U. S. ATOMIC ENERGY COMMISSION
DIRECTORATE OF REGULATORY OPERATIONS

REGION III

Report of Operations Inspection

RO Inspection Report No. 050-010/74-13
RO Inspection Report No. 050-010/74-09

Licensee: Commonwealth Edison Company
P. O. Box 767
Chicago, Illinois 60690

Dresden Nuclear Power Station Units 1 and 2 — License No. DPR-2
Morris, Illinois — License No. DPR-19
Category: C

Type of Licensee: GE, BWR, 200 Mwe and 800 Mwe (net)

Type of Inspection: Special - Announced

Dates of Inspection: September 10-12, 14, 18, 21, 23-25, 28, October 1, 2, 21 and 29, 1974

Dates of Previous Inspection: August 25 and 26, 1974; Unit 1 (Operations)
September 18-20, 1974; Unit 2 (Security)

Principal Inspector: F. Maura HCDance/fm 12/24/74
(Date)

Accompanying Inspectors: P. Johnson
(September 10 and 11, 1974)

C. Williams
(September 14 and October 1, 1974)

R. Cook
(September 18 and 23, 1974)

C. Erb
(September 23, 24 and October 2, 1974)

Other Accompanying Personnel: H. Dance
(September 14, 1974)

D. Hunnicutt
(September 24, 1974)

D. Sullivan
(September 10 and 11, 1974)

HC Dance
Reviewed by: H. C. Dance, Senior Inspector
Operations Branch
12/24/74
(Date)

SUMMARY OF FINDINGS

Enforcement Action

A. Violations considered to be of Category II severity are:

1. Technical Specification 6.2.A.6 requires that detailed written procedures shall be prepared, approved, and adhered to for preventive and corrective maintenance operations which could have an effect on the safety of the facility.

   Technical Specification 6.2.E. requires that any changes to the maintenance procedures shall be reviewed and approved by the Maintenance Engineer and the Technical Staff Supervisor and must have authorization by the Station Superintendent before being implemented.

   Contrary to the above:

   a. On September 29, the sleeve backup seal safety device was removed, to make room for the auxiliary cooler required to make the initial freeze plug. This was a deviation from step 7 of SPM-19. No procedure change authorizing the removal of the safety device had been processed. (Part I, Paragraph 2.d.(1))

   b. On September 30, procedure SPM-19 was changed through the "temporary change" method to permit the fitup of the new pipe and completion of the root pass welding. This was accomplished with the secondary backup seal (Plidco clamp) removed. The use of the temporary change to allow such operation is not considered to meet the intent of the Technical Specification in that such a change modified the intent of the original procedure which was to have effective backup seals available at all times. (Part I, Paragraph 2.d(6))

2. 10 CFR 50, Appendix B, Criterion V, states in part that activities affecting quality shall be prescribed by documented instructions and shall be accomplished in accordance with these instructions.

   Contrary to the above:

   a. The change to hydro test procedure SOP-3 to allow the hydro test to take place with the safety valves gagged was not processed in accordance with Station Quality Control Procedure QCP 5-51.1 Rev. 3, step. C.1.4, in that the "10 CFR 50.59 Safety Evaluation" form was not properly completed. The completed form did not address the change in question. (Part I, Paragraph 2.e)

b Temporary changes to loop repair procedure SPM-19, steps 8 and 15, were not processed in accordance with the Commonwealth Edison Company QA Manual Procedure Q.P. 5-15, Section B, Step 1 in that the change "Requestor" failed to sign and date the change requests to show the change was made prior to performing the work. (Part I, Paragraph 2.e)

B. Violations considered to be of Category III severity are:

10 CFR Part 50, Appendix B, Criterion V, states that activities affecting quality shall be prescribed by documented instructions, procedures, or drawings and shall be accomplished in accordance with these instructions.

10 CFR 50, Appendix B, Criterion IX, states that measures shall be established to assure that special processes such as welding are controlled and accomplished in accordance with applicable codes or other special requirements. The Commonwealth Edison Company Quality Assurance Manual states in Q.R. No. 9.0 that welding quality shall be specified and controlled through surveillance and audit. In addition process control procedures will specify the preparatory steps, processing details, conditions to be maintained, and the inspection, test, and records requirements. Q.R. No. 5.0 states that when ASME code work is involved, repair documents shall be submitted to the Authorized Inspector.

Contrary to the above, the RO review of the Commonwealth Edison Company approved data package for the repair of the "B" primary pump discharge valve bypass line disclosed the following principal deficiencies:

a The weld procedures and supporting documents did not provide for the control of mechanical purge dams or relate to the use of water soluble purge dams. (Part II, Paragraphs 1 & 2)

b It was not evident that the contractor's weld repair plans were approved by his welding engineer and quality control supervisor as required by the contractor's repair procedures. Similarily, the code inspector had not approved the repair data package. (Part II, Paragraphs 1 & 2)

Licensee Action on Previously Identified Enforcement Items

Not inspected.

Unusual Occurrences

A. Four Unit 1 control rod blades became unlatched and failed to follow their respective drives. (Part I, Paragraph 4)

B. Through wall cracks found in Unit 2 recirculation loops 4-inch bypass lines. (Part I, Paragraph 2 and Parts II, III, and IV)

C. Through wall crack found in Unit 3 drywell ventilation inlet 18-inch line. (Part I, Paragraph 3)

Other Significant Findings

A. Current Findings - Unresolved Items: None

B. Status of Previously Reported Unresolved Items: None

Management Interview

Because of the nature of this inspection several management interviews were conducted throughout its duration. The dates and personnel involved are noted below:

A. September 14, 1974 with Mr. A. Roberts, Assistant Station Superintendent:

1. The inspector stated that an apparent violation of the QA requirements had occurred in that the Commonwealth Edison Company approved and implemented primary system repair program was found to contain the following deficiencies:

   a. The wrong weld procedure was contained in the data package.

   b. The weld procedure and welding process requirements (fabrication data sheets) did not relate to the use of consumable purge dams (loop B).

   c. The Phillips Getschow (P-G) weld repair plans indicated that the signature of QC supervisor and welding engineer are required, but they were not available.

   d. The weld repair plans did not provide for accounting for mechanical purge dams after use.

   e. The weld repair data package appeared to require the signature of the code inspector. However, this signature was not in evidence.

   f. The piping material control document did not show the date the material was issued from storage.

   g. The mill certification for the new piping material was illegible.

