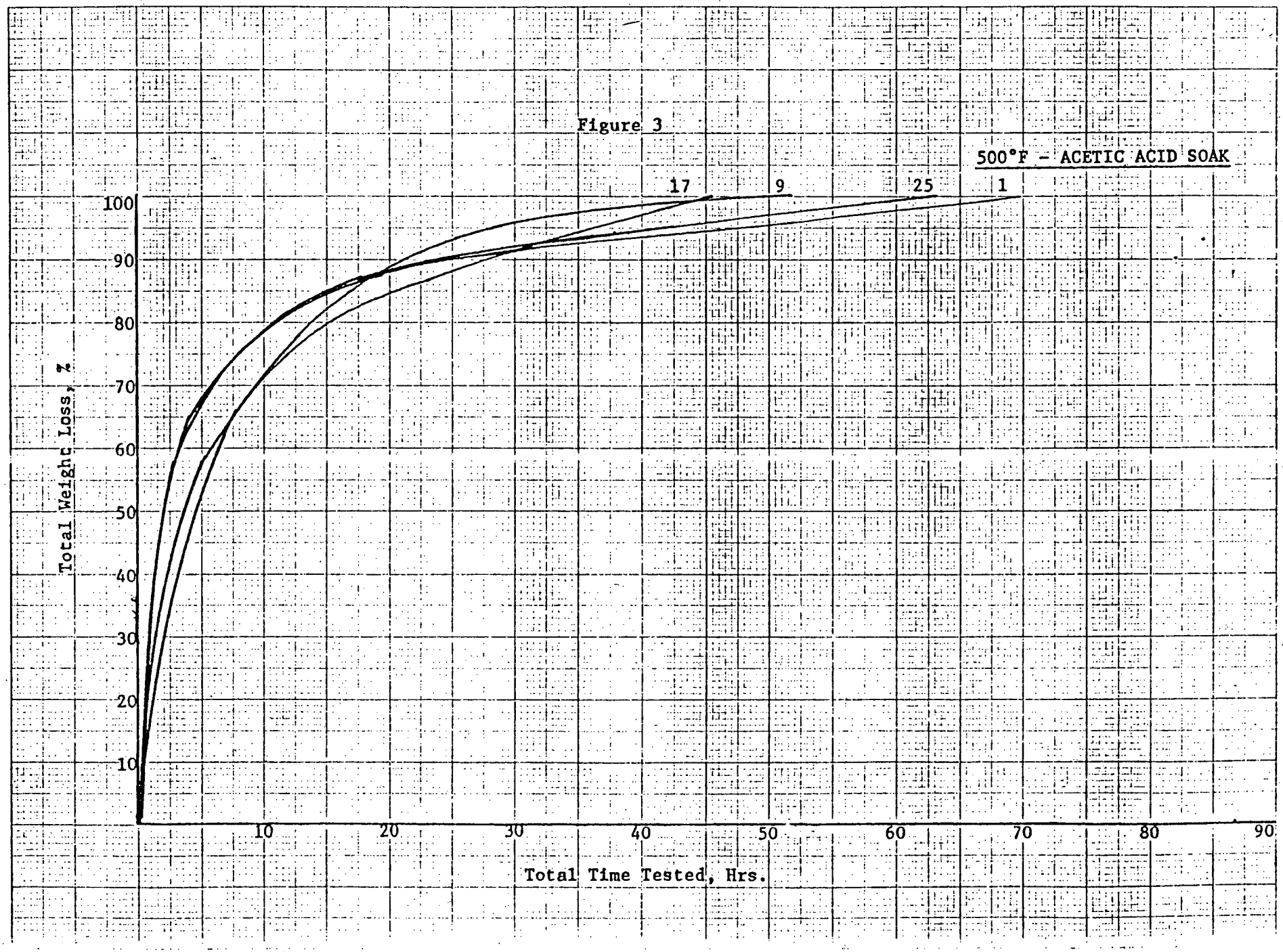

500°F - ACETIC ACID SOAK
17
9
25
1
100
90
80
70
60
50
40
30
20
10
Total Weight Loss, %
10
20
30
40
50
60
70
80
90
Total Time Tested, Hrs.

