

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING APPEAL BOARD

In the Matter of

SACRAMENTO MUNICIPAL UTILITY DISTRICT

(Rancho Seco Nuclear Generating Station)

Docket No. 50-312 (SP)

MOTION OF THE NRC STAFF TO FILE ITS
SUPPLEMENTAL RESPONSE ON RADIOGRAPHIC
EXAMINATIONS OF UNMODIFIED HPI NOZZLES BY MARCH 31, 1983

Roy P. Lessy
Deputy Assistant Chief
Hearing Counsel

January 10, 1983

DESIGNATED ORIGINAL

Certified By

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PDR ADOCK 05000312
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I. INTRODUCTION

In a "Memorandum and Order" dated December 29, 1982, (hereinafter "Order") this Appeal Board directed the Staff to file a supplemental affidavit on the question of the frequency of radiographic examinations on two unmodified HPI nozzles (nozzles C and D). For the reasons discussed below, the Staff now moves the Appeal Board to modify the filing date for its supplemental response to March 31, 1983.

II. BACKGROUND

As part of its continuing sua sponte review of this matter, this Appeal Board in its Order directed the Staff to file a supplemental response to the "Affidavit of Robert A. Dietrich" dated December 14, 1982. In that affidavit, Mr. Dietrich did not agree with the Appeal Board's tentative conclusion in ALAB-703, 16 NRC ____, Slip Op. pp. 12-14, (November 23, 1982) (hereafter ALAB-703) that the two unmodified HPI nozzles (C and D) should undergo radiographic examinations at each

refueling outage until such time as they have been either replaced or modified in the same manner as nozzles A and B. While agreeing to conduct such radiographic inspections at the next refueling outage, now scheduled for February of 1983, the licensee proposed to conduct such further inspections at the third refueling outage, and thereafter, at every fifth refueling outage.

In response to ALAB-703,^{1/} the Staff filed the Affidavit of Dr. Shou-Nien Hou, the Principal Mechanical Engineer of the Mechanical Engineering Branch of the Office of Nuclear Reactor Regulation. Dr. Hou stated therein that the B&W Regulatory Response Owners Group had established a Task Force to consider a generic resolution of loose sleeve and nozzle cracking problems.^{2/} Dr. Hou advanced the interim Staff position in his affidavit that until a generic resolution of the issue was achieved between the NRC Staff and the aforesaid B&W Owners Group, the Staff agreed with the tentative conclusion of the Appeal Board regarding the necessity of radiographic inspections at each refueling outage. In its Memorandum and Order of December 29, 1982, the Appeal Board found Dr. Hou's affidavit

1/ See ALAB-703 supra, Slip Op. p. 14.

2/ Indeed, the Commissioners have been informed of this issue, prior to ALAB-703, and the relationship of this matter not only to Rancho Seco, but B&W plants generally. See attached Memorandum from W.J. Dircks to the Commissioners, SECY-82-186 (May 7, 1982); attached Memorandum from W.J. Dircks to the Commissioners, SECY-82-186A (July 23, 1982).

to be "of limited assistance" for the following three reasons: (1) it failed to comment upon the reasons underlying Mr. Dietrich's position, as above described; (2) it failed to explain the reasons underlying its interim position of agreeing with the Appeal Board's tentative conclusions regarding the need for radiographic inspections at each refueling outage; and (3) it failed to inform the Appeal Board of the "precise inspection intervals the Task Force deems appropriate." Order, pp. 3-4.

