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50-316 Donald C. Cook Nuclear Power Plant, Unit 2, Indiana & 05000316
AUTH.NAME AUTHOR AFFILIATION
DOLAN,J.E. Indiana & Michigan Power Co.
RECIP.NAME RECIPIENT AFFILIATION
DENTON,H.R. Office of Nuclear Reactor Regulation

SUBJECT: Provides info on PWR feedwater lines in response to V Stello 790525 request.

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JUN 26 1979

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INDIANA & MICHIGAN POWER COMPANY

P. O. BOX 18
BOWLING GREEN STATION
NEW YORK, N. Y. 10004

June 21, 1979
AEP:NRC:00215

Donald C. Cook Nuclear Plant Unit Nos. 1 and 2
Docket Nos. 50-315 and 50-316
License Nos. DPR-58 and DPR-74

RETURN TO REACTOR DOCKET FILES

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Denton:

The attachment to this letter contains the information requested by Mr. V. Stello, Jr. of your staff in his letter of May 25, 1979 which we received on May 31, 1979. Details of AEP's investigation into the cause(s) of the cracks are contained in our AEP:NRC:00216 submittal dated June 7, 1979.

As the information transmitted herein has been requested by the NRC staff, AEPSC interprets 10 CFR Part 170 Subsection 22 as requiring that no fee accompany this submittal.

Very truly yours,

John E. Dolan
John E. Dolan
Vice President

JED:em

Sworn and subscribed to before me
this 21st day of June, 1979 in
New York County, New York

Kathleen Barry
Notary Public

KATHLEEN BARRY
NOTARY PUBLIC, State of New York
No. 41-4606792
Qualified in Queens County
Certificate filed in New York County
Commission Expires March 30, 1981

cc: (ATTACHED)

A001
5/1
DRWGS ADVANCED
TO ENG BR

7906250291 P

cc: R. C. Callen
G. Charnoff
R. S. Hunter
R. W. Jurgensen
D. V. Shaller-Bridgman

ATTACHMENT 'A' TO AEP:NRC:00215

[illegible]

INFORMATION REQUESTED ON PWR FEEDWATER LINES

DESIGN

REQUEST/QUESTION NO. 1

Provide as-built piping or isometric drawings of the feedwater line to steam generator sparger within containment. Show details of the design such as dimensions, pipe schedule, support type and locations, pipe restraints, and valve(s).

RESPONSE

As-built drawings of the feedwater line, pipe support locations and support details are shown on the attached drawings.

UNIT NO. 1 DRAWINGS

1-5799-1
1-5799-2
1-5799-2A
1-5799-3
1-5799-4
1-5800-1
1-5800-2
1-5800-3
1-5800-4
1-5800-4A
1-5800-5
1-5800-6
1-5800-7
1-5800-8
1-5800-9
1-5800-10
1-5800-10A
1-5800-11
1-5800-12
1-5296-9
1-GFW-11
1-GFW-13
1-GFW-16
1-GFW-18
1-FW-11
1-FW-13
1-FW-16
1-FW-18

UNIT NO. 2 DRAWINGS

2-5799-1
2-5799-2
2-5799-2A
2-5799-3
2-5799-4
2-5800-1
2-5800-2
2-5800-3
2-5800-4
2-5800-5
2-5800-6
2-5800-7
2-5800-8
2-5800-9
2-5800-10
2-5800-10A
2-5800-11
2-5800-12
2-5296-6
2-GFW-74
2-GFW-75
2-GFW-76
2-GFW-77
2-FW-74
2-FW-75
2-FW-76
2-FW-77

The drawings listed above are contained in Attachment 'B' to this letter.

REQUEST/QUESTION NO. 2

Provide the results of any stress or fatigue analyses which were performed for this system.