Figure 3

Figure 4

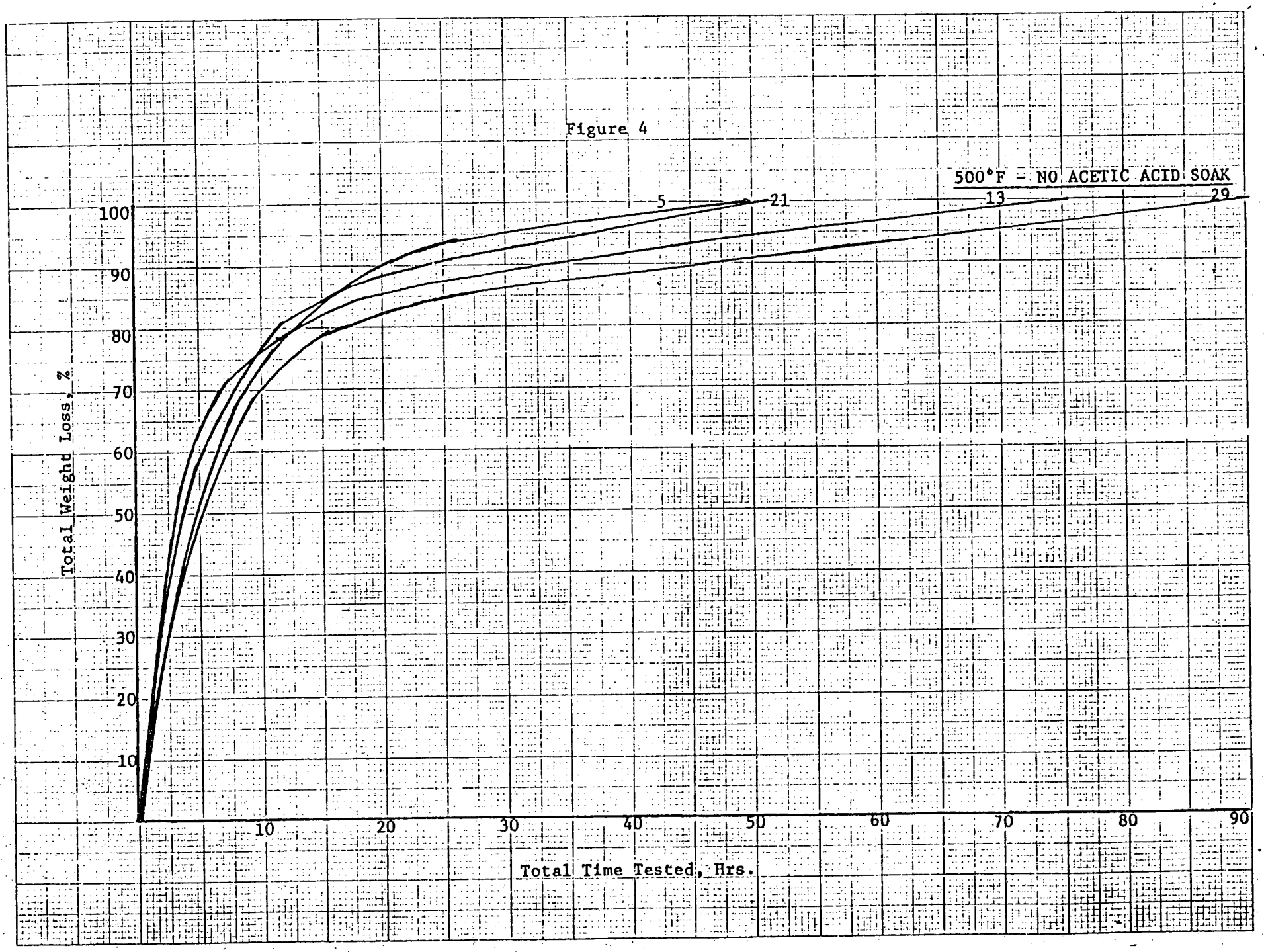

500°F - NO ACETIC ACID SOAK
5
21
13
29
Total Weight Loss, %
100
90
80
70
60
50
40
30
20
10
10
20
30
40
50
60
70
80
90
Total Time Tested, Hrs.

Figure 5

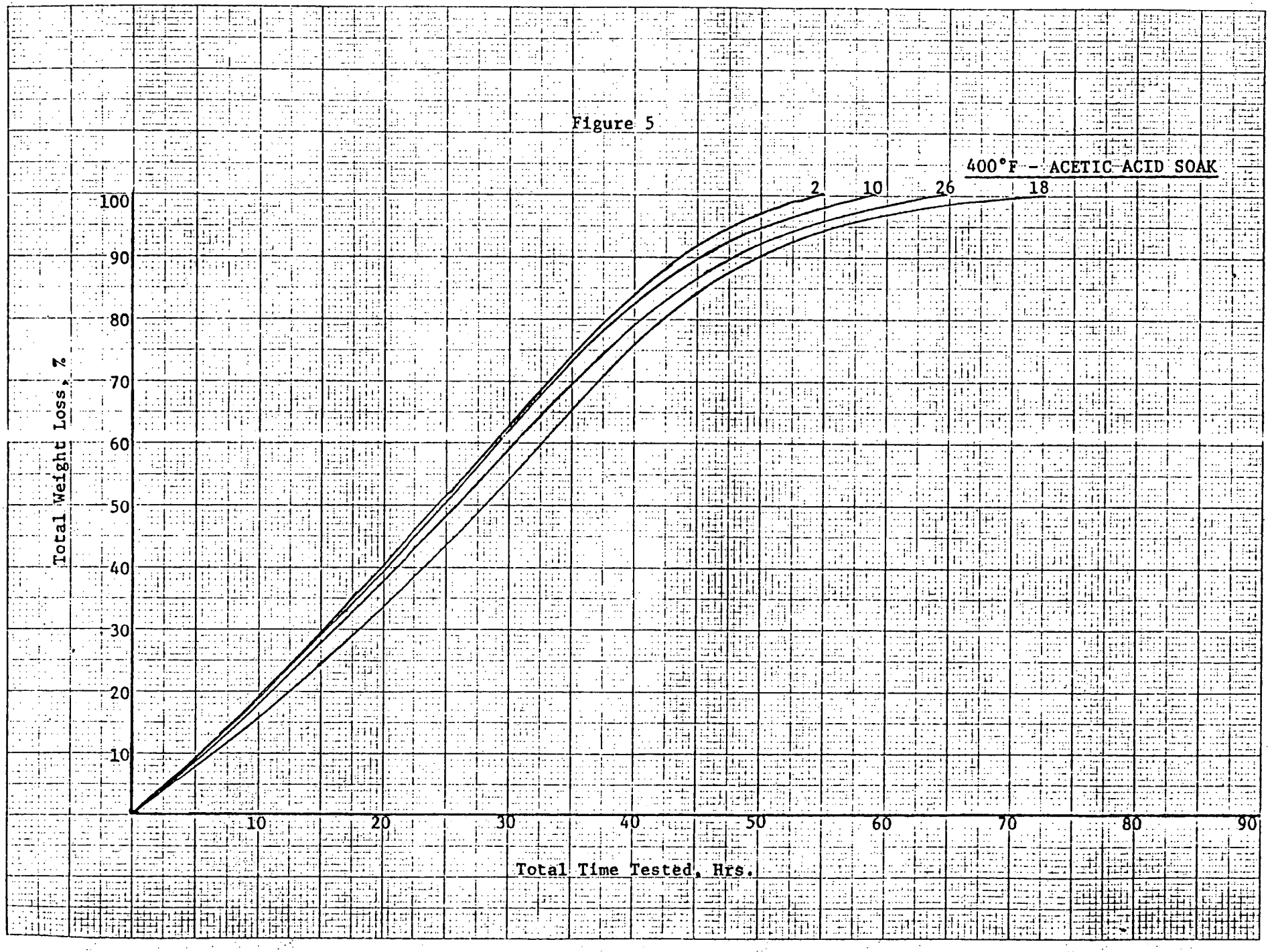

400°F - ACETIC ACID SOAK
2
10
26
18
Total Weight Loss, %
100
90
80
70
60
50
40
30
20
10
10
20
30
40
50
60
70
80
90
Total Time Tested, Hrs.

