ACCELERATED DISTRIBUTION DEMONSTRATION SYSTEM

REGULATORY INFORMATION DISTRIBUTION SYSTEM (RIDS)

ACCESSION NBR:9104240345 DOC.DATE: 91/04/17 NOTARIZED: NO DOCKET #
FACIL:50-389 St. Lucie Plant, Unit 2, Florida Power & Light Co. 05000389
AUTH.NAME AUTHOR AFFILIATION
SAGER,D.A. Florida Power & Light Co.
RECIP.NAME RECIPIENT AFFILIATION
Document Control Branch (Document Control Desk)

SUBJECT: Forwards request for addl info to C-E topical rept CENPD-269-P,Rev 1-P, "Extended Burnup Operation of C-E PWR Fuel."

DISTRIBUTION CODE: A001D COPIES RECEIVED:LTR 1 ENCL 1 SIZE: 6
TITLE: OR Submittal: General Distribution

NOTES:

	RECIPIENT ID CODE/NAME	COPIES LTTR	COPIES ENCL	RECIPIENT ID CODE/NAME	COPIES LTTR	COPIES ENCL
	PD2-2 LA	1	1	PD2-2 PD	1	1
	NORRIS,J	2	2			
INTERNAL:	ACRS	6	6	NRR/DET/ECMB 9H	1	1
	NRR/DET/ESGB	1	1	NRR/DOEA/OTSB11	1	1
	NRR/DST 8E2	1	1	NRR/DST/SELB 8D	1	1
	NRR/DST/SICB 7E	1	1	NRR/DST/SRXB 8E	1	1
	NUDOCS-ABSTRACT	1	1	~~OC/LFMB~~	1	0
	OGC/HDS3	1	0	REG FILE 01	1	1
	RES/DSIR/EIB	1	1			
EXTERNAL:	NRC PDR	1	1	NSIC	1	1

R I D S / A D D S

R I D S / A D D S

NOTE TO ALL "RIDS" RECIPIENTS:

PLEASE HELP US TO REDUCE WASTE! CONTACT THE DOCUMENT CONTROL DESK, ROOM P1-37 (EXT. 20079) TO ELIMINATE YOUR NAME FROM DISTRIBUTION LISTS FOR DOCUMENTS YOU DON'T NEED!

TOTAL NUMBER OF COPIES REQUIRED: LTTR 24 ENCL 22

FPL

P.O. Box 128, Ft. Pierce, FL 34954-0128

L-91-116

APR 1 7 1991

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

Gentlemen:

Re: St. Lucie Unit 2
Docket No. 50-389
Request for Additional Information -
Extended Burnup Operation of
Combustion Engineering PWR Fuel - TAC No. 75947

By letter dated January 25, 1990, Florida Power and Light (FPL) requested that the Nuclear Regulatory Commission Staff review Combustion Engineering (CE) Topical Report CENPD-269-P, Revision 1-P, "Extended Burnup Operation of Combustion Engineering PWR Fuel," dated July 1984, for applicability to St. Lucie Unit 2.

To aid in its review, the Staff requested additional information in a letter dated February 13, 1991.

FPL is providing its response to the Staff's question in Attachment One to this letter. Should there be any questions, or if additional information is needed, please contact us.

Very truly yours,

D.A. Sager

D.A. Sager
Vice President
St. Lucie Plant

Attachment

DAS:JMP:kw

cc: Stewart D. Ebneter, Regional Administrator, Region II, USNRC
Senior Resident Inspector, USNRC, St. Lucie Plant

DAS/PSL #409

A001
1/1

[illegible]

ATTACHMENT ONE

Request for Additional Information
"Extended Burnup Operation of Combustion Engineering PWR Fuel"
(CENPD-269-P)

Florida Power and Light (FPL) provides the following information in response to the Nuclear Regulatory Commission Staff question concerning clad corrosion data for St. Lucie Unit 2 fuel rods.

NRC Question:

The ANO-2 request for a 1-pin burnup limit of 60 MWd/kgU (CENPD-386-P) indicated that the cladding oxidation model and associated data were to be provided on a reactor-specific basis; however, no data or analysis model is presented in the subject topical report specifically for St. Lucie Unit 2. What cladding corrosion data are used as the basis for the cladding corrosion model for St. Lucie Unit 2? If the corrosion data used are not from St. Lucie Unit 2 fuel rods, please provide an explanation of why this data is applicable; i.e., provide a comparison of reactor coolant temperatures, chemistry and corrosion data, and how the model is developed and applied to provide conservative and bounding analyses.

FPL Response:

Cladding corrosion data for ANO-2 were used as the basis for the cladding corrosion model for St. Lucie Unit 2 as described in Combustion Engineering Topical Report CENPD-269-P, Revision 1-P, "Extended Burnup Operation of Combustion Engineering PWR Fuel." Cladding waterside corrosion is dependent on a number of factors that are specific to each operating plant. Thus, an evaluation of high burnup waterside corrosion should be performed on a plant-by-plant basis.

The factors that are known to affect corrosion fall into two basic categories: (1) the thermal, or temperature effects category, and (2) the chemistry effects category. A tabulated comparison of the key parameters for St. Lucie Unit 2 and ANO-2 is provided in Table One of this attachment.

