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VASSALLO,D.B. Operating Reactors Branch 2

SUBJECT: Forwards response to 840907 request for addl info re susceptibility of reactor water cleanup sys to IGSCC & susceptibility of emergency condenser sys to waterhammer,per IE Bulletin 80-11, "Masonry Wall Design."

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NIAGARA MOHAWK

NIAGARA MOHAWK POWER CORPORATION/300 ERIE BOULEVARD WEST, SYRACUSE, N.Y. 13202/TELEPHONE (315) 474-1511

October 25, 1984

Director of Nuclear Reactor Regulation
Attention: Mr. Domenic B. Vassallo, Chief
Operating Reactors Branch No. 2
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Re: Nine Mile Point Unit 1
Docket No. 50-220
DPR-63

Dear Mr. Vassallo:

The Nuclear Regulatory Commission issued Inspection and Enforcement Bulletin 80-11, Masonry Wall Design, during May 1980 which required an analysis of essential masonry walls. The results of the analysis for Nine Mile Point Unit 1 were submitted by letters dated July 8, 1980, November 10, 1980 and June 14, 1982. Niagara Mohawk's analysis identified seventy-five (75) masonry wall systems as being safety related. The analysis concentrated on the effects of seismic loads as applied to masonry walls and modifications required as a result of this analysis were completed during the 1981 refueling and maintenance outage.

Subsequent to the original analysis, we determined that a reanalysis of several masonry walls was required. This was prompted by the lack of consideration of high energy line break effects in the initial analysis and a revised regulatory technical position on Durowall as a horizontal reinforcing element. As a result, a meeting was held on April 27, 1983 with members of your staff to discuss the status of our masonry wall review, provide information regarding previous staff's questions and clarify the design criteria for our reanalysis of the masonry walls. As discussed in that meeting, additional information was required by your staff as indicated by your meeting minutes dated May 13, 1983.

Our submittal of June 24, 1983 provided a document entitled "Design Criteria for Reanalysis of Safety Related Masonry Walls, Nine Mile Point Unit 1." This document summarized the methodology to be used for reanalyzing the masonry walls reinforced with Durowall and the method of resolving pressurization loads due to high energy line breaks.

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Our letter of June 8, 1984 provided the results of the reanalysis with respect to utilizing Durowall in masonry walls. It also provided a preliminary report on our high energy line break analysis. The high energy line break analysis evaluated a leak-before-break concept to determine its applicability for high energy lines at Nine Mile Point Unit 1. The results of this analysis indicated the probability for a catastrophic pipe failure would be extremely small, therefore, making it unnecessary to consider a double ended pipe break as a design basis for defining loads. Our final report on the leak-before-break analysis was provided on August 6, 1984.

In addition, on June 21, 1984 we provided responses to additional questions raised by members of your staff regarding the reanalysis program. This submittal further defined the analysis methodology regarding the utilization of Durowall as a horizontal reinforcing element and provided a summary of the results of the masonry wall test program. It also provided a summary of natural frequencies for sample masonry walls taking into account the effects of different boundary conditions and wall thicknesses.

Your letter of September 7, 1984 requested additional information regarding the leak-before-break analysis for portions of high energy piping systems outside the containment at Nine Mile Point Unit 1 as discussed in our June 24, 1983 submittal. Specifically, you requested information regarding the susceptibility of the reactor water cleanup system to intergranular stress corrosion cracking and the susceptibility of the emergency condenser system to waterhammer. The responses to these specific questions are attached.

Sincerely,

NIAGARA MOHAWK POWER CORPORATION

T. E. Lempges
Vice President
Nuclear Generation

TEL/RJP:bd
Attachments

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

MASONRY WALLS (I.E. BULLETIN 80-11)

Your letter of September 7, 1984 indicated that current limitations on the application of leak-before-break analyses exclude piping systems or portions thereof that are particularly susceptible to intergranular stress corrosion cracking, waterhammer or fatigue. The cleanup and emergency condenser systems were identified as potentially falling within these limitations.

The following additional information is provided on the applicability of leak-before-break analyses in general and specifically with respect to the reactor cleanup and emergency condenser systems at Nine Mile Point Unit 1.

Intergranular Stress Corrosion Cracking

Leak-before-break analyses have been used many times in the past on boiling water reactor systems subject to intergranular stress corrosion cracking. The Commission was instrumental in application of this methodology in the case of reactor recirculation piping systems (NUREG/CR-0838, February 1979).

