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June 3, 1985

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

Subject: Dresden Station Unit 3
Submittal of Recirculation
System Piping Replacement
Plan
NRC Docket No. 50-249

Reference (a): H. R. Denton letter to D. L. Farrar
dated March 15, 1984.

Dear Mr. Denton:

The referenced letter transmitted an Order related to the IGSCC inspection conducted at the last refueling outage. That Order required submittal of plans for inspection and/or modification including replacement of the recirculation piping 90 days prior to the start of the next refueling outage. This letter fulfills that requirement by transmittal of the attached Commonwealth Edison plan to replace the reactor recirculation system and portions of other IGSCC susceptible piping for Dresden Unit 3 during its Fall 1985 outage. Any piping not replaced will be inspected in accordance with Generic Letter 84-11.

Plans are underway to schedule a meeting with members of your Staff to discuss our replacement plans and to answer any related questions.

Commonwealth Edison will submit its ALARA plan, pursuant to Generic Letter 84-07, at a later date. One signed original and forty (40) copies of this transmittal is provided for your use.

Very truly yours,

B. Rybak
B. Rybak
Nuclear Licensing Administrator

lm

Attachment

cc: R. Gilbert - NRR
NRC Resident Inspector - Dresden

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COMMONWEALTH EDISON COMPANY

DRESDEN STATION UNIT 3

RECIRCULATION SYSTEM PIPING REPLACEMENT PLAN REPORT

I. INTRODUCTION

Commonwealth Edison Company is undertaking a project to replace piping susceptible to intergranular stress corrosion cracking (IGSCC) at Dresden Station Unit 3. During the 1983 Dresden Unit 3 outage, inservice inspection revealed cracks in several welds in stainless steel piping located inside the drywell. The cause has been attributed to the IGSCC phenomenon. Temporary repairs to the welds were made by applying weld overlays or Induction Heating Stress Improvement (IHSI). Permanent repairs will be made by replacing the IGSCC susceptible piping, safe ends, and some drywell penetrations. IHSI treatment is being considered for the new piping welds.

The replacement activity is scheduled to commence during the fall 1985 Dresden Unit 3 refueling outage.

The following report provides an overview of the piping replacement project outlining the basic approach and describing the major aspects.

II. REPLACEMENT SCOPE

A. Reactor Recirculation (RRCI)

Reactor recirculation loops A and B provide forced circulation of reactor water through the reactor vessel. Most of this system will be replaced. The RRCI discharge valve bypass lines and the ring header cross-tie line along with associated valves will be deleted.

Piping connecting the Reactor Pressure Vessel (RPV) to the recirculation pumps and piping connecting the pumps to the ring headers will be replaced. In addition, the two ring headers with 10 riser pipes connected to the RPV are to be replaced. Associated safe ends are also included in the replacement scope.

B. Low Pressure Coolant Injection (LPCI)

The two LPCI systems provide cooling water to the reactor vessel in the event of a loss-of-coolant accident. Piping will be replaced from the two RRCI 28" header connections to the outboard isolation valves.

C. Reactor Water Clean-Up (RWCU)

The RWCU system is used to remove contamination from the primary fluid during normal operation. Piping will be replaced from the Shut Down Cooling (SDC) header, through the drywell wall, and up to the outboard isolation valve. In addition, the 6" blind flange and the 2" tap line connected to the RPV drain line will be replaced.

D. Shut Down Cooling (SDC)

The two Shut Down Cooling systems provide decay heat removal during normal shutdown or following an accident. Piping from the 28" RRCI Suction Line up to but not including the SDC inboard isolation valves are to be replaced.

E. Core Spray (COSP)

The COSP system provides cooling to the fuel in the reactor under loss-of-coolant conditions associated with large pipe breaks and reactor vessel depressurization. Piping from the RPV to the COSP inboard isolation check valves are to be replaced. Associated safe ends will also be included in the scope.

F. Control Rod Drive Return Line (CRDS)

The CRD system provides a water source for charging the scram discharge accumulators, normal drive operations, and cooling of each control rod drive mechanism. The CRD return line provides a flow path to the reactor vessel for CRD flow in excess of that required for CRD operation. The return line will be "cut and capped" from the RPV nozzle including the safe end, up to but excluding the check valve outboard of the shield wall. The remaining RPV nozzle, drywell penetration, and uncut CRD return piping will be capped.

G. Isolation Condenser Return Line (ISCO)

The Isolation Condenser system provides cooling to the RPV, without loss of water, when the RPV is isolated from the main condenser. The ISCO return line from the SDC header line up to but not including the inboard isolation valve is to be replaced.

III. ENGINEERING

The principle engineering objective is to provide a revised design for the IGSCC affected piping that will minimize the potential for future cracking. The general approach will be to use an IGSCC resistant replacement material in an optimized piping configuration that minimizes the number of welds and facilitates inservice inspections.

A. Material Selection

The replacement piping material will be Type 316 NG stainless steel with maximum contents of 0.02 weight percent carbon and 0.10 weight percent nitrogen (0.06 weight percent minimum). This material meets the ASME strength requirements for regular grades of Type 316 stainless steel and the guidelines set forth in NUREG-0313, Revision 1.

