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SUBJECT: Requests reevaluation of NRC denial of Relief Request RR-12 based on submitted info.

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SUSQUEHANNA STEAM ELECTRIC STATION
SECOND INSERVICE INSPECTION INTERVAL
PROGRAM RELIEF REQUEST RR-12, NUREG-0313,
TECHNICAL REPORT ON MATERIAL SELECTION
AND PROCESSING GUIDELINES FOR BWR
COOLANT PRESSURE BOUNDARY PIPING
PLA-4537 FILES R41-2, R15-10

Docket Nos. 50-387
and 50-388

References:

1. *Letter from R.G. Byram (PP&L) to NRC Document Control Desk, (PLA-4387), "Second Inservice Inspection Interval Program Relief Request RR-12: NUREG-0313, Technical Report on Material Selection and Processing Guidelines for BWR Coolant Pressure Boundary Piping," dated 11/13/95.*
2. *Letter from J.F. Stolz (NRC) to R. G. Byram (PP&L), "Susquehanna Steam Electric Station, Units 1 and 2, Second Inservice Inspection Interval Program-Denial of Relief Request RR-12, NUREG-0313," dated 6/24/96.*

Pennsylvania Power & Light Company (PP&L) has reviewed the NRC response (Reference 2) regarding PP&L's Relief Request No. RR-12. PP&L is requesting a reevaluation of the NRC's denial of Relief Request No. RR-12 based on the following:

PP&L's proposal in Relief Request No. RR-12 provides inspections to monitor both short term and long term effects and trends that may develop over an inspection interval from IGSCC/MSIP. Our Relief Request would translate to 50% of all MSIP welds being ultrasonically examined within two cycles of stress improvement with the balance being examined over the remainder of the interval. With the completion of the Second 10-Year Interval Testing, another reassessment of Relief Request No. RR-12 would be done.

PP&L concludes that this approach provides prudent, cost-effective, low dose monitoring of stress improved weldments plus assures the safety of the public. With this approach in mind, we offer our responses to the staff's comments.

NRC Comment (1):

The intergranular stress corrosion cracking (IGSCC) is a time-dependent process. For IGSCC susceptible welds, its potential for IGSCC to occur is likely to increase with the aging of the operating plants. Therefore, it is not prudent to decrease the inspection scope and increase the interval between inspections as plant's age.

PP&L Response:

Stress corrosion cracking of piping components requires three elements to be present. They are material susceptibility, corrosive environment and tensile stress. The tensile stress driving force for cracking has been removed by the application of MSIP. Field experience is that after 8 years of operation, cracking would be detected.

To date, no cracking has been found on either unit with improved techniques and well-trained UT operators -- this indicates the MSIP process was effective. Continued monitoring by advanced ultrasonic techniques addresses the time dependent concern by scrutinizing a portion of the welds each outage under the proposed frequency.

NRC Comment (2):

The quality of UT inspections has been improved significantly with the use of automatic inspection mode. However, the techniques of inspection and personnel qualification have been focused on the detection of circumferential cracks and, consequently, axially oriented cracks, in many instances, have continued to be missed. Recently, a number of deep axial cracks (with some essentially through wall) were found at several stress improved welds. It is most likely that these axial cracks were missed in earlier inspections prior to stress improvement. However, we can not completely rule out the possibility that the subject mitigation technique is not effective in arresting the axial cracks. The axial cracks would not impact the structural integrity of the welds because their length is limited to the width of a heat affected zone (<1 inch); however, they can grow in depth and result in reactor coolant leakage, which is not acceptable for safe plant operation.

PP&L Response:

The stress improvement processes performed on both Susquehanna Units were performed for Unit 1 within two (2) years of initial operation and for Unit 2 prior to initial operation. Because of the timely treatment of the welds, undetected axial cracking should not be a problem for the piping in question. Additionally, crowns on Class 1, 2 and 3 welds were removed prior to commercial operation of both units. With the crown removal, detection of any axial cracking is greatly increased.

Efforts by the industry such as the Performance Demonstration Initiative (PDI) and EPRI training in the detection of Intergranular Stress Corrosion Cracking (IGSCC) have provided a mechanism for the training of NDE personnel. Currently, PP&L's NDE Level III in Ultrasonics is both PDI and EPRI certified. With this certification and the use of "state of the art" automated and manual inspection techniques, PP&L can detect and evaluate any cracking found in our piping systems.

