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FACIL:50-315 Donald C. Cook Nuclear Power Plant, Unit 1, Indiana & 05000315
AUTH.NAME AUTHOR AFFILIATION
DOLAN,J.E. Indiana & Michigan Power Co.
RECIP.NAME RECIPIENT AFFILIATION
DENTON,H.R. Office of Nuclear Reactor Regulation

SUBJECT: Forwards addl info re reinsertion of two previously irradiated Westinghouse fuel assemblies in place of Exxon Nuclear Co assemblies damaged during refueling outage. Discusses decision not to perform revised accident analysis.

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September 7, 1979
AEP:NRC:00263

Donald C. Cook Nuclear Plant Unit No. 1
Docket No. 50-315
License No. DPR-58
Revised Unit 1, Cycle 4 Core Loading

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Denton:

This letter supplements our July 16, 1979 submittal (AEP:NRC:00212) which addressed the reinsertion of two previously irradiated Westinghouse fuel assemblies in place of two Exxon Nuclear Company (ENC) assemblies which were damaged during the recent Unit 1 refueling outage. In the referenced letter we stated that we did not plan to perform any revised accident analysis with respect to this replacement. The purpose of this letter is to discuss the bases for this decision.

The affected core locations are not high power regions. The incore measured F_Q of the peak pin of the reinserted assemblies is 1.073 as compared to the core peak pin value of 1.633 (unpenalized values). This is to be compared with the F_Q limit of 1.90 established for Cycle 3 Westinghouse assemblies. The 1.90 limit is in fact conservative as discussed in our letter of January 24, 1979 (AEP:NRC:00136). A particular conservatism worthy of reiteration is that the limit was established on the basis of as-built fuel parameters. Therefore credit was not taken for the decrease in average pellet temperature due to burnup (reinserted assemblies had burnups of 16,400 MWD/MT). In addition, there has been extensive ECCS analysis of the ENC fuel as reported in References 1, 2, 3 and 4, in accordance with 10 CFR 50 Appendix K requirements.

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The core was reanalyzed to ascertain the effect of the reinsertion on the predicted core power profile. The results of the neutronic reanalysis are reported in References 5 and 6. Figure 1 of Attachment 1 presents the predicted relative power distribution for the original and modified cores at a burnup of 100 MWD/MT. Figure 2 presents a similar map for a burnup of 10,200 MWD/MT. As seen in these figures, there is a change of 2.5% in assembly relative power in regions surrounding the affected core locations and power peak changes of less than 1% have been determined. Figure 3 is a map of the predicted and measured values of the power distribution at 212 MWD/MTU. The measurements show good agreement with predictions.

Reactivity control parameters were reanalyzed. The calculated critical boron concentration at Hot Zero Power (HZP) changed by about 1 ppm. Even though the replacement assemblies do not contain control rods, the worths of control banks A, B, C, and D were recalculated(7) and the assembly replacement is shown to change the rod worths by a maximum of 4 pcm. Finally, the assembly infinite multiplication factors of the original and replacement assemblies are illustrated in Figure 4 of Attachment 1. Very similar values of assembly K_∞ are evidenced (1.028 vs. 1.036).

The hydraulic and mechanical design compatibility of the Westinghouse and ENC fuel assemblies was also considered. This led to the conclusion that the assemblies are indeed compatible. References 8, 9 and 10 provide technical justification for this conclusion.

In addition, Westinghouse performed a quality control review of the replacement assemblies and found them to be acceptable for Cycle 4 use.

The above facts, particular emphasis being made of the fact that the replacement assemblies are not peak power assemblies, in conjunction with our three years experience of operating with a mixed Westinghouse/ENC core loading, constitute our technical basis for not reperforming the existing safety analysis and for concluding that the current Unit 1, Cycle 4 safety analysis report (11) remains valid.