RESPONSE

In 1970, on behalf of AEP, Sargent & Lundy performed a stress analysis of the feedwater lines for the Donald C. Cook Station Unit-1. The analysis conformed with the Preliminary Safety Analysis Report (PSAR), the Power Piping Code (USAS B31.1, 1967) and the Nuclear Piping Code (ANSI 31.7, 1969) and other state-of-the art design-analysis techniques for fatigue analysis, plastic analysis, etc.

The final results of stress analysis met all design provisions for the above mentioned documents.

In evaluating the fatigue life of the feedwater piping, a simplified elastic-plastic analysis in accordance with B31.7 was performed for the essential nodal points, (anchors, elbows and branch points) where the primary plus secondary stress intensity (S_n) exceeded the ($3S_m$) level.

The following thermal cyclic loadings were applied:

(a) Plant unloading
(b) Plant loading
(c) Hot standby
(d) Loss of Load for Full Power
(e) Reactor Trip Out from Full Power

The stress analysis of the feedwater lines was performed on the basis of extremely conservative data and design information in the following areas:

1. Loading Combinations based on the worst steam generator nozzle displacement movement due to postulated coolant piping ruptures.

2. Thermal Gradient Analysis, based on a severe fluid temperature change and a high film coefficient (h=2000).

Based on the imposed loads, the cumulative usage factor for load cases (d) and (e) above (the governing thermal transient loadings) was calculated. It was found that the cumulative usage factor (U) was less than 1.0 and that the piping met the analysis requirements of ANSI 31.7, 1969.

The original stress analysis of the elbow to nozzle junction was based on schedule 80 pipe. Sargent and Lundy has reviewed the original analysis to determine the effect of the as built local thickness of schedule 60. Our conclusion is that the original conclusion of meeting all design analysis code requirements is unchanged.

FABRICATION HISTORY

REQUEST/QUESTION NO. 1

Supply a list of the materials for the steam generator sparger, steam generator feedwater nozzles and feedwater piping within containment.

RESPONSE

The following is the list of materials used at Cook:

Steam Generator Sparger	A-106 Grade B
Steam Generator Nozzle	SA-508 Cl. 2
16" Elbow	A-234 Grade WPB
16" x 14" Reducer	A-234 Grade WPB
14" Pipe	A-106 Grade B

REQUEST/QUESTION NO. 2

Provide the details of the welding process(es) used to make the nozzle-to-pipe, pipe to sparger and piping welds. Include details of welding such as preheat, joint configuration (include with or without backing ring), and post weld treatment, if any.

RESPONSE

We have replaced the feedwater line elbows that are attached to the Steam Generator nozzles. The original welds on Unit 1 were a shielded metal arc weld using E7018 electrodes and backing rings. A preheat of 50°F minimum and a post weld heat treatment of 1150°F minimum for 1 hour was used. On Unit 2 Steam Generator Nos. 2, 3, and 4 nozzle to pipe elbow welds were made in the same manner. The nozzle to pipe elbow joint on Steam Generator No. 1 used an open root gas tungsten arc weld utilizing carbon steel filler metal. On Unit 2 the preheat was the same as Unit 1 and the post weld heat treatment was maintained between 1150 and 1200°F for one hour minimum. The geometry of the end preparation for both the nozzle and the elbow is shown in Figure 1.

The nozzle to elbow welds for the replacement elbows in both units were made with an open butt weld. The root pass was a gas tungsten arc weld using E 70S-2 electrodes, followed by a shielded metal arc weld fill of E 7018. The weld cap is E 70S-2. Preheat was 300°F minimum and post weld heat treatment was maintained between 1100 and 1150°F for one hour minimum. The end preparation geometry for both the nozzle and the elbow is 37 ½°bevel with a small extended land.

There are no welds connecting the feedwater piping to the Steam Generator sparger. The thermal sleeve is connected to the sparger by a butt weld located inside the Steam Generator and the thermal sleeve is force fit into the feedwater nozzle.

REQUEST/QUESTION NO. 3

Provide the NDE performed during and after fabrication of the weld joints requested in Question 2.

