

Regulatory

File Cy.

Received w/Ltr Dated 8-6-71

PROPOSED CHANGE NO. 6
FOR THE
SOUTHWEST EXPERIMENTAL FAST OXIDE REACTOR

August 5, 1971

Re: LICENSE DR-15

DOCKET 50-231

GENERAL ELECTRIC COMPANY

310 DeGuigne Drive

Sunnyvale, California 94086

Proposed Change No. 6

for the

Southwest Experimental Fast Oxide Reactor

I. Introduction

Under the authority of License DR-15, General Electric operates the Southwest Experimental Fast Oxide Reactor at a site near Strickler, Arkansas.

A revision of the current Technical Specifications is desired as described herein. The applicable revised pages of the Technical Specifications are also included as Attachment A.

II. Proposed Changes

Pursuant to the provisions of 10 CFR 50.59, General Electric requests that the SEFOR Technical Specifications be changed by substituting Pages 3.12-2, 3.12-3, and 3.12-5 in Attachment A of this document for the corresponding pages of the current Technical Specifications. These revisions will change the minimum allowable 20-inch travel time for the Fast Reactivity Excursion Device (FRED) from 0.085 seconds to 0.097 seconds.

III. Purpose of the Proposed Change

The purpose of this proposed change is to update the minimum allowable FRED 20-inch travel time so as to limit the maximum reactivity insertion rate of the super-prompt slug to 20 \$/sec.

IV. Discussion

The present Technical Specifications limit of 0.085 sec was the 20-inch travel time estimated to give a maximum reactivity insertion rate of 20 \$/sec with a 1.3\$ slug. This estimate was made prior to design changes in the FRED documented in Reference 1 and prior to in-reactor

slug position versus time and slug worth versus position measurements. At the beginning of the transient test program such measurements indicated that the minimum 20-inch travel time would have to be increased (Reference 2).

As discussed in Reference 2, the reactivity insertion rate can be determined as a function of axial position of the poison slug during a transient from the following relation:

$$\frac{dk}{dt} = \frac{dk}{dx} \frac{dx}{dt}$$

where $\frac{dk}{dt} \equiv$ reactivity insertion rate,

$\frac{dk}{dx} \equiv$ reactivity change per inch movement of poison slug as determined from slug worth versus position measurements,

$\frac{dx}{dt} \equiv$ poison slug velocity.

The minimum 20-inch travel time of 0.097 sec, necessary to give an insertion rate of 20\$/sec for a slug worth 1.30 dollars, has been determined by ratioing the rate which would have been obtained from the sub-prompt slug, if the poison section had been positioned 0.9 in. lower in the rod, a position that corresponds to the location of the poison section for the super-prompt slug. The sub-prompt slug worth with the poison section at this lower position would have been 101.1¢. Figure 1 gives the measured worth versus position characteristics of the sub-prompt slug. Figure 2 shows the slope, $\frac{dk}{dx}$, of Figure 1 and also the FRED velocity characteristics as reported in Reference 2. The insertion rate that would be obtained by firing the sub-prompt slug so that the initial position of the poison section corresponds to the position of the poison section of the super-prompt slug can be determined by shifting the velocity versus position curve for the sub-prompt slug by 0.9 in., as shown on Figure 2. The reactivity

change per inch ($\frac{dk}{dx}$) of the poison section as a function of position would not be shifted.

The insertion rates obtained by multiplying the velocity curves in Figure 2 by the dk/dx curve are given in Figure 3. The maximum reactivity insertion rate determined in this manner is 14.4 \$/sec. As discussed in Reference 3, the dynamic worth (as determined from reactor response) of the sub-prompt slugs was 4% greater than the static worth. Therefore, the reactivity insertion rate of 14.4 \$/sec, and the slug worth of 1.011\$, which are based on static slug measurements, are each increased by 4% to 15.0 \$/sec and 1.051\$, respectively, for the determination of the reactivity insertion rate for a 1.3\$ slug:

$$15.0 \left(\frac{1.30}{1.051} \right) = 18.5 \text{ $/sec}$$

The calculated reactivity insertion rate of 18.5 \$/sec is based on a FRED 20-inch travel time of 105 msec. Smaller 20-inch travel times would yield larger reactivity insertion rates. Since the insertion rate is approximately inversely proportional to the 20-inch travel time for small changes in the 20-inch travel time, a travel time of 97 msec yields an insertion rate of 20 \$/sec. This rate provides significant margin with respect to the rate of 50 \$/sec (with a sodium-out Doppler coefficient, $T \frac{dk}{dT}$, of -0.004) for which the safety of the plant has been assessed (Reference 4).

