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September 27, 1979

Sheldon J. Wolfe, Esquire
Atomic Safety and Licensing
Board P
U.S. Nu[illegible] egulatory
Commis[illegible]
Washingto[illegible].C. 20555

Mr. Frederick J. Shon, Member
Atomic Safety and Licensing
Board Panel
U.S. Nuclear Regulatory
Commission
Washington, D.C. 20555

Dr. Paul W. Purdom, Director
Environmental Studies Group
Drexel University
32nd and Chestnut Streets
Philadelphia, Pennsylvania 19104

Re: In the Matter of the Application of	)	
Public Service Company of Oklahoma,	)	
Associated Electric Cooperative, Inc.	)	Docket Nos. STN 50-556
and	)	STN 50-557
Western Farmers Electric Cooperative	)	
	)	
(Black Fox Station, Units 1 and 2)	)	

Gentlemen:

Consistent with the tenets of full disclosure as articulated by the Appeal Board in McGuire,* Applicants are submitting the enclosed memorandum and letters for the information of the Licensing Board and the parties. The enclosures consist of the following:

1. A letter dated September 10, 1979 from Dr. John B. West to Joseph Gallo, Esquire;

1261 320

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* Duke Power Company (William B. McGuire Nuclear Station, Units 1 and 2), ALAB-143, 6 AEC 632 (1973).

7911020177

2. a letter dated July 27, 1979 from Mr. Martin E. Fate, Jr. to Mr. William G. Gang; and

3. a memorandum dated July 24, 1979 with enclosures* to Mr. Martin E. Fate, Jr. from Dr. John B. West.

This information is relevant to Board Question 15-1 and the Applicants are presently pondering whether or not to file a proper motion requesting that this information be made a part of the evidentiary record.

The foregoing information documents a decision made by the Applicants to replace the piping material for the Black Fox reactor recirculation system from 304 stainless steel to 316K stainless steel material. The purpose of this change is to mitigate to the maximum extent the occurrence of the intergranular stress corrosion cracking phenomenon in the reactor recirculation systems for the Black Fox Station.

Sincerely,

Joseph Gallo

Joseph Gallo
One of the Attorneys
for the Applicants

1261 321

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* Table II to the memorandum is not enclosed because it contains Company confidential financial information.

6212DIN8-017-605

PUBLIC SERVICE COMPANY OF OKLAHOMA

A CENTRAL AND SOUTH WEST COMPANY

P.O. BOX 201 / TULSA, OKLAHOMA 74102 / (918) 583-3611

PSO

Public Service Company of Oklahoma
Black Fox Station
IGSCC Mitigation Alternatives for
Reactor Recirculation System

File 6212/6912.215.1412.21L
6212/6912.215.0200.21L

September 10, 1979

Mr. Joseph Gallo
Isham, Lincoln & Beale
1050 17th St., N.W., 7th Floor
Washington, D.C. 20036

Dear Joe:

You will recall that during the Black Fox Station safety hearings PSO indicated that we were studying alternatives for the mitigation of Intergranular Stress Corrosion Cracking for the recirculation system piping. We have concluded that substitution of 316 stainless steel piping (General Electric Company internal designation 316K) for 304 stainless steel is the most viable alternative and have so informed G.E. Attached is a memo submitted to Mr. M. E. Fate, Jr., presenting the BFS Engineering recommendation and a letter of intent to G.E. documenting the management decision to use 316 (316K) stainless steel.

If you have questions please do not hesitate to contact me.

Very truly yours,

John B. West
Manager, BFS Engineering

1261 322

JBW:br
Attachment

cc:T.N.Ewing
G.W.Muench
J.K.Martin
E.A.Maas
C.J.Ross-Black & Veatch
V.L.Conrad

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SEP 14 1979

Attachment #2

6212DIN8-016-850

PUBLIC SERVICE COMPANY OF OKLAHOMA

A CENTRAL AND SOUTH WEST COMPANY

P.O. BOX 201 / TULSA, OKLAHOMA 74102 / (918) 583-3611

Martin E. Fate, Jr.
Executive Vice President

Public Service Company of Oklahoma
Black Fox Station
NSSS Contract - Quote #86
Recirculation and RHR Suction
Piping Material Modification