   The licensee's representative acknowledged these remarks and stated that corrective action would be taken prior to the initiation of repair welding. The cracked piping was being removed during this inspection. Implementation of the correc-

tive action was confirmed during a subsequent inspection on October 1, 1974. (Part II, Paragraph 1)

2. The inspector stated that there was no evidence that the site QA organization, or other persons responsible for the implementation of the QA requirements were involved in this extraordinary repair activity. Further, it appeared that those who reviewed and approved the repair data package had done so with insufficient diligence.

   The licensee's representative indicated that some measure to include comprehensive QA review of significant repair activity would be implemented. Further, greater diligence would be used during review of specifications and QA/QC records. Subsequent to this inspection, the licensee indicated that the QA Department has informed the site manager that they (QA) are to be informed prior to initiating significant repairs for primary system components.(Part II, Paragraph 1)

B. <u>September 18, 1974 with Mr. B. Stephenson, Station Superintendent</u>:

1. The inspector stated that the planned repair is considered an unreviewed safety question in that the probability of an unisolatable opening in the primary system below core top occurring, due to repair seal failure, has been increased. The licensee agreed to consider our concern. The inspector was later informed that the licensee had agreed with the interpretation and would submit the repair proposal to Directorate of Licensing for approval. (Part I, Paragraph 2.b)

2. The inspector stated that before RO III accepts the proposed repair method the licensee will have to prove it is a safe, workable, method and that personnel who will participate in the repair have been thoroughly trained with the help of mockups. In order to accomplish this we want to witness:
   a A drill of the repair procedure, excluding the steps required to freeze and thaw a primary seal, all steps conducted with a minimum of 20 psig against the seals.
   b A drill of all emergency procedures to be in effect in case of seal failures. This means the mockup must be designed so that approximately 20 psig can be maintained when a primary seal is failed and a secondary seal is being installed.

   The licensee agreed to the need for ensuring the different tools involved in the repair would work and that personnel were properly trained in their use. He stated we would be informed when they were ready to demonstrate the repair and emergency procedures to us. (Part I, Paragraph 2.b)

3. The inspector noted that these repairs are presently considered to be temporary until the studies (metallurgical examination and stress analysis) into the cause of the failure are completed.

C. September 24, 1974 with Mr. Stephenson, Station Superintendent:

1. The inspector stated that after witnessing the performance of the repair crews in the handling of the redesigned backup seals and the primary rubber plug seal he has confidence that the method will work if the procedures are adhered to. The inspector requested to be informed when the licensee is ready to commence the first freeze plug operation, if the repair method is approved by the Directorate of Licensing. (Part I, Paragraph 2.b)

2. The inspector inquired into the licensee's plans regarding the inspection of Unit 2 drywell ventilation inlet 18" line in light of the failure experienced on Unit 3, and determination into the cause of the crack.

   The licensee stated that Unit 2 will be magnetic particle inspected to ensure it does not have a similar failure. In addition Commonwealth Edison Company's Operation Analysis Department will be given the failed section of pipe for depermination of cause. (Part I, Paragraph 3)

D. September 28, 1974 with Mr. Diederich, Administrative Assistant:

1. The inspector stated that he was disappointed by what appeared to be lack of understanding by some members of the repair crew. regarding their function in case of an emergency. It appears that although those mainly concerned with the actual repair knew their job well, those with peripheral jobs had not been properly instructed. The licensee acknowledged the deficiency. (Part I, Paragraph 2.C.(3))

2. The inspector stated that he noted the primary rubber seal still had slight contamination of FEL-PRO lubricant and that handling by the repair crew was not as good as desired just prior to the start of the job. That although at his direction the plug was re-cleaned and sealed in plastic, great care must be exercised during future handling since the threaded portion is covered with lubricant. (Part I, Paragraph 2.C.(1))

E. October 1, 1974 with Mr. Diederich:

The inspector discussed two record deficiencies. The licensee stated the matters would be reviewed. (Part II, Paragraph 2)

F. October 21, 1974 with Mr. Diederich:

The inspector reviewed the violations of procedure noted to have taken place during the repair work which are listed under Enforcement paragraphs A.1 and A.2.