Figure 6

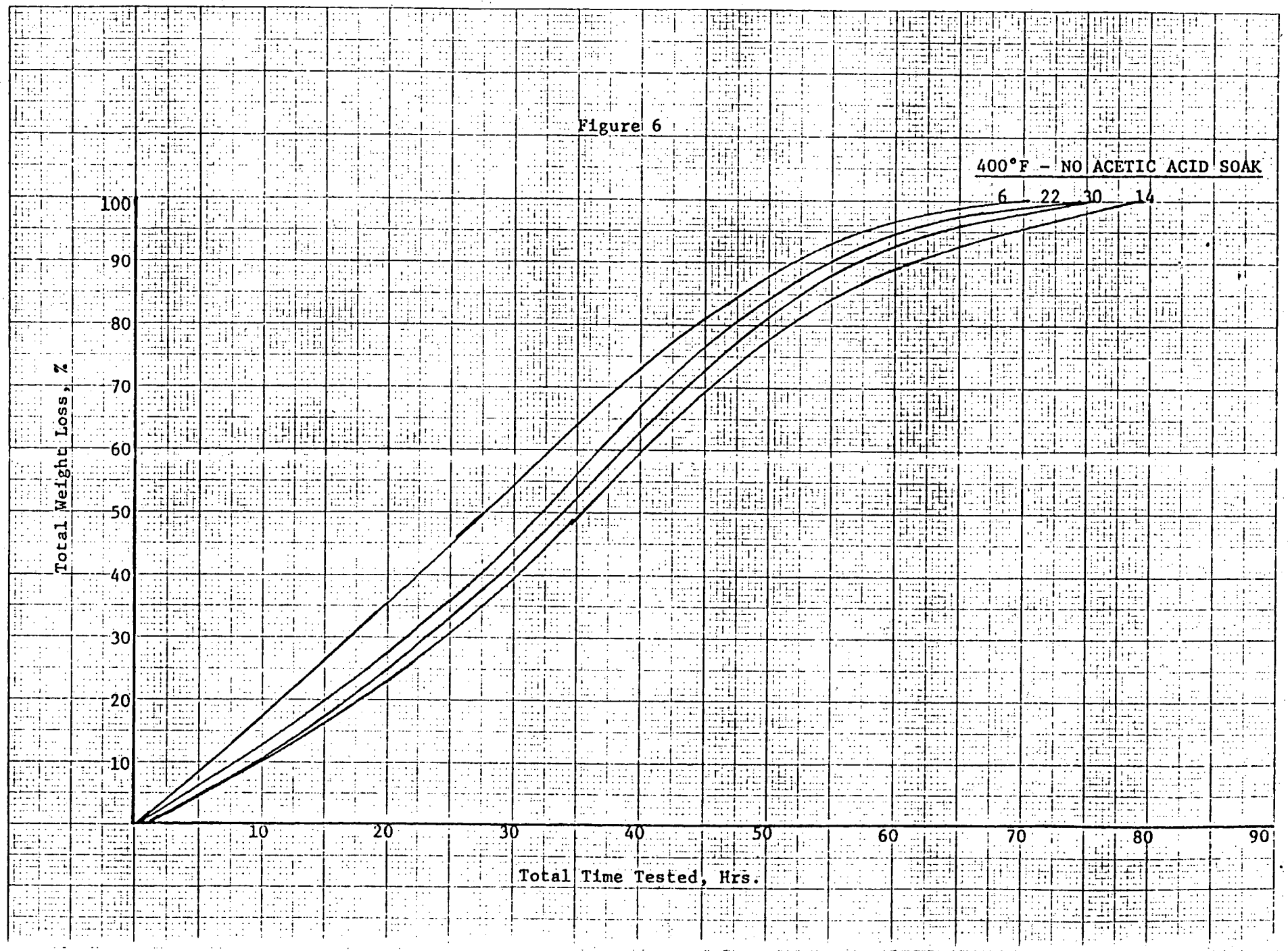

400°F - NO ACETIC ACID SOAK
6
22
30
14
Total Weight Loss, %
100
90
80
70
60
50
40
30
20
10
10
20
30
40
50
60
70
80
90
Total Time Tested, Hrs.

