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June 6, 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) W. G. Counsil letter to R. Reid dated May 17, 1979.

Gentlemen:

Millstone Nuclear Power Station, Unit No. 2
Sleeved CEA Guide Tubes

In Reference (1), Northeast Nuclear Energy Company (NNECO) submitted information to support our previously docketed conclusion that Millstone Unit No. 2 fuel assemblies remain acceptable for Cycle 3 operation. Subsequently, NNECO has obtained additional information from Combustion Engineering, Incorporated, regarding the performance of sleeved guide tubes at another operating facility.

Attachment I is provided to advise the NRC Staff of recently obtained data on sleeve crimps. Included are sections on, (a) Sleeved fuel assemblies at Millstone Unit No. 2, (b) Discussion of crimp size, (c) Summary of crimp size estimates based on eddy-current test results, and (d) Operational guidelines.

We trust this information will be useful in conducting your ongoing evaluations. NNECO's previously stated conclusions regarding the acceptability of the fuel assemblies for Cycle 3 operation remain unchanged.

Very truly yours,

NORTHEAST NUCLEAR ENERGY COMPANY

W. G. Counsil

W. G. Counsil
Vice President

Attachment

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DOCKET NO. 50-336

ATTACHMENT 1

MILLSTONE NUCLEAR POWER STATION, UNIT NO. 2

SLEEVED CEA GUIDE TUBES

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JUNE, 1979

Sleeved Fuel Assemblies at Millstone 2

In Reference (1), a submittal was made that discussed the implications to Millstone 2 of certain observations made on guide tube wear sleeves at Calvert Cliffs 1. This document contains additional information on the subject, which was obtained by further interpretation of the ECT data. This analysis has been done since issuance of the May 14-18 statement.

The conclusion reached in the original submittal is unchanged, namely, the observation of abnormally small crimps at Calvert Cliffs I is unique to that plant and does not impact the anticipated performance of sleeves at Millstone 2 during the current cycle.

However, it has since been discovered that the crimp sizes in other categories of fuel assemblies are undersized to a lesser extent. In light of these data, operational guidelines on control rod movement are to be followed until additional data are available or further analysis is performed.

Discussion of Crimp Size

During hot operation, the 3.6 mil differential thermal expansion between the stainless steel sleeve and zircaloy guide tube will cause the two components to be in intimate contact over the expanded length of the sleeve (7 inches in control rod locations). The 3.3 mil maximum installed gap between the two was set to ensure this condition.

The 10 mil minimum outward crimp of the sleeve was originally chosen as a conservative size that would prevent withdrawal of the sleeve upward thru the non-crimped region of the guide tube. Realistically, crimps as small as 4 mils are capable of performing this function even after long term operation (since the cold gap would not exceed the 3.6 mil differential thermal expansion, even with relaxation values approaching 100%). This appears to be the case from the pull test data from Millstone 2 and Calvert Cliffs 1:

a. At Millstone 2, three sleeves with 3.0 mil crimps and one sleeve with a 3.5 mil crimp were pull tested, and showed no movement at net loads in excess of 20 pounds. (crimp size derived from eddy current test results.)

b. At Calvert Cliffs 1, where the sleeves that were pull tested had crimps ranging from 0 to 4 mils, movement was detected for crimps of up to 3.5 mils.* (crimp sizes derived from eddy current results.)

Therefore, the 4 mil size has been established as the minimum crimp that prevents sleeve movement under cold CEA operation. For sizes less than 4 mils, current evaluation of the data would indicate operational guidelines to limit control rod movement are prudent.
These guidelines refer to a minimum system temperature for control rod movement, which is based on the temperature required to ensure interference between the sleeve crimp and the non-crimped guide tube I.D.

* At the time of the previous submittal, pull tests had not been performed on Calvert Cliffs 1 sleeves with crimps greater than 2 mils.

Discussion of Crimp Size Data

As described in the submittal last week, there are four categories of sleeved fuel assemblies at Millstone 2:

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

The data from C-E sites on crimp sizes for these various types are summarized in Table 1.

Although the shallowest crimps are clearly isolated to Calvert Cliffs 1 fuel that was sleeved in 1978 in the irradiated condition, it has further been discovered that crimp sizes as small as 2.5 mils may exist in the Category (C) and possibly (D) fuel at Millstone 2. At the time of our earlier submittal (May 17, 1979) the eddy current test signals had just arrived from the field. Subsequent analysis of the data indicates the presence of the crimp throughout the sample tested. After correlating the eddy current test (ECT) signals to indicated crimp size for the new crimp geometry, it was evident that the crimps made may not be as deep as desired or as first thought. It is these fuel types which are addressed by the operational guidelines discussed in the next section.

(c)

SUMMARY OF CRIMP SIZE ESTIMATES

BASED ON EDDY CURRENT TEST RESULTS

Category	Plant	Batch	Number of Assemblies	Crimp Size Range Mils Diameter	Average	Under CEA's in Cycle 3
Irradiated Unworn Sleeved 1978 (Old Style Crimp)	CC1	A	8	1.5 - 7.0	3.9	
	CC1	C	15	0 - 4.0	2.9	
	CC1	D	28	0 - 6.0	1.7	
	MPII	B&C	6	3.0 - 10.5	5.9	Yes (8 Assy's)
	SL1	B&C	8	2.0 - 19.0	9.5	
Non-Irradiated Unworn Sleeved in 1978 (Old Style Crimp)	CC1	E	9	4 - 10.0	6.7	
	MPII	D	4	11 - 14	12.6	Yes (8 Assy's
	SL1	D	4	>2.0*	-	
Irradiated Unworn Sleeved in 1979 (New Style Crimp)	CC1	D	16	2.5 - 5.0	3.8	
	SL1	B&D	13	3.5 - 6.0	4.5	
	MPII	D	2	5.0 - 8.0	6.0	Yes (41 Assy's
Non-Irradiated Unworn Sleeved in 1979 (New Style Crimp)		No Data				Yes (12 Assy's

* Positive indication of expansion coincident with bottom of sleeve. Actual measurement cannot be made.

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OPERATIONAL GUIDELINES

As explained in the previous section, the fuel assemblies which had sleeves with abnormally small crimps (0 to 4 mils) were included in a particular category at Calvert Cliffs I (sleeved in 1978 in the irradiated condition). However, other categories of fuel representative of that in Millstone 2 do exhibit crimps which are undersized to a lesser extent (2.5 mils minimum).

At the startup of Cycle 3, all sleeves supply adequate resistance to axial motion in CEA locations, based on the following:

a. All sleeves installed in 1979 have been pull tested to a net force greater than 20 pounds.

b. Sleeves installed in irradiated fuel in 1978 have been ECT sampled (3.0 mil minimum crimp) and extensively pull tested (45 sleeves). This sampling indicates that, for the 8 assemblies of this type located under CEA's in Cycle 3, there is adequate resistance to axial movement in the cold condition.

c. The remaining sleeves, installed in 1978 in unirradiated fuel, have been sampled and found to have crimp sizes (11 mils minimum) in excess of those which have successfully passed pull tests after one cycle of operation.

The effects of irradiation in Cycle 3 will be to cause relaxation, or continuation of relaxation, in the guide tube and sleeves. To preclude the possibility of sleeve movement during later shutdowns, it would be prudent to restrict movement of control rods at system temperatures below 400° F. The basis for this temperature is that it is a conservative minimum temperature at which the sleeve crimp diameter will exceed the guide tube I.D. in the non-crimp region.