RESPONSE

The following NDE examinations were performed on the elbow-to-nozzle welds on the feedwater lines at the D. C. Cook Plant Unit Nos. 1 and 2.

(1) Fit-up inspections and visual root inspections were performed on each weld.

(2) Acceptable radiographic examinations were performed prior to post-heat treatment on each weld.

(3) Acceptable radiographic examinations were performed on the Unit No. 1 elbow-to-nozzle welds following post-heat treatment.

A summary of the inspections performed on the elbow-to-nozzle welds is shown in the following Table:

	Fit-up Inspection	Root pass Inspection Visual	Final RT Inspection RT prior to Stress Relief	Stress Relief	Final inspection RT following post-heat
SG*-11	x	x	x	x	x
SG-12	x	x	x	x	x
SG-13	x	x	x	x	x
SG-14	x	x	x	x	x
SG-21	x	x	x	x	o
SG-22	x	x	x	x	o
SG-23	x	x	x	x	o
SG-24	x	x	x	x	o

x = performed

o = not performed

* = Steam Generator - "first digit is the Unit number, second digit is the loop number"

REQUEST/QUESTION NO. 4

Provide the Code edition to which the feedwater piping system was fabricated.

RESPONSE

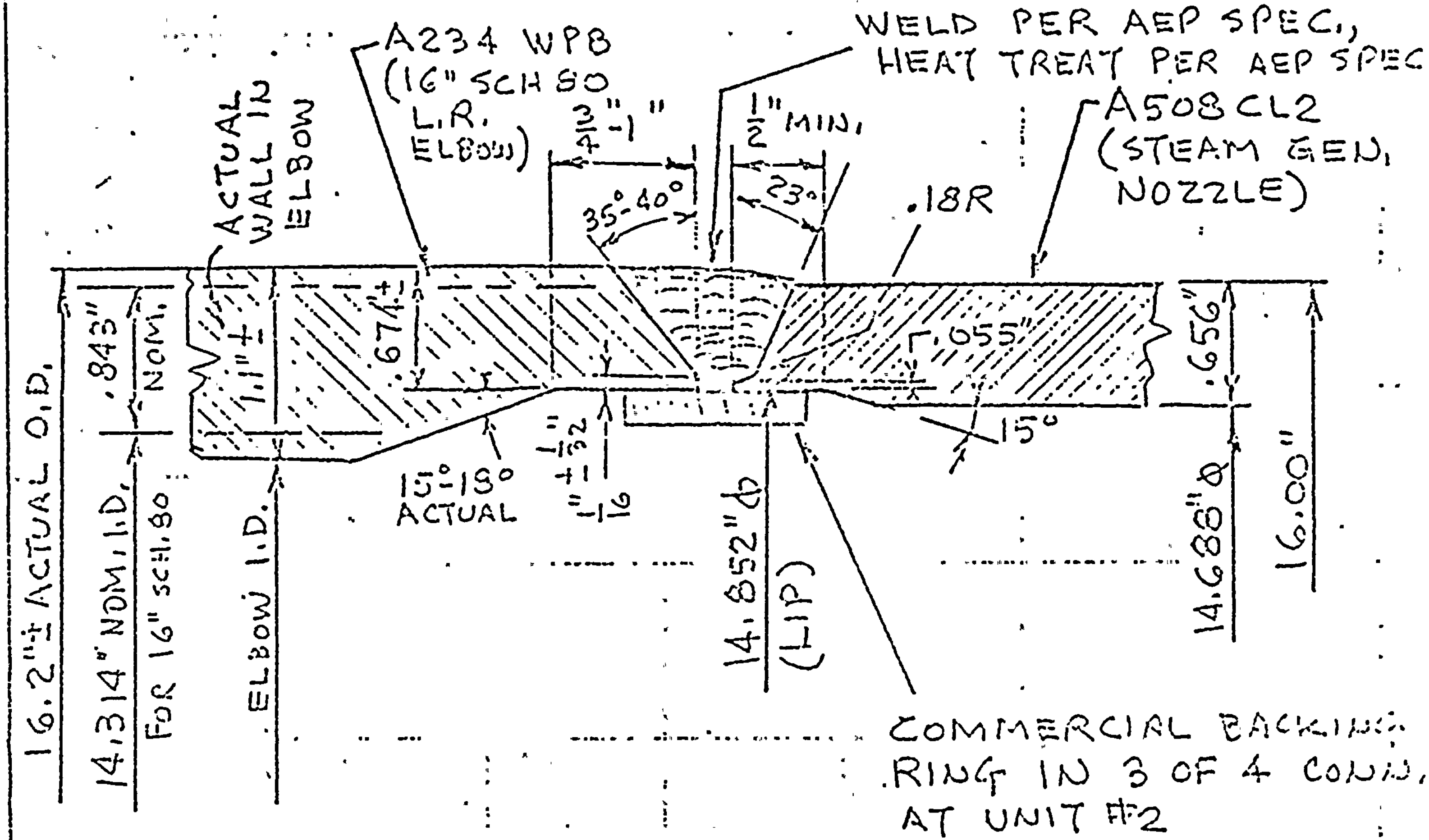
The feedwater piping inside containment was designed to the 1967 Edition of The B31.1 Code and erected to the 1969 Edition of the B31.7 Code.