The licensee responded that in the case of the change to allow new pip fitup their contention is that the intent of the procedure was to perform the job in a safe manner but not to have backup seals installed at all times. (Part I, Paragraphs 2.d.(1) and (6) and 2.e)

Report Details

Part I Prepared by F. Maura

1. Personnel Contacted

B. Stephenson, Station Superintendent
A. Roberts, Assistant Station Superintendent
J. Diederich, Administrative Assistant to Station Superintendent
T. Watts, Supervisory Engineer, Technical Staff
G. Budzechowski, Operating Engineer, Unit 1
D. Scott, Operating Engineer, Unit 3
R. Bishop, Engineer, Technical Staff
J. Wujciga, Engineer, Technical Staff
J. Sierzant, Engineer, Technical Staff
R. Herbert, Engineer, Technical Staff
R. Meadows, Engineering Assistant, Technical Staff
R. Coen, Engineering Assistant, Technical Staff
B. Zank, Engineering Assistant, Training
R. Dyer, Maintenance Foreman
G. Crane, Maintenance Foreman
G. Lamping, Maintenance Foreman
F. Dunkel, Shift Engineer
R. Christensen, Shift Foreman

Phillip Getchow Company

A. Marconi, Welding Engineer
D. Faze, Foreman
R. Hite, Foreman
T. Sullivan, Foreman
P. Kelly, Quality Control

General Electric Company

J. Pobre, Engineer

2. Unit 2 Recirculation Loop Pipe Failures

a Discovery of 4" Pipe Failures

On September 12, 1974, the unit was shutdown as the unidentified primary system leakage within containment was approaching the 5 gpm limit. On September 13, the licensee discovered a circumferential crack in the four-inch stainless steel bypass line around the "B" recirculation pump discharge valve. On September 15, a similar failure was found in the "A" loop. Refer to attachment A for location and size of cracks.

A review of the records for the leak detection methods in use

showed the following history preceeded the crack discovery in Unit 2:

Period	Unidentified Leakage	Airborne Activity after 4-hour Decay of Sample (multipoint sampling system)
9/1-5/74	1.0 to 1.5 gpm	1 to 2.5 x 10^{-9} uC/cc
9/7-10/74	2.9 gpm	6 to 8 x 10^{-9} uC/cc
9/11 unit off system on9/13/74	3.8 gpm	1 to 5 x 10^{-9} uC/cc

In summary, while the unidentified leakage showed two distinctive jumps in the leakage rate, the first on September 7, 1974, from 1.9 to 2.9 gpm and the second on September 11, 1974, from 2.9 to 3.8 gpm, the airborne activity of the 22 sample points was not very useful in detecting or locating the developing cracks.

A review of similar records for unit 3, covering the same period showed the unidentified leakage in the range of 1 to 1.5 gpm and the airborne activity in the range of 1 to 2 x 10^{-8} uC/cc. The licensee could not readily explain why the unit 3 airborne activity was higher than at Unit 2 where a leak existed.

b Repair Program

The "B" loop failure was easily repaired since the line could be isolated and drained. A section approximately 10 inches long was cut and replaced with identical pipe material, i.e. ASTM 312 Type 304 Schedule 80. For details of repair inspection refer to Details Section, Part II.

The "A" loop repair was complicated by the fact that the failure could not isolated. The licensee considered three repair methods as noted:

(1) removing all fuel and control rods to permit draining the line. This was complicated by the fact that the Unit 2 spent fuel pool did not have enough empty spent fuel locations to accomodate 724 elements.

(2) development and manufacturing a plug for each jet pump on "A" loop (10) so that the recirculation line could be drained without lowering the vessel water to the 2/3 core height level.

(3) development of the tools and methods needed to plug the 4" line so that repairs could be performed without draining the recirculation loop.

On September 18, 1974, RO III was informed by the licensee that the third method had been selected contingent upon sucessful demonstration, using a mockup, that a reliable

seal could be made at the weldolet where the 4 inch bypass line ties to the 28 inch recirculation line. General Electric would proceed with the development of a jet pump seal in case a reliable seal at the weldolet could not be demonstrated.

The licensee was informed of our concerns and requirements that same day. (Refer to September 18, 1974, Management Interview)Throughout the next few days several visits were made to the site to insure that:

(1) the equipment and procedures developed for the repair of the "A" loop, including all possible emergency conditions which could arise, were capable of performing their function.

(2) personnel had been adequately trained to perform the repair in accordance with the developed procedures.

(3) a proper repair was performed in accordance with the license requirements and AEC regulations.

During the early mockup trials several modificatons to, both, equipment and procedures were required in order to insure a leak tight primary seal and a sound secondary backup seal in case of primary seal failure. The importance of developing a secondary backup seal for each condition in the repair procedure was stressed several times during the mockup trials.

By September 27, 1974, the inspectors had witnessed enough mockup tests to be confident that the repair could proceed with an excellent chance of success. The tests had demonstrated that:

(1) the plummer's plug could easily accomplish the zero leakage seal required for welding.

(2) if the plummer's plug failed:

  (a) while the Plidco clamp is the secondary seal the clamp would hold and no leakage experienced.

  (b) while the old pipe was being cut, or the new pipe fitted, the sleeve backup seal could be installed around the pipe cut and the leakage reduced to less than 1 gpm within 2 minutes.

  (c) while the rubber taper plug was acting as backup seal the plug could be driven into the pipe and essentially zero leakage obtained in approximately 1 minute.

(3) it was possible to weld near the rubber plug without causing a deterioration of the rubber as long as the

temperature was maintained below 500 F. A temperature limit of 250 was established.

(4) it was possible to weld within 4 inches of a freeze seal without encountering moisture problem.

(5) if the freeze seal failed during the initial cut or the final weld fit up, the backup seal (sleeve) could be installed and leakage reduced to less than 1gpm within 2 minutes.

c. Preparations Prior to Repair Work

On September 28, prior to the start of the first freeze, the inspector verified that all prerequisites listed in repair procedures SPM-19, Revision 2, and SPM-20, Revision 1, and on Special Procedure SOP-2, Revision 1, had been complied with. A few weak areas were noted as follows:

(1) a review of the equipment to be used showed that it complied with the procedure requirements except for the plummer's plug which had its rubber plug contaminated with N-1000 FEL-PRO lubricant, a bronze compound anti-seize lubricant containing approximately 25 ppm halogen, 40 ppm sulfur, and other contaminants. At the inspector's direction, the plug was decontaiminated following its assembly inside the drywell, and was then sealed in plastic until its use was required.

