U. S. NUCLEAR REGULATORY COMMISSION
REGION I

Report No. 50-354/91-02

Docket No. 50-354

License No. NPF-57

Licensee: Public Service Electric & Gas Company

Facility Name: Hope Creek Generating Station

Inspection At: Hancocks Bridge, New Jersey

Inspection Conducted: January 28-31, 1991

Inspectors: R. A. McBrearty/W.J.K for — 3-1-91
R. A. McBrearty, Reactor Engineer — date

Approved by: E. H. Gray/W.J.K for — 3-1-91
E. H. Gray, Chief, Materials & Processes Section, EB, DRS — date

Inspection Summary: Inspection on January 28-31, 1991 (Inspection Report No. 50-354/91-02)

Areas Inspected: A routine, unannounced inspection was conducted of the licensee's inspection activities to ascertain that those activities were conducted in accordance with applicable ASME Code and regulatory requirements. Particular emphasis was placed on actions taken with respect to recirculation system pipe weld cracks, NDE personnel qualification/certification records, and the documentation of nonconforming nondestructive examination results. In addition, the licensee's latest response to Generic Letter 88-01 was inspected.

Results: The inspector concluded, based on the areas inspected, that the licensee's activities complied with applicable requirements. Commitments made in the licensee's response to Generic Letter 88-01 complied with requirements of the GL and its response showed that previous commitments were complied with.

Details

1.0 Persons Contacted

Public Service Electric & Gas Company

J. DiMarzio, Inservice Inspection Supervisor
*B. E. Hall, Technical Manager - Hope Creek
*R. Hovey, Operations Manager - Hope Creek
*L. F. Lake, Inservice Inspection Engineer
*E. Maloney, Principal Engineer - Quality Assurance
M. Oliveri, Nondestructive Examination Supervisor
*D. A. Smith, Station Licensing Engineer
*W. P. Freston, Senior Inservice Inspection Supervisor

U.S. Nuclear Regulatory Commission

*T. Johnson, Senior Resident Inspector
*K. Lathrop, Resident Inspector

2.0 Inservice Inspection Activities (73753)

The Hope Creek facility is in the 2nd period of the 1st 10-year inspection interval. The 1991 outage, the 3rd overall refueling outage, is the 1st refueling outage of the period. Refueling outages at the facility presently are scheduled on an 18 months cycle. The 1983 Edition, Summer 1983 Addenda of the ASME Boiler and Pressure Vessel Code Section XI governs the examinations which are required to be completed during the 10-year interval.

Inservice Inspection (ISI) results associated with ultrasonic and liquid penetrant examination of recirculation system pipe welds were selected for inspection to verify compliance with procedural and programmatic requirements. Additionally, licensee actions related to the detection of defects in recirculation system pipe welds were inspected.

Background

During scheduled inservice inspections, indications of surface cracks on a 28" diameter A-loop recirculation system pipe weld were detected by the liquid penetrant examination method. Subsequent examination of the corresponding B-loop weld revealed similar indications. Both were shop welds which were subjected to solution heat treatment to mitigate intergranular stress corrosion cracking (IGSCC).

Licensee Actions

Licensee actions subsequent to discovery of the cracks included metallurgical analysis of samples obtained from the welds by the General Electric Company, the liquid penetrant examination of all remaining 28" diameter recirculation system welds and one 12" diameter safe-end weld, a total of 39 welds. The Electric Power Research Institute (EPRI) was contacted and an EPRI representative was sent to the site to assist in the development of a supplemental ultrasonic examination technique capable of detecting cracks in the upper portion of a weld. (The Section XI inservice ultrasonic examination concentrates on the lower 1/3 of the weld). Additionally, EPRI fabricated a demonstration block to prove that the supplemental ultrasonic technique could detect the type of cracks for which it was designed. The block was fabricated with three cracks as follows:

Crack #1 - Open to the outside surface, 0.40" deep, 3" long and circumferentially oriented.

Crack #2 - Open to the outside surface, 0.30" deep, 1½" long with transverse orientation.

Crack #3 - Subsurface, 0.25" to 0.50" deep, 5¼" long and circumferentially oriented.

Note: Orientation is with respect to the weld axis.

The licensee determined that there were fifty shop welds which were later solution heat treated. The fifty welds included thirty 12" welds, four 22" welds, and sixteen 28" welds. A sample of the fifty welds was selected by the licensee to be examined with the supplemental ultrasonic technique, and with the liquid penetrant method. Based on the use of MIL-STD-105D, the licensee determined that the sample size should be made up of eight welds, and selected five 28" welds and three 12" welds from the fifty weld population of shop welds which were solution heat treated. The NRC discussed the adequacy of the sample size for determining the return of the facility to service after the refueling outage, and the use of MIL-STD-105D to determine the sample size. Licensee discussions with NRR and NRC Region I staff regarding sample size and use of the MIL-STD were in progress at the conclusion of this inspection.