REQUEST/QUESTION NO. 5

State the fracture toughness requirements, if any, for the feedwater piping system.

RESPONSE

There are no fracture toughness requirements for the feedwater piping.



FULL SCALE SECTION OF EXISTING WELD BETWEEN 16" SCH. 80 L.R. ELBOW IN AEP FEEDWATER LINE AND 16" SCH 60 WELD CONNECTION OF (W) STEAM GENERATOR

$t_{min.}$ PER ANSI B31.1 = .563" FOR A234 WPB STL.

$t_{min.}$ PER ANSI B31.1 = .425" FOR A508 CL.2 STL.

t_{WELD} = .674"±

PIPE SYSTEM FEEDWATER		DR. SH	PLANT D.C. COOK PLANT / SH. __ OF __
REF. DWGS.	REV. △1 6/4/79	CK. NB	MSK-53179 A REV. No △1
		DATE [illegible]	

PRESERVICE/INSERVICE INSPECTION AND OPERATING HISTORY

REQUEST/QUESTION NO. 1

State whether the feedwater system welds received a preservice inspection in accordance with ASME B&PV Code, Section XI.

RESPONSE

Feedwater system welds did not receive a preservice inspection in accordance with ASME B&PV Section XI. At the time D. C. Cook was licensed, Section XI was not required for preservice inspections. Base line radiographs of all field and shop welds on the Class II feedwater piping were taken in accordance with the AEP Piping Specification.

REQUEST/QUESTION NO. 2

Provide the extent of inservice inspection performed on the feedwater pipe to steam generator nozzle welds. Include the results of the examinations, any corrective actions taken and the causes of any failures.

RESPONSE

No inservice inspection had been performed on the feedwater pipe to nozzle welds of D. C. Cook Units 1 and 2 prior to the discovery of the cracks on Unit 2 nozzle welds.

REQUEST/QUESTION NO. 3

Provide the schedule and extent of inservice inspection for the feedwater system for the next inspection interval.

RESPONSE

Southwest Research Institute is preparing a "10-year inservice inspection program for class 2 and 3 components" (which includes the feedwater system) in accordance with ASME Section XI for D. C. Cook Units 1 and 2.

REQUEST/QUESTION NO. 4

Provide any history of water hammer or vibration in the feedwater system and design changes and/or actions taken to prevent these occurrences.

RESPONSE

As reported during our presentation to the NRC on June 11, 1979, there was no observable evidence of water hammer damages on Unit 1 prior to January, 1976 - although there were several occurrences heard. On January 2, 1976, we discovered water hammer damage in Unit 1 on Steam Generator No. 4 feedwater line. This event caused damage to two snubbers which have been repaired. A second water hammer in Unit 1 occurred on March 10, 1977. This resulted in the failure of two snubbers outside and one inside containment on the Steam Generator No. 1 feedwater line, and a small crack was found in the auxiliary feedwater line to Steam Generator No. 2.