III. DISCUSSION

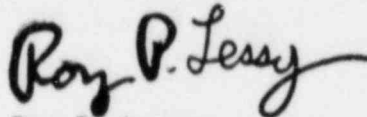
It was the Staff's intention in Dr. Hou's December 23, 1982, affidavit to set forth the Staff's interim position on the Appeal Board's tentative conclusion, pending a generic resolution of this matter in the context of the ongoing dynamic process, outlined in SECY-82-186 and SECY-82-186A, between the B&W Owners Group and the NRC Staff. If Dr. Hou, to use the Appeal Board's phrase, left the Appeal Board "entirely in the dark respecting the precise inspection intervals the task force deems appropriate" the reason is the task force has not yet issued its report on this subject, although such a report is expected by the beginning of February, 1983. The Staff, however, can now state that the preliminary conclusions of the task force regarding unrepaired HPI nozzles, such as Rancho Seco nozzles C & D, would be to conduct radiographic examinations during the next five refueling outages, and then at every fifth refueling outage thereafter. Once the task force report is issued, it would then be up to each individual licensee to either adopt the recommendations of the report or explain its contrary position, if such contrary positions still remain extant. It is expected that individual

licensee's responses to the task force recommendations would be completed by the end of February, 1983. It would thus have been premature for Dr. Hou in December either to have reported on the task force's recommendations or to have specifically filed a rebuttal to Mr. Dietrich's position. It is still premature to do so. We do not know what SMUD's final position on this matter will be once the task force report has been issued, and has been considered by the licensee. Since the task force report has not yet been issued, the NRC Staff does not yet have a recommendation from that group to review.

A viable solution to this problem is for the Staff to file its final, rather than interim, response to ALAB-703 once the deliberative process involving the B&W Owners Group has been completed. At this point, the supplemental Staff filing directed by the Appeal Board, which would include a delineation and explanation of the Staff's position on this matter, could be made by the Staff by the end of the first quarter of this year. To prepare for the contingency that SMUD will maintain its current position on this matter in the face of a B&W owner's group report that may be somewhat different from the SMUD position, the Staff has requested additional information from SMUD regarding the underlying technical bases of Mr. Dietrich's December 14, 1982 affidavit. Armed with such information, the Staff will be in a better position to subjectively comment upon and critique Mr. Dietrich's affidavit, assuming such an exercise is not mooted by a subsequent change of position by SMUD. Moreover, once the Staff has completed its review of the task force report, it will then be in a position to explain in more detail the reasons supporting its formal position on this matter.

In accordance with the above discussion, the Staff hereby moves the Appeal Board to extend its response date to the Appeal Board's Order to March 31, 1983. This is the same date by which the Staff has previously committed to complete and report upon its review of the licensee's proposed modifications to the auxiliary feedwater system -- the other open issue from ALAB-703. No harm will flow from this extension inasmuch as SMUD has already committed to conduct radiographic examinations of nozzles C & D at its February, 1983 refueling outage (See Affidavit of Robert A. Dietrich, December 13, 1982), and the subsequent refueling outage is not scheduled for approximately eighteen months thereafter.

Respectfully submitted,



Roy P. Lessy
Deputy Assistant Chief Hearing
Counsel

Dated at Bethesda, Maryland
this 10th day of January, 1983

May 7, 1982



SECY-82-186

POLICY ISSUE (Information)

For: The Commissioners

From: William J. Dircks
Executive Director for Operations

Subject: STATUS OF MAKE-UP NOZZLE CRACKING IN BABCOCK & WILCOX
(B&W) PLANTS

Purpose: - To inform the Commission of the current status of the
make-up nozzle cracking problem in B&W plants.

Discussion: Since early February 1982, all eight of the B&W plants
licensed to operate have completed inspections on the high
pressure injection (HPI) and make-up nozzles for evidence of
degradation initially discovered at the Crystal River Unit 3
(CR-3) plant. Cracking has been found in make-up nozzles
of four of the B&W plants.

For all B&W plants, except Oconee, the normal make-up nozzle
is one of four nozzles to the cold leg of the reactor coolant
system that are used in the event HPI is required. At Oconee,
two of the four lines are used for normal make-up. The make-up
line is a "double-duty" line in that it is used for normal
primary coolant make-up in addition to its HPI function.
Thermal sleeves are installed within all of the HPI/make-up
nozzles to protect the nozzles from the effects of cool water
from the make-up tank or borated water storage tank thermally
shocking the nozzles that are in contact with hot reactor
primary coolant water. A typical thermal sleeve design for
B&W plants is shown in Figure 1.