The average 20-inch travel time for the FRED is 105 msec with a statistical standard deviation of 1.7 msec (Reference 1). As discussed in Reference 1, page 11, a highly unlikely series of equipment malfunctions and bypassing of procedural controls would be necessary to substantially lower the 20-inch travel times.

Therefore, the proposed limit of 0.097 sec for the 20-inch travel time can be met and will provide adequate assurance that the maximum reactivity insertion rate will remain within safe limits.

REFERENCES

1. "Summary of Results from Testing of the Fast Reactivity Excursion Device," submitted to the AEC-DRL on April 12, 1971, by the Breeder Reactor Development Operation of the General Electric Company.
2. Dr. K. Cohen, Letter to Dr. P. A. Morris, "Characteristic Curves for the FRED Poison Slugs," April 23, 1971.
3. "Results of the Familiarization and Sub-Prompt Critical Transients for Core I," submitted to the AEC-DRL on July 16, 1971, by the Breeder Reactor Department of the General Electric Company.
4. SEFOR FDSAR, Volume II, Section 16.4.2.3.

FIGURE 1 CALIBRATION OF SUB-PROMPT SLUG

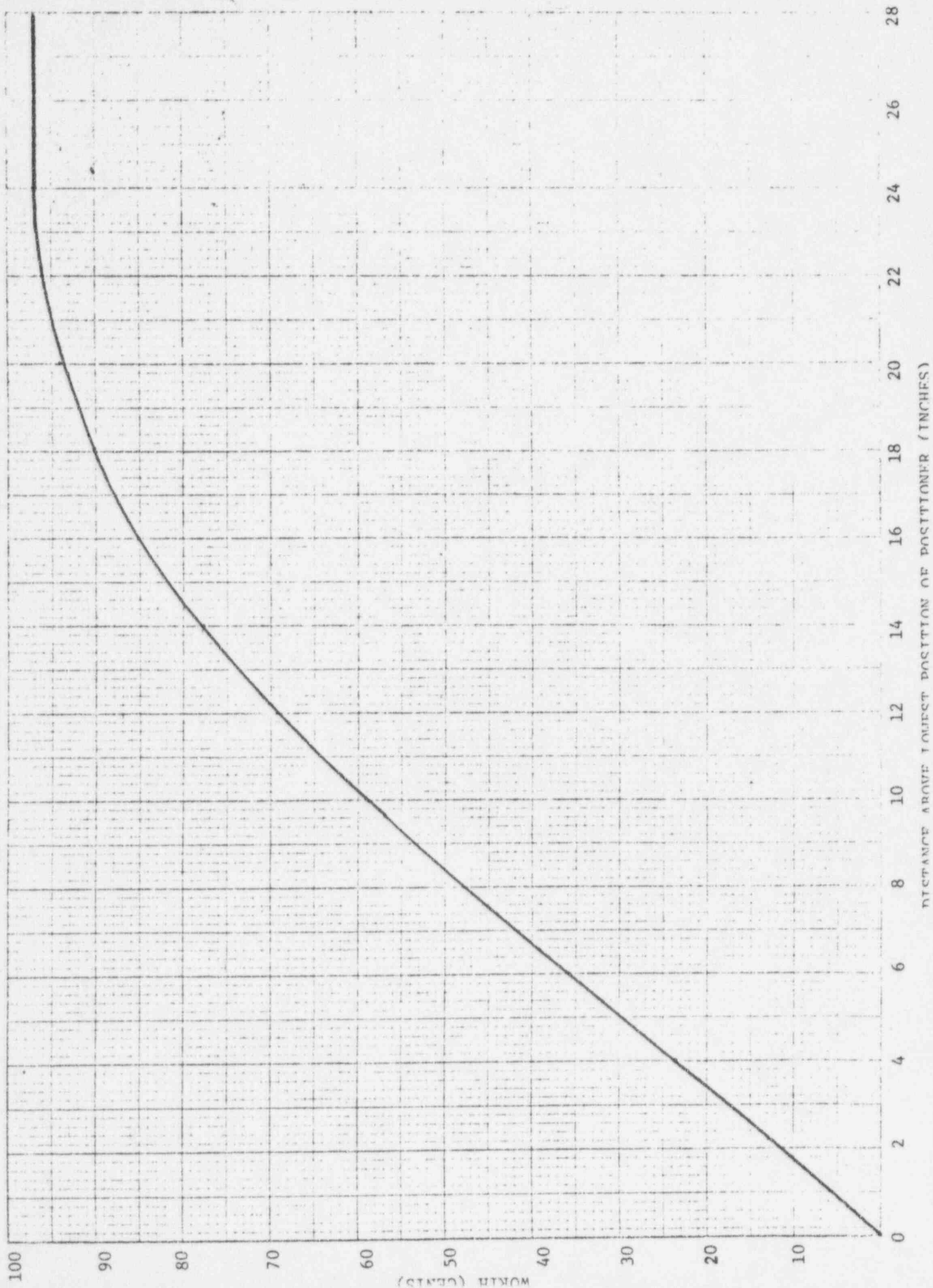


FIGURE 2 CHARACTERISTICS OF SUB-PROMPT SLUG

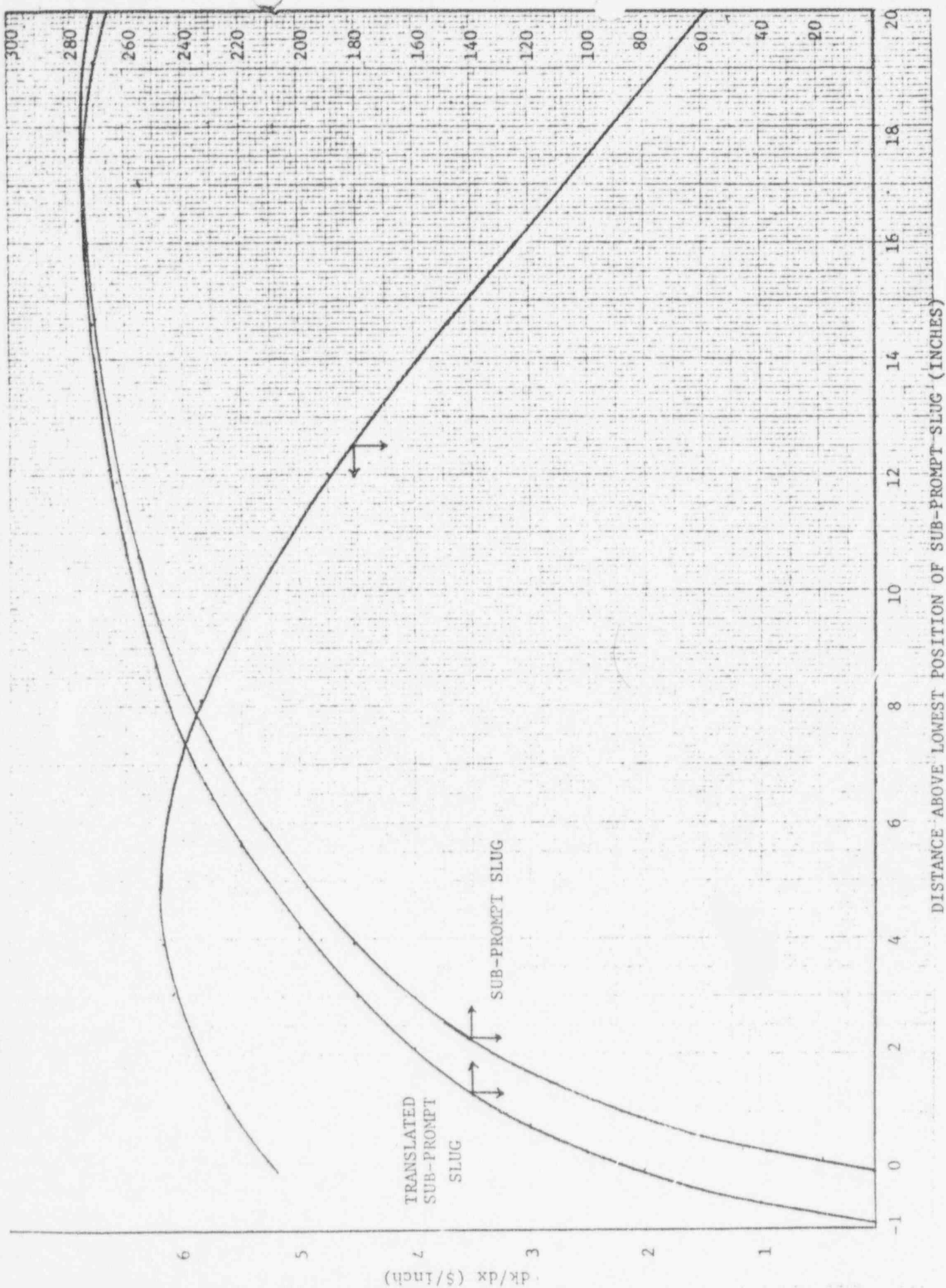


FIGURE 3 REACTIVITY INSERTION RATES FOR SUB-PROMPT SLUG

