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May 17, 1979

Docket No. 50-336

Director of Nuclear Reactor Regulation
Attn: Mr. R. Reid, Chief
Operating Reactors Branch #4
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Reference: (1) R. Reid letter to W. G. Counsil dated May 12, 1979.

Gentlemen:

Millstone Nuclear Power Station, Unit No. 2
CEA Guide Tube Sleeves

In Reference (1), the NRC Staff documented its conclusion regarding the acceptability of the sleeved fuel assemblies for Cycle 3 operation. Since that time, additional information regarding the performance of sleeved guide tubes at another operating unit has been obtained.

In response to verbally expressed NRC Staff concerns, Attachment 1 is provided. Northeast Nuclear Energy Company's (NNECO) previously docketed conclusion that the Millstone Unit No. 2 fuel assemblies remain acceptable for Cycle 3 operation remains valid, as supported by the attached material.

Very truly yours,

NORTHEAST NUCLEAR ENERGY COMPANY

W. G. Counsil
Vice President

Attachment

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DOCKET NO. 50-336

ATTACHMENT 1

MILLSTONE NUCLEAR POWER STATION, UNIT NO. 2

CEA GUIDE TUBE SLEEVES

MAY, 1979

ACCEPTABILITY OF SLEEVED FUEL ASSEMBLIES AT MILLSTONE UNIT NO. 2

Introduction

During the current refueling at Calvert Cliffs 1, it was found that several guide tube sleeves did not exhibit the expected resistance to axial motion. The purpose of this document is to compare the information available on Millstone Unit No. 2 sleeves to that for Calvert Cliffs 1.

It is concluded that the observations at Calvert Cliffs 1 is unique to that plant, and have no impact on the anticipated performance of sleeves at Millstone Unit No. 2 during Cycle 3.

Background

During the current refueling outages at Calvert Cliffs 1 and St. Lucie 1, as well as at Millstone Unit No. 2, CE conducted CEA guide tube sleeve inspection programs. Reviewing briefly, top of the core TV scans performed at all three plants at the end of the cycles showed no problems with proper sleeve seating. Furthermore, eddy current tests of guide tube sleeves installed during the previous outages, and subsequently operated in CEA locations for one cycle, demonstrated that no detectable wear had occurred during reactor operation.

At Calvert Cliffs 1, however, the CE inspection also revealed some fuel assemblies sleeved in the previous outage (1978) contained sleeves that could have a less than adequate crimp. This was discovered during a review of the same eddy current measurement used to evaluate wear of the sleeves.

Eddy current indications and pull test results of the type encountered at Calvert Cliffs 1 were not encountered in the inspections at Millstone Unit No. 2. This document describes the data on sleeve crimps obtained at Millstone Unit No. 2 and its relationship to that from the other sites.

Purpose of the Sleeve Crimp

The purpose of the crimp at the base of the guide tube sleeve is to prevent axial movement of the sleeve in the cold condition. The crimp is not intended to contribute to the reinforcement of worn fuel assemblies, since the properties of the sleeve in bending alone are utilized in the calculations which justify handling and continued operation of assemblies with guide tube wear.

Calculations of the differential thermal expansion between the stainless steel sleeves and zircaloy guide tubes have demonstrated that the two are in intimate contact, over the expanded length of the sleeve, following heatup of the reactor. The lengths of contact are seven (7) inches for sleeves installed in unworn fuel assemblies and two (2) inches minimum for those in worn guide tubes. Although some relaxation of the stress that is induced by differential thermal expansion would take place during operation, the two components would remain in intimate contact.

Therefore, the crimp is intended to perform its function during cold conditions only. Movement of the control rods is the only significant source of axial force on the sleeves in the cold condition. Recent tests involving measurement of drag force between irradiated control rod assemblies and sleeved fuel assemblies have shown this force to be less than ten (10) pounds total for the five control rods in the assembly. These tests confirm previous laboratory tests.

Installation Procedure Used at Millstone Unit No. 2

The installation procedure followed at Millstone Unit No. 2 in 1978 differed significantly from that used at Calvert Cliffs 1. Specifically, a 50-pound pull test (including tool weight of approximately 12 pounds) was performed on the sleeves after crimping them into the guide tubes, but prior to expanding them along their required lengths. This procedural change prevented the additional resistance of the expanded sleeve from masking the presence of an inadequate crimp. At Calvert Cliffs 1, the pull test was conducted after both operations were completed.

The sleeves at Millstone Unit No. 2 were installed in 1978 subsequent to the operation at Calvert Cliffs 1. Although the sleeve design and installation equipment were identical, experience at Calvert Cliffs 1 was an additional factor contributing to the differences in crimp strength discussed in the next section.

For sleeves installed during 1979, one other change has been introduced. The crimp geometry has been modified such that it is installed by a shorter elastomer, but to the same final diameter. This produces a much better defined expansion of the sleeve and guide tube walls and the data support the conclusion that the process produces much more uniform results.

