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54.17

NLS2009092
November 16, 2009

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555-0001

Subject: Response to Request for Additional Information for the Review of Cooper Nuclear Station License Renewal Application
Cooper Nuclear Station, Docket No. 50-298, DPR-46

References:

1. Letter from Tam Tran, U.S. Nuclear Regulatory Commission, to Stewart B. Minahan, Nebraska Public Power District, dated October 15, 2009, "Request for Additional Information for the Review of the Cooper Nuclear Station License Renewal Application (TAC No. MD9763 and MD9737)."

2. Letter from Stewart B. Minahan, Nebraska Public Power District, to U.S. Nuclear Regulatory Commission, dated September 24, 2008, "License Renewal Application" (NLS2008071).

Dear Sir or Madam:

The purpose of this letter is for the Nebraska Public Power District to respond to the Nuclear Regulatory Commission Request for Additional Information (Reference 1) regarding the Cooper Nuclear Station License Renewal Application (Reference 2). This response is provided in the Attachment to this letter.

Should you have any questions regarding this submittal, please contact David Bremer, License Renewal Project Manager, at (402) 825-5673.

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NRR

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I declare under penalty of perjury that the foregoing is true and correct.

Executed on 11/16/09
(Date)

Sincerely,

Stewart B. Minahan
Vice President – Nuclear and
Chief Nuclear Officer

/wv

Attachment

cc: Regional Administrator w/ attachment
USNRC - Region IV

Cooper Project Manager w/ attachment
USNRC - NRR Project Directorate IV-1

Senior Resident Inspector w/ attachment
USNRC - CNS

Nebraska Health and Human Services w/ attachment
Department of Regulation and Licensure

NPG Distribution w/ attachment

CNS Records w/ attachment

Attachment

Response to Request for Additional Information
for License Renewal Application
Cooper Nuclear Station, Docket No. 50-298, DPR-46

The Nuclear Regulatory Commission (NRC) Request for Additional Information (RAI) regarding the License Renewal Application is shown in italics. The Nebraska Public Power District's (NPPD) response to this RAI is shown in block font.

NRC Request: *RAI B.1.30-2 One Time Inspection -Small Bore Piping*

Background

In a letter dated May 1, 2009, the staff requested additional information on how the applicant plans to address volumetric inspections of socket welds in its aging management program (AMP) for American Society of Mechanical Engineers (ASME) Class 1 small-bore piping. In a letter dated June 15, 2009, the applicant responded stating that, "NUREG Section XI.M35 does not explicitly address socket welds. Because there is no accepted industry standard method for volumetric examination of socket welds, no such examinations are included in the CNS [Cooper Nuclear Station] program." The applicant goes on to discuss the fact that a surface inspection and visual inspection (VT-2) of ASME Class 1 small-bore piping socket welds will be performed in lieu of a volumetric inspection. Finally, the applicant stated that a review of site-specific operating experience had been performed and that no history of cracking in Class 1 small-bore piping, including socket welds, had been identified.

Issue

The staff does not consider the performance of surface and VT-2 inspections to be a suitable alternative to volumetric inspections as a means of detecting cracking of socket welds in ASME Class 1 small-bore piping. Specifically, these types of inspections are not effective for detecting sub-surface cracks that may exist in these welds.

It is also not clear that relevant industry operating experience was considered when the decision was made to not perform volumetric inspections of these socket welds. The staff performed a cursory review of available operating experience and identified several examples of socket weld failures resulting from cracking. Since 1997, as many as 47 socket weld failures have occurred at 35 nuclear power plants. Aging effects identified during the cause analysis was largely cracking on the inside diameter (below the visible surface of the weld) stemming from intergranular stress corrosion and fatigue. At least 12 of the 47 occurrences resulted in plant scrams or other significant operational challenges.

Request

The staff requests the applicant provide an AMP for detecting cracking in ASME Class 1 small-bore piping, including sub-surface cracking in socket welds. As discussed in NEI 95-10, "Industry Guidelines for Implementing the Requirements of 10 CFR Part 54 - The License Renewal Rule," the staff also requests that a review of relevant industry operating experience be conducted to determine whether it changes the conclusions drawn from the previously performed plant-specific determinations.

NPPD Response:

To manage the effects of aging on ASME Class 1 small-bore piping, NUREG-1801 recommends the program described in Section XI.M35, "One-Time Inspection of ASME Code Class 1 Small-Bore Piping." NPPD credits the AMP described in NUREG-1801, Section XI.M35 to manage the effects of aging on ASME Class 1 small-bore piping at Cooper Nuclear Station (CNS). The operating experience attribute of AMP XI.M35 states:

> This inspection uses volumetric inspection techniques with demonstrated capability and a proven industry record to detect cracking in piping weld and base material. However, the application of the specific technique to ASME Code Class 1 small-bore piping needs to be qualified before the examination.