Figure 7

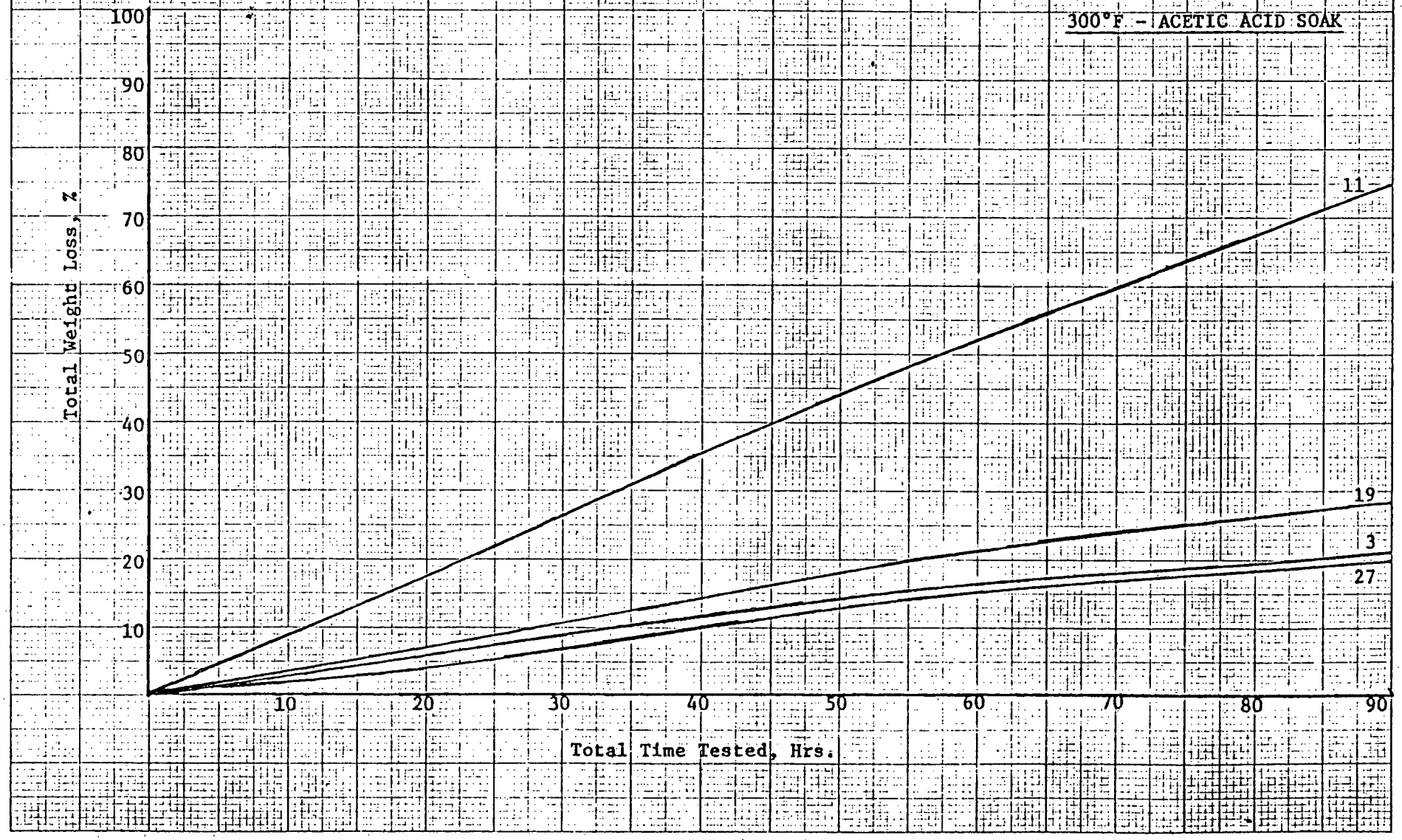

300°F - ACETIC ACID SOAK
Total Weight Loss, %
100
90
80
70
60
50
40
30
20
10
11
19
3
27
10
20
30
40
50
60
70
80
90
Total Time Tested, Hrs.

Figure 8

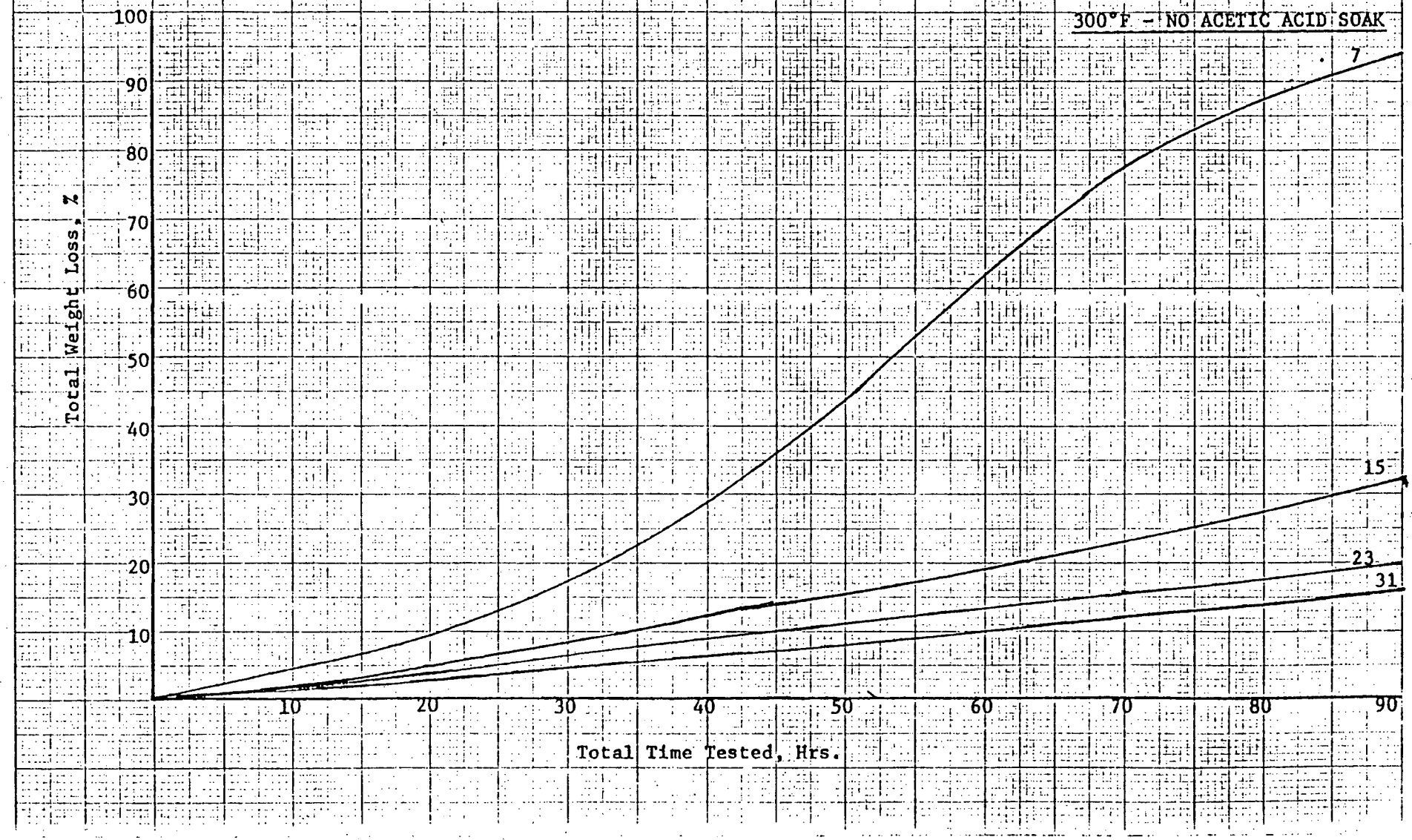

300°F - NO ACETIC ACID SOAK
7
15
23
31
Total Weight Loss, %
100
90
80
70
60
50
40
30
20
10
10
20
30
40
50
60
70
80
90
Total Time Tested, Hrs.