The make-up nozzle at CR-3 and Rancho Seco, and one of the
two make-up nozzles at each of the Oconee Units 2 and 3
exhibited degradation. The other three nozzles to the reactor
coolant system did not display cracks. Inspections have been
completed at Oconee 1, Davis-Besse 1, Three Mile Island, Unit 1
and ANO-1 with no degradation detected in any of the nozzles.
The cracks found in the make-up nozzle at CR-3, Oconee 2 and 3
and Rancho Seco were located near the upstream end of the

Contact:
Darrell G. Eisenhut
(Ext. 27672)

safe end that connects the stainless steel HPI/makeup line to the carbon steel nozzle of the RCS cold leg pipe. The crack configurations appear to be transgranular, characteristic of thermally induced stress cracks. The safety concern was that a pipe break at the crack location could result in a non-isolatable small-break loss-of-coolant condition from the RCS corresponding to about a 2-inch diameter break.

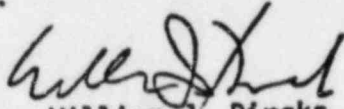
Following the degradation initially discovered at CR-3 in early February 1982, and subsequently at Oconee 2 and 3, in early March 1982, it appeared likely that this problem may be generic to all B&W plants. Accordingly, the B&W Regulatory Response Group (RRG) was activated in early March 1982 to evaluate the investigation findings. A meeting with the B&W RRG and the staff was held on March 8, 1982 to discuss the findings at CR-3 and Oconee and the recommendations for the inspection actions needed at other operating B&W plants. At that time, the B&W units in operation included Davis-Besse 1, Arkansas Nuclear One, Unit 1 (ANO-1), and Rancho Seco. Although the NRC staff concluded that immediate shutdown of the operating B&W plants was not necessary, the staff requested and received letters from the licensees of these plants providing justification for continued operation to the scheduled planned shutdown when inspections would be made.

The staff found the scheduled shutdowns for Davis-Besse 1 and ANO-1, March 13 and 26, respectively, to be acceptable. For the Rancho Seco plant, the licensee proposed to operate until September 1982, and following subsequent meetings and discussions, the staff insisted and the licensee agreed that the facility be shut down before April 9, 1982 to make the inspections. The licensee subsequently shut down the Rancho Seco plant on April 3, 1982.

Although the affected licensees haven't determined the cause of the cracking, from the investigation findings to date, it appears that the cracking problem is related to the condition of the thermal sleeve. In each instance where nozzle cracks have been detected, the associated thermal sleeve has been loose or, for Rancho Seco, missing and has yet to be located elsewhere in the primary system. The sleeve repair being employed calls for hard rolling of the HPI/make-up line end of the sleeve in lieu of the contact roll which had been employed. All of the cracked nozzles in the safe end areas have been or will be replaced before restart of the plants involved. The through-wall crack discovered at the check valve/make-up nozzle interface at CR-3 which initiated the subsequent inspections was limited to CR-3.

The staff is continuing to evaluate this problem and the B&W Owners have established a Task Group to oversee followup action. That Group has been requested to expeditiously formulate plans to evaluate the cause of the cracking problem and develop long term solutions to prevent recurrence. The B&W Group expects to meet with the staff in early May 1982 regarding these plans.

A summary of the inspection findings and current status of CR-3, Oconee 2 and 3 and Rancho Seco is enclosed.