Date: July 27, 1979
File: 6212/6912.312.5500.44L

Re: 1. GE letter GSJ-79-842 of June 22, 1979, same subject
2. GE letter GSJ-79-832 of June 11, 1979

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JUL 27 1979
PROJECT
DOCUMENT CONTROL

General Electric Company
175 Curtner Avenue
San Jose, California 95125

Attention: Mr. W. G. Gang, MC395

Gentlemen:

It is the intent of the Company to exercise and contract for Option C (86C), referenced letter one (1). Details of incorporation will be negotiated at a later date to be determined.

Very truly yours,

M. E. Fate, Jr.
Executive Vice President

MEF:JMR:skk

cc: J. B. West
C. E. Benson
A. T. O'Toole
M. J. Robinson
C. J. Ross
L. R. Cannard

1261 323

PUBLIC SERVICE COMPANY OF OKLAHOMA

FOR INTRA-COMPANY CORRESPONDENCE ONLY 6212 DIN 8-017-604

File 6212/6912.215.1412.21L
6212/6912.215.0200.21L

SUBJECT IGSCC Mitigation Alternatives for BFS Reactor Recirculation System DATE July 24, 1979

TO M. E. Fate, Jr. DEPT. Executive OFFICE LOCATION 2-GO

FROM J. B. West EXT. 2761 DEPT. BFS Engr. OFFICE LOCATION 4-GO

Black Fox Station Engineering recommends that Public Service Company replace the 304 stainless steel piping in the BFS Reactor Recirculation System provided by G. E. with 316K material. For their internal purposes General Electric has designated as 316K stainless steel with a closely controlled low carbon, high nitrogen content which is within the code composition limits defined for 316 SS. By closely controlling the carbon content it is possible to retain the resistance to IGSCC of 316L stainless while maintaining the mechanical properties of 316 which are equal to or better than 304 stainless steel. We believe that this option, while the most costly of alternatives, provides the best currently available technical solution to mitigation of IGSCC problems and provides the least economic risk over the design lifetime of the station.

General Electric Company presented to PSO four alternative proposals for mitigation of Intergranular Stress Corrosion Cracking (IGSCC) in the BFS reactor recirculation piping. We have considered three of these proposals as being technically acceptable and have rejected the fourth which incorporates heat sink welding. Of the three acceptable proposals, utilizing complete replacement of 304 stainless steel would provide PSO with the least economic risk due to costs associated with ASME Section XI In-Service Inspection and the potential for field weld repair. The use of 316K also would have ALARA benefit since it would avoid an increase in radiation exposure time due to In-Service Inspection. However, the initial cost for this option is approximately $2,000,000 greater than the option using 304 stainless steel pipeing with corrosion-resistant clad, solution heat treated shop welds and some small 316K spools or transition pieces. While the latter option is regarded as technically acceptable, it would result in an increase in field construction complexity, with 18 corrosion resistant clad field welds per unit and would make In-Service Inspection more difficult.

The third G.E. proposal, while technically adequate, increases substantially the number of welds in the system. There is a significant initial cost increment compared to the CRC/SHT options but with no compensating technical advantage.

The history of IGSCC occurrences prompted G.E. to issue over the last several years a series of recommendations to PSO concerning piping materials, welding and water chemistry control to mitigate IGSCC. In testimony before the ASLB, PSO indicated that G.E.'s recommendations were under study and later we indicated we had reservations regarding the use of Heat Sink Welding (HSW), largely due to the lack of regulatory acceptance and lack of field experience. Based on the high evaluated costs of performing HSW in the erection of the recirculation system, PSO requested that G.E. evaluate and propose additional options to PSO which did not include HSW.