Findings

The inspector determined that ASME Code Section XI requirements regarding sample expansion were complied with. The original recirculation system inspection sample was comprised of eight welds. The sample size was increased by eight additional welds subsequent to finding the 28" diameter cracked A-loop weld. When the second 28" diameter weld was found to be cracked (B-loop), all remaining 28" diameter welds were liquid penetrant

examined. Liquid penetrant examination revealed the two cracked welds, therefore that method was used to examine the expanded sample. In addition to the 38 additional 28" diameter welds, one 12" diameter safe-end weld was penetrant tested with no additional indications.

The inspector's review of data associated with ultrasonic, magnetic particle and liquid penetrant examinations verified that welds on the recirculation system and other piping systems were examined in accordance with applicable ASME Code and regulatory requirements.

Observation by the inspector of the use of the supplemental ultrasonic examination technique on the known cracks in the demonstration block confirmed that the technique was a viable method for assessing weld quality when used in conjunction with another nondestructive examination (NDE) method such as liquid penetrant.

Qualification/certification records of the licensee's ISI vendor personnel responsible for performing examinations associated with data reviewed by the inspector were examined. The records confirmed that each individual was certified per SNT-TC-1A to the appropriate level of expertise required for his assigned responsibilities. Additionally, personnel responsible for the recirculations system ultrasonic examinations were listed on the latest EPRI "Registry of Qualified Personnel for UT of IGSCC."

Conclusion

The licensee's ISI program is being implemented in compliance with applicable ASME Code and regulatory requirements and nondestructive examinations are performed by certified technicians.

Licensee actions resulting from the recirculation system pipe weld cracks involved licensee, General Electric, and EPRI personnel and incorporated state-of-the-art equipment and techniques. Actions taken by the licensee included the fabrication of a special ultrasonic demonstration/calibration block and the development of a supplemental ultrasonic examination technique to determine the extent of the cracking problem. Those actions along with a metallurgical analysis of samples obtained from the cracked welds exceeded Section XI requirements to expand the sample and perform expanded sample examinations using the method which detected the defects originally.

3.0 Licensee Response to Generic Letter (GL) 88-01 (92703)

Intergranular stress corrosion cracking near weldments in BWR piping has been occurring for almost 20 years. Early cases were in relatively small diameter piping. In early 1982, cracking was identified in large-diameter piping in a recirculation system of an operating BWR plant in this country. Since then, extensive inspection programs have been conducted in BWR piping systems which have resulted in the detection of significant numbers of cracked weldments in almost all operating BWRs.

Substantial efforts in research and development by the BWR Owners Group for IGSCC, related work by vendors and consulting firms, and confirmatory research sponsored by the NRC have permitted the development of revised staff positions regarding the IGSCC problems.

The technical bases for these positions are detailed in NUREG-0313, Revision 2, "Technical Report on Material Selection and Guidelines for BWR Coolant Pressure Boundary Piping". NUREG-0313, Revision 2 describes the technical bases for the staff positions on materials, processes, and primary coolant chemistry to minimize and control IGSCC Problems. Inspection schedules and inspection sample sizes are based on the susceptibility of weldments to initiation and propagation of IGSCC. Inspection schedules are comparable to those specified in Section XI of the ASME B&PV Code in cases where the piping material is IGSCC resistant.

This Generic Letter applies to all BWR piping made of austenitic stainless steel that is four inches or larger in nominal diameter and contains reactor coolant at a temperature above 200°F during power operation, regardless of Code classification. The letter also applies to reactor vessel attachments and appurtenances such as jet pump instrumentation penetration assemblies and head spray and vent components. Licensees were requested to respond to the GL within 180 days of the receipt of the letter. The GL provides a list of specific items which should be included by licensees to constitute an acceptable response to the GL.

The licensee's original response to the GL dated July 29, 1988, was documented in Inspection Report 50-354/89-03 and identified that twenty welds were classified as Category G per NUREG-0313, Revision 2. The response committed to inspect all of those welds by the end of the second refueling outage. The schedule complied with the GL recommendation that all Category G welds must be examined at the next refueling outage after issuance of the letter. The commitment to inspect the "G" welds was met, and resulted in the welds reclassification to Category D.

An NRC request for additional information, dated March 24, 1989, resulted in a second licensee response, dated June 2, 1989, in which the reinspection schedule was changed from the fourth and sixth refueling outage to the third and fifth outage. The revised schedule was approved by the NRC staff, although the original schedule did comply with the generic letter.