<u>NRC Comment (3)</u>:

In addition to the UT inspection uncertainties, there is a concern regarding the lack of test data to verify the effectiveness of the process control parameters because most of the sensitivity studies were performed by analytical methods. The staff also has a concern regarding the potential of a relaxation of compressive residual stresses as a result of operating loads as well as the anticipated and unanticipated transient loads. Therefore, it is necessary to continue the monitoring of the subject welds in accordance with the current scope and frequency.

PP&L Response:

The second part of NRC Comment (3) states the following: "The staff also has a concern regarding the potential of a relaxation of compressive residual stresses as a result of operating loads as well as the anticipated and unanticipated transient loads." Under the proposed testing frequency, approximately 50% of the welds/Unit will be ultrasonically inspected by the end of the second interval. This proposed frequency still maintains the conservative approach of monitoring a segment of the population to ascertain if the relaxation phenomena is in effect in the long and short term.

In terms of conventional engineering design, creep and stress relaxation are negligible in austenitic stainless steels such as 304 and 316 at BWR operating temperatures. However, austenitic stainless steels as a general rule do not exclusively deform elastically below a well-defined yield stress. Rather, some plastic deformation can occur at stresses above the proportional limit but below the nominal "design yield" strength (0.2% offset). The strain required to reach the proportional limit is rate dependent and is lower for slowly applied loading than for fast loading circumstances.

The best measure as to whether MSIP-generated residual compressive stresses relax over time is the growth of pre-existing cracks treated with MSIP. There are ten (10) weldments in the industry that had significant pre-existing cracks prior to treatment with the MSIP. None of these cracks have grown as determined by UT examinations performed during subsequent refueling outages. A description of these flaws is summarized in Table 1. These known cracks in the fleet that have had cracks prior to MSIP should be monitored. If any of these cracks should grow, then reassessment of our inspection plan would be appropriate based on fleet performance.

Ten (10) of the MSIP-treated weldments had significant pre-existing flaws, including two (2) weldments with axial cracks. Of the 1,258 weldments protected by MSIP, none have exhibited new flaws, and the pre-existing flaws have not grown.

TABLE 1

MSIP-Treated Weldments With Pre-Existing Cracks

Plant Name	Date of Application	Nominal Pipe Size	Type of Joint	Direction of Crack	Depth of Crack	Length of Crack
Brunswick 2	2-88	28"	Nozzle-SE	Axial	0.5"	3"
	2-88	28"	Nozzle-SE	Axial	0.5"	3"
Oskarshamn 2	8-88	9"	Pipe-Elbow	Circ.	16%	23%
Nine Mile Point 2	11-90	10"	SE-Extension	Circ.	41%	11%
Kuosheng 2	12-90	10"	Pipe-Elbow	Circ.	15%	2%
	12-90	20"	Pipe-Valve	Circ.	20%	4%
Limerick 1	4-92	12"	Nozzle-SE	Circ.	29%	23%
Perry 1	4-92	12"	Nozzle-SE	Circ.	15%	5%
	4-92	12"	Nozzle-SE	Circ.	13%	7%
	4-92	12"	Nozzle-SE	Circ.	10%	2%

NRC Comment (4):

MSIP is a relatively new process developed in the mid-1980's. In 1988, this process was accepted by the NRC in GL-88-01 as an effective process to mitigate IGSCC. The majority of applications of MSIP to piping welds in nuclear power plants occurred in the last few years and, therefore, its service experience is limited. Since the plant life is designed for 40 years, it is not prudent to reduce the inspection of such welds as proposed by PP&L until more service experience is gained.

PP&L Response:

The MSIP process has been accepted by the NRC as an effective process to mitigate IGSCC on piping with up to a 30% thru wall defect. Because of the timelines of our MSIP treatment of our welds relative to plant operation we believe that there is negligible safety impact upon the units with the deferral of one inspection. Continued inspection of the subject welds on a slightly different frequency maintains a prudent approach plus assures the safety of the public.

Since 1986, MSIP has been applied to 1,258 piping weldments in thirty (30) different operating BWR units. By the end of 1989, 526 or already 42% of the 1,258 weldments had been treated (please see Table 1 for Number of MSIP Treated Weldments By Year). This population of 526 MSIP-treated weldments includes all major types and sizes of joint configurations. Therefore, a full representation of MSIP-treated weldments has been exposed to BWR operating environments for at least six (6) and one half years, and some for as long as ten (10) and one-half years or 26% of plant design life.