Very truly yours,

John E. Dolan

John E. Dolan
Vice President

JED:em

cc: (attached)

(1) K. P. Galbraith et. al., "Donald C. Cook Unit 1 LOCA Analyses Using ENC WREM - Based PWR ECCS Evaluation Model (ENC-WREM II)," XN-76-51 Exxon Nuclear Company, January, 1977.

(2) K. P. Galbraith et. al., "Flow Blockage And Exposure Sensitivity Study for D. C. Cook Unit 1 Reload Fuel Using ENC WREM-II Model" XN-76-51, Supplement 1, Exxon Nuclear Company, January, 1977.

(3) G. C. Cooke, "Flow Blockage And Exposure Sensitivity Study for ENC D.C. Cook Unit 1 Reload Fuel Using ENC WREM-II Model," XN-NF-76-51 (P) Supplement 2, Exxon Nuclear Company, January, 1978.

(4) R. E. Collingham and G.C. Cooke, "Flow Blockage And Exposure Sensitivity Study for ENC D.C. Cook Unit 1 Reload Fuel Using ENC WREM-II Model," XN-NF-76-51, Supplement 3 (NP), Exxon Nuclear Company, April, 1978.

(5) R. L. Feuerbacher et. al., "D.C.Cook Unit 1, Cycle 4 Startup and Operations Report," XN-NF-79-46, Exxon Nuclear Company, June 6, 1979.

(6) M. R. Killgore, "D. C. Cook Unit 1, Cycle 4 Modified Core Loading Pattern" Letter Report PWR-010-79, Exxon Nuclear Company, May, 1979.

(7) M. R. Killgore, "D.C. Cook Unit 1, Cycle 5 Final Core Loading," Letter Report PWR-011-79, Exxon Nuclear Company, June, 1979.

(8) J. Yates, "Single Phase Hydraulic Performance of Westinghouse and Exxon Nuclear H.B. Robinson Fuel Assemblies," XN-74-44, Exxon Nuclear Company October 1974.

(9) C. A. Brown, "Combined Seismic -LOCA Mechanical Evluation for Exxon Nuclear 15 x 15 Reload Fuel For Westinghouse PWR's," XN-76-47 (P), Exxon Nuclear Company, April 8, 1977.

(10) L. T. Gesinski, "Fuel Assembly Safety Analysis for Combined Seismic And Loss-of-Coolant-Accident," WCAP-7950, Westinghouse Nuclear Energy Systems, July, 1972.

(11) M. R. Killgore, "D.C.Cook Unit 1 Cycle 4 Safety Analysis Report," XN-NF-79-10, Exxon Nuclear Company, February 23, 1979.

cc: R. C. Callen
G. Charnoff
D. V. Shaller -Bridgman
R. S. Hunter
R. W. Jurgensen

ATTACHMENT 1

TO

AEP:NRC:00263

	H	G	F	E	D	C	B	A
8	.927 .929	1.073 1.074	.959 .960	1.063 1.062	1.066 1.059	.856 .835*	.887 .879	.916 .911
9	1.074 1.078	.953 .955	1.157 1.159	.992 .991	1.149 1.144	.925 .917	1.233 1.225	.936 .933
10	.958 .961	1.156 1.158	1.002 1.004	1.221 1.222	1.169 1.168	1.114 1.112	.908 .905	.849 .847
11	1.062 1.062	.989 .991	1.217 1.219	1.001 1.003	1.153 1.154	.975 .975	1.140 1.141	.649 .649
12	1.064 1.064	1.145 1.146	1.166 1.168	1.151 1.153	1.082 1.084	.921 .923	.935 .936	
13	.847 .845	.922 .922	1.111 1.113	.972 .974	.921 .923	1.068 1.071	.643 .644	
14	.887 .886	1.231 1.232	.905 .907	1.138 1.141	.934 .936	.634 .644		
15	.916 .916	.935 .937	.847 .849	.648 .650				

