Proposed Change No. 13

YANKEE ATOMIC ELECTRIC COMPANY

441 STUART STREET, BOSTON 16, MASSACHUSETTS

January 5, 1962

DOCKETED
USAEC
Division of
Licensing & Regulation
JAN 3 1962
Docket Officer

U. S. Atomic Energy Commission
Washington 25, D. C.

Attention: Division of Licensing and Regulation

Reference: License No. DPR-3 (Docket NO. 50-29) (Proposed)

L&R File Copy

Dear Sirs:

Pursuant to paragraph 3.A of License No. DPR-3, as amended, Yankee Atomic Electric Company hereby requests authorization to make the following change:

PROPOSED CHANGE: Reference is made to Section 101 of the license application, "Core Mechanical Design", and particularly to pages 101:7 and 101:8. At the present time, uncertainity exists as to the physical condition of the original control rod absorber sections and the need for their replacement during the first reactor refueling. Control rod examination at that time will dictate whether or not replacement is necessary.

The proposed change covers an alternate design of control rod absorber section, similar to the original design in all respects, except for the addition of longitudinal, segmented, stainless steel rubbing straps on each of the eight vane surfaces. Authorization is requested to replace the original absorber sections with new sections of the alternate design.

Reasons for Change:

It will be remembered that the original control rod absorber sections are of Ag-In-Cd alloy and are provided with a diffusion bonded nickel plate for corrosion resistance. We are concerned that some wear and abrasion of the nickel plated surfaces may have taken place during operation of the reactor up to the first refueling. Any such action would, of course, expose the base metal to undesirable corrosion effects. The addition of rubbing straps in the alternate design, which project slightly from the blade surfaces, and which will bear against the core plate guide blocks and the fuel assembly rubbing straps will prevent any such wear or abrasion during reactor operation.

Safety Considerations:

In our opinion, the proposed change does not present significant hazards considerations not described or implicit in the license application, as amended to June 23, 1961, the date of issuance of Amendment No. 3 to License No. DPR-3, and does not affect the accident analysis set forth in Section 4 of the license application.

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Reduction of control rod worth, due to the removal of absorber material and the addition of stainless steel rubbing straps has also been considered. Initial core startup experiments demonstrated a nominal 3.5% Δ K/K shutdown margin with the core in a hot, clean, zero power condition compared to the minimum of 3% Δ K/K required by Paragraph D 2.a.(3) of the Technical Specifications. Analysis indicates that upon installation of a complete set of the alternate design control rods, total rod worth will be reduced by a maximum of 0.3% Δ K/K. The actual shutdown margin will be checked experimentally during startup testing.

Scheduling of Change:

This change is not subject to precise scheduling since when authorized it would merely permit use in the reactor of the alternate design of control rod absorber section at some future time. Replacement would be made only if inspection of the original absorber section discloses objectionable surface wear or deterioration.

The proposed change requires authorization by the Commission pursuant to paragraph 3.A of the license, since it involves a change in the design specifications of the reactor which are set forth in the license application and incorporated by reference in the technical specifications. (See paragraph B.1 of Appendix A to License NO. DPR-3).

Enclosed herewith as supporting information for the proposed change, in draft form, are new or superseding pages for the license application as follows:

101:7 (to supersede page 101:7 dated 1/10/60)
101:7A
101:8A

Upon authorization of this change by the Commission these new or superseding pages will be submitted in final form as an amendment to the license application. Their incorporation in the license application will bring the document up to date and provide for the use of the original or alternate design of control rod absorber section in the reactor as conditions may warrant.

Respectfully submitted,

YANKEE ATOMIC ELECTRIC COMPANY

Roger J. Coe

Roger J. Coe, Vice President

Commonwealth of Massachusetts
Suffolk, ss

January 5, 1962

Then personally appeared before me Roger J. Coe, who, being duly sworn, did state that he is a Vice President of Yankee Atomic Electric Company, that he is duly authorized to execute and file the foregoing request in the name and on behalf of Yankee Atomic Electric Company, and that the statements therein are true to the best of his knowledge and belief.

Donald G. Allen

Donald G. Allen Notary Public
My Commission Expires Jan. 21, 1967

Control Rods

The reactor rods are cruciform in shape and 24 in number. The control rods are fabricated from a silver-indium-cadmium alloy (80% Ag, 15% In, 5% Cd) which has a relatively high neutron absorption cross section, is essentially "black" to thermal neutrons and has a wealth of resonance structure to enhance its worth. The Ag-In-Cd alloy has approximately the same worth as hafnium and is available at a lower cost.

Since the corrosion resistance of Ag-In-Cd is marginal even under the normal low oxygen conditions in the Yankee reactor, the control rods are plated with nickel to a nominal thickness of 0.5 mils*. Heat treatment following plating gives a diffusion bond between the Ni and Ag-In-Cd, anneals the Ag-In-Cd alloy and thus gives maximum creep strength, and stress relief to the materials.

Although the initial 24 control rods are not equipped with rubbing straps, such a feature is, however, incorporated in an alternate design which has been released for fabrication. Replacement control rods will therefore be equipped with four longitudinal (type 348) stainless steel straps attached to each control rod vane surface, each strap being approximately 22 inches long. Straps will be approximately 3/8 inches wide by 0.061 inches thick and will be chamfered on all edges. Assembly of the four straps into a 0.05 inch recessed slot in each vane surface will create a nearly continuous rubbing surface except for approximately 1/4 inch spaces between strap segments. The straps are fastened to each vane by 32 welded pins. Arrangement of the rubbing straps on the replacement control rod absorber section may be seen on page 101:8A.

Connected to the active portion of the control rod is a Zircaloy-2 follower which acts as a guide and prevents the formation of a "water-slot" in the core when the control rod is withdrawn. The follower also serves to prevent excessive by-pass coolant flow through the control rod channel. The joint between the absorber section and the follower has been designed to allow maximum handling flexibility in that a single handling tool can be used to handle either the absorber or the follower. In addition, since the joint can be "broken", less head room is needed during handling operations. The figure on page 101:8 shows the joint design. The fact that the joint can be broken does not lead to an operational hazard because disengagement is accomplished by rotation and rotation is impossible in the assembled vessel.

In the reactor core, the types of fuel assemblies are limited to two, in order to simplify the fabrication process and the loading of the core. This results in a core having 32 cruciform slots of which only 24 are occupied by movable control rods. The remaining 8 cruciform slots are filled by fixed shim rods. These fixed shim rods consist of a boron stainless steel section and a Zircaloy-2 section. Each end of the rod is

*YAEC-140, J.R. Dazen, "Nickel Plating of Ag-In-Cd Alloy and Fabrication Of A Prototype Control Rod". (To be issued).

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101:7A
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mechanically identical with the other, so that the rod may be inverted and either section may be used as material in the core. If little or no absorption effect is desired from the fixed elements, Zircaloy-2 will be placed in the core with the boron stainless steel section as the extension. If an absorption effect is required for reactivity shim and it is desired to have a lower flux peak than would be produced by Zircaloy-2, boron stainless steel may be placed in the core with Zircaloy-2 as the extension. However, the boron stainless rods might have to be removed during core life in order to permit full core life of 10,000 full power hours. In either case, the rod will reduce the undesirable neutron flux peaking which would occur if the water were not excluded from the slots. The decision as to which material to use will be made on the basis of the initial criticality tests.

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Yankee Atomic Electric Company
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ENCLOSURES:

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