Figure 9

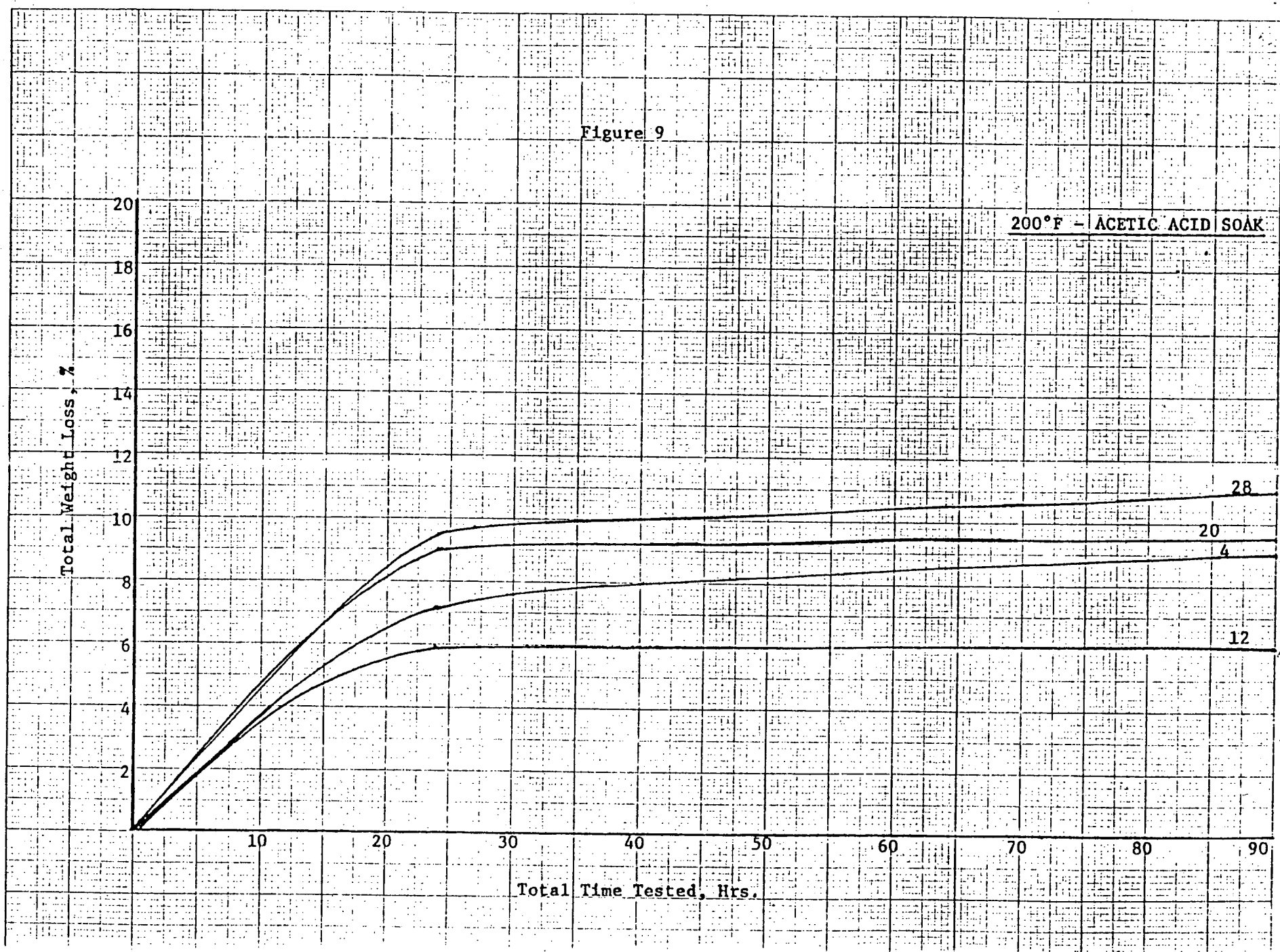
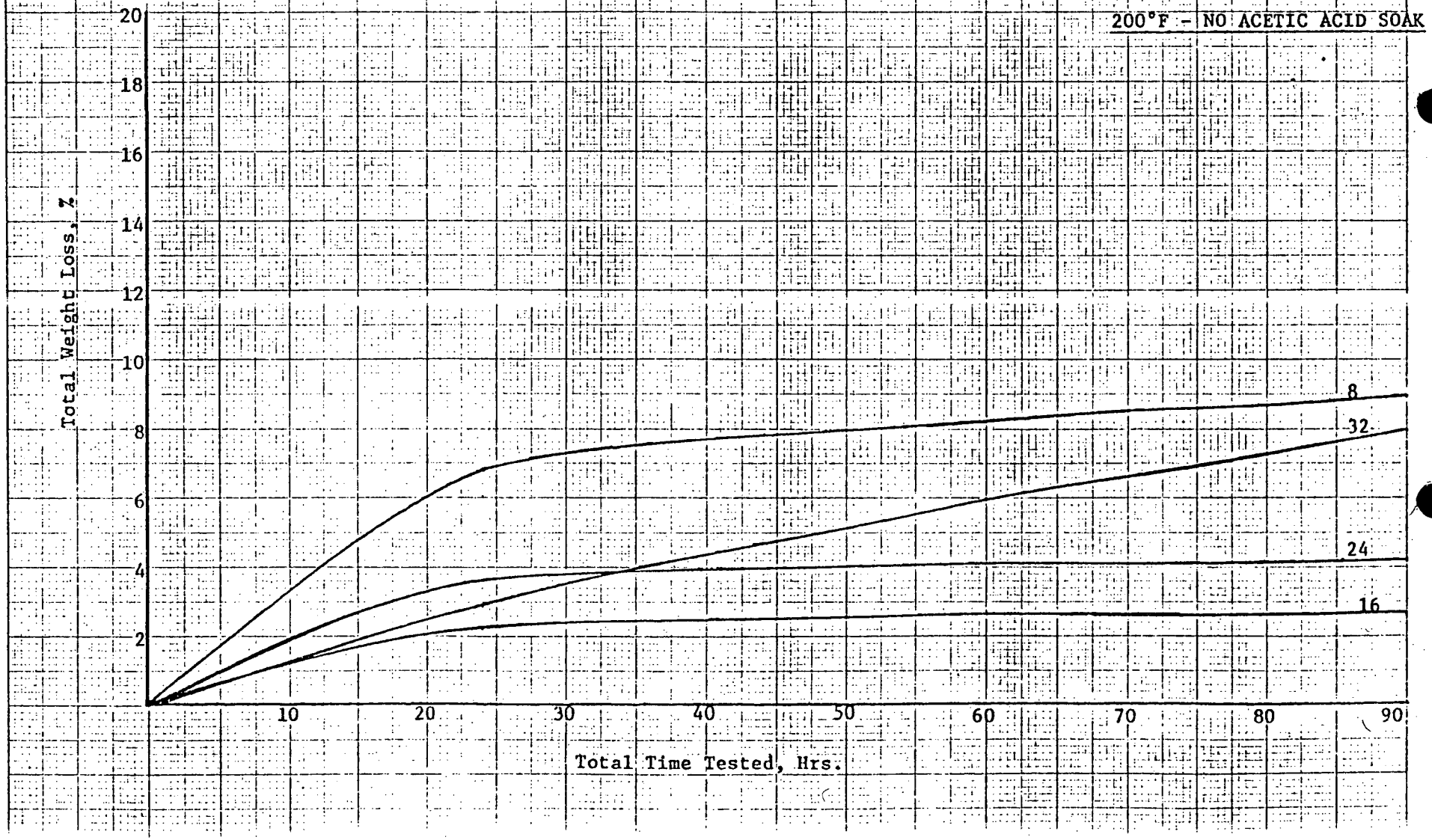

200°F - ACETIC ACID SOAK
Total Weight Loss, %
20
18
16
14
12
10
8
6
4
2
28
20
4
12
10
20
30
40
50
60
70
80
90
Total Time Tested, Hrs.