(2) the licensee experienced some difficulty obtaining a large enough (32") section of ASTM 312, type 304, schedule 80 pipe free of surface defects.

A 3-foot section of new pipe was machined to remove all surface linear indications. New wall thickness measurements were obtained by UT, and at both ends with a micrometer. The minimum wall thickness measured was 0.326 inch which is above the minimum required thickness of 0.295 inch.

(3) discussion with the repair crew just prior to the start of the repair work showed that their knowledge of the crew limitations in case of an emergency, as stated in procedure SPM-19, were not adequate. Specifically, the personnel were not aware that they were limited to a 15 minute period to install a backup seal in case of a primary seal failure, after which they were to evacuate the drywell. In addition the rad protection man had not been instructed as to what constituted a "marked increase in the gamma radiation level," the point at which he was supposed to notify the repair crew to leave the area. This was brought to the attention of management and personnel were informed that the

limit was 3 rems/hr.

d. Repair Work

The repair work commenced on September 28 with the establishment of primary containment and the start of the first freeze at 1800 hrs. The final weld was completed at 1410 hrs on October 2, 1974, with the freeze removed by 1800 hrs. Therefore, the entire repair from first freeze to last thaw lasted approximately four days or twice the initial estimate. Highlights of the repair including time required to accomplish were:

(1) establishment of first freeze plug accomplished at approximately 1345 hrs on September 29, 1974, or approximately 20 hours after start of freeze. Delay appeared to be caused by convection currents. An auxiliary cooler consisting of copper tubing wrapped around pipe was installed between original cooler and elbow. In order to make room for the auxiliary cooler safety device No. 3 (sleeve backup seal) was removed in violation to the repair procedure and T.S. 6.2.A.6. A change to the procedure was not processed as required by T.S. 6.2.E. Although the licensee thinks that the safety device was reinstalled prior to the pipe cutting, the step by step log maintained at the job does not show that to be the case.

(2) first cut near elbow, installation of plummer's plug and thaw of freeze seal, approximately 3 hrs.

(3) establishment of seal at weldolet and installation of backup seals, approximately 1 3/4 hrs.

(4) second cut (at weldolet) and removal of old pipe, approximately 3 hrs.

(5) weld preparation at weldolet, approximately 5 hrs.

(6) fitup of new pipe, approximately 6 hrs. Considerable difficulty was experienced in the line up. Following installation of the safety devices a gap of 3/16" between pipe and weldolet existed on the right side. The licensee modified the procedure, through the use of a temporary change, to remove the plidco clamp until the pipe was fitted and the root passes completed. This was accomplished with essentially no backup seals since safety devices 1 and 2 would have been ineffective had the plummer's plug failed. After completing the root passes the plummer's plug shaft was forced to move approximately 2" in order to permit installation of the plidco clamp. The final weld passes were then completed. The use of a temporary procedure change to permit such a major change in the repair procedure is considered to be a violation of T.S. 6.2.A.6 and 6.2.E. in that the change modified the intent of the

orginial procedure which was to have effective backup seals available at all times.

(7) completion of first weld, approximately 12.5 hours.

(8) repair to first weld, approximately 16.5 hours.

(9) second freeze and fitup of new pipe to elbow, approximately 4.5 hours. Approximately 45 minutes were lost locating and removing rag left in 4" line inadvertently.

(10) second weld, approximately 6 hours.

(11) Thaw second freeze, approximately 2 hours.

Following completion of the repairs the licensee obtained UT base line data, and performed a satisfactory hydrostatic test of the system in accordance with ASME Code Section XI - 1974. During the first hydro attempt the "E" safety valve set to lift at 1210 psig popped at 1084 psig. The hydrostatic test was then performed with all safety valves gagged. The "E" valve was then replaced with a spare, set with steam to lift at 1210 $\pm$ 12 psig.

e. Repair and Emergency Procedures

Special repair and emergency procedures were prepared, reviewed and approved, prior to start of the fix in loop "A", in accordance with T.S. requirements. RO:III inspectors reviewed and commented on the procedure while in draft form. The main concerns centered on:

(1) personnel involved in repair be fully trained and protected.

(2) backup seals be in position at all times, except for the short intervals required to change from one type to another.

(3) communication with the control room be available at all times.

(4) licensee recognize and deal with the potential dangers such as flow rate if seals failed, energy of water jet, human temperature-time limitations, etc.

(5) only material and equipment of high quality be utilized, never close to its limits (all limits be spelled out), and whenever possible be tested in advance to insure it will perform its job well.

Throughout the repair the procedures required several changes to conform with working conditions not anticipated in advance. A review of these changes showed that in addition to the two previously discussed violations (paragraphs 2.d.(1) and 2.d.(6)) the following

violations of Commonwealth Edison Company's QA Procedures were noted:

(1) temporary changes to SPM-19 steps 8 and 15 were processed to permit verification of the freeze by the frost line on the pipe and to close the vent and drain valves to allow the freeze plug to form. Both changes violated the Q.A. Manual Q.P. 5-51, Section B, Step 1 in that the change "Requestor" failed to sign and date the change requests, Q.P. Form 5-51-2 and as a result the changes appear as having taken place on October 3, 1974 one day after the repair was completed, when the Permanent Procedure Change was approved.