Thermal and chemistry effects on waterside corrosion in the St. Lucie Unit 2 core have been considered. Thermal effects experienced by St. Lucie Unit 2 fuel rods are less aggressive than those experienced at ANO-2 with respect to cladding corrosion. Coolant chemistry effects for St. Lucie Unit 2 fuel cannot be judged to be less aggressive than those experienced by ANO-2 since data are not available to quantitatively evaluate the impact of the difference in chemistry effects. It should also be noted, however, that a maximum oxide thickness on the order of 120 microns or less, as presented in the topical report, should not impair the thermal and mechanical performance of the St. Lucie Unit 2 fuel rods and should therefore be an acceptable thickness for operation of St. Lucie Unit 2 at a maximum fuel rod burnup of 60 MWd/kgU. A discussion of the temperature and chemistry effects follows.

Thermal or Temperature Effects

The St. Lucie Unit 2 core axial and radial peaking factors are comparable to ANO-2. As a result, the St. Lucie Unit 2 linear heat rate distributions (and the resulting surface heat flux distributions) over the active fuel length will always be lower than those experienced at ANO-2. When the lower linear heat rates are considered in combination with a lower coolant inlet temperature, lower local coolant and cladding surface temperatures will be present everywhere in the reactor core. Based on these comparisons, it is concluded that the thermal effects experienced in the St. Lucie Unit 2 core are less aggressive with respect to corrosion than those encountered in the ANO-2 core.

The achievement of a fuel rod maximum burnup of 60 MWd/kgU at St. Lucie Unit 2 would require a longer total irradiation time, perhaps an additional cycle of operation, than for ANO-2 because of the inherently lower linear heat rates. Additionally, corrosion on the fuel rods that achieve comparable burnups will tend to be less severe when the power level is lower during irradiation. Therefore, based upon this consideration, as well as that cited above, the St. Lucie Unit 2 corrosion projection due to thermal effects to 60 MWd/kgU is expected to be bounded by the ANO-2 corrosion projection to 60 MWd/kgU.

Chemistry Effects

Chemistry effects are primarily characterized by coolant chemistry parameters, but may include the Zircaloy cladding material, as alloying elements are known to affect corrosion. However, the trend to improve the cladding material corrosion behavior is expected to continue and need not be considered here.

With respect to primary coolant chemistry, lithium content in the coolant is generally considered to be the most important parameter affecting cladding corrosion. A detailed review of the lithium chemistry history from ANO-2 during the cycles when fuel was measured for corrosion behavior indicated that the lithium chemistry guidelines in existence at the time (i.e., lithium level between 1 and 2 ppm) were generally followed. Thus, the ANO-2 corrosion data base is associated with five (5) cycles of exposure with primary coolant lithium between 1 and 2 ppm. The first batch of St. Lucie 2 fuel assemblies which is being considered for extended burnup operation was in its first cycle during St. Lucie Unit 2 Cycle 5. An elevated lithium chemistry program was implemented in Cycle 5 to reduce out of core radiation fields. Initially, the lithium concentration was maintained at 3.5 ppm for approximately the first half of Cycle 5 until a pH of 7.4 was reached. The lithium concentration was then gradually reduced to below 2 ppm over the remainder of the cycle. A modified lithium chemistry program supported by EPRI has been implemented starting in Cycle 6, which significantly reduces the operating time above 2 ppm to less than five percent of the Cycle.

Even though it cannot be conclusively stated that the ANO-2 database will bound the expected oxide thickness evolution at St. Lucie 2, the lithium chemistry is being maintained under a controlled program, and the period of time spent outside of this database for cycles 6 and beyond is expected to be less than five percent.

TABLE ONE

COMPARISON OF CORE GEOMETRIC AND OPERATING PARAMETERS
St. Lucie Unit 2 and ANO-2

Corrosion Parameter	St. Lucie Unit 2	ANO-2
Reactor Power, MW_t	2700	2815
Number of fuel assemblies	217	177
Core average linear heat generation rate (LHGR), kw/ft	4.7	5.6
Assembly pitch, in.	8.180	8.180
Fuel rod diameter, in.	0.382	0.382
Fuel rod pitch, in.	0.506	0.506
Matrix hydraulic diameter, in.	0.4714	0.4714
Core flow area, $ft.^2$	54.39	44.36
Active fuel length, in.	136.7	150.0
Core flow rate, $lb_m/hr\text{-}ft^2$	$2.5x10^6$	$2.7x10^6$
Core average surface heat flux, $BTU/hr\text{-}ft^2$	$1.61x10^5$	$1.92x10^5$
Coolant inlet temperature, degrees F	549	555
Coolant outlet temperature, degrees F	600	613

Discussion

Thermal effects on waterside corrosion can be characterized by an evaluation of specific core geometric and operating parameters as tabulated above. Values for each parameter are provided for St. Lucie Unit 2 and ANO-2 for comparision purposes. Operating parameters are at an assumed 100% power level.

The tabulated parameters are not independent. Core average linear heat generation rate (LHGR) and surface heat flux are dependent on core power, the number of fuel rods, and the active fuel length; similarly, outlet temperature is dependent on inlet temperature, core power and flow rate.