B. Codes Requirements

The original piping systems met the requirements of USAS B31.1.0-1967. In addition, all piping from the reactor vessel up to the first isolation or stop valve was under the jurisdiction of ASME Section I, 1965 edition, winter 1966 addenda. In addition, nuclear code cases N-1, N-2, N-3, N-4, N-7, N-8, N-9, N-10, and N-11 were used. These original codes of record shall be maintained. New requirements will be reconciled to these codes such that the original codes of record will be preserved.

The 1977 edition with addenda through summer 1979 of ASME Section XI governs the plant operation and inspection.

ANSI/ASME B31.1 and, as applicable, ASME Section I (edition and addenda as referenced above, will govern the piping replacement work. In addition, the following supplemental requirements have been optionally added in order to assure that all replacement work is to the extent practical consistent with the quality level of current codes and standards. These supplemental requirements will not alter the code of record.

a. Materials will meet the following additional requirements from ASME Section III; exemptions from material examinations due to size will not be allowed.

   NB-2130
   NB-2150
   NB-2432
   NB-2433
   NB-2500

b. Analysis will be in accordance with Article NB-3000 of ASME Section III, however the analysis will be reconciled with USAS B31.1.0-1967 to maintain the code of record.

c. Fabrication will also meet the following from ASME Section III:

   NB-4122
   NB-4230
   NB-4240
   NB-4250
   NB-4320
   NB-4330
   NB-4410
   NB-4450

d. Examinations will be in accordance with Article NB-5000 of ASME Section III. In addition, preservice examination shall be performed in accordance with ASME Section XI as supplemented by nuclear code case N-335.

e. Hydrostatic testing will be performed in accordance with IWA-5000 of ASME Section XI.

C. Design Improvements

In addition to reducing the potential for future IGSCC by using type 316 NG stainless steel, the revised piping system design eliminates as many welds as possible by utilizing bent pipe instead of fittings. The number of large pipe to pipe welds in the Recirculation System have been reduced from approximately 115 to 70, a 39 percent reduction. Similar percentage of weld reductions are expected for the other systems included in the Recirculation System Piping Replacement Project scope. Reduction of the number of welds not only minimizes the potential for future cracking, but also reduces radiation exposure to personnel during construction as well as during inservice inspections for the remainder of plant life.

As part of the configuration optimization effort, the RRCI ring header cross-tie and valves will be deleted in the modified design. The technical specification now prohibits opening the cross-tie valves during reactor operation. The RRCI discharge valve by-pass will also be eliminated to further minimize the number of welds.

D. Design and Analysis

The new material and modified piping configuration will require that various analysis be done on the replaced piping, safe ends and flued heads. These analyses will be performed in accordance with Article NB-3000 of ASME Section III, 1980 edition with addenda through Summer 1982. In addition, the analysis will be reconciled with USAS B31.1.0-1967 to maintain the code of record. Reinstalled pipe supports, pipe whip restraints, branch lines and instrumentation lines will be analyzed to original criteria. New supports and new portions of old supports will be designed to the criteria of MSS-SP58 (1975 or 1983), MSS-SP69 (1976 or 1983), ANSI and B31.1 (1980, Addenda through Summer 1981).

The design pressure and temperature for the RRCI suction piping is 1175 psig and 575°F, and 1375 psig and 580°F for RRCI discharge piping. All other affected piping in the replacement scope has a design temperature and pressure of 575°F and 1250 psig. These pressures and temperatures including piping weight will constitute the design loads for the ASME Section III Class I piping analysis. Service level analysis of the piping will include combinations of the design loads plus the original designed pressure/temperature transients and seismic response spectra. Subarticle NB-3200 of the ASME Section III code will be used for the Class I stress and fatigue analysis of the flued heads and safe ends.

The replacement safe end and transition piece for the recirculation inlet nozzle will be furnished as ASME Section III, Class 1 material. For the safe end, this is consistent with the classification of the original safe end since it was supplied under the jurisdiction of ASME Section I. The transition piece, if used to replace the thermal sleeve reducer, is not a primary pressure boundary component but for convenience has been designed to have the same classification as the safe end.

In the design of the safe end, mechanical pipe reaction loads and thermal sleeve reaction loads have been applied to the safe end. The thermal cycles, which have been specified for the safe end thermal and fatigue analysis, represent only the operating cycles that involve a temperature transient in the nozzle. These transients have been categorized into service levels, which are required by the ASME Section III code, based on the frequency of the thermal transient and the function of the nozzle during the transient.

A tunning fork design will be supplied to minimize thermal stresses on the nozzle. The length of thermal liner to be replaced, from safe end to jet pump, will depend on the finding of intergranular stress corrosion cracking (IGSCC) near the existing safe end. A deep cut replacement is planned if IGSCC is found. Safe end and thermal sleeve replacement material will be type 316 NG Stainless Steel.

The functional requirements which will be met for the safe end design are that it must interface with the existing nozzle and thermal sleeve and the replacement piping without affecting the performance of the recirculation system and the reactor vessel. Additionally, the safe end replacement is to be accomplished without affecting the fitup and operation of the components which are a part of the jet pump. This will require control of the alignment of the remaining inner thermal sleeve pipe in the nozzle during the repair.