In addition, a simplified leak-before-break methodology has recently been included in the American Society of Mechanical Engineers (ASME) Code, Section XI, IWB-3600, to cover stress corrosion cracks being left unrepaired in pipes. It should be noted, however, that the ASME code leak-before-break methodology is less sophisticated than that used for the analyses of the piping systems at Nine Mile Point Unit 1, since it does not consider extreme loads or possible through wall flaws. During 1983 numerous other boiling water reactors with intergranular stress corrosion cracking in stainless steel piping systems applied this code methodology. The final leak before break analysis for high energy piping systems outside of the primary containment for Nine Mile Point Unit 1 was submitted on August 6, 1984.

Waterhammer

A leak-before-break analysis of a system subject to waterhammer is valid if appropriate consideration is given to extreme (i.e. bounding) loads and conservative estimates are made of system compliance effects and material properties. Careful consideration of system compliance effects, often lead to the conclusion that failure would be initiated by classical plastic collapse not tearing instability leading to a double ended break. When this happens, the plastic collapse failure mode is always limiting regardless of the size of the plastic load, so long as it is large. Therefore, uncertainties in calculating the exact waterhammer load are irrelevant to considerations of unstable tearings.

Specifically, in the analysis of the emergency condenser system previously submitted on August 6, 1984, consideration was given to extreme loads and conservative system compliance effects and material properties. It was found that plastic collapse is the limiting failure mode in this system. Therefore, the result that unstable tearing would not occur is valid equivalently for safe shutdown earthquake or waterhammer loads.

It should be noted that the conservative estimate made of system compliance assumed the failure of all snubbers. Additionally, very conservative stainless steel weld metal tearing modulus properties were used in the analysis. Therefore, leak-before-break analyses are applicable to Nine Mile Point Unit 1 systems subject to hypothetical waterhammer loads.

Fatigue

A leak-before-analysis of a piping system subject to fatigue loading presents no analytical difficulties. Calculation of stress intensity ranges during the cyclic load and the resultant crack growth rate is straight forward. Critical flaw sizes for tearing instability and plastic collapse under fatigue loadings are the same as for other loadings. The additional factor which must be considered in the evaluation of fatigue generated flaws is crack growth from the point when the crack results in a detectable leak until a critical flaw size is reached. The time available to take action is dependent upon system leakage detection capability and crack growth rates, which in turn depend on the magnitude of loads, frequency of load cycling and material crack growth and tearing modulus properties. Assessment of leakage flow as a function of crack size and loading is also required. Significant analytical and experimental data are available in each of these areas and as a result they can be appropriately considered in leak-before-break analyses. Therefore, such analyses are applicable to evaluations involving fatigue.

Clean-up System

In the case of the reactor cleanup system at Nine Mile Point Unit 1, the highest temperature portion of the system was included in the leak-before-break analysis. In addition, the original stainless steel piping was replaced with carbon steel during 1975. The replacement piping is not subject to intergranular stress corrosion cracking. However, heat exchanger nozzles and other portions of the cleanup system piping are stainless steel and may be susceptible to intergranular stress corrosion cracking in weld heat affected zones.

There are several mitigating factors regarding integranular stress corrosion cracking and leak-before-break safety margins in this system. First, at Nine Mile Point Unit 1 cleanup system use is maximized during reactor operation and thereby eliminating stagnant conditions which have been shown to be conducive to intergranular stress corrosion cracking. Second, the cleanup system area in the Reactor Building is continuously monitored with thermal sensors in order to detect leaks early.

Emergency Condenser System

The emergency condenser system at Nine Mile Point Unit 1 has experienced waterhammer events. During initial functional operation of the system, excessive vibration was observed in both the steam supply and condensate return lines. To eliminate this vibration, drain lines were installed in the piping system downstream of the steam supply isolation valves. Also additional analysis was performed to evaluate the adequacy of the restraints on the piping system. This resulted in the installation of snubbers on the system. These modifications took place between 1969 and 1974. Since 1974, there have been no reported waterhammer occurrences or excessive vibrations in the operation of this system. Finally, during the 1984 refueling and maintenance outage a trip of the motor driven feedpump on reactor high level was installed to preclude water from entering into the main steam and emergency condenser steam supply lines and causing potential waterhammer problems.

Therefore, based on the above, the leak-before-break analyses of high energy piping systems outside the containment at Nine Mile Point Unit 1 previously submitted are valid and applicable to the systems studied.

MGM/bd