G.E. presented four alternate methods to mitigate IGSCC in the BFS reactor recirculation piping. These four alternate methods are outlined in letter GSJ-79-832 which is attached to this recommendation. The following is a discussion of what I perceive to be the relevant information PSO must consider in the selections of one of these options:

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Option A - Combined use of Solution Heat Treatment, Corrosion-Resistant Cladding, and Heat Sink Welding. This is a no cost quotation to PSO. G.E. has provided this option as part of their BWR/6 improvement program. The use of heat sink welding in this option makes it technically unacceptable to PSO for three reasons:

1. The NRC has defined their regulatory position for this topic in NUREG-0313. This document does not mention heat sink welding as an acceptable IGSCC mitigation technique. Acceptable techniques mentioned include Solution Heat Treating (SHT), Corrosion Resistant Cladding (CRC) or the replacement of 304 and 316 stainless steel materials with low carbon materials not sensitive to IGSCC.

2. BFS Construction personnel and B&V have stated that heat sink welding will be very difficult to accomplish in the field. G.E. has stated that water quality control and heat removal would have to be used to accomplish this type of welding. Heat sink welding has not been used to erect a field piping system.

3. G.E.'s test data indicates that heat sink welding is the least effective IGSCC countermeasure.

NO BWR owner has accepted this option according to information available to PSO (Table I).

Option B - Combined use of shop solution heat treatment, corrosion resistant cladding and the use of some 316K spool pieces. This option would eliminate approximately 37 heat sink welds at a cost of about $280,000 per unit. Major criticism of this option involves the corrosion resistant clad welds for which ultrasonic inspection is significantly more difficult to conduct and interpret. Nine of the CRC welds are field welds for which fit-up and weld repair could potentially cause difficulty. The NRC has accepted the methods utilized in this option in NUREG-0313 and Regulatory Guide 1.44.

Option C - Replacement of the 304 stainless steel reactor recirculation piping with 316K stainless steel. G.E. has quoted costs of about $1.2 million for Unit One and $1.3 million for Unit Two.

This option has the distinct advantages of minimizing the total number of welds in the reactor recirculation system, deleting all heat sink welding and all corrosion resistant clad welds. Since the original 304 material has been delivered to the fabricator this option has the largest economic penalties. G.E. has included in this quote credits for NSSS money for the reactor recirculation piping for fabrication, a $12,000 scrap value of the 304 piping, and an undetermined amount which G.E. allowed as part of their product improvement program. The 316K material is an ASME-accepted material of controlled carbon and nitrogen content.

Option D - The recirculation system would be fabricated with the use of 304 stainless steel and 316K stainless steel. All heat sink welding and corrosion resistant cladding would be deleted. The cost would be about $682,000 per unit.

This option has the advantage of having only 316K to 316K welds to perform. Less time would be required to perform field welding than with the clad welds in Option B. Option D adds twenty-seven additional welds per unit.

Since the potential for IGSCC increases with the number of welds and these additional welds would require Section XI In-Service Inspection, this option is considered to be less desirable than Options B of C.

Additional CRC Weld Considerations

Welds in the Reactor Recirculation System come under ASME Section XI requirements for In-Service Inspection (ISI) and there are some aspects of Option B which must be addressed. Past industry experience indicates that clad welds require two to four times as long to inspect and interpret. This is due to interference of the ultrasonic beam at the weld metal/base metal interface. The increased ISI has been estimated by B&V and is included in the attached cost comparison. The large penalty shown for Options B & D is associated with the number of welds added by these options and with clad weld ISI difficulties. In addition, since the Reactor Recirculation System is one of the highest radiation areas in the station, any increase in the inspection requirements would contribute to occupational exposure. No man-rem cost penalty was included in the B&V cost comparison.

Cost Comparison

Table I, attached, indicates that of the three technically acceptable Options (B,C, and D) that Option B is the most cost effective. This cost analysis uses B&V's previous estimates for field heat sink welding. Also attached as Table II is the present status of BWR's under construction, awaiting CP's or LWA's.

I would appreciate the opportunity to discuss this recommendation with you at your convenience.