← Original Loading
← Modified Loading

		Original	Modified
Peak Assembly	=	1.233 (B9)	1.232 (G14)
Peak F_{xy}	=	1.424 (E10)	1.422 (G14)
Peak $F_{\Delta H}$	=	1.372 (B9)	1.366 (G14)
Peak F_Q^N	=	1.685 (B9)	1.685 (G14)

* 2.25 w/o Westinghouse Assembly, 16,400 MWD/MT

Figure 1 D. C. Cook Unit #1, Cycle 4, Relative Power Distribution, 100 MWD/MTU, 3,250 MWt, ARO

	H	G	F	E	D	C	B	A
8	.972 .973	1.089 1.089	.986 .986	1.065 1.066	1.067 1.006	.907 .900*	.916 .915	.912 .912
9	1.090 1.091	.983 .983	1.135 1.135	.997 .998	1.120 1.120	.952 .950	1.175 1.174	.924 .925
10	.985 .986	1.134 1.135	1.000 1.000	1.159 1.160	1.122 1.123	1.096 1.096	.932 .932	.868 .869
11	1.065 1.064	.996 .996	1.157 1.157	.992 .993	1.117 1.118	.989 .989	1.110 1.111	.689 .690
12	1.066 1.065	1.119 1.119	1.121 1.121	1.117 1.117	1.077 1.079	.955 .956	.945 .945	
13	.899 .897	.951 .950	1.095 1.095	.988 .988	.955 .956	1.070 1.070	.692 .692	
14	.916 .916	1.174 1.174	.931 .931	1.110 1.110	.945 .945	.692 .692	← Original Loading ← Modified Loading	
15	.912 .912	.924 .924	.868 .868	.689 .689				

		Original	Modified
Peak Assembly	=	1.175 (B9)	1.174 (B9)
Peak F_{xy}	=	1.320 (B9)	1.320 (B9)
Peak $F_{\Delta H}$	=	1.305 (B9)	1.304 (B9)
Peak F_Q^N	=	1.447 (B9)	1.448 (B9)

* 2.25 w/o Westinghouse Assembly, 16,400 MWD/MT

Figure 2 D. C. Cook Unit #1, Cycle 4, Relative Power Distribution, 10,200 MWD/MTU, 3,250 MWt, ARO

	H	G	F	E	D	C	B	A
8	.951 .931	1.103 1.063	.981 .985	1.074 1.054	1.059 1.073	.821* .791	.863 .834	.846 .793
9	1.110 1.102	.983 .994	1.194 1.169	1.017 1.023	1.161 1.131	.910 .890	1.191 1.093	.871 .876
10	.982 1.014	1.193 1.148	1.039 1.026	1.273 1.230	1.203 1.179	1.128 1.088	.898 .863	.798 .754
11	1.072 1.104	1.013 1.036	1.265 1.222	1.036 1.029	1.192 1.185	.990 .981	1.113 1.069	.618 .605
12	1.060 1.071	1.162 1.148	1.200 1.176	1.189 1.182	1.100 1.093	.936 .919	.894 .866	
13	.839 .826	.917 .896	1.130 1.121	.988 .966	.937 .935	1.064 1.025	.616 .619	
14	.873 .898	1.202 1.122	.901 .877	1.114 1.076	.895 .871	.616 .603		
15	.855 .825	.879 .833	.802 .783	.619 .637				

* 2.25 w/o W assembly.

Assembly $F_{\Delta H}$
Predicted
Measured

Figure 3: D. C. Cook Unit #1, Cycle 4, Comparison of Measured and Predicted Power Distributions at 212 MWD/MTU Burnup and 93% Relative Thermal Power.

