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FACIL:50-315 Donald C. Cook Nuclear Power Plant, Unit 1, Indiana & 05000315
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SUBJECT: Application for amend to Licens DPR-58, revising Tech Specs to increase allowed peak pellet exposure for Advanced Nuclear Fuel Corp fuel. Nonproprietary & proprietary evaluations encl. Proprietary evaluation withheld. Fee paid.

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P.O. BOX 16631
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February 20, 1987
AEP:NRC:1018

Donald C. Cook Nuclear Plant Unit No. 1
Docket No. 50-315
License No. DPR-58
PROPOSED TECHNICAL SPECIFICATION CHANGE REGARDING
EXTENSION OF PEAK PELLET EXPOSURE FOR
ADVANCED NUCLEAR FUEL CORPORATION FUEL

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

Dear Sirs:

This letter and its attachments constitute an application for amendment to the Technical Specifications (T/Ss) for the Donald C. Cook Nuclear Plant Unit No. 1. Specifically, we propose to modify T/Ss 3/4.2.2 (Heat Flux Hot Channel Factor - $F_Q(Z)$) and 3/4.2.6 (Axial Power Distribution) to allow an increase in the allowed peak pellet exposure for Advanced Nuclear Fuel Corporation (ANF) (formerly Exxon Nuclear Company) fuel from its present value of 48.0 MwD/kg to 51.0 MwD/kg.

Predictions of fuel burnup made prior to the beginning of the current cycle indicated that the ANF fuel would not exceed the current peak pellet exposure limit of 48.0 MwD/kg. However, recent flux maps have indicated the potential for the ANF fuel to slightly exceed the limit prior to discharge at the end of cycle. According to our flux maps, the limit may be exceeded as early as May 3, 1987, approximately three weeks prior to the start of the upcoming Unit 1 refueling outage, currently scheduled to begin on May 24, 1987. Because this situation creates the potential for a required early shutdown of the unit, we request an expedited review of the proposed changes and a response by April 30, 1987. We are currently preparing proposed simplifications to the D. C. Cook Unit 1 power distribution monitoring T/Ss. These proposed changes, which are intended to provide consistency between the D. C. Cook Units 1 and 2 T/Ss, will most likely propose deletion of the burnup requirements from the T/Ss. However, because we will reach our peak pellet exposure limit in early May 1987, we have decided to submit the peak pellet exposure extension request separately to allow adequate time for NRC review.

The reasons for the proposed changes and our analysis concerning significant hazards considerations are contained in Attachment 1 to this letter. The proposed revised T/S pages are contained in Attachment 2. Attachments 3 and 4 contain evaluations performed by ANF in support of the changes. These evaluations are discussed in more detail in Attachment 1.

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Since Attachment 4 contains ANF proprietary information, we have included an affidavit to that effect with it. Attachment 5 contains a non-proprietary version of the ANF document in Attachment 4.

The ANF analyses we have attached provide justification for an extension of the allowed peak pellet exposure for their fuel to 48.7 Mwd/kg, rather than the 51.0 Mwd/kg we have proposed in this submittal. As detailed in Attachment 1, it is our understanding that the additional analyses necessary to support the value of 51.0 Mwd/kg can be reviewed by us under the provisions of 10 CFR 50.59 and therefore will not require an additional submittal. The value of 48.7 Mwd/kg should be sufficient to allow operation to continue until the start of the Unit 1 refueling outage, currently scheduled for May 24, 1987. At this time, however, we are investigating the possibility of delaying the outage start date due to various system concerns, such as outages in other of our operating units. For this reason, we are considering having analyses performed to justify peak pellet exposure limits for ANF fuel greater than 48.7 Mwd/kg. ANF has informed us that these analyses may be extensive and involve several weeks preparation time. In order to allow adequate time for NRC review of our proposed changes and for our own evaluation of our peak pellet exposure needs, we have chosen to submit analyses supporting peak pellet exposures of 48.7 Mwd/kg and to pursue exposures beyond this value via the 10 CFR 50.59 process. This approach was discussed with the NRC staff on February 12, 1987. Since at the present time we can only justify a value of 48.7 Mwd/kg, we would implement administration controls to prohibit operation above peak pellet exposures for ANF fuel of 48.7 Mwd/kg without appropriate analyses and 10 CFR 50.59 review.

We believe that the proposed changes will not result in (1) a significant change in the types of effluents or a significant increase in the amounts of any effluents that may be released offsite, or (2) a significant increase in individual or cumulative occupational radiation exposure.

