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Docket No. 50-220

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Niagara Mohawk Power Corporation
ATTN: Mr. Thomas J. Brosnan
Vice President and
Chief Engineer
300 Erie Boulevard West
Syracuse, New York 13202

Gentlemen:

Your letter dated February 24, 1972, requested authorization to make changes consisting of a partial refueling of the Nine Mile Point reactor using Type 3 gadolinia-bearing fuel.

We have reviewed the information you provided and have concluded that the proposed partial refueling and subsequent operation of the Nine Mile Point reactor using Type 3 fuel does not involve an unreviewed safety question, nor does it involve a change to the Technical Specifications of Provisional Operating License No. DPR-17. Therefore, you may perform the refueling as described in your letter of February 24, 1972, in accordance with paragraph 50.59(a) of 10 CFR Part 50.

Sincerely,

/s/

Donald J. Skovholt
Assistant Director for
Reactor Operations
Division of Reactor Licensing

cc: Arvin E. Upton, Esquire
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UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

MAR 17 1972

D. L. Ziemann

Files (Docket No. 50-220)
THRU: D. L. Ziemann, Chief, ORB #2, DRL

EVALUATION OF TYPE 3 RELOAD FUEL FOR NIAGARA MOHAWK NINE MILE POINT REACTOR

Introduction

By letter dated February 24, 1972, Niagara Mohawk Power Corporation described plans and presented a safety analysis for second partial refueling of the Nine Mile Point (NMP) Unit 1 reactor. The partial refueling will provide adequate core reactivity for continuous operation through the summer peak demand period and will reduce radioactivity releases by replacing defective fuel. During the first partial refueling outage (September 18 to October 26, 1971) 24 Type 2 fuel bundles and 15 reconstituted Type 1 fuel bundles were installed. The next partial refueling is scheduled to begin on April 2, 1972, and is to include up to 32 Type 2 fuel bundles which we reviewed previously ("Evaluation of Gadolinia-Bearing Reload Fuel for Niagara Mohawk Nine Mile Point Reactor", dated September 14, 1971) and 40 new Type 3 fuel bundles. Seven reconstituted Type 1 fuel bundles are available and they may be installed during the April 1972 outage if necessary to replace fuel leakers. All of the remaining poison curtains are to be removed.

Type 3 fuel is similar to the Type 2 fuel already in use. The principal changes in the Type 3 as compared with the Type 2 fuel are the use of three instead of four gadolinia-bearing rods incorporating a slightly higher content of gadolinia, and a lower average U-235 enrichment (2.3 w/o U-235 for Type 3 compared with 2.5 w/o for Type 2). Although the proposed refueling involves no change to the NMP Technical Specifications, we have evaluated the proposed partial refueling to determine if it involved an unreviewed safety question as defined in Section 50.59 of 10 CFR Part 50. Our evaluation considered the effects of the proposed fuel on NMP reactor operation as regards mechanical design of the fuel, nuclear and thermal hydraulic characteristics of the core, quality control, operating considerations, and effect on NMP safety analysis. This evaluation is summarized below.

Mechanical Design

The Type 3 fuel assembly is mechanically similar to Type 2 fuel and is designed to be fully compatible with the initial core, Type 1, and

[illegible]

reload, Type 2, fuel bundles. All fuel types have the same basic lattice arrangement. In addition to the differences in gadolinia content and average enrichment previously discussed, Type 3 fuel assemblies contain fewer rods filled with dished pellets than Type 2 fuel, a minor difference.

Nuclear, Thermal Hydraulic Characteristics

Since the geometry and materials of the Type 3 fuel are similar to those of Types 1 and 2, the nuclear characteristics of the new reload fuel are similar to those of the present core fuel. Although the shutdown margin is being reduced from about 4% $\Delta k/k$ to 1% $\Delta k/k$ with the control rod of highest reactivity worth fully withdrawn, the same nuclear design bases of the present core loading are maintained for the Type 3 fuel (i.e., shutdown $k_{eff} \lesssim 0.99$). Nuclear characteristics of core effective multiplication, control system reactivity worths, and reactivity coefficients of temperature and void remain the same or differ only slightly from those of the present loading. There are no changes to the Technical Specifications required to accommodate the Type 3 fuel or removal of the poison curtains.