Site Data

There are four basic categories of sleeved fuel assemblies at Millstone Unit No. 2 and Calvert Cliffs:

a) Sleeved in 1978, previously irradiated.
b) Sleeved in 1978, unirradiated.
c) Sleeved in 1979, previously irradiated (new crimp geometry).
d) Sleeved in 1979, unirradiated (new crimp geometry).

It has been concluded from the eddy current data that the problem at Calvert Cliffs 1 is isolated to the first fuel type listed above. This conclusion is based on the following facts.

(1) At Calvert Cliffs 1, a large number of the sleeves in Category (a) have inadequate crimps. A total of 235 sleeves of this type were inspected.

(2) Also at Calvert Cliffs 1, a total of 45 sleeves from Category (b) have been inspected without any indications of inadequate crimp size. These were installed by procedures identical to those used in the Category (a) fuel.

(3) An additional 40 sleeves from Category (b) were eddy current tested at St. Lucie 1 and Millstone Unit No. 2, again with no indications of a problem.

(4) An additional 40 sleeves from Category (c) were inspected at St. Lucie 1 and Calvert Cliffs 1. All produced uniform strong crimp signals, indicative of adequate crimp deformation.

(5) Although no data are available on Category (d) fuel, the fact that sleeves in irradiated fuel assemblies could be adequately crimped leads to the same conclusion for unirradiated fuel sleeved in 1979.

Therefore, discussion of the data will be confined to fuel sleeved during 1978 in the irradiated condition.

At Millstone Unit No. 2, 30 sleeves from Category (a) have been eddy current tested. None of the crimp signals from these sleeves is as small as those that are being placed in a marginal classification at Calvert Cliffs 1. Pull tests on 20 of these sleeves show acceptable results, and corroborate the relationship between the eddy current signal and an adequate resistance to axial motion of the sleeve. Four of the five sleeves with the smallest crimp indications have been successfully pull tested (the fifth was not pull tested) with a net axial force of approximately 38 pounds, well in excess of the 20 pounds that has been established at Calvert Cliffs 1 as a conservative test to further segregate sleeves with low eddy current signals. The conservatism of the 20-pound test is based on the control rod drag tests discussed earlier.

A total of 45 sleeves have been subjected to pull testing at Millstone Unit No. 2. The sleeves are all in Category (a). None of the 45 sleeves moved at the 20-pound force set as a criterion at Calvert Cliffs 1.

Since the frequency of the possibly inadequate crimp is approximately 50% in this particular fuel type at Calvert Cliffs 1, and is zero in the Millstone Unit No. 2 sample, it is concluded that there is high probability that adequate crimps exist in all Millstone Unit No. 2 assemblies in this category. Thus, all four types of Millstone Unit No. 2 assemblies are acceptable for plant operation.

Operation During Cycle 3

Only eight Millstone Unit No. 2 fuel assemblies in the category where the problem has been detected at Calvert Cliffs 1 (sleeved in the irradiated condition during 1978) are to be returned to control rod locations for Cycle 3. The sleeves in these assemblies operated under control rods during Cycle 2 without incident. Although there are no specific data on these sleeves, data do exist on companion assemblies of this type which indicate an adequate resistance to movement of the sleeves under anticipated loads in the cold condition.

Additional fuel assemblies with sleeves in this category will return to unrodded locations for Cycle 3. Again, these sleeves performed their function, without incident, under control rods during Cycle 2. For Cycle 3, there will be no axial force applied to the sleeves in either the cold or hot condition. Fuel assemblies in unrodded locations are inserted into blind holes in the fuel alignment plate. The sleeves are, thus, captured.

It should be noted that sleeves have been completely removed by CE from assemblies at Calvert Cliffs 1 and Millstone Unit No. 2. A sleeve at Calvert Cliffs 1 and a small eddy current indication required approximately 3000 pounds axial force for removal. An even higher force was necessary to extract a Millstone Unit No. 2 sleeve.

Summary and Conclusion

It is concluded that the conditions observed at Calvert Cliffs 1 do not exist at Millstone Unit No. 2 and, therefore, do not affect the planned operation at Millstone Unit No. 2 during Cycle 3. This conclusion is based on the following points.

(1) The problem at Calvert Cliffs 1 has been isolated to a particular category of fuel assembly.

(2) This category of fuel has operated for one cycle at Millstone Unit No. 2 under control rods without incident. A core scan at the end of the cycle revealed no anomalies. Eddy current measurements show signals in excess of those considered worthy of additional inspection at Calvert Cliffs 1. The minimum crimps detected at Millstone Unit No. 2 have been shown by pull test to be more than adequate to resist movement under cold conditions.

(3) Procedural changes were made for sleeve installation between the original sleeving operations at Calvert Cliffs 1 and Millstone Unit No. 2, which provides a high degree of confidence that the sleeves were correctly installed.