These proposed changes have been reviewed by the Plant Nuclear Safety Review Committee (PNSRC), and will be reviewed by the Nuclear Safety and Design Review Committee (NSDRC) at their next regularly scheduled meeting.

In compliance with the requirements of 10 CFR 50.91(b)(1), copies of this letter and its attachments have been transmitted to Mr. R. C. Callen of the Michigan Public Service Commission and Mr. G. Bruchmann of the Michigan Department of Public Health.

Pursuant to 10 CFR 170.12(c), we have enclosed an application fee of $150.00 for the proposed amendment.

This document has been prepared following Corporate procedures which incorporate a reasonable set of controls to insure its accuracy and completeness prior to signature by the undersigned.

Very truly yours,

M. P. Alexich
Vice President

cm

Attachments

cc: John E. Dolan
W. G. Smith, Jr. - Bridgman
G. Bruchmann
R. C. Callen
G. Charnoff
NRC Resident Inspector - Bridgman
J. G. Keppler - Region III

Attachment 1 to AEP:NRC:1018

Reasons and 10 CFR 50.92
Analyses for Changes to the
Donald C. Cook Nuclear Plant Unit No. 1
Technical Specifications

Background

This letter proposes to increase the allowable peak pellet exposure for ANF fuel from its present value of 48.0 Mwd/kg to a higher value of 51.0 Mwd/kg. Peak pellet exposure is in general limited by either LOCA analysis considerations or fuel mechanical design characteristics. For ANF fuel in Unit 1, the value has been included in the T/Ss specifically because of LOCA analysis considerations, which are discussed in more detail below. The limit of 48.0 Mwd/kg appears in the graphs of exposure-dependent F_Q limit (F_Q^L (E ℓ)) and normalized F_Q limit (T (E ℓ)) found in Figure 3.2-4 of the Unit 1 T/Ss (page 3/4 2-23). It also appears in the F_Q uncertainty factors $E_p(Z)$ (page 3/4 2-7) and F_p (page 3/4 2-20).

During the design phase of a fuel cycle, predictions of peak pellet exposure are made, and these predicted exposures are ensured to be within applicable limits (mechanical and LOCA, as well as T/S where applicable). For ANF assemblies in D. C. Cook Unit 1, we monitor burnup via flux mapping to ensure adherence to T/S limits. Recent flux mapping has demonstrated that the potential exists for several ANF fuel assemblies to slightly exceed. their 48.0 Mwd/kg T/S limit by May 3, 1987, approximately three weeks prior to the scheduled start of the upcoming Unit 1 outage, which is currently scheduled to begin on May 24, 1987.

Currently, all new fuel for D. C. Cook Unit 1 is being supplied by Westinghouse Electric Corporation (Westinghouse). The present cycle (Cycle 9) uses only 34 ANF assemblies. Of these 34 assemblies, only 4 are expected to exceed the current peak pellet exposure limit of 48.0 Mwd/kg. By May 24, 1987 none should have exceeded the limit by more than 0.7 Mwd/kg, which represents an excess of less than 2%. Current design plans for the Cycle 10 core do not call for any of the ANF assemblies to be reused, although these plans are subject to change should we encounter unanticipated fuel failures or damaged assemblies during refueling.

ANF has evaluated the safety impact of operation up to 51.0 Mwd/kg for LOCA considerations (Attachment 3), but only to 48.7 Mwd/kg for mechanical design

considerations (Attachment 4). The mechanical design evaluation was limited to 48.7 Mwd/kg because this value could be supported in large part by extrapolations from existing analyses. ANF has informed us that analyses to support higher values of peak pellet exposure may be extensive and involve several weeks preparation time. Thus, we were unable to have these analyses performed in time to accompany this letter and still allow adequate time for NRC review. Additionally, as discussed in the cover letter, we are unsure at this time whether peak pellet exposures beyond 48.7 Mwd/kg are even necessary. We are therefore unsure whether we want to undertake the expense and effort to have the analyses performed.

ANF has informed us that in meetings with the NRC staff held in August 1986, the staff explained that fuel mechanical design analyses could be reviewed under the provisions of 10 CFR 50.59 without NRC review provided that ANF followed the methodology outlined in their document XN-NF-82-06, Rev. 1, "Qualification of Exxon Nuclear Fuel for Extended Burnup", and if the batch average is below the approved high burnup level in this document. Should we decide to pursue peak pellet exposures beyond 48.7 Mwd/kg, which equates to batch average burnup considerably less than batch average burnups approved in XN-NF-82-06 Rev. 1, we propose to have ANF do so using the parts of XN-NF-82-06 Rev. 1 which are applicable to peak pellet exposure, and to review these analyses under the provisions of 10 CFR 50.59. (Since peak rod and peak assembly exposures are not being changed beyond that addressed in the currently approved mechanical design safety evaluation, XN-NF-84-25, not all aspects of the XN-NF-82-06 Rev. 1 methodology need to be addressed.)

