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Addendum No. 2 to

Proposed Change No. 3

for the

Southwest Experimental Fast Oxide Reactor

January 27, 1971

Re: License No. DR-15

Docket No. 50-231

465

I. Introduction

Proposed Change No. 3 to the SEFOR Technical Specifications was submitted on July 8, 1970, and Addendum No. 1 to this change was submitted on September 8, 1970. Addendum No. 2, submitted herein in response to Reference 1, proposes additional changes to be included with the original submittal of July 8, 1970, and replaces the proposed additional changes submitted on September 8, 1970.

II. Additional Proposed Changes

Pursuant to the provisions of 10 CFR 50.59, General Electric requests that the SEFOR Technical Specifications be changed as shown on pages 2.1-1, 2.1-2, 2.1-3, 2.1-3a, 2.1-4, 2.1.4a, 2.1-5, 2.1-5a, 2.1-6, 2.2-2, 2.2-3, 2.2-3a, 2.2-5, 3.3-2, 3.3-7, 4.3-1, and 4.3-1a, in Attachment A of this document. The obsolete portions are lined out and the new portions are indicated by brackets in the margin on the enclosed pages. Where only part of a line has been added, the new portions are underlined.

III. Discussion

The proposed changes submitted herein reduce the Limiting Safety System Setting (LSSS) and the safety limit for reactor power when guinea pig rods are located under the innermost refueling ports, such that the limiting values of linear power density for the guinea pig rods are reduced to the values used for all standard rods in the core. Approval of this change will permit the use of guinea pig rods throughout the test program to verify the margins to fuel damage, as was originally intended in the design of SEFOR. The present specifications prohibit the use of guinea pig rods under the innermost refueling ports during steady state reactor operation above 17.5 MWt.

Also included in the proposed changes is additional surveillance of the innermost guinea pig rods when the reactor is operated at power levels greater than 17.5 MWt. The increased surveillance provides an appropriate means of demonstrating that operation of the guinea pig rods at power densities above those originally permitted by the license will not result in fuel rod damage.

The power density at which the guinea pig rods will operate is expected to remain essentially constant at the values determined by using the ratios given in Reference 11 of Specification 2.1. These ratios depend on the flux profile and will not be significantly affected by loading changes, the position of the reflector segments when the reactor is operated at 20 MWt, or by the distribution of B_4C poison rods in the core when they are arranged as required by proposed Specification 3.3.N.

Previous calculations[(2)] indicate that with one reflector segment completely lowered and the others completely raised, power densities on the lowered reflector side of the core decrease, compared to an average reflector raised condition, while power densities increase slightly on the side diametrically opposite the lowered reflector. The calculated increase in the power density at a radius of 18.6 cm (the location of the centermost guinea pig rod) on the opposite side of the core from the lowered reflector is one percent. The actual increase at 20 MW in SEFOR will be less than half of this however, because at this power level the most unsymmetrical reflector pattern possible is one with nine reflectors completely raised and one reflector lowered approximately 50 cm out of its 100 cm stroke. This is a consequence of the actual worth of a reflector as a function of axial position and the SEFOR Technical Specification which stipulates that the excess reactivity at 20 MW shall be $\leq$50¢. In this configuration, the top of the partially lowered reflector is two inches or more above the core midplane and five inches or more above the axial location at which the peak power density occurs. As compared to a completely symmetrical reflector configuration, this pattern can thus cause only a very small increase in the peak power density of the hottest guinea pig rod located at a core radius of 18.6 cm.

The local perturbations in power density that occur in SEFOR when a fuel rod is replaced by a core poison (B_4C) rod are small. The maximum increase in power density of the center-most guinea pig rod as a result of placing one poison rod anywhere in the core is estimated to be of the order of 0.25%.

Calculations indicate that at a constant total power, a poison rod decreases the power density in the adjacent fuel rods by 2.7%, decreases the average power density of a seven channel cluster containing the poison rod at its center by 1.0%, and decreases the average power density in a 19 channel cluster by approximately 0.6%. The power density in the remaining 89 fuel channels increases slightly (∿0.13% on the average).