William J. Dircks
Executive Director for Operations

Enclosures:
Figure 1 and
Summary of Inspection
Findings & Current Status
of B&W Plants

TYPICAL B+W MAKE-UP/HPI NOZZLE | THERMAL SLEEVE DESIGN

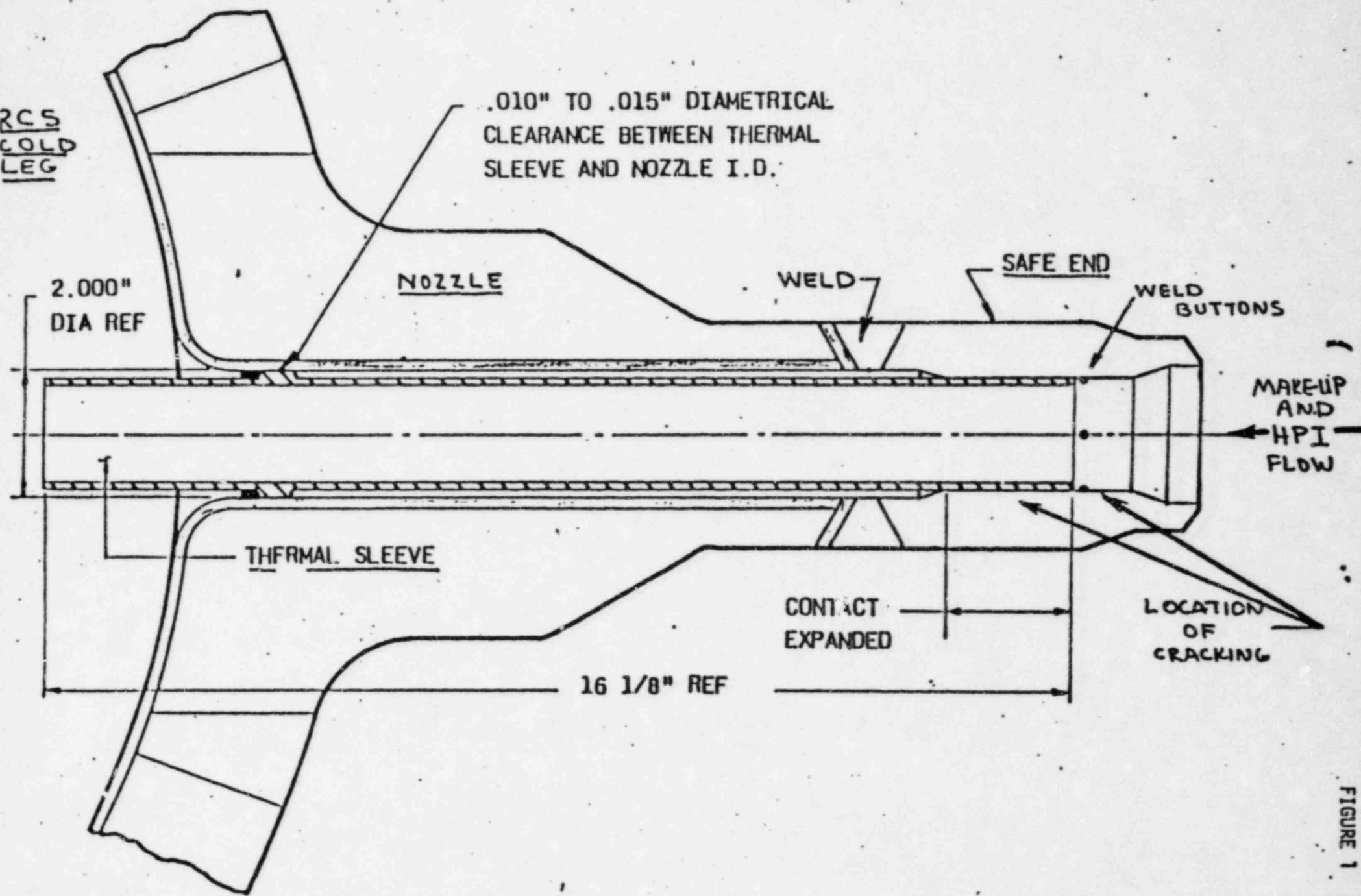


FIGURE 1

SUMMARY OF INSPECTION FINDINGS AND CURRENT STATUS
OF B&W PLANTS WHERE HPI/MAKE-UP NOZZLE DEGRADATION WAS DISCOVERED

Crystal River-3

On February 5, 1982 a visual inspection of the Crystal River-3 make-up system was being performed to determine the source of unidentified reactor coolant system (RCS) leakage. A crack was found in the interface between the normal make-up nozzle and the last check valve before the RCS cold leg pipe. The crack was circumferential, through-wall, and extended approximately 180°. Investigation of the crack surfaces indicated that the cracks initiated from both the I.D. and O.D. of the check valve, progressed inward, and met toward the center of the valve thickness resulting in a leakage path. Examination of an adjacent safe end part of the nozzle showed cracks in the order of 20% thru-wall with one up to 50%; the thermal sleeve inside of the make-up nozzle was loose and exhibited axial cracks. Abnormal wear had also occurred at the rolled joint. The nozzle cracks at CR-3 have been determined to be transgranular fatigue with no chemical attack. It is felt that the cracks resulted from thermal cycling and have been present for at least a year.

Examination of the other three HPI nozzles showed no cracks or other significant abnormalities.

It was noted that the as built design was not in accordance with the design assumptions used for the thermal stress analysis since the check valve was "butted" directly to the nozzle safe end and that the failure occurred at the NSSS/Architect-Engineer interface of design responsibility. As a result, the repair included moving the check valve back by inserting a short section of piping (about 5 inches long) between it and the safe end. All of the newly installed equipment in the area of interest were ultrasonically tested (UT) and penetrant tested (PT) before and/or after assembly.

Additional corrective actions at CR-3 consists of increasing the minimum bypass flow through the make-up line from approximately 1 gpm to 15 gpm to increase the flow velocity in the nozzle for cooling purposes; and to add instrumentation (strain gauges and thermocouples) to the areas of the line in question to obtain additional operational information.

Oconee 2 and 3