In summary, NUREG-1801 AMP XI.M35 recommends volumetric testing using qualified techniques with demonstrated capability to detect cracking in small-bore piping.

For socket welds, there are no volumetric inspection techniques with demonstrated capability and a proven industry record to detect cracking in piping weld and base material. This position was reaffirmed by the staff in the following passage from the Beaver Valley license renewal Safety Evaluation Report issued on June 8, 2009 (ADAMS Accession Number ML091600216):

> The staff confirms that because there is no accepted method to volumetrically inspect these welds, it has accepted visual inspection of socket welds and notes that any cracks that form in these welds would initiate from the inside diameter, which would be very difficult to detect using a volumetric technique due to the configuration of the socket welds. The staff concludes that a visual inspection at operating temperature and pressure is the only practical method for inspecting these welds.

NPPD employs visual inspection at operating temperature and pressure for inspecting ASME Class 1 small-bore piping at CNS.

In response to the staff request, a review of recent industry operating experience was performed using the NRC ADAMS database. NPPD reviewed licensee event reports (LER) from ADAMS

that contained the word "socket." The review identified 70 items of which only 22 were related to cracking of Class 1 piping socket welds. These events were the result of high-cycle fatigue cracking due to vibration or weld defects during installation. Cracking due to high-cycle fatigue is the result of improper design or installation that creates an unanalyzed condition that will lead to failure of the component early in life if not corrected. It is not related to the effects of aging. Typical industry response to cracking caused by high-cycle fatigue is to modify the design to prevent recurrence including using improved socket welds and changing the installation to eliminate the vibration.

The plant shutdowns required by some of these events were the result of Technical Specification requirements regarding reactor coolant system leakage even though the size of the leaks did not impact the ability of the systems to perform their design functions. None of the LERs identified stress corrosion cracking or corrosion as the cause of the cracking.

The conclusions of this review are also supported by information published by the NRC in NUREG/CR-6936, *Probabilities of Failure and Uncertainty Estimate Information for Passive Components – A Literature Review,* May 2007. It states:

> Vibration fatigue failures are normally a result of poor piping design or installation and welding practices. A relatively large share of vibration fatigue failures initiates at the fillets of socket and support attachment welds due to a high stress concentration at the juncture of the weld and base metal. Small-bore pipe socket welded vent and drain connections less than 25.4 mm (<1.0 in.) in the immediate proximity of vibration sources tend to be most susceptible to this failure mechanism (Olson 1985; EPRI 1994 Riccardella et al, 1997; Shah et al 1998).
>
> Unlike the previously discussed mechanisms, vibration fatigue may not always lend itself to periodic inservice examinations (i.e., volumetric, surface) as a means of managing this degradation mechanism. This is especially true if the inspections occur at the normal inservice inspection frequency of once every 10 years. The nature of this mechanism is such that, generally, almost the entire fatigue life of the component is expended during the initiation phase. Once a crack initiates, failure quickly follows. Therefore, the absence of any detectable crack may not ensure reliable component performance.

This industry operating experience supports the adequacy of the inspections of small-bore piping socket welds at CNS described in response to RAI B.1.30-1. As additional clarification to the cited response to RAI B.1.30-1, prior to 2004 NPPD experienced socket weld cracking due to high-cycle fatigue from excessive vibration that was not related to the effects of aging. That response stated that small-bore piping and socket welds are inspected in accordance with ASME Code requirements. These Code requirements take into consideration the low safety significance of small-bore piping leakage and the predominant mechanism of high-cycle fatigue (vibration). The inspection consists of a VT-2 visual inspection during system leakage tests each refueling

outage per the requirements of IWB-2500-1, Examination Category B-P. This type of inspection has been determined sufficient for the current period of operation and approved by the NRC under 10 CFR 50.55a. Any change in the requirements for inspections of socket welds would be addressed by a change to the ASME Code which would be adopted by CNS. Current industry and site operating experience described above have identified only cracking in small-bore socket welds due to high-cycle fatigue and provides no evidence for the need to change existing requirements for inspections of socket welds.

Through the period of extended operation, NPPD will continue to implement at CNS the requirements of ASME Code Section XI as endorsed and modified by the NRC staff in 10 CFR 50.55a. This will include any future provisions for volumetric examination of small-bore socket welds when methods for such examination are developed and endorsed by the ASME Section XI Code and the NRC staff.

ATTACHMENT 3 LIST OF REGULATORY COMMITMENTS©[4]

Correspondence Number: NLS2009092

The following table identifies those actions committed to by Nebraska Public Power District (NPPD) in this document. Any other actions discussed in the submittal represent intended or planned actions by NPPD. They are described for information only and are not regulatory commitments. Please notify the Licensing Manager at Cooper Nuclear Station of any questions regarding this document or any associated regulatory commitments.

COMMITMENT	COMMITMENT NUMBER	COMMITTED DATE OR OUTAGE
None		