



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SEP 20 1978

MEMORANDUM FOR: L. Shao, RES
W. Hazelton, NRR
R. Gamble, NRR
K. Seyfrit, I&E
A. Tabaoda, SD
J. Muscara, RES

50
331

FROM: Harold R. Denton, Director
Office of Nuclear Reactor Regulation

SUBJECT: PIPE CRACK STUDY GROUP

Reference: Memorandum fm. Lee V. Gossick to above addresses,
September 14, 1978

By memorandum dated September 14, 1978, from Lee V. Gossick, you were each named to participate on the recently-formed NRC Pipe Crack Study Group. Recent events have led us to amend the scope of the Study Group as indicated in that memorandum. A new item should be added to the purposes of the Study Group and should read:

- "5. Examine the significance of cracking in the Inconel safe ends that has been experienced at the Duane Arnold operating facility, and develop any recommendations regarding NRC actions taken or to be taken."

This item is added because cracking in the safe ends for the recirculation nozzles at the Iowa Electric Light and Power Company's Duane Arnold facility was observed in June 1978. Metallographic samples were taken from the nozzle safe ends and sent to Battelle-Columbus and Southwest Research for examination. Results of preliminary laboratory examinations to date indicate that the cracking is relatively severe and appears to be intergranular stress corrosion cracking.

Harold R. Denton, Director
Office of Nuclear Reactor
Regulation

cc: See next page

7811280491

50-331 P

L. Shao

Date: SEP 29 1978

Serial No.: IE:ROI: 78-10

TRANSFER OF LEAD RESPONSIBILITY

TO: B. K. Grimes, Assistant Director for Engineering and Projects, NRR

SUBJECT: SAFE ENDS FOR RECIRCULATION NOZZLES

RESPONSIBLE ASSISTANT DIRECTOR: E. L. Jordan

DESCRIPTION OF ITEM REQUIRING RESOLUTION:

With regard to operating BWR's, GE has identified five types of safe ends which have been used to connect recirculation inlet lines to reactor vessel nozzles. Four of these types include thermal sleeves which are welded to the safe ends. The material is inconel for Type 1 safe ends and stainless steel for Types 2, 3, and 4 safe ends. The design of Types 1 and 3 safe ends includes a crevice at the thermal sleeve to safe end joint. The design of Types 2 and 4 safe ends precludes the crevice at the joint, but does include stagnant water.*

Duane Arnold has Type 1 safe ends. All of them have cracked and one crack extends thru the safe end wall. The safe ends have been removed and are being replaced with others of modified design. Metallographic examination of the cracked safe ends is in progress to determine the cause of cracking. This work is being performed by independent laboratories under contract to the licensee and IE.

*S.W.F.
B.C.*

Two other units, Brunswick 1 and 2, have Type 1 safe ends. Based on preliminary metallographic results from Duane Arnold, an immediate action letter has been sent to the licensee for Brunswick specifying volumetric examination of the safe ends in the vicinity of the thermal sleeve to safe end welds.

W. Harold Stone

Preliminary metallographic results obtained for Duane Arnold safe ends indicate that the cause of cracking may be stress corrosion at the tip of the crevice. Nevertheless, vibration induced fatigue originating from the jet pump riser may be a contributing factor.

Because of the presence of crevices and stagnant water in the Type 3 design, NRR and IE do have some concern for the long term integrity

*See Enclosure for identity of safe ends at each operating plant.

CONTACT: W. J. Collins, TP
49-28180

7811280493

SEP 29 1978

of these safe ends. Type 4 safe ends have a more complex geometry which eliminates the crevice or locates it away from the safe end wall, but does not eliminate stagnant water.

For BWR's operating and under construction which have Type 1, 2, 3 or 4 safe ends, resolution is needed in the areas of inservice inspection, modification, and design qualification.

RECOMMENDATIONS AND PROPOSED COURSE OF ACTION:

1. NRR will evaluate the basis for continued operation of affected plants including assurance that appropriate interim actions are taken.
2. NRR will evaluate on a priority basis the need for installing accelerometers on a safe end at Duane Arnold and other units.
3. IE will obtain refueling outage schedules from Type 3 plants and other plants as requested by NRR.
4. IE will inform NRR and the NRC Pipe Crack Study Group of the results of safe end inspections and metallographic examinations as they are obtained.
5. IE will inspect for compliance with any requirements established by NRR.

CONCURRENCE:

E. L. Jordan for
Edward L. Jordan, Assistant Director
for Technical Programs, DROI, IE

9/22/78
Date

B. K. Grimes
B. K. Grimes, Assistant Director
for Engineering and Projects, DOR, NRR

9/27/78
Date

SEP 29 1978

Enclosures:

1. Recirc Inlet Nozzle Summary
2. PNO-78-163

cc: R. S. Boyd, DPM
V. Stello, DOR
D. G. Eisenhut, DOR
R. W. Reid, DOR
W. S. Hazelton, DOR
V. S. Noonan, DOR
R. W. Klecker, DOR
M. B. Fairtile, DOR
J. G. Davis, IE
N. C. Moseley, IE
H. D. Thornburg, IE
J. H. Sniezek, IE
G. W. Reinmuth, IE
B. H. Grier, RI
J. P. O'Reilly, RII
J. G. Keppler, RIII
K. V. Seyfrit, RIV
R. H. Engelken, RV
K. Terney, MPA
S. H. Hanauer, EDO
R. J. Mattson, DSS
L. Shao, RES

TYPE 1

800
ENGINE, SAFE END AND INTERNAL SLEEVES END, LONG CRUSTIC
SHEATH WELD:

A. BLAKE ARNOLD, B. BRIDGEMAN 1 AND 2

TYPE 2

TYPE 304 TUBING FROM SAFE END AND INTERNAL SLEEVES,
THIS TUBING SLEEVES:

MILLSTONE, VERMONT VARIETY

TYPE 3

TYPE 316 SAFE END, SINGLE TYPE 304 INTERNAL SLEEVES,
SPONGE WELD WELD SERVICE (.097).

BREASTON 2 AND 3, PEARCE BOTTOM 2 AND 3, BAYBROOK FERRY 1,
2, AND 3, QUAB CENTER 1 AND 2

TYPE 4

DOUBLE INTERNAL SLEEVES (304) WELDED TO NOZZLE FORGED I.D.
BUILDUP, TYPE 304 SAFE END:

PEARCE, MILLSTONE, COOPER, BATCH 1 AND 2,
AND FITZPATRICK

TYPE 5

NO INTERNAL SLEEVES (OR SET PUMP) TYPE 316 SAFE END:
OYSTER CREEK, NINE MILE POINT 1, BIG ROCK POINT,
BREASTON 1 (304L)

LAS
5/29/73