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Mr. George Wessman, Director
Plant Licensing Division
General Atomic Company

Dear Mr. Wessman:

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION ON H-451 GRAPHITE

We have reviewed your responses of October 30, 1978 and November 17, 1978 to our questions pertaining to our review of grade H-451 graphite. In order to complete this review we find that additional information will be necessary which is requested in the enclosure. Based on our discussions with you on January 10, 1979 we anticipate that our safety evaluation will be issued by April 1, 1979.

The findings of our safety evaluation, if favorable will be contingent on successful irradiation performance of the H-451 test elements in the Fort St. Vrain reactor. Establishment of successful irradiation performance will require post irradiation examination in accordance with our policy on fuel surveillance transmitted to Mr. J. K. Fuller of the Public Service Company of Colorado on January 3, 1979. In this regard, a commitment to supply post irradiation examination information on the eight H-451 test fuel elements scheduled for insertion with the first Fort St. Vrain reload core would be required prior to NRC final approval for a full reload of fuel using H-451 graphite.

If you have any questions, please let us know.

Sincerely,

Original Signed By
Themis P. Speis

Themis P. Speis, Chief
Advanced Reactors Branch
Division of Project Management

Enclosure:
Request for Additional
Information

cc: See next page.

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DATE	1/10/79	1/10/79	1/10/79	1/10/79		

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cc: Mr. J. K. Fuller, Vice President
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OFFICE ➤						
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ENCLOSURE
REQUEST FOR ADDITIONAL INFORMATION

Review of Grade H-451 Graphite, General Atomic Report, GLP-5588

130.2 In your response to Q130.1a, you indicated that unirradiated H-451 graphite does not experience fatigue damage under reversed stress cycling unless stressed above a homologous stress limit of 0.63 in the axial direction or 0.74 in the radial orientation. These homologous stress limits are understood to be established on the basis of 50 percent survival. Indicate your rationale for not using limits for 99 percent survival. If the limits for 99 percent survival are used, will your conclusion be still the same?

231.17 The response to 1st round question 231.3b indicated that, because of the high degree of complexity of strain behavior in the radial orientation (as compared with axial strain behavior), no general comparison of stresses caused by irradiation strain in H-327 and H-451 graphites has been provided. Yet the effects of these radial shrinkages are said to have been included in the analyses. Notwithstanding the asserted complexity in radial strain behavior, some linkage must be provided, at least in the form of an exemplar calculation, between the radial strains and the stress provided in Table 2-1 of GLP-5588.

231.18 As a point of clarification only, it should be noted that code verification usually implies a comparison of code predictions with experimental data, not a comparison with results from another code. Thus, the comparison of axial stresses computed by the SAFE GRAPHIT code with stresses computed by the FESIC code or with hand calculations (response to Q231.7), while interesting, does not, in itself, constitute true verification.

231.19 (a) Although there are no data for the diffusion of strontium in H-451 graphite, it is stated in the report that, based on the data shown in Table 7 and Figure 3, "there appears to be no dependence on the type of graphite." Please indicate which of the referenced data are for near-isotropic graphites. If little or no strontium diffusion data exist for near-isotropic needle-coke graphites, discuss the applicability of the data to H-451 graphite.

(b) The strontium diffusion data in Figure 3 of the report have a fairly wide scatter (1 to 2 orders of magnitude) in the lower range of temperatures whereas at high temperatures the scatter is smaller. Please indicate the range of expected operating temperatures in the Fort St. Vrain H-451 blocks.

231.20 (a) The report indicates that, whereas strontium diffusion in graphite can be described by Fick's Law, cesium transport is a more complex phenomenon. Yet cesium transport is described in the report in terms of a permeation coefficient, defined by the equation $J = \pi (C_1-C_2)/L$, (report equation 9), which is a form of Fick's Law. Please discuss this apparent contradiction; that is, discuss how a process that is acknowledged to be more complex, can be described b, Fick's Law, when Fick's Law is known to be generally applicable only to very simple diffusion cases.

(b) There appears to be only one datum (see report Figure 4) indicating the effect of irradiation on cesium permeation coefficients for H-451 graphite and none for H-327. It is difficult, therefore, to accept the conclusion that "the permeation coefficient for Cs in H-451 graphite is significantly reduced in-pile." Please discuss the effect of using the permeating coefficients for unirradiated graphite as interim values until more data are obtained on cesium diffusion in H-451 in-pile. Please indicate whether such data are to be obtained on the 8 test elements currently scheduled for the first reload in Ft. St. Vrain.

231.21 The response to 1st-round question 231.16 indicates (Table 1) that the creep tests on H-451 graphite will not be completed until 1983, whereas H-451 graphite reload fuel elements could be placed in Fort St. Vrain as soon as late 1980 or early 1981. Moreover, much of the current creep data base on near-isotropic graphite appears to have been generated on Gilsocarbon-based, near-isotropic graphite rather than petroleum coke-based, near-isotropic graphites. In view of (a) the current limitations on the data base on H-451 graphite and (b) the uncertainty regarding the applicability of Gilsocarbon graphite creep data, please indicate how the test data yet to be developed would lead the expected irradiation exposures of reload elements. Also show how the planned post-irradiation examination program on the 8 test elements and fu re reload elements will provide dimensional change data that would e used to verify the predicted changes that are based, in part, on expected creep behavior.