John B. West

JBW:br
Attachments

cc: T.N.Ewing
G.W.Muench
V.L.Conrad
J.R.Corn
J.M.Royce

TABLE I

BWR RR PIPING STATUS

PLANT	304 STATUS	REPLACEMENT STATUS
*ALLENS CREEK	IN FABRICATION	QUOTE LIKELY TO GO 316K
BLACK FOX (TWO UNITS)	MATERIAL DELIVERED FABRICATION ON HOLD	FOUR OPTIONS
CLINTON	DELIVERED TO SITE	WILL USE CRC AND 316K RISERS NO HSW ACCEPTED
GRANDGULF 1	DELIVERED TO SITE	304 INSTALLED WITH CRC
*GRANDGULF 2	DELIVERED TO SITE	WILL REPLACE WITH 316K
*HARTSVILLE (FOUR UNITS)	DELIVERED TO SITE	WILL REPLACE WITH 316K
HOPE CREEK	BEING INSTALLED	CRC FOR ALL WELDS
*LIMERICK	DELIVERED TO SITE	WILL REPLACE WITH 316K
*NINE MILE 2	IN FABRICATOR'S SHOP	QUOTED-LIKELY TO GO 316K
PERRY 1	BEING INSTALLED	CRC FOR ALL WELDS
PERRY 2	DELIVERED TO SITE	CRC FOR ALL WELDS
*PHIPPS BEND (TWO UNITS)	IN FABRICATION	WILL REPLACE WITH 316K
RIVERBEND	DELIVERED TO SITE	NOT YET QUOTED
SKAGIT	DELIVERED TO SITE	NOT YET QUOTED
FERMI 2 LASALLE SHOREHAM HANFORD 2 SUSQUEHANNA	VARIOUS STAGES OF INSTALLATION AT PLANT SITE	SHT ON RISERS, SOME OF THESE PLANTS HAVE CRC ON RISERS

*8 UNITS 316K
*2 UNITS LIKELY TO GO 316K

1261 327

WORKING FILE

GENERAL ELECTRIC

NUCLEAR ENERGY

PROJECTS DIVISION

GENERAL ELECTRIC COMPANY, 175 CURTNER AVE., SAN JOSE, CALIFORNIA 95125
MC 395, (408) 925-3129

June 11, 1979
GSJ-79-832

6212 DIN 8-016-247
6212-312-5500.440

RMB
COPIES TO
JMRoyce
JBW
JBP
RJK
Letter Only
WJK
BJG
HHE
B&V
JRC

Mr. T. N. Ewing
Project Manager
Black Fox Station Nuclear Project
Public Service Company of Oklahoma
P. O. Box 201
Tulsa, OK 74102

RECEIVED AND FILED
JUN 14 1979
PROJECT DOCUMENT CONTROL

Attention: J. B. West/J. K. Martin

Gentlemen:

SUBJECT: INTERGRANULAR STRESS CORROSION CRACKING COUNTERMEASURES (IGSCC) FOR BLACK FOX RECIRCULATION PIPING SYSTEM

Reference: GE letter GSJ-78-592, from W. G. Gang to T. N. Ewing, dated 7/24/78

The purpose of this letter is to describe the various options for the recirc piping IGSCC for Black Fox Station. A quote is now being prepared for PSO consideration for each of these options. The options are as follows:

Option A Recirc piping system would be fabricated to the IGSCC AID 40-78 which includes solution heat treat (SHT), corrosion resistant clad (CRC) and heat sink welding (HSW). AID 40-78 was transmitted to PSO by the referenced letter.

Option B Recirc piping would be fabricated with SHT, CRC and some material replacement with 316K stainless steel. This option deletes all HSW and decreases the number of CRC weld joints. Details of this option are given in Figure 1 (attached).

Option C This option is a complete new system fabricated from 316K material. This approach deletes all HSW and CRC and minimizes the number of weld joints. The reference document for this option is the present Recirculation Loop Piping Purchase Part Drawing 762E843 (B33-G001). This document has been previously transmitted to Black and Veatch and PSO.

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Option D This option would be to modify the existing Type 304 piping system by adding 316K short spool pieces (pups) and fittings to delete all HSW and CRC weld joints. Details of this option are given in Figure 2 (attached).

The 316K material for Options B and D are shown by the cross-hatching on attached figures. The 316K material is a GE designation for 316 stainless steel with special requirements to meet the recirculation piping application.

The above options also will cover the RHR suction line. The RHR suction line has a 304 stainless steel spool piece between the recirc tee and the vertical elbow of the RHR suction line (see GE Drawing 112D1470). For Option A, the spool will be CRC at the weld joints. For Options B, C and D, the spool will be replaced with a 316K spool.

