DRAFT

ENCLOSURE 1

GUIDANCE FOR PROPOSED LICENSE AMENDMENTS

RELATING TO REFUELING

A. INTRODUCTION

The refueling of a power reactor represents a change in the facility which may involve a change in the technical specifications or an unreviewed safety question. Title 10, CFR Part 50, Section 50.59(a) permits a licensee to make changes in the facility as described in the SAR, changes in the procedures as described in the SAR and conduct tests or experiments not described in the SAR without prior Commission approval unless such changes involve a change in the technical specifications or involve an unreviewed safety question. The request for NRC authorization for any such change must include an appropriate safety analysis report (SAR). The format and content of such a SAR is the subject of this guide.

B. DISCUSSION

The licensee must demonstrate that safe operation will continue with the new core. Generally, a refueling will involve only changes in the core loading. Any changes in facility design not associated with the refueling (reload) design and its effect on subsequent operation should be addressed by a separate document. Significant changes in fuel design or reactor control procedures may be addressed by reference to topical reports.

Two operating cycles or "loads" are of interest in a reload submittal. The "reload cycle" is the upcoming cycle, whose safety is to be evaluated. The "reference cycle" is the cycle to which the proposed

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reload is to be compared. The appropriate reference cycle is therefore the cycle which has the most up-to-date, inclusive safety analysis report approved by the Commission. In most cases, this will be the "present", currently operating cycle. However, an applicant may use any cycle or analysis back to the FSAR cycle for reference, if this analysis bounds the parameters of the proposed reload and uses currently approved analytical methods. The various safety analyses may be expedited by such reference if the reload cycle parameter values are bounded by the reference cycle values.

The amount of detailed analysis required in any submittal depends on the type of reload. For equilibrium cycle reloads, where mechanical design and enrichment do not change it is expected that accident parameters will remain within their previously analyzed ranges and a reanalysis may not be required. Conversely, for non-equilibrium cycle reloads, the thermal and nuclear characteristics generally require new analysis and a full evaluation. When a reload involves different analytical methods or design concepts, a complete review of these changes and their effects is necessary.

C. REGULATORY POSITION

Changes in design, analysis techniques, and other information relevant to a reload are often generic in nature. Generic information may be provided by reference to generic report rather than giving explicit justification in a reload SAR for a specific plant.

A reload submittal should be submitted at least 90 days before the planned startup date. If significant different analytical methods or design concepts are to be incorporated into the reload core and have not been justified by generic review or if the changes otherwise entail a significant hazards consideration, a significantly greater time period may be required. In cases where timing is a problem, there may be cases in which the submittal may be provided in sections so that the staff review can be expedited. The submittal should contain the following:

1. Introduction and Summary

Give the purposes of the submittal and summarize the contents of the submittal.

2. Operating History

Discuss any operating anomalies in the current cycle which may affect the fuel characteristics in the reload cycle. It is recognized that only information from the first part of the cycle will be available.

3. General Description

Provide a core loading map for the planned reload core, showing the position, by zone, of new and irradiated fuel. Include the position of any test assemblies. Show the initial enrichment distribution of the fresh fuel, the initial burnup distribution, and the burnable poison distribution and concentration (if any). Deviations from this planned map at actual reload time are acceptable provided the finalized reload core's safety parameters are bounded by the safety analysis.

4. Fuel System Design

4.1 Fuel Design

The reload fuel submittal should provide a table that presents the following items for both the proposed and the reference cycle fuel: fuel assembly type, planned number of reload and residual assemblies in the core, initial fuel enrichment, initial fuel density, initial fill gas pressure, region burnups at BOC, and clad collapse time. For the new core loading in PWRs, the limiting region or fuel assemblies based on fuel performance considerations should be identified.

4.2 Mechanical Design

Where fuel assemblies are considered new in concept, the following information should be provided, by reference or explicitly, for the reload fuel assemblies:

The vibration, flow and structural characteristics including seismic response should be presented. The dimensions and configuration of fuel assembly components should be presented in tables and drawings. Particular attention should be given to the following items:

(1) For PWRs, control rod assembly accommodation and associated operational functions (for example, damping and travel limits).

(2) Fuel cladding mechanical interaction.

(3) Fuel rod bowing as related to fuel rod axial position and spacer grid flexibility.

(4) Steady-state fuel assembly hold-down and lift-off forces.

(5) Verification techniques for location and orientation of fuel assemblies in the core.

(6) Specific dimensional or material changes from present approved assemblies.

(7) Design of spacer grids as related to local flow effects, DNB considerations, and mechanical strength and integrity of the assembly.

Demonstrate by calculation with approved methods or tests that the new fuel design satisfies such design limits as stress intensity, strain, deflection, collapse, fretting wear and fatigue for all conditions, steady-state, normal, and abnormal transients. Any changes in design limits should be identified and justified.

Demonstrate by calculation with approved methods or tests that the new fuel design meets the requirements of Appendix K of 10 CFR 50.