The licensee's response to the GL, dated December 18, 1990, included Table A which identified the results and dates of previous inspections, and a revised schedule for future inspections whereby all susceptible weldments will be inspected during the fourth and sixth outage, reverting to the schedule set forth by the July 29, 1988 response. The licensee's revised inspection schedule complies with the intent of the Generic Letter which requires that all Category D welds be inspected every two refueling cycles. The schedule was revised to accommodate anticipated

refueling outage work loads associated with the required 10 year plant inservice inspection which shows integrated leak rate tests (ILRT) scheduled for the fifth and seventh refueling outages.

Conclusion

The licensee has complied with Generic Letter 88-01 regarding previous commitments and inspection requirements. The latest inspection schedule, although different than earlier schedules submitted to the NRC, complies with the inspection schedule identified by Table 1, Attachment A of Generic Letter 88-01.

4.0 Erosion/Corrosion Examination Program (57080)

Concern regarding erosion and corrosion in balance of plant piping systems has been heightened as a result of the December 9, 1986 feedwater line rupture that occurred at Surry Unit 2. This event was the subject of NRC Information Notice 86-106 issued December 16, 1986 and its supplement issued on February 13, 1987.

The inspector reviewed the licensee's actions with regard to the detection of erosion/corrosion in plant components. The inspection was conducted to ascertain the scope of the licensee's program and the results to date.

The licensee has established an inspection program to assess the condition of various components in the plant with regard to erosion/corrosion. The program was developed with the aid of the EPRI-generated CHEC computer diagnostic program in conjunction with engineering judgement. Components are selected for inspection prior to a scheduled outage based on previous inspection results.

The results of the latest inspection conducted during the 1991 refueling outage show that eighty five areas were examined, and that no significant thinning was detected. Inspection results are entered into a computer data base which permits more efficient data review, calculation of a corrosion rate, and enhances the licensee's trending capabilities.

Responsibility for developing an ultrasonic examination procedure for performing thickness measurements is assigned to the ISI Group, and the ISI engineer, the piping engineer and the system engineer who are required to review the results of the ultrasonic thickness measurements. Components or areas that are found to be below the code minimum thickness must be evaluated by the cognizant system engineer and the cognizant piping engineer to determine the need for immediate replacement or to allow continued use. The Nuclear Mechanical Engineering Group has the ultimate responsibility for disposition of results.

Conclusion

The licensee has an effective program for assessing erosion/corrosion in plant components which is based on industry standards. The responsibility for developing procedures, review of inspection results, and the disposition of inspection results is assigned to the groups and individuals who are qualified to perform each of those functions.

5.0 Review of Inservice Inspection Related Deficiency Reports (73753)

Deficiency reports (DR) Prepared by the licensee to document unacceptable inservice inspection results were selected for inspection to ascertain that the documentation was properly prepared, the unacceptable condition was clearly defined, corrective action was acceptable and the items were properly closed out. The following were included in the inspection:

- DR# HMD - 91-037 dated 1/14/91
  The report documented three linear magnetic particle indications detected on 18" diameter RHR system B-loop elbow to pipe weld No. 1-BC-18GBB-004 C-3. The documentation verified that the source of the indications was removed by a light flapping operation which was proven not to violate minimum wall thickness requirements. Documentation further confirmed that re-examination with the magnetic particle method confirmed that, subsequent to the flapping operation, the weld was free of indications and acceptable for continued service.

  At the time of this inspection all required corrective actions were completed, but the DR remained open pending the required close-out signatures.

- DR# HMT - 91-083 dated 1/29/91
  The report was prepared to document an unacceptable magnetic particle indication on 12" diameter RHR system pipe to elbow weld No. 1-BC-12GBB-063A-2.

The source of the indication was removed by a flapping operation. Subsequent examinations confirmed removal, that minimum wall thickness requirements were not violated, and that the weld was restored to an acceptable condition.

At the time of this inspection all required corrective actions were completed, but the DR remained open pending the required closeout signatures.

- DR# HMT - 91-084 dated 1/29/91

  The report was prepared to document an unacceptable linear magnetic particle indication on the 20" diameter HPCI steam system pipe to tee weld No. 1-FD-20 HBB-006-2.

The source of the indication was removed and subsequent examinations verified removal, that minimum wall thickness requirements were not violated, and that the weld was restored to an acceptable condition.

At the time of this inspection all required corrective actions were completed, but the DR remained open pending the required closeout signatures.

Conclusion

The reports were clearly written, the problem was well defined and proposed corrective action was documented. Further, the corrective action was performed promptly in accordance with engineering instructions, and ASME code non-destructive examination requirements were complied with.

6.0 Exit Meeting

The inspector met with licensee representatives, denoted in paragraph 1, at the conclusion of the inspection on January 31, 1991. The inspector summarized the scope and findings of the inspection.

At no time during the inspection was written material provided by the inspector to the licensee. The licensee did not indicate that proprietary information was involved within the scope of this inspection.