Figure 10


200°F - NO ACETIC ACID SOAK
Total Weight Loss, %
20
18
16
14
12
10
8
6
4
2
10
20
30
40
50
60
70
80
90
Total Time Tested, Hrs.
8
32
24
16

ATTACHMENT G

SINGLETON MATERIALS ENGINEERING LABORATORY
TESTING OF SIDE STREAM SAMPLING PROOF
FLUSH EFFECTIVENESS

TVA 64 (05-1983)

UNITED STATES GOVERNMENT

Memorandum

TENNESSEE VALLEY AUTHORITY

cc: EM Pierce 10/8

MEB '821005 301

TO : C. A. Chandley, Chief, Mechanical Engineering Support Branch, W7C126 C-K

FROM : Frank Van Meter, Chief, Construction Services Branch, 500 SPT-K

DATE : October 5, 1982

SUBJECT: ALL NUCLEAR PLANTS - PROOF FLUSHING DURING CHEMICAL CLEANING

In response to MEB '820423 004, the effectiveness of a proof flush sampling method similar to methods described in Construction Specification G-39, Section 8 has been tested. The apparatus shown in figure 1 was assembled from available materials. Flow was maintained by adding water from a fire hydrant to the 55-gal drum. Flow rates were measured volumetrically by collecting a quantity of liquid over a timed interval. Debris was added approximately 8 ft upstream from the 1- or 2-in. sampling traps. Debris material in each case consisted of 20 pieces of duct tape, small steel cylinders, or weld slag. The sampling trap opened immediately after the debris was added, remained open approximately 30 s while the debris was deposited in the sampling trap sieve or flushed to the end of the pipe, and caught by the nylon trap. The test assembly (see figure 1) allowed observation of the debris as it deposited in the sieve which collected material sampled by the trap or passed downstream to be retained in the nylon trap. The 20-mesh sieve and nylon trap were removed upon completion of each flushing test and the number of debris pieces in each was recorded.

Table 1 shows flow rates through the 1- and 2-in. sampling traps as a function of flow rate in the 3-in. pipe. Table 2 contains results from 72 flushing tests. Steel cylinders and weld slag pieces were all deposited in the sieve below the sampling trap except in tests 45 and 47 where two cylinders remained in the 3-in. pipe. The number of duct tape pieces deposited in the sieve was not reproducible at any given flow rate. Duct tape pieces were observed stuck together, stuck to the 3-in. PVC pipe walls, and floating freely in the glass pipe section. In general, the number of tape pieces deposited in the sieve increased with decreased flow rate.

Original signed by
Frank Van Meter

Frank Van Meter

cy sent to RMP on 10-8-82

WHC:LES:MHD
Attachments
cc (Attachments):
W. H. Childres, SME-K
MEDS, W5B63 C-K

Principally prepared by Larry E. Smith, extension 2771.