At the Oconee Nuclear Station, during early March 1982, four thermal sleeves were determined to be loose (two in Unit 2 and two in Unit 3), an additional thermal sleeve was determined to be cracked in Unit 2, and pipe cracks were discovered in one line in Unit 2 and one line in Unit 3. The pipe cracks were in the make-up lines. No problems with either loose

thermal sleeves or pipe cracks were discovered in Unit 1 which utilizes a different thermal sleeve design.

For all nozzles, radiographic tests (RT) were used to indicate the position of the thermal sleeves; and the ultrasonic tests (UT) were used to determine the presence of cracks. In addition, Dye Penetrant tests (PT) and visual inspections were used for those areas needing either nozzle or thermal sleeve repair. The repair efforts at Oconee 2 and 3 have been completed. Oconee 2 is still shutdown for refueling; Oconee 3 returned to power on March 31, 1982.

Rancho Seco

As a result of make-up nozzle cracking experienced at CR-3 and Oconee plants, the staff required that the Rancho Seco facility be shutdown to permit UT and Radiographic Testing (RT) of the four high pressure injection nozzles. The plant was shutdown on April 3, 1982 to perform the nozzle examinations, and the results of the examinations are as follows:

For normal make-up nozzle "A" complete circumferential and longitudinal I.D. cracking of the nozzle safe end was found upstream of the thermal sleeve. The cracking was believed to have initiated at the I.D. of the safe end and progressed to a maximum of 20% through wall. RT examinations of the safe end showed the thermal sleeve weld "buttons" to be worn, but in place. The thermal sleeve appeared to be missing.

The configuration of the thermal sleeve is such that it could enter the RCS inlet nozzle and be carried downward to the bottom of the reactor vessel where it could be trapped below the flow distributor or between the flow distributor and lower grid support. B&W and the licensee are evaluating what effects the dislocated thermal sleeve might have on reactor operations. To date, no flow distribution effects have been noticed with the reactor at power.

For HPI nozzle "B", no nozzle or safe end cracking was detected. An RT examination indicated the thermal sleeve had moved 1" upstream toward the weld buttons, and two out of the eight buttons were missing.

For HPI nozzles "C" and "D", no nozzle or safe end cracking was detected. The positioning of the thermal sleeve was found to be satisfactory and all weld buttons were in place.

The licensee has scheduled and trained appropriate personnel to perform the repairs and has received the necessary replacement material.