4.3 <u>Thermal Design</u>

Where fuel assemblies are considered new in concept, fuel thermal performance calculations based on the above mechanical design and the vendor's approved fuel performance model should be provided. Fuel cladding integrity and collapse considerations should be included. This may be accomplished by suitable reference.

4.4 Chemical Design

Where fuel assemblies are considered new in concept or utilize component materials that differ from the present design, chemical compatibility of all possible fuel-cladding-coolant-assembly interactions should be analyzed. This may be accomplished by suitable reference.

4.5 Operating Experience

Previous operating experience as related to safety considerations with comparable fuel rod/assembly designs should be presented. This may be accomplished by suitable reference.

5. NUCLEAR DESIGN

5.1 Physics Characteristics

Provide information regarding any changes from the reference cycle to the reload cycle for the following parameters used in the safety analysis:

For BOC, EOC, and any extremum during the cycle:

(1) Moderator Coefficients (e.g., temperature, pressure, density, or void. Give or reference the power distributions used in their development.)

(2) Doppler Coefficient

(3) Maximum Radial and Axial (or Total) Peaking Factors

(4) Ejected Rod Worth (for PWRs)

(5) Rod Drop Parameters (for BWRs)

For BOC and EOC:

(1) Delayed Neutron Fraction

(2) Critical Boron Concentration (for PWRs)

(3) Boron Worth (for PWRs)

(4) Standby Liquid Control System Worth (for BWRs)

(5) Scram Function (for BWRs)

For PWRs, provide, in tabular form, a detailed calculation of the shutdown margin for the BOC and EOC and any mid-cycle minimum of the reference and reload cycles. This table should also indicate the required margin. For BWRs, provide the shutdown margin curve.

For PWRs, specify the control rod patterns to be used during the reload cycle, including any rod interchanges and any differences from the reference cycle.

5.2 Analytical Input

Describe briefly the information gathered on the burnup history of the exposed fuel, and how it was used in the reload analysis only if required to support reload design changes. This may be done by reference. Indicate how the incore measurement calculation constants (or matrices) to be used in calculating bundle powers were prepared for the reload cycle. This may be done by reference.

5.3 Changes in Nuclear Design

Describe any changes in core design features, calculational methods, data or information relevant to determining important nuclear design parameters which depart from prior practice for this reactor, and list the affected parameters. This should be done by reference where possible.

Discuss in detail or give a reference describing any significant changes in operational procedure from the reference cycle with regard to axial power shape control, radial power shape control, xenon control, and tilt control.

In cases where different analytical methods are used, detailed information on the new analytical methods for evaluating core neutronic behavior should be supplied, and any interfacing between the new and old methods should be described. This should be done by reference where possible.

6. Thermal Hydraulic Design

In the event there are changes in the fuel geometry, such as spacer grid design, spacer grid axial separation, fuel pin spacing, or of the fuel pin or control rod guide tube; or if there are changes in the radial or axial design power distributions of the core, evaluate the effects of these changes on:

(a) The minimum DNBR/CHFR/CPR values for normal operation and anticipated transients.

(b) The hydraulic stability of the primary coolant system for all conditions of steady-state operation, for all operational transients including load following maneuvers, and for partial loop operation.

This may be done by appropriate reference.

In cases where different calculational procedures for thermal hydraulic design are used, these procedures and appropriate calculations should be described or referenced.

7. Accident and Transient Analysis

The potential effect of any changes in the reload fuel design on each incident listed in the Accident and Transient Analysis section of the reference cycle analysis should be considered

Provide a table of the input parameters applicable to all accidents and transients. This table of "common" parameters should list two columns for each parameter: the limiting values for the reference cycle and the limiting values for the reload cycle.

A second table should be provided which lists each accident with its accident-specific input parameters. The table should also list limiting values for the reference cycle and the reload cycle.

In case an accident input parameter falls outside of bounds previously analyzed, provide or reference a re-analysis of the accident.

Justify any changes from the reference cycle in accident analysis techniques, calculational methods, correlations, and codes. If this is not done by reference to a topical report, an appropriately longer time period will be required for approval of the reload submittal.

8. Proposed Modifications to Technical Specifications

Present the proposed modifications to the Technical Specifications. Justify the changes.

9. Startup Program

List and briefly describe the planned startup tests associated with core performance. Recommended tests include:

For PWRs:

(1) Control Rod Drive Tests and Drop Time (Hot)

(2) Critical Boron Concentration

(3) Control Rod Group Worth

(4) Ejected Rod Worth

(5) Dropped Rod Worth

(6) Moderator Temperature Coefficient

(7) Power Doppler Coefficient

(8) Startup Power Maps

For BWRs:

(1) Control Rod Drive Tests and Scram Time (Cold and Hot)

(2) Shutdown Margin With Most Reactive Rod Withdrawn

(3) Patterns for Criticality