Description of Proposed Changes

The ANF evaluations presented in Attachments 3 and 4 provide support for a peak pellet exposure limit of 51.0 Mwd/kg based on LOCA considerations, but only 48.7 Mwd/kg based on mechanical design considerations. These analyses allow the exposure-dependent peaking factor limit, $F_Q^L(E\ell)$ of T/S Figure 3.2-4 (p. 3/4 3-23) to remain at 1.82 (its present value at 48.0 Mwd/kg peak pellet exposure). We have redrawn T/S Figure 3.2-4 to show the curve extending to an $F_Q^L(E\ell)$ value of 1.82 at 51.0 Mwd/kg. $T(E\ell)$, the normalized $F_Q^L(E\ell)$, which is also contained in T/S Figure 3.2-4, has been

similarly redrawn. We have also modified the values of $E_p(Z)$ in T/S 4.2.2.2 (p. 3/4 2-7) and F_p in T/S 3.2.6.g. (p. 3/4 2-20) to define these factors as 1.0 from 48.0 to 51.0 Mwd/kg peak pellet exposure. $E_p(Z)$ is an uncertainty factor to account for a reduction in the F_Q^L (E ℓ) curve due to an accumulation of exposure between flux maps. The quantity F_p is a similar factor for use with the Axial Power Distribution Monitoring System (APDMS). The values of these factors are related to the slope of the F_Q^L (E ℓ) curve from T/S Figure 3.2-4. A flat slope for the F_Q^L (E ℓ) curve, as we have proposed between 48.0 and 51.0 Mwd/kg, results in no change in the allowable value of F_Q^L (E ℓ) between flux maps and thus no penalty (penalty factor of 1.0). This is consistent with the value of 1.0 assigned to these factors between peak pellet exposures of 0.0 and 17.62 Mwd/kg where the slope of F_Q^L (E ℓ) is also flat. Since at the present time we can only justify a peak pellet exposure of 48.7 Mwd/kg, we would implement administrative controls to prohibit operation beyond 48.7 Mwd/kg without an analysis which uses the methodology from the appropriate sections of XN-NF-82-06 Rev. 1 and a subsequent review of these analyses under 10 CFR 50.59.

Justification for Proposed Changes

The following justifications address LOCA considerations up to 51.0 Mwd/kg and mechanical design considerations up to 48.7 Mwd/kg. As discussed previously, we propose that any additional mechanical design analyses which may be performed in support of higher peak pellet burnups will be performed using the approved methodology of XN-NF-82-06 Rev. 1 and will be reviewed under the provisions of 10 CFR 50.59.

1. LOCA Considerations

F_Q does not vary as a function of burnup for Westinghouse fuel in either the D. C. Cook Units 1 or 2 T/Ss. For ANF fuel, it varies as a function of burnup only in the Unit 1 T/Ss. The reason the burnup dependence is included for ANF fuel in Unit 1 is that the limits were based on ANF LOCA analyses dating back to the mid-1970s, which used a burnup-dependent F_Q. More detailed and modern ANF LOCA analyses do not require F_Q to be burnup-dependent. For example, F_Q for ANF fuel in

D. C. Cook Unit 2 is a constant at 2.10, with no exposure dependence or limits found in the T/Ss. The newer ANF analyses have determined the limiting exposures with regard to peak clad temperature concerns to be at relatively low exposures (less than 10 Mwd/kg). Similarly, Westinghouse LOCA models assume a constant value for F_Q throughout the cycle.

ANF has recently performed a new limiting break K(Z) LOCA/ECCS analysis for Unit 1. This analysis, which is contained in XN-NF-85-115 Rev. 2, was sent to you directly by ANF in their letter GNW:001:87, dated January 15, 1987 (as noted in our letter AEP:NRC:0940E, dated January 29, 1987). This analysis used the modern ANF evaluation methods including the Fuel Cooling Test Facility (FCTF) reflood heat transfer correlations. The document discusses analyses performed for peak pellet exposures of 2 Mwd/kg and 9 Mwd/kg, which ANF has determined to be bounding with regard to peak clad temperature. These analyses assumed an F_Q value of 2.04 peaked at the core midplane at 2 Mwd/kg and 1.95 peaked at the core top at 9 Mwd/kg. Both of these values are conservative with respect to the value of 1.82 required by Unit 1 T/S Figure 3.2-4 at 48 Mwd/kg.