The quotation for the above options are scheduled to be transmitted to PSO during the week of June 18. Due to the time limitations on the piping vendor quotations, the quote will be valid only until July 27, 1979.

If you have any questions or concerns about the above options, please contact Mr. G. L. Hayes at (408) 925-2374 at your earliest convenience.

Very truly yours,

G. L. Hayes
for

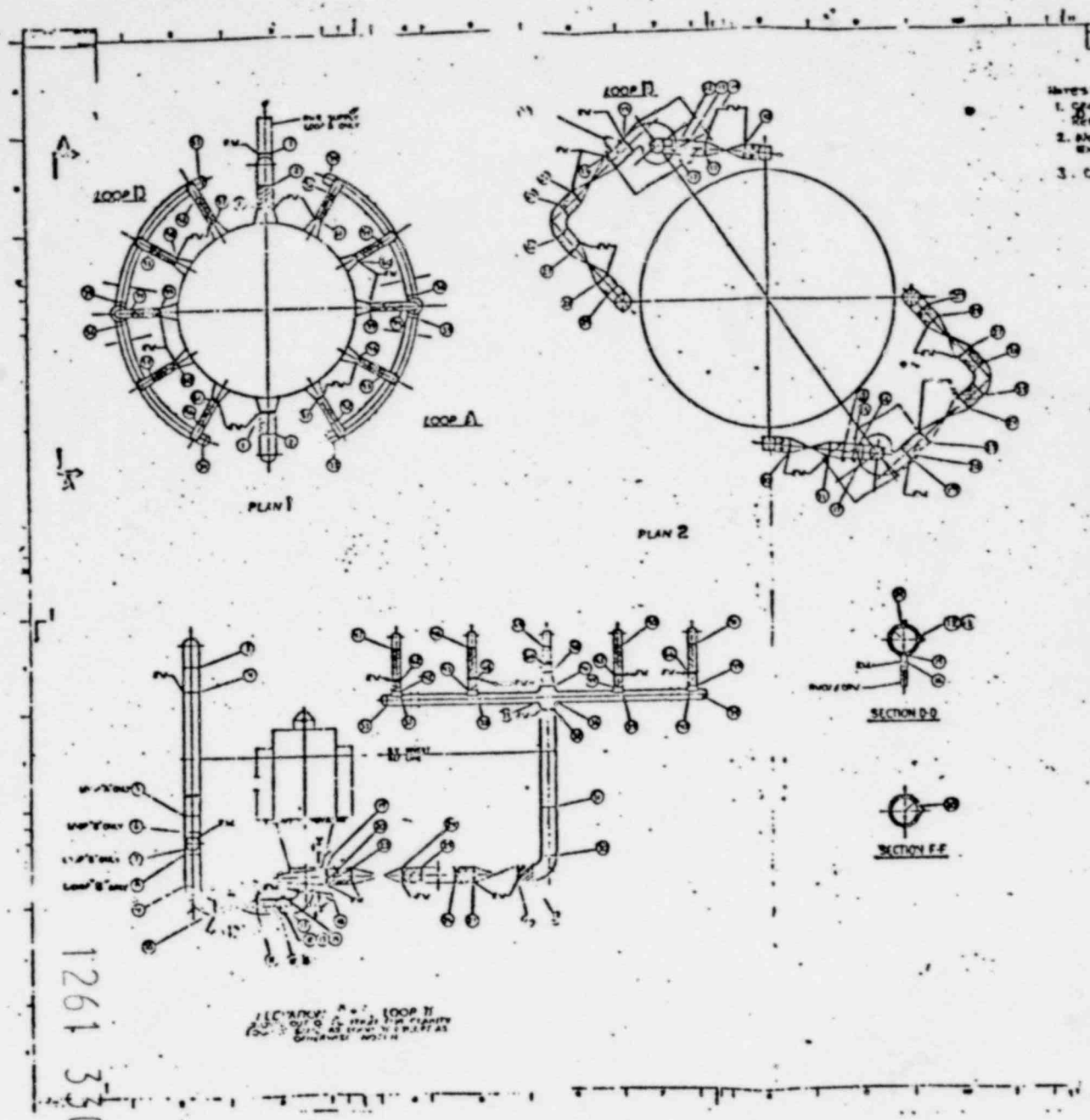
William G. Gang
Project Manager
Black Fox Project

WGG:bjr/1177-78

Attachment

cc: J. R. Corn, (PSO), w/attach
Dr. M. J. Robinson, w/attach.
L. R. Cannard, w/attach.
C. J. Ross, (B&V), w/attach.
J. M. Royce (PSO), w/attach.

