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MAY 29 1979

Mr. Colin Fisher, Director
Division of Licensing
General Atomic Company
P. O. Box 81608
San Diego, California 92138

Dear Mr. Fisher:

SUBJECT: QUESTIONS AND COMMENTS ON GA-LTR-23

Please find enclosed questions and comments pertaining to our review of your safety analysis report, "Use of UC_2 Fissile Fuel Particles on Fort St. Vrain Fuel Element," GA-LTR-23. We plan to be able to complete this review about thirty days after receipt of your responses. For our scheduling purposes your responses should be received as early as possible and not later than July 30, 1979. Please let us know if you have any questions.

Sincerely,

Original Signed By
Themis P. Speis for

William P. Gammill
Assistant Director for Standardization
and Advanced Reactors
Division of Project Management

DIST:

Docket File	RMattson	WBrooks
ARB R/F	MTokar	
NRR R/F	RMeyer	
PWilliams	DRoss	
TSpeis	KKniel	
WGammill	RTedesco	
RE	ACRS (16)	
NRC PDR	JBuchanan, NSIC	
GKuzmycz	TAbernathy, TIC	
RIreland	Vendor File	
RSchamberger	JKnight	
RBoyd	PTan	
HGearin	DFieno	

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OFFICE	ARB/DPM	ARB/DPM	ADSAR/DPM			
SURNAME	PWilliams:dr	TPSpeis	WPGammill			
DATE	5/23/79	5/25/79	5/25/79			

QUESTIONS AND COMMENTS ON SAFETY ANALYSIS REPORT
USE OF UC_2 FISSILE FUEL PARTICLES
IN FORT ST. VRAIN FUEL ELEMENTS, GA-LTR-23

231.1 (a) The second page of the response to Lead Item VIII contains the statement that "The TRISO coated UC_2 particle design is developed on the basis of calculated SiC stress distributions which assure that the expected particle failure from internal fission gas pressure is less than or equal to that calculated for FSV TRISO coated $(Th/U)C_2$ fuel." This statement appears to be inconsistent with the design basis presented in earlier submittals and publications on TRISO UC_2 particles (see, for example, Gulden, et al, "The Mechanical Design of TRISO-Coated Particle Fuels for the HTGR," *Nucl. Techol.* 16,100 (1972) and General Atomic report GA-A12971). Perhaps the quoted statement is intended to provide the design basis for only the Fort St. Vrain UC_2 fissile particles and not the design basis for the large HTGRs in general. Please explain.

(b) The above-quoted statement appears to ignore potential fuel failure mechanisms such as kernel migration or SiC-fission product interaction. In the case of the large HTGR applications (viz. the Summit, Fulton, and GASSAR plant), kernel migration was explicitly tied to the thermal design, and the buffer carbon coating thickness was related

both to the thermal design and the kernel migration rate (i.e. are all interrelated). Please explain, therefore, why the above-quoted design basis statement ignores kernel migration and other potential failure mechanisms and addresses only pressure vessel-type failure.

231.2 Please provide the origins or basis (and appropriate references) for the 231 MPa (33,500 psi) failure criterion listed on the third page of the response to Lead Item VIII.

231.3 The "expected" failure fractions of 0.002 and 0.005 that are given in the response to Lead Item VIII for TRISO coated UC_2 and $(Th/U)C_2$, respectively, are said to be based on nominal fuel properties, expected property distributions, peak irradiation exposure conditions and empirically determined failure criteria for each fuel type. This statement requires substantial elaboration with regard to the details of the assumptions and numerical values used for the calculation. For example, it would be instructive to learn how the TRISO UC_2 particles with approximately 75% FIMA at end-of-life are expected to have a lower pressure vessel failure rate than the TRISO coated $(Th/U)C_2$ particles which have a maximum burnup of about 20% FIMA. That is, can you show what design features in the TRISO

UC_2 particle compensate for the effects of higher burnup (and higher internal fission gas pressure)?

231.4 Figure 3 in the response to Lead Item VIII shows a comparison of Kr-85m R/B (rate of release/rate of birth) data obtained from irradiation test results with predicted Kr-85m R/Bs. The test then says that "...the observed Kr-85m R/B values are substantially less than predicted, which implies that...performance is equal to or better than the current $(Th/U)C_2$ FSV fuel" (emphasis added). Yet no comparison is actually made with either predicted or observed Kr-85m R/B values on $(Th/U)C_2$ particles. Please either show the comparison or delete the quoted statement from the text.

231.5 The response to Lead Item VIII refers to tests conducted in cell 2 of capsule GF-4 without explanation of what capsule GF-4 was or where the tests were conducted. Please provide this information and list a reference where further information can be obtained.

231.6 Please provide more background (i.e. previous irradiation history) for the CHST samples described in the response to Lead Item VIII. For example, list the reactor and time in reactor, nominal and peak operating temperatures, etc.

231.7 Manufacturing process variables for both the kernal and the coatings of the fuel particles are known to affect materials properties and performance in retention of fission products. While TRISO coated UC_2 fissile particles have been demonstrated to be effective in retaining both gaseous and metallic fission products under reactor conditions, how can this performance be guaranteed if the process variables used the fuel particle manufacture are not to be included in their licensing basis?

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