(2) a permanent change to hydro test procedure SOP-3 was processed to allow the performance of the primary system hydro with the safety valves gagged. The change was not performed in accordance with Station Quality Control procedures Q.C.P. 5-51.1, Revision 3, Step C.L.4 in that the "10 CFR 50.59 Safety Evaluation" form was not properly completed. The completed form did not address the performance of a hydro with the safety valves gagged and instead only referred to the need to perform a hydro.

f. Investigation for Similar Cracks at Unit 1 and 3

In response to RO Bulletin No. 74-10 dated September 18, 1974, the licensee performed a UT inspection of the two identical bypass lines in Unit 3. As in the case of Unit 2 only 10 of the 12 welds in each loop could be UT inspected. No defects were found. In the case of Unit 1, which is not of a similar design to Units 2 and 3, the licensee UT inspected the 10 welds in the B loop 6 inch diameter bypass line. The Unit 1 bypass line had experienced crack problems during 1965-67 period and had been replaced at that time. The loop is not only different in design but the material is Type 304L versus Type 304 used for Units 2 and 3.

g. Operation with 4" Bypass Loop Valve Open

As of November 1, 1974, both units continued operating with the recirculation 4" bypass loop valves closed. A procedure modification to open the valves, as recommended by the General Electric Company, is being reviewed.

3. Containment Ventilation Line Crack - Unit 3

On September 24, 1974 the licensee informed the inspector that a crack on the 18 inch drywell ventilation inlet line had been found at the location of flow element 8541-6. An inspection of the crack showed it to be circumferential starting approximately 3 inches above the boss for the pitot tube, running through the boss and extending for approximately another 10 inches.

The licensee speculated that the crack may have been caused by cold shocking the pipe during inerting operations, but at the same time he could not recall ever experiencing a low temperature annunciation from monitor 8541-3.

4. Unit 1 CRD Problem

a. Friction Test Results

The inspector reviewed the results of friction testing conducted on August 3, 1974 and used by the licensee to "verify" that control rods A-5, A-7, D-4 and D-10 were unlatched and stuck in the full in position. A comparison of the August 3, results with those obtained previously on April 6, 1974 or May 18, 1974, prior to unit startup, and on October 14, 1973 showed that three of the four rods should have been suspected earlier as noted below:

Friction Test Results, psi

CRD	10/14/73	4/6 or 5/18/74	8/3/74
A-5	107	49	34
A-7	68	65	35
D-4	83	49	46
D-10	73	52	40
B-3	67	97	85
B-9	71	66	69
C-8	65	95	72
D-5	65	63	67
E-6	58	49	66
G-10	107	99	92

b. Investigation of problem

In accordance with earlier commitments (Keppler to Lee letter dated August 15, 1974) the licensee shut down the reactor and proceeded to investigate the cause of control rod unlatching during early September. The Inspector witnessed the initial core top inspection, verification that the four control rods were not latched, the unloading of the fuel around control rod D-4, and the inspection of the latching components following control rod removal. The investigation was conducted in accordance with approved procedures. Observation of components was performed with the aid of an underwater TV camera and of binoculars.

The results of the initial investigation were:

(1) The four suspected control rods were noted to be a few inches higher than the remaining 76 control rods.

(2) When CRD's A-5, A-7, D-4 and D-10 were withdrawn 3 notches

their respective control rods failed to follow.

(3) During the initial core top inspection two damaged fuel channels were noted:

(a) Fuel assembly UN-304 had its southeast ear partially torn.

(b) Fuel assembly DU-83 had its northeast and southwest ears missing.

Both fuel elements were subsequently rechanneled and returned to the core.

(4) Although control rod D-4 was oriented correctly it was unlatched.

(5) CRD D-4 spud and anti-rotation bearing were not damaged. The female portion of the control rod coupling was in good condition.

(6) The upper section of the control rod coupling casting had four shinny marks approximately 90° apart. The four fuel elements which surrounded the control rod were examined and similar marks were noted on the corner of the lower tie plate casting which faced the rod.

From the observations it is obvious that during the last refueling outage control rod D-4 was not properly latched to its drive during reinstallation. The pull-test conducted to ensure proper latching was deficient since it failed to identify the problem. During initial scram testing the blade continued its upward travel until restricted by the surrounding four fuel element lower tie plate castings. At that time the force exerted was sufficient to jam the control rod coupling casting between the four lower tie plates and the control rod was then unable to follow its drive during subsequent withdrawals.

c. Improved Pull Test Procedure

Because previous pull test did not positively identify uncoupled control rods the procedure has been modified to require CRD withdrawal of one notch prior to pull testing. If the CRD return to full in position during the pull tests a more positive indication of latching is obtained. In addition the force required to move the blade and drive is measured and recorded. Following the relatching of the four unlatched drives the licensee proceeded to verify on September 14 and 15, 1974 that all 80 control rods were latched using the new approved procedure. The measured force

required to pull the blade and drive ranged from 145 to 187 lbs. The licensee has previously calculated the force to be approximately 170 lbs.

d. Refueling

During the outage the licensee discharged 37 fuel assemblies located in the core periphery. Thirty new fuel assemblies were loaded in the core central region with the displaced fuel being relocated in the periphery. An additional seven reconstituted fuel elements were loaded. The discharged fuel elements had an accumulated exposure history ranging from >20,300 mwd/t to < 26,000 mwd/t. The refueling was based on reactivity considerations and no sipping was performed.

According to the licensee the shutdown margin at the start of cycle IX B with the most reactive rod (A-6) withdrawn is 3.8% Δk. The Keff for the core (all rods in) is 0.931.

A review of the reconstituted fuel records showed that the criteria for fuel rod rejection was based on eddy current testing indication of 91.5% clad thickness penetration or defect found through visual examination with an underwater TV camera.

Fuel element UN-067 records demonstrated that three pins (A-6, E-6 and F-5) were found defective by E/C and one (F-6) by visual examinations. The four pins were replaced with satisfactory pins from element UN-066 which met the exposure history criteria established in the procedures. All procedures and changes to procedures regarding the reconstitution of fuel elements were found to meet the review and approval requirements of the Technical Specifications and AEC regulations.