FIGURE 1 - DESIGN MEMO 125-19



NOTES:
1. CROSS-HATCHED PIPING PIECES SHALL BE REPLACED WITH TYPE 316L MATERIAL
2. WELDS OCCUR IN BOTH LOOPS "A" AND "B" EXCEPT AS INDICATED
3. CRC SHALL BE ACCORDANCE TO PONTTSAI

TABLE I - IGSCC MITIGATION APPLIED BY FABRICATOR

WELD	SHT	CRC	316L	WELD	SHT	CRC	316L
1			X-D	34	X		
2	X		X-U	35	X		
3	X			36		X	
4		X		37	X		
5A		X		38	X		
6B		X		39	X		
7B		X-U		40	X		
8B	X			41	X		
9	X			42	X		
10		X-U		43	X		
11		X-D		44	X		
12	X			45	X		
13	X			46	X		
14	X			47	X		
15	X			48	X		
16		X-U		49	X		
17	X			50	X		
18		X-U		51	X		
19			X-D	52	X		
20	X			53	X		
				54	X		
				55	X		
23			X-U	56	X		
24			X-D	57			X-U
25	X		X-U	58			X-U
26	X		X-D	59			X-U
27			X-U	60			X-U
28			X-D	61			X-U
29	X		X-U	62			X
30	X			63			X
31		X		64			X
32		X		65			X
33	X			66			X