TABLE 2
Number of MSIP-Treated Weldments By Year

Year	Number of Welds Treated	Cumulative Number of Welds Treated	Cumulative Percentage of Welds Treated
1986	52	52	4.1
1987	92	144	11.4
1988	239	383	30.4
1989	143	526	41.8
1990	86	612	48.6
1991	111	723	57.5
1992	204	927	73.7
1993	55	982	78.1
1994	175	1157	92.0
1995	55	1212	96.3
1996	46	1258	100.0

<u>NRC Comment (5)</u>:

The staff believes that a significant saving of the total personnel radiation exposure in performing the subject UT inspection can be achieved by implementing measures discussed below as appropriate:

(a) To apply an effective decontamination process to reduce the radiation level of the piping systems where the UT inspection will be performed.

PP&L Response:

At this time, PP&L is considering the use of chemical decontamination on a limited, as needed basis. Plans are to use this process only if absolutely necessary and then on a limited number of systems. In addition, the examinations in question are scheduled to be performed after the introduction of Hydrogen Water Chemistry (HWC) at Susquehanna. During the first few outages following HWC introduction, it is expected that radiation levels will increase from 5 to 10 times their current levels. It is hoped that the elimination of these exams will aid in the reduction of Man-Rem accrued by inspection personnel.

(b) To apply an effective chemical process to remove the hot spots in the piping systems where the UT inspection will be performed.

PP&L Response:

As stated above, chemical decontamination of piping is being considered on a limited, as needed basis. Because of its limited use, we cannot consider the use of chemical decontamination as a reliable means for dose reduction. The avoidance of hot spots is always a goal in the PP&L ALARA program, and inspectors utilize appropriate ALARA mitigation techniques whenever hot spots are present in the piping systems being inspected.

(c) To implement an effective hydrogen water chemistry (HWC) program at both units so that the extent of an IGSCC inspection can be cut in half as allowed by GL 88-01.

PP&L Response:

PP&L is implementing a HWC program with the intent of reducing the onset and effects of IGSCC. One of the reasons for the submittal of Relief Request RR-12 was to help to mitigate the effects of the increased radiation dosage brought about due to the introduction of HWC

(d) To implement an effective shielding program so that the radiation level can be significantly reduced in the areas where a UT inspection will be performed.

PP&L Response:

PP&L's goal is to maintain all work ALARA. Shielding if practical is applied to piping being inspected. However, consideration must be given regarding exposure rates to the workers installing the shielding and the need to access the piping to perform the inspections. While shielding is an important consideration in any effective ALARA program its use cannot always counted upon to reduce dose.

(e) To develop and implement an integrated inservice inspection program so that the personnel radiation exposure associated with the subject inspection can be minimized. For example, in the inspection of dose intensive nozzle-to safe-end welds, if it can be scheduled to coincide with the reactor pressure vessel inspection, significant savings in personnel radiation experience could be realized because the effort in opening shield doors, removing the insulation and the installation of scaffolding will not be duplicated. Similar schemes can be arranged with other relevant inservice inspection and testing programs to minimize the personnel radiation exposure.

PP&L Response:

PP&L's current ISI program interacts with all facets of the Susquehanna SES operations. ISI activities are scheduled and integrated with plant activities to reduce dose and avoid unnecessary work associated with the erection of scaffolding or removal of insulation.

(f) To perform automatic or UT inspections on small size piping welds. This could save some inspection time and personnel radiation exposure.

PP&L Response:

PP&L already utilizes the most effective technology/techniques to perform our inspections. In some cases this may include the use of automated UT techniques. However, the use of these techniques is bounded and limited by the type of inspection, the pipe size and the accessibility of the components to be inspected.

In conclusion, the MSIP process is an effective process to mitigate IGSCC on piping. In addition, PP&L has already implemented steps to reduce dose to its employees and has utilized all of the methodologies suggested by the commission. The Relief Request RR-12 asked for a reduction in inspections on MSIP welds as they were considered to be unnecessary given that they were just performed, exposed personnel to unnecessary dose and provided no added benefit from the standpoint of safety to the public.

If you have any questions, please contact Mr. C. T. Coddington at (610) 774-7531.

Very truly yours,

R. G. Byram

Attachment

copy: NRC Region I
Mr. M. Jenison, NRC Sr. Resident Inspector
Mr. C. Poslusny, NRC Sr. Project Manager