Attachment:
Attachment A

REPORT DETAILS

Part II

Prepared by C. Williams D W Hayes for 12-24-74 (Date)

Reviewed by D. M. Hunnicutt D M Hunnicutt 12/24/74 (Date)

1. Review of Records - Loop B Primary Pump Discharge Valve Bypass Piping

On September 14, 1974, the bypass piping repair data package was reviewed by the inspector. This data package was prepared and implemented by Phillips Getschow Company (P-G). The data package had been previously reviewed and approved by the appropriate members of the Commonwealth Edison Company (CE). Further, CE representatives stated that the repair data package (proposal) had also been reviewed by their insurance inspector. At the time of the inspection, the repair of Loop B had been initiated. The inspector identified the following deficiencies, inconsistencies, and areas of nonconformance during its review of the CE approved repair data package:

a. An incorrect welding procedure (No. IA-MA-88-0) was included in the approved repair data package. The procedure failed to identify or relate to the use of a consumable ring, although the use of a consumable ring was specified on the weld data sheet.

b. The welding procedures, including the weld sequence data sheet, failed to relate to the use of a water soluble purge dam. Further, although documents attesting to the halogen content of the consumable purge dam were available, documents establishing a criteria for the halogen content were unavailable (Loop "B").

c. The P-G weld process procedures (weld sequence sheets) required the signatures of the welding engineer and the QC supervisor. However, the signatures were unavailable.

d. The repair documents and welding sequence instructions failed to provide for the accountability of mechanical purge dams used during the repair.

e. The repair data package appeared to require the signature of the code inspector. However, the signature was not available.

f. The repair data package included the new pipe material control documentation. However, the material release tag (received

February 8, 1971) did not identify the date of issue.

g. The mill certification document for the new pipe material was completely illegible in the area of interest. The heat number was obscured.

Review of the remaining areas of interest (radiography, liquid penetrant test, ultrasonic testing, personnel qualifications, filler material certification, welding parameters, and the hydro test proposal) showed that these items conformed to the requirements.

2. Inspection Followup - October 1, 1974

Subsequent to this inspection, the licensee reported that they had corrected each of the problem areas identified by the inspector. During a followup inspection, on October 1, 1974, the inspector confirmed by review that those problems identified above had been properly resolved. However minor deficiencies regarding the repair records were identified. They were as follows:

a. Review of the radiographs associated with the Loop "B" repair showed that, in each case, the RT reader sheet failed to identify the RT procedure used. The licensee stated this matter will be reviewed.

b. CE did not document a deficiency report regarding those items of nonconformance and deficiencies identified by RO:III during the inspection of September 14, 1974. The licensee indicated that such a document would be written for future occurrences of this type.

REPORT DETAILS

Part III

Prepared by C. M. Erb for D M Hunnicutt 12/24/74 (Date)

Reviewed by D. M. Hunnicutt 12/24/74 (Date)

1. Persons Contacted While Verifying Fabrication and Quality Control Procedures and Operations

Commonwealth Edison Company (CE)

R. Meadows, Engineer Assistant
R. Dyer, Maintenance Foreman
G. Lamping, Maintenance Foreman

Phillips Getschow (P-G)

A. Marconi, Welding Engineer
P. Kelly, Supervisor - Quality Assurance

Conam Inspection, Incorporated (Conam)

S. Hamilton, Radiographer - Level 2
L. Fleming, Radiographer - Level 2

2. Construction Inspector Activities

The inspector followed the repair of the four-inch Loop "A" equilization pipe line which could not be isolated from reactor coolant by valving. The two repair welds in Loop "A" are identified as RRE-1A and RRE-2A in line number 2030-3A.

Fabrication operations, usage of safety devices and nondestructive examination in mock-up tests were witnessed on September 23, 25, and October 2, 1974. The inspector stressed the necessity for a tryout in the mock-up stage of all changes to the procedure, since unverified changes could lead to serious, unforeseen effects when the actual repair is made.

3. Procedures, Specifications, and Instructions

The inspector examined the following documents relating to quality.

Title	Designation
Repair Procedure	SPM-19

Title	Designation
Weld Procedure	1A-MA-88
Radiography	RT-1-NP
Ultrasonics	NDT-CT-2
Radiographic Technique	Developed in Field
Pipe Material Certifications	--
Weld Rod Certifications	--

4. Weld Details - Procedure No. 1A-MA-88

The welds were made using a Grinnell Type consumable insert with the Tungsten Inert Gas process (TIG) for three root passes. The fusion of the insert was observed by a fitter through gaps left in the root area for this inspection. Argon gas was used to inert the inside of the pipe and also provided the cover gas for the weld puddle. Radiographs and penetrant tests were made of the root area to determine quality before proceeding with the balance of the weld.

Completion of the weld was made in two or three passes, using the shielded metal arc process (SMAW). The weld was then ground, followed by radiography and penetrant test.

A hydrotest was performed, followed by an ultrasonic inspection for a base-line reference. Procedure No. NDT-CT-2 was used for the UT examination. This procedure was qualified by C' QC personnel and was performed by qualified CE personnel.

5. Radiographic Examination

The radiographic examination required that six exposures be made. Since a lead screw for the rubber seal plug remained in the center of the pipe, the area of the weld directly under it was not penetrated by the x-rays, thus requiring added exposures to cover the entire circumference. The final radiographic exposures were made with the following technique.

Source - 60 curies iridium
Source Film Distance - 7"
Screens Lead - 0.010 front and back
Penetrameter - #10 film side
Film - "M"
Shim - 1/8"

The exposure time was 1 1/2 minutes, and only the weld nearest the film was read.