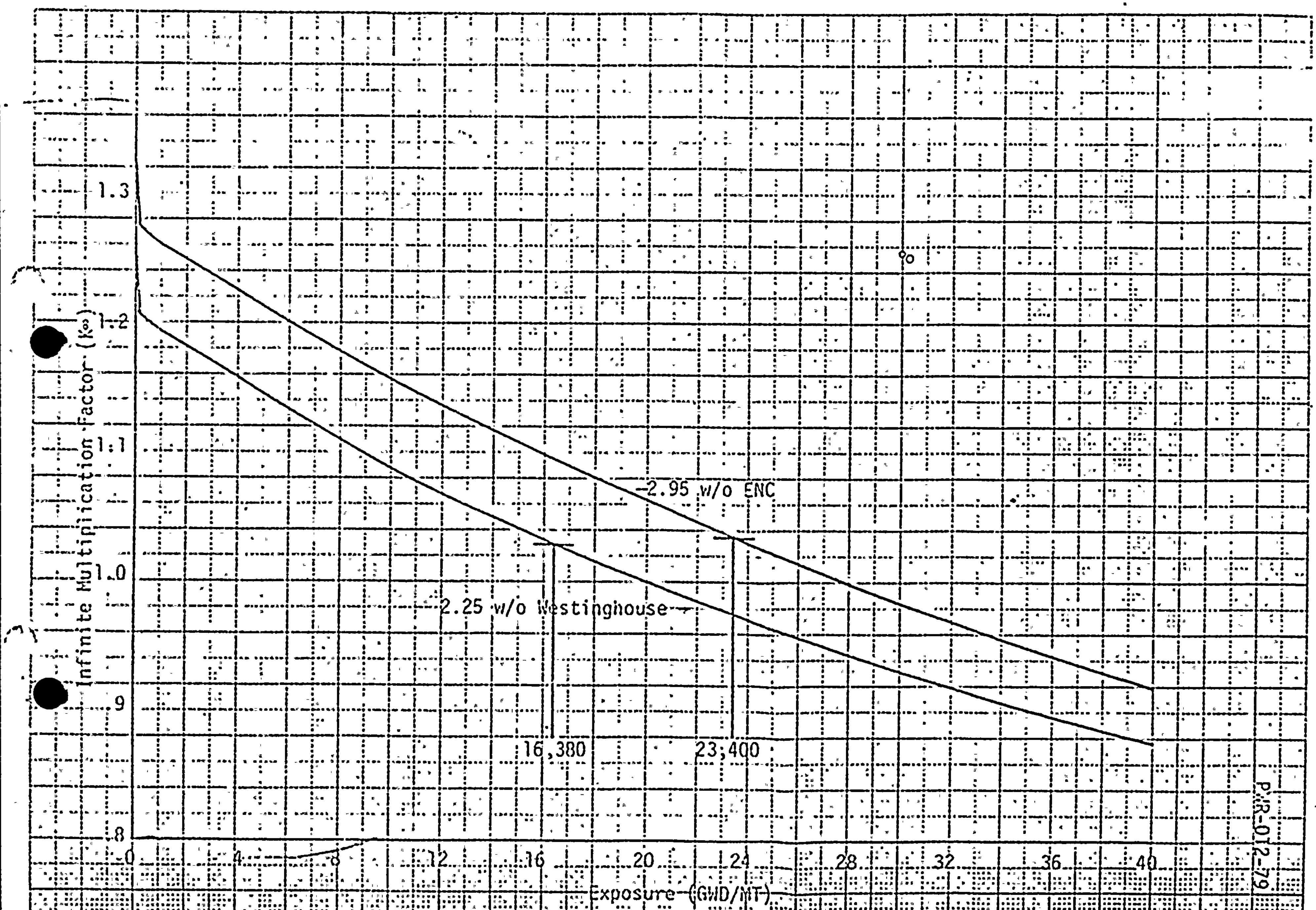

Figure 4 : Assembly K∞ versus Exposure

K-E 10 X 10 TO THE CENTIMETER 18 X 25 CM KEUFFEL & ESSER CO. MADE IN U.S.A. 461510