On June 24, 1978, Unit 1 returned to service with J-tubes installed in each Steam Generator. There has been no further evidence of water hammer on Unit 1.

Unit 2 Steam Generators were initially put in service with J-tubes. There has been no evidence of water hammer on Unit 2.

An administrative limit of 150 GPM to each Steam Generator auxiliary feedwater flow has been set whenever the Steam Generator level is below the feedwater ring.

The NRC on March 14, 1979 issued a Safety Evaluation which concluded that, "the means for reducing the potential for steam generator water hammer at this facility are adequate. These means are, therefore, acceptable to the staff and no further action is required of the licensee....".

REQUEST/QUESTION NO. 5

Provide a description of feedwater chemistry controls and a summary of chemistry data.

REQUEST/QUESTION NO. 5 (CONT'D.)

RESPONSE

Following is a description of the feedwater chemistry controls for the Cook units and feedwater chemistry summary data.

Feedwater dissolved oxygen is removed and pH controlled by feeding hydrazine and ammonium hydroxide respectively. Both are injected at the condensate booster pump suction. Hydrazine feed is adjusted manually depending on the hydrazine values determined at the common feedwater inlet to a unit's steam generators. The control range specified is 3-5 ppb residual at the feedwater inlet sample point.

Ammonium hydroxide (NH_4OH) feed is controlled automatically to obtain a feedwater pH range of 8.8-9.2 (and a pH range of 8.5 to 9.0 in the steam generators). Ammonia values are determined daily on grab samples of feedwater to verify that the correlation of NH_4OH concentration, pH, and total conductivity (which is used to control NH_4OH feed) agrees with the theoretical relationship.

The recorded feedwater (and condensate) decationized conductivity are used to detect condenser leakage or other cycle contamination. Grab sample analyses are made daily to check the recorded values. Sodium and chloride are also determined daily on grab samples to monitor for leakage or other possible cycle contamination.

Weekly determinations of suspended solids, iron and copper indicate the amount of cycle corrosion product pick-up from system components, e.g. feedwater piping and condenser tubing, etc. Suspended solids also give an indication of insoluble material contamination from other sources, e.g. condenser leakage.

Silica is determined weekly to verify that the quantity present is neglible thereby insuring low values in the steam generators to minimize the quantity carried over in the steam.

Tritium and gross beta/gamma, determined as necessary, are used to detect incipient primary to secondary leakage or cycle contamination from other such radioactive sources.

FEEDWATER CHEMISTRY DATA SUMMARY

A thorough review of dissolved oxygen data for both the Cook Units has shown no extremely high dissolved oxygen levels for any extensive period at the feedwater inlets to the steam generators. Most of the time the dissolved oxygen values have been below 10 ppb. Rarely have they exceeded 30 ppb except during unit start-ups and similar cycle operations.

During unit startups, and hot standby, the auxiliary feedwater pump(s) which take suction directly from the condensate storage tanks are used to supply makeup water to the steam generators. The condensate storage tank dissolved oxygen levels have generally ranged from 1 to 3 ppm.

The pH value for both units has been maintained within the 8.8-9.0 limits except during unit startup and for very short periods of condenser inleakages, or makeup water quality deterioration.

Decationized conductivities have averaged 0.55 to 0.65 μmho. Maximums as high as 2.0 μmho have occurred during unit startups and as high as 1.25 during condenser inleakages or makeup excursions.

Sodium and chloride values have been below 500 ppb except during periods of condenser leakage or makeup plant upsets.

Upon indication of cycle contamination immediate action has been taken to restore feedwater chemistry to the normal range.

ATTACHMENT 'B' TO AEP:NRC:00215

ADVANCED TO ENGINEERING BR