6. Improvements in Procedure

Slight 'sugaring' of the root on one weld, indicating water vapor

inside the pipe, required a small amount of grinding to remove this weld metal. The welding engineer for P-G felt that this was due to freeze plug ice giving up water vapor, due to the effect of heat from the weld and from the purge gas. In the future, this problem would be eliminated by using a dissolvable paper dam between the freeze plug and the weld root area.

7. Personnel Qualifications

The inspector examined the welder qualifications for the welders assigned to the job. Six welders and six fitters were assigned and worked under actual conditions for the welds during mocking-up operations. The following welders were assigned from P-G.

Name	Identification
W. Baker	V
C. Rashke	IV
V. Stateman	A
V. Anderson	ZS
J. Toke	GZ
J. Taylor	B4

The NDE (radiography and PT) were performed by Conam. The following personnel from Conam were used for the mock-up weld tests and repair welding.

Name	
O. Millang - Level 2	Radiography
L. Fleming - Level 2	Radiography
S. Hamilton - Level 2	Radiography

REPORT DETAILS

Part IV

Prepared by R. J. Cook R. J. Cook 12/24/74 (Date)

Reviewed by E. L. Jordan E L Jordan for 12/24/74 (Date)

A. Meeting at General Electric Co. San Jose, California

A meeting had been held at AEC-HQ on October 3, 1974 with members of Commonwealth Edison Company (CE) staff, representatives of General Electric Company (GE), associated consultants, and members of various AEC organizations to discuss cracking which had occured in 4 inch bypass lines in GE boiling water reactors (GE-BWR's). As a continuation of this meeting, a meeting was held at GE - San Jose, California on October 29, 1974 between members of the AEC and GE to discuss the results of GE's continued evaluations into the cause of the cracking.

Persons Attending the October 29 Meeting

General Electric Company

D. Hill
R. Shipp
J. Kass
D. Delwiche
J. Major
C. Rowland

AEC

R. Cook, RO:III
F. Almeter, DOL
J. Weeks, BNL/DOL

The following is a synopsis of items discussed at the GE meeting and the preliminary conclusions derived:

1. Common Heat Pipe

Cracks have been detected at Dresden-2 (D-2), Quad Cities-2 (QC-2) and Millstone reactor plants. The piping material used for these plants is from a common type 304 stainless steel heat. However, GE stated that similar cracking had been detected in two foreign based reactors which used a different stainless steel

at the GE - San Jose meeting agreed that there appeared to be no anomolies in the chemical composition of the piping material.

7. Vibration

GE has taken operational vibration amplitude measurements at the Duane Arnold plant. The maximum amplitude measured is approximately 0.005 inches (sinusoidal). It was believed that during residual heat removal (RHR) operations, the amplitude may be slightly greater but the quantitative value was not known. The piping installation and relative location of the 4 inch valve at the Duane Arnold Plant is claimed to be similar to the installations at D-2 and QC-2. GE is continuing investigations as to whether vibrations could be a significant contribution to crack nucleation and propogation.

8. Stresses

Stress assisted corrosion cracking has been designated as the type of attack experienced at D-2, QC-2, and Millstone. It was established that minimum stress levels of approximately yield point are required to induce this type of attack. Stress calculations for combined pressure, weight and thermal expansion loadings were performed for the reduced (from weld preparation) pipe cross section in the proximity of the crack location. These calculations indicate nominal combined stress levels of 6000 psi or less - much less than yield point stresses. The geometry of the pipe cross section at the crack location does not appear erratic enough to produce stress risers which would yield significant shape factors.

The qualitative sensitivity of the bypass line to thermal gradient stresses, system stresses and vibrations was discussed as a plausable source of yield point stress levels in the common design used at D-2, QC-2 and Millstone. Although yield point stress levels could not be quantitatively accounted for, the participants at the meeting were in agreement that GE's recommendation to leave the 4 inch bypass valve open would relieve the stress contributions from thermal gradients and thermal expansion and the corrosion complications which may be induced by quasi stagnant water.

B. Meeting at Argonne National Laboratories

Agronne National Laboratories (ANL) has been retained as a consultant to CE and has performed extensive metallurgical examinations on pipe crack samples from D-2 and QC-2. A meeting was held between ANL staff members, CE, and AEC to discuss the results of these metallographic examinations.

Persons Attending Meeting

ANL

C. Cheng
R. Weeks

Commonwealth Edison Company

E. Bailey
D. Galle

AEC

R. Cook, RO:III
F. Almeter, DOL
A. Taboada, RS
J. Weeks, BNL/DOL
H. Isaacs, BNL/DOL
R. Moser, CH
J. Borg, CH

The following items were discussed at the ANL meeting:

1. Fatigue Striations

Metallographic examinations performed by ANL of the fracture surface from a D-2 pipe sample revealed the presence of some minor fatigue striations. It was postulated that these fatigue striations occured after crack nucleation and probably not until late in crack life.

2. Residual Stresses

ANL performed x-ray defraction measurements in the proximity of the weld and in the piping base metal. A qualitative comparison between these defraction measurements revealed that significant residual stresses may be present close to the weld. At the time of the meeting, ANL was preparing to have quantitative residual stress measurements taken at another laboratory as ANL does not posses the necessary equipment to accurately perform such measurements.