As discussed in Attachment 3, ANF has informed us that the analyses they performed for XN-NF-85-115 Rev. 2 are applicable up to a peak rod average exposure of 47 Mwd/kg, which corresponds to a peak pellet exposure of 51 Mwd/kg. This is based on comparisons of exposure analyses ANF performed for their fuel in D. C. Cook Unit 2 and St. Lucie Unit 1. The analyses for both of these units demonstrated maximum values of peak clad temperature occurring in the very low exposure range. For D. C. Cook Unit 2, the peak temperature occurred at an exposure of only 2 Mwd/kg. Since all the ANF assemblies have undergone significant burnup, we did not need an F_Q value as high as that supported by the ANF analyses and have thus conservatively proposed to maintain F_Q at a value of 1.82, which corresponds to its present limit at 48.0 Mwd/kg.

2. Mechanical Design Considerations

The analysis supporting the current peak pellet exposure of 48.0 Mwd/kg is contained in ANF report XN-NF-84-25 (P), entitled "Mechanical Design Report Supplement for D. C. Cook Unit 1 Extended Burnup Fuel Assemblies." This document was submitted directly to you by ANF with their letter JCC:113:84, dated August 21, 1984. It was referenced by us in our letter AEP:NRC:0745M, dated August 23, 1984, which proposed to increase peak pellet exposure for ANF fuel in D. C. Cook Unit 1 from 42.2 Mwd/kg to its present value of 48.0 Mwd/kg. The changes were approved by the NRC via Amendment 82 to the D. C. Cook Unit 1 T/Ss, which is dated November 29, 1984.

Attachment 4 to this letter contains an evaluation by ANF to support extending the peak pellet burnup to 48.7 Mwd/kg. This evaluation demonstrates that applicable ANF mechanical design criteria would be satisfied with a peak pellet exposure limit of 48.7 Mwd/kg.

Of these criteria, which are discussed in Attachment 4, ANF has determined that all criteria except steady-state strain, corrosion, hydrogen absorption, and fuel rod internal pressure are essentially independent of the peak pellet exposure limit. For steady-state strain, corrosion, and hydrogen absorption, ANF performed extrapolations of their analyses reported in XN-NF-84-25 (P). The results of these extrapolations, reported in Attachment 4, demonstrate significant margin to the ANF design limits. For fuel rod internal pressure, ANF performed a new analysis using their RODEX2 code. The peaking factor was increased by 2% at the maximum axial region from that used for the XN-NF-84-25 analysis to bound the increased peak pellet burnup. The results of this analysis demonstrated a peak internal pressure well below the ANF design criteria limit of 2250 psia specified in XN-NF-84-25.

Significant Hazards Considerations

Per 10 CFR 50.92, a proposed amendment will not involve a significant hazards consideration if the proposed amendment does not:

(1) involve a significant increase in the probability or consequences of an accident previously evaluated,

(2) create the possibility of a new or different kind of accident from any accident previously evaluated; or

(3) involve a significant reduction in a margin of safety.

Criterion 1

We have presented analyses which demonstrate that operation up to 48.7 Mwd/kg peak pellet exposure will not violate any applicable safety limits or design criteria. In addition, we would implement administrative controls to prohibit operation beyond 48.7 Mwd/kg unless analyses are performed using methodology that is known to be acceptable to the NRC. Therefore, we conclude that the proposed changes will not significantly increase the probability of occurrence or consequences of a previously evaluated accident, nor will they involve a significant reduction in a margin of safety.

Criterion 2

LOCA analyses and fuel mechanical design limits are the principal areas of concern regarding peak pellet exposure. We have presented evaluations which conclude that applicable criteria with regard to these issues will continue to be met for exposures up to 48.7 Mwd/kg, and have committed to not exceed that limit without analyses which use methodologies acceptable to the NRC. Thus, we conclude that the proposed changes will not create the possibility of a new or different kind of accident from any accident previously analyzed or evaluated.

Criterion 3

See Criterion 1, above.

Lastly, we note that the Commission has provided guidance concerning the determination of significant hazards by providing certain examples (48 FR 14870) of amendments considered not likely to involve significant hazards consideration. The sixth of these examples refers to changes which may result in some increase to the probability of occurrence or consequences of a previously analyzed accident or may reduce in some way a safety margin, but the results of which are clearly within limits established as acceptable. Because these proposed changes involve extension of a limit contained in the T/Ss, they may be perceived as involving a reduction in safety margin; however, for reasons previously presented, we do not believe that any reductions would be significant.