The environmental conditions used on the exterior of the nozzle are the same as those used for the original nozzle design. The design life of the replacement safe end and transition piece is forty years.

Additional analysis will examine:

- Flow characteristics of the redesigned recirculation system to ensure that no significant differences in flow will result from the new configuration.

- Valve and pump loads to ensure that they are within acceptable limits.

- Lifting point loads to determine the adequacy of the structural steel members to take the additional loads.

- Shielding loads on structures, piping, and supports to ensure that no over loads occur:

In addition to the design analysis tasks, engineering activities will center around design, process and procurement specification preparation, project documentation, and field support/construction change review.

IV. CONSTRUCTION

The primary objective during the implementation phase aside from expediting equipment removal and replacement will be the prudent management of material and personnel to meet project ALARA and quality assurance requirements. All work in radiation areas will be planned, scheduled, implemented and reviewed to minimize personnel exposure. All work in Radiation areas will be reviewed and approved in accordance with the project ALARA Plan. Procedures, as necessary, will be integrated into the overall plan to accomplish the work in the most effective manner, while minimizing personnel exposure and environmental impact.

Tooling, fixtures, shielding, and decontamination will be designed and used to prudently reduce exposure levels.

All onsite piping replacement project personnel will receive training through the onsite Commonwealth Edison Nuclear General Employee Training (NGET) program. Training includes general radiation procedures, ALARA procedures, contamination control measures, and site emergency plans and procedures. Special training will be provided for specific tasks utilizing mock-ups and the actual equipment and tools intended to be used in performing the actual work.

In support of the piping replacement project a training facility and a fabrication facility will be constructed. Classroom training and initial welder qualification will be performed in the training facility. Mock-ups located in the fabrication facility will be utilized to train and qualify personnel in conditions simulating the actual piping configurations and the use of protective clothing.

V. OPERATIONS

Plant conditions to support the replacement program will be established to maintain a safe shutdown condition, implement radiation reduction activities, sustain required water levels or other special lay-up needs, and control or isolate equipment and systems for plant and worker safety.

Post outage preoperational and startup test procedures will be utilized with such objectives as to demonstrate:

- system flow path verifications
- isolation valve operability and response
- system thermal expansion and vibration movements
- drywell leak rate conformance to technical specifications
- operability of the reinstalled interferences

Final test results will demonstrate that system characteristics are not significantly different than those evaluated in the FSAR and the performance of engineered safety features are not degraded by the replaced piping systems.

VI. LICENSING

Licensing reports and safety evaluations will be prepared for the replacement project. Specific activities are as follows:

- 10 CFR 50.59 Safety and Licensing Evaluation:

  A systematic safety evaluation will be performed and documented for each aspect of the IGSCC Pipe Replacement Project in accordance with 10 CFR 50.59 and the Technical Specifications. It is anticipated that the plant can be operated in accordance with the current operating license with only minor administrative changes to the existing Technical Specifications. Replacement of the recirculation and associated piping is not expected to result in any unreviewed safety questions. No changes to the accident evaluations presented in Chapter 14 of the FSAR are anticipated as a result of the piping replacement project.

  No significant difference in recirculation flow will occur as a result of the replacement since piping size and effective pipe length are essentially unchanged. Hydraulic analyses have determined that the riser flows will change less than 1% and the system resistance change is negligible. Therefore core flow distribution will remain unchanged after the replacement. During startup testing on approximately the 100 percent rod line jet pump surveillance data will be obtained.

  Modifications to existing pipe whip restraints, changes to a restraint's location or it's removal, and any changes in peak pipe stress point locations will be examined for any impact on the original pipe break analysis. Piping stress calculations will demonstrate that stress levels in relationship to material allowable stresses are not increased over those currently evaluated.

No changes in operating parameters are anticipated as a result of these repairs. Replacement of existing 304 material with low carbon 316NG can be expected to enhance plant safety. This is because the possibility of reactor pressure boundary leakage will be significantly reduced with the expected reduction or elimination of IGSCC.

- ALARA Licensing Report:

  A document describing the project radiation protection program will be issued at a later date. Included will be a description of the pre-outage planning procedures, shielding, equipment, personnel training, estimated total cumulative dose and other measures to be initiated to keep exposures as low as reasonably achievable.

VII. IDENTIFICATION OF PRINCIPAL AGENTS AND CONTRACTORS

Principal agents involved in the pipe replacement efforts are:

A. Commonwealth Edison Company (CECo)
Chicago, Illinois

CECo is the sole owner and licensee of the Dresden 3 Nuclear Plant and is the overall project manager.

B. IMPELL Corporation
Bannockburn, Illinois

Commonwealth Edison Company has contracted IMPELL to design, plan, engineer and assist in the execution of the piping replacement activity.

C. Chicago Bridge and Iron Company (CBI)

CBI will serve as the piping installer at Dresden 3.

D. London Nuclear Services, Inc. (LNS)
Niagara Falls, New York

LNS has been selected to decontaminate the reactor coolant system prior to pipe removal.