3. Thermal Stresses

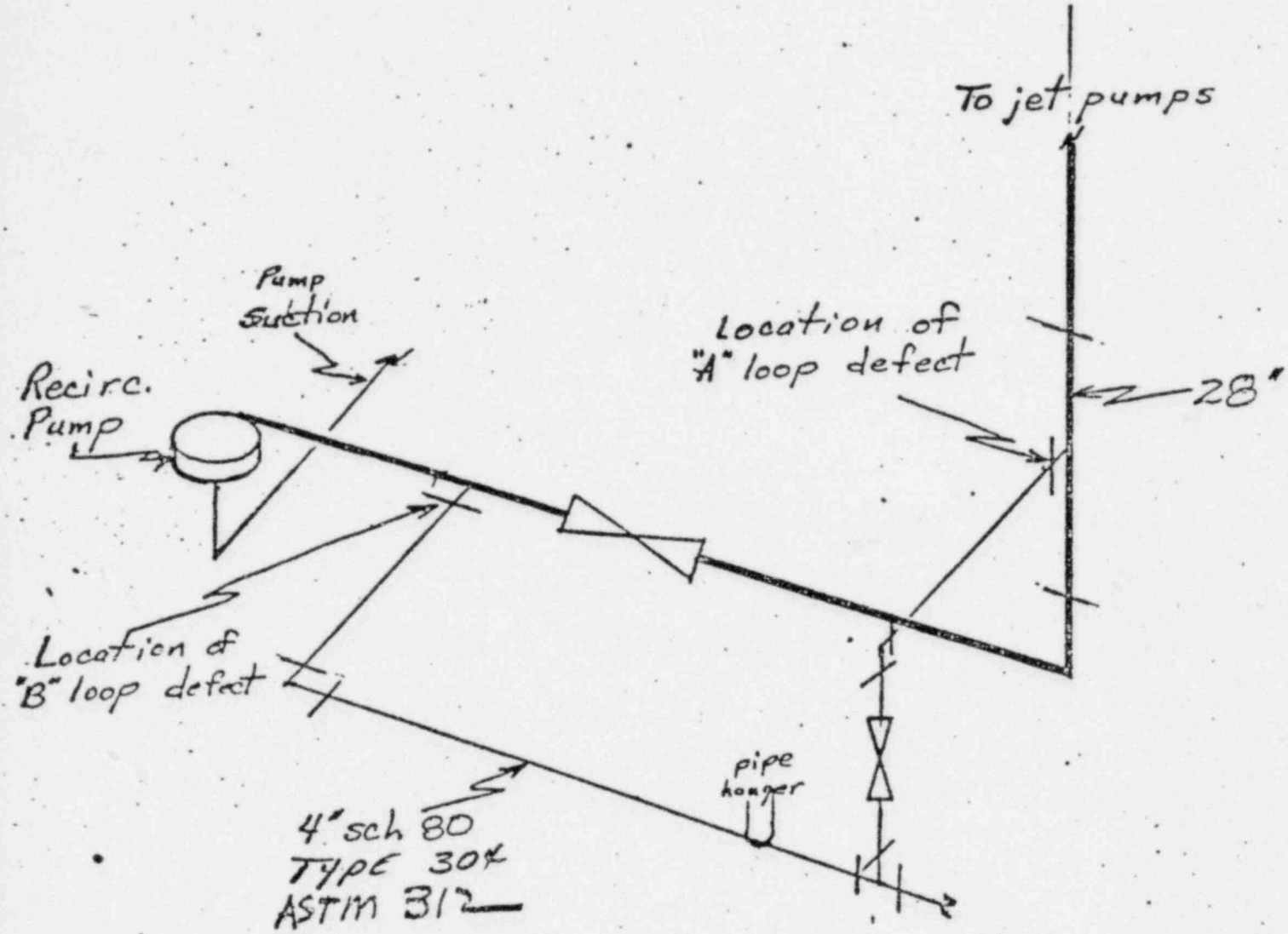
The sensitivity of the reduced pipe cross section (from weld preparations) to thermal gradient stresses was discussed as a possible source of additional stress necessary to induce stress assisted corrosion cracking. The results of an analytical

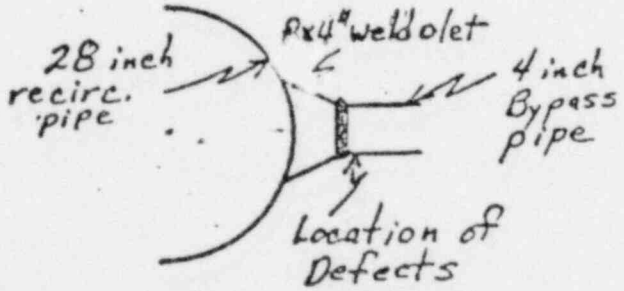
analysis performed to demonstrate the sensitivity of the 4 inch bypass line to thermal gradients revealed that moderate differential temperatures could, when combined with applied weight and pressure loads, induce yield point stresses.

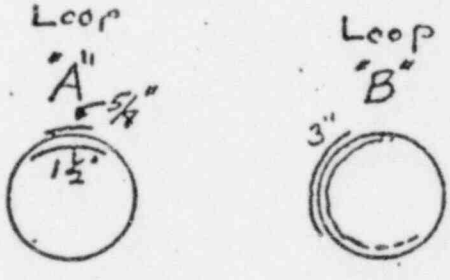
4. Ultrasonic Testing

ANL used ultrasonic testing (UT) techniques to establish crack orientation in the laboratory samples. Additional crack indications were detected in the laboratory which had not been previously detected by field UT or radiographs. The presence of these additional crack indications was discussed. It was the opinion of ANL that the techniques used in the field UT examinations probably would not have detected these cracks.

Dresden 2 Recirculation Pipe Defects
Sept. 13, 1974







OD and ID cracks in 4" pipe

UNITED STATES
ATOMIC ENERGY COMMISSION
DIRECTORATE OF REGULATORY OPERATIONS
REGION III
799 ROOSEVELT ROAD
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RO Inspection Report No. 050-010/74-13

A. RO Inspection Report No. 050-010/74-09

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