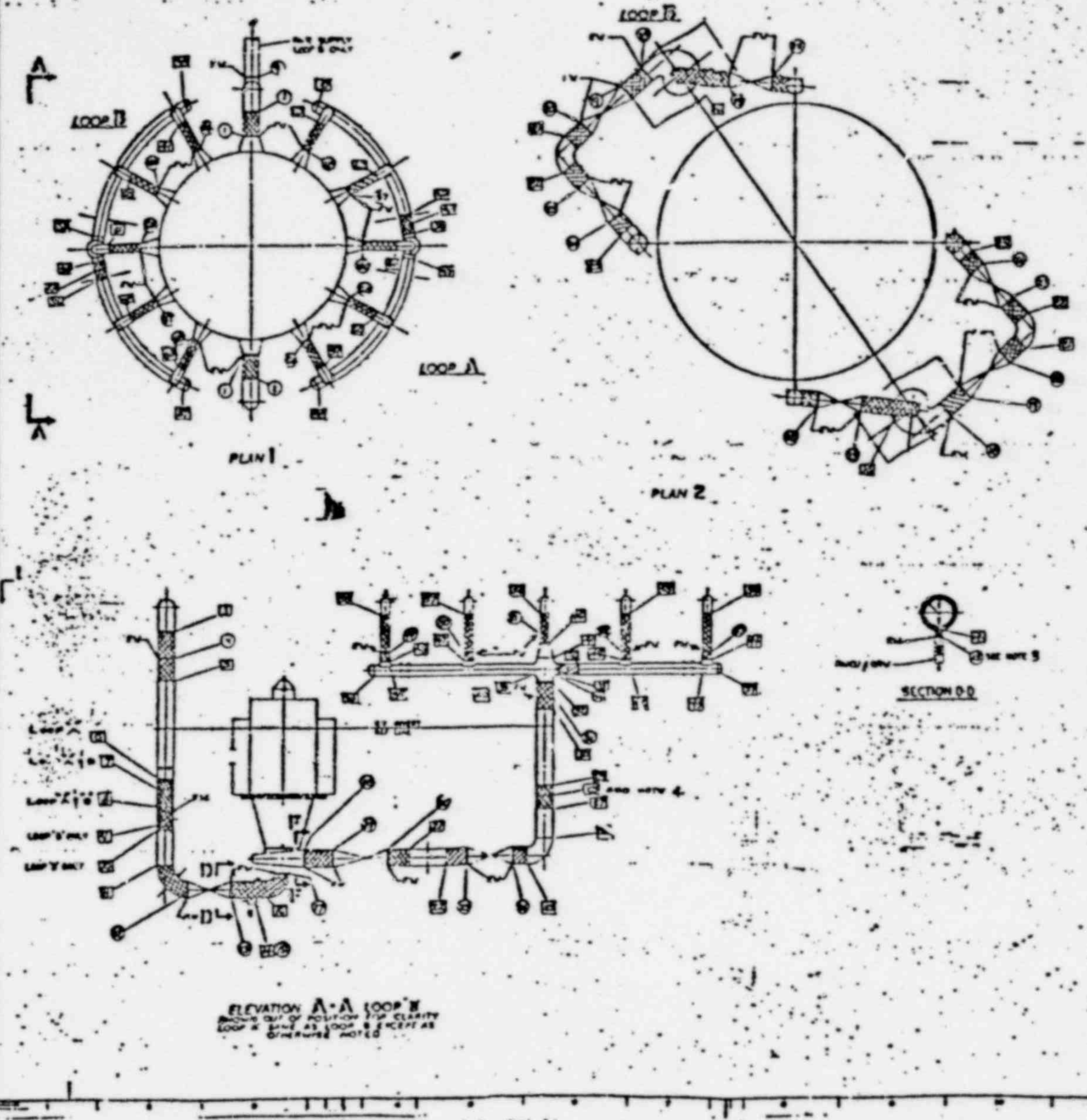
FIGURE 1 - DESIGN MEMO 125-19

SECURITY FILE

Attachment to 8-016-247
B.A.P. - 75-832

POOR ORIGINAL

1261 330



NOTES: (FOR TABLE 1)

1. Requirements are for circumferential butt welds and contour nozzle welds only.
2. Welds occur in both Loops A and B except as indicated.
3. Pipe to contour nozzle weld: 316K Nozzle-G.E. scope: Pipe - A.E. Scope.
4. Welds 27, 28 and 29 may not be present in the actual configuration. These welds may be allowed in some cases to achieve SHT of other welds when the spool lengths are too great to be accommodated by the furnace and/or quench tank.

LEGEND

- Field Welds
F.W. - Field Weld
SHT - Solution Heat Treatment
316K Pipe & Fitting -
304 Pipe & Fitting -
IGSCC - Intergranular Stress Corrosion Cracking
- Shop Welds
BASIS - BWR 6 - 238 Std. Plt. - DWG. 762E843 Rev. 0

TABLE 1 - Shop Welds to be solution heat treated.

[illegible]

POOR ORIGINAL

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of the Application of	)	
Public Service Company of Oklahoma,	)	
Associated Electric Cooperative, Inc.	)	Docket Nos. STN 50-556
and	)	STN 50-557
Western Farmers Electric Cooperative	)	
	)	
(Black Fox Station, Units 1 and 2)	)	

CERTIFICATE OF SERVICE

I hereby certify that the following:

Letter to the Atomic Safety and Licensing Board from Joseph Gallo, dated September 27, 1979

in the above-captioned proceeding was served upon the persons shown on the attached list by depositing copies thereof in the United States mail, first class postage prepaid, this 27th day of September, 1979.

Joseph Gallo
JOSEPH GALLO
One of the Attorneys
for the Applicants

Sheldon J. Wolfe, Esquire
Atomic Safety and Licensing
Board Panel
U.S. Nuclear Regulatory
Commission
Washington, D.C. 20555

Mr. Frederick J. Shon, Member
Atomic Safety and Licensing
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Washington, D.C. 20555

Dr. Paul W. Purdom, Director
Environmental Studies Group
Drexel University
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Docketing and Service Section
Office of the Secretary of
the Commission
U.S. Nuclear Regulatory
Commission
Washington, D.C. 20555
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Tulsa, Oklahoma 74103

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General Manager
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1261 333