MEB MASTER FILE

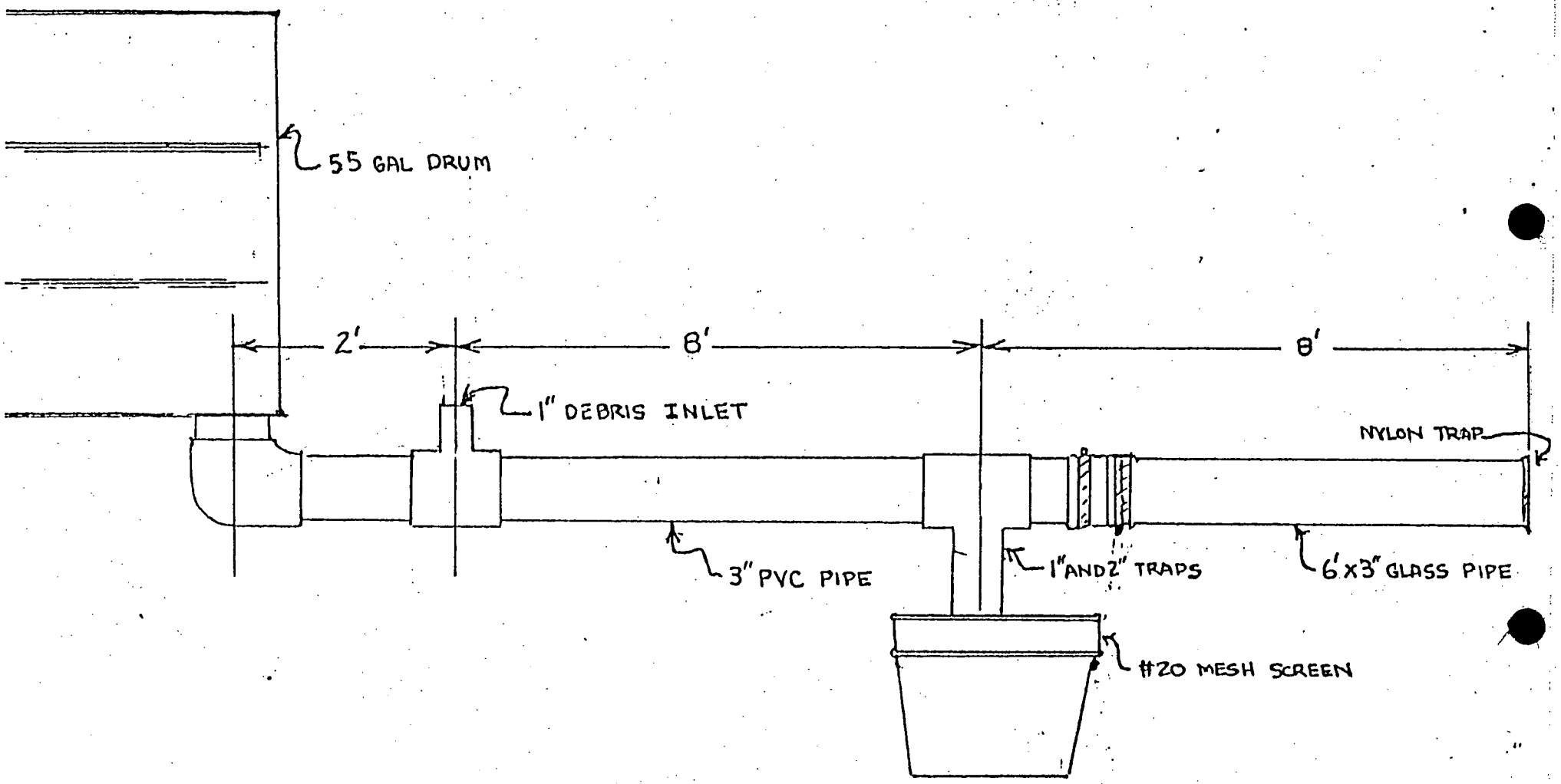


Figure 1. Proof Flush Test Assembly

Table 1

FLOW RATES IN 1- AND 2-IN. TRAPS

Flow Rate (3-in. pipe) (GPM)	Flow Rate (1-in. trap) (GPM)	Flow Rate (2-in. trap) (GPM)
99	17.5	14.6
87		14.6
84	17.5	
80		14.0
73	17.0	
67	17.0	13.4
60	17.0	11.8
51	17.0	11.7
48		12.3
47	17.0	

Table 2

PROOF FLUSH SAMPLING RESULTS

Test Number	Flow Rate (GPM)	Debris (size)	Drain I.D. (in.)	Location of Debris After Test: Sieve (sampling trap)	Nylon (end of pipe)	Pipe
1	46	Duct Tape (1/2" x 1/2")	1	10	10	0
2				14	6	0
3				13	7	0
4	85		1	0	20	0
5				2	18	0
6				1	19	0
7	84		2	5	15	0
8				3	17	0
9				4	16	0
10	87		2	3	17	0
11				16	4	0
12				16	4	0
13				9	11	0
14				5	15	0
15	88		2	13	7	0
16				13	7	0
17				11	9	0
18	84		2	9	11	0
19				6	14	0
20				7	13	0
21	60		2	19	1	0
22				15	5	0
23				14	6	0
24				18	2	0

Table 2
(cont'd)

PROOF FLUSH SAMPLING RESULTS

Test Number	Flow Rate (GPM)	Debris (size)	Drain I.D. (in.)	Location of Debris After Test: Sieve (sampling trap)	Nylon (end of pipe)	Pipe
25	84	Duct Tape (1" x 1")	2	4	16	0
26				6	14	0
27	60		2	10	7	3
28	85		2	3	14	3
29				11	6	3
30				7	13	0
31				3	17	0
32				8	12	0
33	62		2	18	1	1
34				18	2	0
35				17	3	0
36	90	Duct Tape (1" x 1-1/2")	2	4	11	5
37				9	11	0
38	85		2	7	12	1
39				13	7	0
40				12	8	0
41				16	1	3
42				8	8	4
43	62		2	18	2	0
44				19	1	0
45				20	0	0

Table 2
(cont'd)

PROOF FLUSH SAMPLING RESULTS

Test Number	Flow Rate (GPM)	Debris (size)	Drain I.D. (in.)	Location of Debris After Test: Sieve (sampling trap)	Nylon (end of pipe)	Pipe
46	77	Steel Cylinder (1/8"-dia,1/8" hgt)	1	18	0	2
47				18	0	2
48				20	0	0
49				20	0	0
50	76		2	20	0	0
51				20	0	0
52	79	Steel Cylinder (1/4"-dia,1/8" hgt)	1	20	0	0
53				20	0	0
54				20	0	0
55	81		2	20	0	0
56				20	0	0
57	86	Weld Slag (≤1/2"-dia)	1	20	0	0
58				20	0	0
59				20	0	0
60	78		2	20	0	0
61				20	0	0
62	60		2	20	0	0
63				20	0	0
64	85	Weld Slag (≤1/2"-dia<1")	2	20	0	0
65				20	0	0
66	60		2	20	0	0
67				20	0	0

Table 2
(cont'd)

PROOF FLUSH SAMPLING RESULTS

Test Number	Flow Rate (GPM)	Debris (size)	Drain I.D. (in.)	Location of Debris After Test: Sieve (sampling trap)	Nylon (end of pipe)	Pipe
46	77	Steel Cylinder (1/8"-dia,1/8" hgt)	1	18	0	2
47				18	0	2
48				20	0	0
49				20	0	0
50	76		2	20	0	0
51				20	0	0
52	79	Steel Cylinder (1/4"-dia,1/8" hgt)	1	20	0	0
53				20	0	0
54				20	0	0
55	81		2	20	0	0
56				20	0	0
57	86	Weld Slag (≤1/2"-dia)	1	20	0	0
58				20	0	0
59				20	0	0
60	78		2	20	0	0
61				20	0	0
62	60		2	20	0	0
63				20	0	0
64	85	Weld Slag (≤1/2"-dia<1")	2	20	0	0
65				20	0	0
66	60		2	20	0	0
67				20	0	0

Table 2
(cont'd)

PROOF FLUSH SAMPLING RESULTS

Test Number	Flow Rate (GPM)	Debris (size)	Drain I.D. (in.)	Location of Debris After Test: Sieve (sampling trap)	Nylon (end of pipe)	Pipe
68	76	Mixture	1	15	5 (tape)	0
69		(5 small cylinders) (5 large cylinders) (5 small slag)		15	5 (tape)	0
70		(5 1/2" x 1/2" tape)	2	17	3 (tape)	0
71		↓		17	3 (tape)	0
72				17	3 (tape)	0

ATTACHMENT H

ANSI N45.2.1

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W. L. Rinder, Baltimore Gas & Electric Company, Baltimore, Maryland

W. L. Walker, General Electric Company, San Jose, California

3.1.2 Class B—A high level of cleanness applicable to reactor coolant systems, components, and other items, such as the reactor coolant purification system, which have similar cleanness requirements.

Piping and components in systems which are designed as requiring Class B cleanness shall meet the following requirements:

1. The surface shall appear "metal clean" when examined without magnification under a lighting level (background plus supplementary lighting) of at least 100 foot candles. Scattered areas of rust are permissible provided the aggregate area of rust does not exceed 2 square inches in any one square foot area.