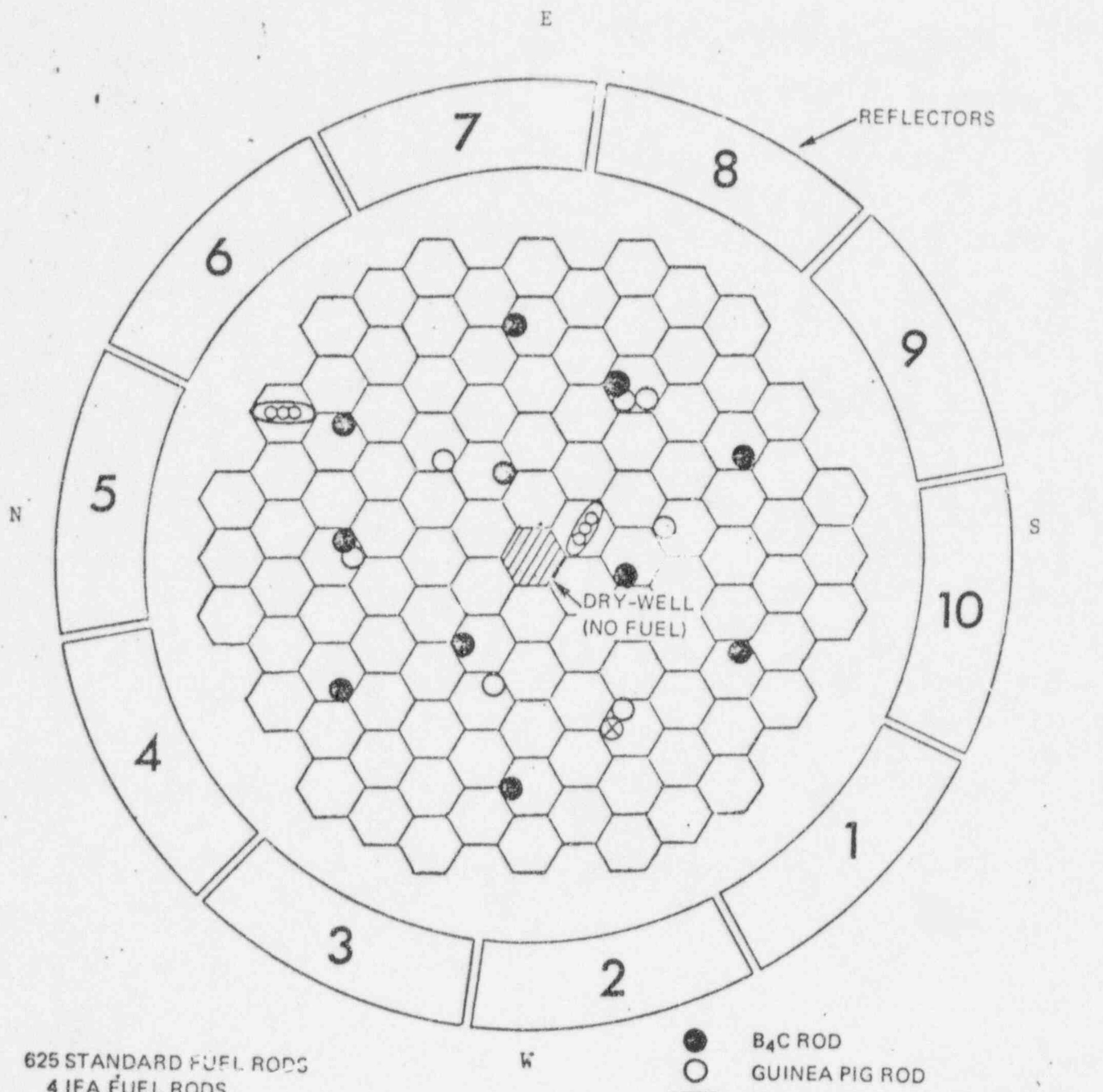
The increase in power density of a centermost guinea pig rod would be maximized when a core poison rod is placed near the core periphery, but diametrically opposite the guinea pig rod. Since a seven channel cluster at the core periphery subtends approximately the same angle on the periphery as one reflector segment, the effect of a one percent power reduction (caused by one boron rod) in this cluster can be approximately estimated from the reflector effect calculation illustrated in Reference 2. This comparison shows that a one percent reduction in power density of a seven channel cluster near the core periphery (at a mean radius of ∿36 cm) would result (including the 0.13% effect noted above) in a 0.25% increase in power density of the centermost guinea pig rod (at a radius of 18.6 cm) on the diametrically opposite side of the core.

When additional poison rods are distributed throughout the core, their effects will tend to cancel each other. Figure 1 shows the arrangement of poison rods currently installed in the reactor. This arrangement was chosen to provide a reasonably uniform distribution of poison rods consistent with the needs of the test program.

References:

1. Letter to Dr. Karl Cohen, General Electric Co., from Dr. P.A. Morris, Director, DRL, dated January 18, 1971.

2. SEFOR FDSAR, Supplement 10, Figure 3-1.



625 STANDARD FUEL RODS
4 IFA FUEL RODS
106 STANDARD TIGHTENER RODS
2 IFA TIGHTENER RODS
11 B_4C RODS
7 GUINEA PIG RODS
1 SS ROD

Figure 1. Core Loading for Assembly I-J

Attachment A