The thermal hydraulic design parameters of Type 3 fuel are similar to those of Types 1 and 2 as shown by the comparison below:

Table 1

Comparison of Fuel Types

Parameter	Type 1 UO_2 fuel	Type 2 GD_2O_3/UO_2 fuel	Type 3 GD_2O_3/UO_2 fuel
1. Maximum Linear Heat Generation Rate During Operation - kW/ft	17.5	14.0	15.1
2. Onset of Fuel Center Melting - kW/ft	21.5	19.5	19.2
3. Clad Damage - 1% Plastic Strain - kW/ft	28.0	26.5	27.2

The comparative values shown for the Type 2 and Type 3 fuel reflect the conditions for the fuel rod containing the gadolinia poison while the rest of the rods in the fuel bundle reflect Type 1 fuel conditions. The peak heat flux of the gadolinia containing rods is never greater than

86% of the peak heat flux in the pure UO_2 rods in the core. Thus, the refueled core thermal-hydraulic limits as described in the FSAR are not changed and remain at 17.5 kW/ft maximum linear heat generation rate and $\gtrsim$1.90 minimum critical heat flux ratio.

Quality Control

The licensee described a program of quality assurance for the previous partial refueling and indicated its continued applicability to the forthcoming refueling. We evaluated the program and concluded it was acceptable for the initial refueling as documented in "Evaluation of Gadolinia-Bearing Reload Fuel for Niagara Mohawk Nine Mile Point Reactor" dated September 14, 1971. We have concluded that the program previously described is acceptable for future refueling.

Operating Considerations

One of the purposes of this partial refueling is to replace fuel leakers to reduce radioactive offgas release rates. The licensee has been reasonably successful in maintaining low offgas rates; this success is attributed to these partial refuelings and using a control rod pattern which holds the flux distribution axially low in the core. The average radioactive offgas release rates have been maintained generally within the range of 15,000 to 20,000 uCi/sec since the previous partial refueling. These release rates represent about 2.5% of the Technical Specification limit and are considered acceptable.

Safety Analysis

The licensee has evaluated the operating transients and accidents to determine the affect, if any, from introduction of the Type 3 reload fuel. Loading errors, consisting of misplaced pellets in a fuel rod, misplaced rods in a fuel bundle and misplaced bundles in the core have been considered. Since the nuclear, thermal and hydraulic characteristics of the reload fuel are similar to the Types 1 and 2 fuel, Niagara Mohawk concludes, and we agree, that the effects on the fuel and system response to transients are not significantly changed, because the fuel damage limits are not changed and the results of the analyses are not changed.

The licensee also reanalyzed the effect of the new reload fuel on calculated peak clad temperatures following an assumed loss-of-coolant accident (LOCA). This reanalysis was performed in accordance with the requirements of the Commission's Interim Policy Statement for the performance of Emergency Core Cooling Systems. The results of this analysis are summarized in Table 2 below:

Table 2

NMP Calculated Peak Clad Temperatures Following LOCA

Fuel Type	Peak Clad Temperature °F
Type 1 - Initial Core Fuel	2237
Type 2 - Initial Reload Fuel	2265
Type 3 - Second Reload Fuel	2280

The increasing peak clad temperature shown by Table 2 reflects the design effort to achieve maximum fuel utilization by seeking a flat power distribution. The U-235 enrichment level and gadolinia poison distribution are variables used to improve fuel utilization. A flatter power distribution within the fuel bundle results in a slight increase in local peaking factor (the maximum local peaking factor is not changed) of the inside rods of the bundle which reach the highest temperatures following a LOCA. Only a few of the total fuel rods reach the peak calculated temperatures, and the average of these peak clad temperatures generally reflects a slight increase. Since the peak clad temperature calculated is below the Commission's criterion of 2300°F, we find the proposed reload fuel acceptable.

Conclusion

On the basis of our evaluation, we have concluded that no changes to the Technical Specifications are necessary, the refueling and subsequent operation with Type 3 fuel does not involve an unreviewed safety question, and that there is reasonable assurance that the health and safety of the public will not be endangered by the proposed refueling and operation.

C.J. DeBevec

C. J. DeBevec
Operating Reactors Branch #2
Division of Reactor Licensing

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