NOTE

Localized rusting may indicate pitting of the surface and should be evaluated metallurgically). Thin temper films resulting from welding or post-weld heat treatment are acceptable.

2. The surface shall be free or particulate contaminants such as sand, metal chips, weld slag, etc.
3. The surface shall be free of organic films and contaminants such as oils, paint, and preservatives as determined by a visual examination or an organic solvent-dampened white cloth or an equivalent alternate method.
4. When a visual inspection is not possible and the surfaces are accessible, a dry white-cloth wipe, followed by a solvent-dampened white-cloth wipe, may be used to evaluate the cleanness of the surface. If either cloth exhibits indications of contamination, the system shall either be recleaned or the specific contaminant shall be determined and evaluated as to its potential deleterious effect.

[redacted] The system shall be flushed at its normal design velocity (or other velocity if specified by procurement documents) until the screen shows no more than slight particle speckling and no more than slight rust staining. There shall be no particles larger than $^1/_{32}$ inch in any dimension, except fine hairline slivers of less than $^1/_{32}$ inch thickness are permissible up to $^1/_{16}$ inch long. There shall be no evidence of organic contamination in the effluent water or on the filter.

3.1.3 Class C—An intermediate level of cleanness generally applicable to closed service-water systems that cool components containing reactor coolant, engineered safety systems, and other high integrity systems. Surfaces shall meet the requirements for Class B cleanness, except:

1. Thin uniform rust films are acceptable on carbon steel surfaces.
2. Scattered areas of rust are permissible provided that the area of rust does not exceed 15 square inches in any 1 square foot on corrosion resistent alloys.
3. Flush-test filters may exhibit considerable rust staining.

3.1.4 Class D—The level of cleanness applicable to fire-protection, open service water, and similar systems requiring only a nominal degree of cleanness. The following are acceptable on items which meet Class D cleanness:

1. Tightly adherent mill scale on carbon steel surfaces.
2. Paint or preservative coatings on carbon steel surfaces that will not peel or flake when exposed to cold-water flushing.
3. Rust films on carbon steel and stainless steel surfaces that resist removal by scrubbing with a bristle brush.
4. If flushing is the only practical means of determining system cleanness, the system shall be evaluated by examining a 14-mesh (ASTM E11-70, Specification for Wire Cloth Sieves for Testing Purposes) or fine filter, or the equivalent, installed on the outlet of the cleaning circuit. The system shall be flushed at its normal velocity until the screen shows no more than occasional particle speckling. There shall be no particles larger than $^1/_{16}$ inch in any dimension, except hairlike slivers of less than $^1/_{64}$ inch thickness are permissible up to $^1/_4$ inch long. There shall be no evidence of organic contamination on the screen; considerable rust-staining is acceptable.

3.2 Water Quality Requirements

The selection of the water quality for a specific application shall be made by the organization responsible for the cleaning operations unless otherwise specified in the purchase document. In cases where the water quality for operating systems is lower than that

ATTACHMENT I

JANUARY 19, 1983, TELECON WITH JACK HICKS
TO GET HIS INTERPRETATION OF
ANSI N45.2.1, SECTION 3.1.2, ITEM 5
(in re, ADEQUACY OF SIDE STREAM SAMPLING)

TVA 64 (05-06-85)

UNITED STATES GOVERNMENT

Memorandum

TENNESSEE VALLEY AUTHORITY

MEB 83 0121 018

TO : Mechanical Engineering Support Branch Files

FROM : D. T. Drouhard, Chemical Engineer, W7A64 C-K

DATE : JAN 21 1983

SUBJECT: BELLEFONTE NUCLEAR PLANT - INTERPRETATION OF ANSI N45.2.1 (1973) ON CLEANLINESS VERIFICATION

TELECON WITH JACK HICKS

1.0 DATE AND TIME:

January 19, 1983, 3:45 p.m.

2.0 REQUESTED BY:

J. R. Palatinus

3.0 PARTICIPANTS:

D. T. Drouhard	W7A64 C-K	MEB	TVA-EN DES
J. R. Palatinus	W7A54 C-K	MEB	TVA-EN DES
Jack Hicks			ANSI Subcommittee

4.0 PURPOSE OF TELECON:

To get an interpretation of ANSI N45.2.1 from Jack Hicks, who is the chairman of the working group.

5.0 COMMENTS:

5.1 According to ANSI N45.2.1-1973, section 3.1.2, paragraph 5, "If flushing is the only practical means for determining system cleanliness, the system shall be evaluated by examining a 20-mesh or finer filter, or the equivalent, installed on the outlet of the cleaning circuit." TVA has interpreted this to allow side-stream sampling and cartridge filters while the NRC interprets this to require in-line, full-flow strainers.

5.2 Jack Hicks stated that side-stream samples should be okay if the samples are reasonably representative. We told him we normally use a 2-inch system drain, and he thought that would be reasonable.

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5.3 Jack Hicks also agreed that when doing a once-through flush, "installed on the outlet" can mean that the sample or strainer be located at the end of the flow path being cleaned. In a recirculation flush, any place in the flow path is acceptable.

5.4 Jack Hicks agreed with our position that a successful proof flush does not mean that the last particle has been removed from the system but is merely an indication of the cleanliness of the system.

D. T. Drouhard

DTD:JES
cc: C. A. Chandley, W7C126 C-K
All Attendees

CAC:JES JAN 21 1983
cc: R. M. Hodges, 1117 IBM-K
W. R. Brown, 102 ESTA-K
M. N. Sprouse, W11A9 C-K

MNS:JES JAN 21 1983
cc: L. S. Cox, Bellefonte CONST (3)
MEDS, W5B63 C-K

Principally Prepared By: D. T. Drouhard, Extension 3797

ENCLOSURE 2

Draft FSAR Amendment Material

Insert "A"

Page 14.2-12

1.37	Quality Assurance Requirements For Cleaning of Fluid Systems and Associated Componants of Water-Cooled Nuclear Power Plants (3/73)	Conforms to the intent of the regulatory guide with the following exception: Some low solubility glue was used for installation of purge dams, therefore, exception is taken to the ANSI N45.2.1 acceptance criteria for particles and adherent residue resulting from weld purge dam materials. (Documented in Bellefonte nonconformance report (NCR) 1725.)

(MATERIAL TO BE INCLUDED IN UPCOMING FSAR AMENDMENT)