Repairs are still proceeding on the make-up nozzle "A" which exhibited cracking; and on the HPI nozzle "B" regarding the loose thermal sleeve. Completion of repairs are expected to take several more weeks.



July 23, 1982

SECY-82-186A

POLICY ISSUE
(Information)

For: The Commissioners

From: William J. Dircks
Executive Director for Operations

Subject: Make-up Nozzle Cracking in Babcock & Wilcox (B&W) Plants

Purpose: To inform the Commission on the actions taken to resolve the make-up nozzle cracking problem in B&W plants

Background: As previously discussed in the status report to the Commissioners on this subject (SECY-82-186 dated May 7, 1982), cracking was found in the normal make-up/high pressure injection (HPI) nozzles of four B&W plants following an inspection of all eight of the B&W plants currently licensed to operate.

From investigation of the information collected it appeared that the cracking problem was related to the condition of the thermal sleeve. In each instance where nozzle cracks had been detected, the associated thermal sleeve had been loose or as in the case of Rancho Seco the sleeve was missing. Therefore, short term recommended repair consisted of hard rolling the HPI/make-up end of the new thermal sleeve in lieu of the contact roll previously employed and replacing the cracked safe end areas of the nozzle.

At the time of the previous report to the Commissioners, three of the four plants exhibiting nozzle cracks, Crystal River Unit 3 and Oconee 2 & 3, had completed repairs. Crystal River Unit 3 and Oconee 3 returned to power on March 2, 1982 and March 31, 1982 respectively. Oconee 2 was still shut-down for refueling. The Rancho Seco plant repairs to the make-up nozzle had not yet been completed.

Discussion: Since the previous status report, Oconee 2 returned to power on May 17, 1982. The repairs on the make-up/HPI nozzle for Rancho Seco have been completed. However, the plant is still

Contact:
S. Miner, NRR
X28352

shutdown to complete repairs and modifications to the auxiliary feedwater header in the steam generators. This completed the short term resolution for the nozzle cracking problem.

The B&W Owners Group task force, established to evaluate the cause of the cracking and to develop recommendations for long term solutions to prevent recurrence of the problem, met with the Staff on May 7, 1982 to discuss their results at that time and their future program plan. The information developed to date by the task force appears to confirm that the loose thermal sleeves in the make-up nozzles allowed hot primary loop coolant to flow between the outside of the thermal sleeve and the inside of the safe end. This along with the cold makeup water caused thermal cycling in the safe end and caused the thermal fatigue cracking. Accordingly, B&W is performing analyses and tests to demonstrate whether hard rolling the thermal sleeve will provide a long term solution to the cracking problem. Following the estimated completion of these analyses and tests in September 1982, the task force expects to prepare a report on the results and provide recommendations on augmented inservice inspections, operational changes and any additional design changes. The task force report is scheduled to be issued by the end of 1982.



William J. Dircks
Executive Director for
Operations

David S. Kaplan, Esq.
General Counsel
Sacramento Municipal Utility District
P.O. Box 15830
Sacramento, CA 95813

Herbert H. Brown, Esq.
Lawrence Coe Lanpher, Esq.
Hill, Christopher and Phillips, P.C.
1900 M Street, N.W.
Washington, D.C. 20036

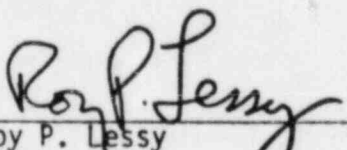
Thomas A. Baxter, Esq.
Shaw, Pittman, Potts & Trowbridge
1800 M Street, N.W.
Washington, D.C. 20036

Docketing and Service Section*
Office of the Secretary
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Christopher Ellison, Esq.
Dian Grueneich, Esq.
California Energy Commission
1111 Howe Avenue
Sacramento, CA 95825

Atomic Safety and Licensing
Board Panel*
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Atomic Safety and Licensing
Appeal Panel*
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555



Roy P. Lessy
Deputy Assistant Chief Hearing
Counsel