



OREGON STATE UNIVERSITY

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March 1, 1994

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555

Reference: Oregon State University TRIGA Reactor (OSTR),
License No. R-106, Docket No. 50-243; USNRC Regulation
10 CFR 50.64(c)(2)

Subject: Proposal submitted in response to the Commission's regulations requiring
conversion of the OSTR from high enriched uranium (HEU) fuel to low
enriched uranium (LEU) fuel

Gentlemen:

In accordance with the Commission's regulations contained in 10 CFR 50.64(c)(2), Oregon State University (OSU) hereby submits a proposal describing our current efforts relative to converting the OSTR from HEU fuel to LEU fuel. As noted in last year's proposal to you, Oregon State University received funding from the USDOE to prepare all licensing documents necessary to allow refueling from HEU to LEU fuel. As a result of this funding, which was extended through June 14, 1994, OSU is now in the process of drafting proposed changes to the OSTR's License, Technical Specifications, Safety Analysis Report, Emergency Response Plan, and Physical Security Plan. However, during our analysis of the proposed new fuel we discovered a potential problem associated with a fuel characteristic, namely the erbium content, which could influence the suitability of this fuel for use in the OSU TRIGA. We have expressed our concern to the appropriate personnel within the USDOE and await their response. A copy of OSU's letter to the DOE on this matter is attached.

Regarding the schedule for our refueling, we understand from conversations with DOE staff that they currently have plans to request funding in FY96 to allow purchase of new fuel for the OSU TRIGA.

If there are questions regarding our current activities under the Commission's regulations in 10 CFR 50.64, or questions regarding our proposed schedule, please let me know.

Yours sincerely,

A.G. Johnson
Director

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Attachment

cc: See Page 2

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U.S. Nuclear Regulatory Commission

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cc: Regional Administrator, Region V, USNRC, Walnut Creek, CA
Leroy R. Norderhaug, Region V, USNRC, Walnut Creek, CA
Phil Qualls, Region V, USNRC, Walnut Creek, CA
Al Adams, Project Manager, Non-Power Reactor, Decommissioning, and
Environmental Projects Directorate, USNRC, M.S. OWFN 11-B-20,
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Richard E. Stephens, Director, Office of University & Science Education, Office of
Science, Education, & Technical Information ET-3, US Department of Energy,
1000 Independence Ave SW, Washington, DC 20585
Oregon Department of Energy, Salem, OR, Attn: Mr. David Stewart-Smith
T. V. Anderson, Reactor Operations Committee
S. E. Binney, Chairman, Reactor Operations Committee
Brian Dodd, Reactor Administrator
J. F. Higginbotham, Senior Health Physicist
D. S. Pratt, Health Physicist

January 31, 1994

Mr. Richard E. Stephens
Director, Office of University
and Science Education Programs
Office of Science, Education, and
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Subject: Preparation of the Oregon State University (OSU) Application to the
USNRC for Authorization to Convert the OSU TRIGA Reactor from
High-Enriched Uranium (HEU) Fuel to Low-Enriched Uranium (LEU)
Fuel

Dear Rich:

In a recent discussion with Keith Brown regarding our fuel conversion effort, he suggested that we write to you about a situation we discovered which involves an unsuitable characteristic of the current LEU replacement fuel for the OSU TRIGA. More specifically, when we began the HEU to LEU conversion process we were under the impression that the LEU fuels developed for converting the FLIP-fueled TRIGA reactors were more or less direct replacement fuels, and that our core characteristics would not change appreciably as a result of the HEU-LEU conversion. However, as it turns out our analysis shows that by using the NRC-approved 20 wt%, 20% enriched TRIGA fuel (20/20 fuel) we will considerably reduce the size of our operating core. This in turn will result in significantly lower neutron fluxes in our rotating rack, thermal column and beam ports. Because a large part of our reactor use is related to these facilities, a smaller core size will significantly reduce the OSTR's usefulness and effectiveness, which is something we cannot afford to let happen.

To provide a bit more detail on this issue consider the following. When the current FLIP core was originally loaded it went critical with 65 fuel elements. In comparison to this, our analysis shows that the critical size of a 20/20 core in our grid would be about 51 elements. This is validated reasonably well by the fact that the Bangladesh TRIGA reactor (albeit a 20/20 core with a hexagonal grid) went critical with 50 elements. Our normal operational core excess is about \$7, which gives us a core size of about 88 elements. This in turn almost fills the entire core grid through the outermost G ring. However, a 20/20 core with the same excess reactivity would require only about 65 elements, which would only fill the core grid through the E ring. With a 65 element 20/20 core, we would have, except for 5 elements in the F ring, an empty F and G ring between the core and the rotating rack irradiation facility. With these two rings basically empty, we would also have a considerable drop in the neutron flux, which would be very damaging to our research capabilities and clearly not in the best interest of long term reactor use.

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Core excess in TRIGA fuels is very dependent upon the amount of erbium poisoning present in the fuel. The currently approved 20/20 fuel has 0.47 wt% erbium built in. We have performed a series of calculations in order to determine the erbium concentration necessary to allow us to load about 90 of the 20/20 elements into our core and still have a core excess of about \$7. It seems that about 0.85 wt% erbium would meet this criterion; however, more work will need to be done to assess fuel element reactivity changes as a function of erbium and fuel burnup over the core lifetime.

From our perspective, the problem we have identified raises a number of important questions which need to be answered before we can proceed much further with the preparation of our application for authorization to convert to LEU. This may also be true for the other TRIGAs. As far as we can tell right now, the 20/20 fuel being offered as a replacement for our FLIP fuel is unacceptable, due to the fact that this fuel will cause us to have an undesirably small core size and a subsequent loss of neutron flux in our key irradiation facilities. A similar 20/20 fuel with about 0.85 wt% erbium would probably be acceptable to us. However, the following issues need to be settled:

1. Can General Atomics manufacture such a fuel? (Yes)
2. Will the new fuel require a new NRC safety evaluation report? (Possibly not)
3. Who will prepare and submit the necessary information to support the SER? (Presumably GA if DOE or NRC requests that they do so)
4. Is such a modified fuel suitable for the other TRIGA conversions, or will each facility require different erbium concentrations?
5. Who will provide the lead in sorting this problem out?
6. What do we do in the meantime with respect to our application?

While we recognize that TRIGA conversions are not a top priority item at this time, we nevertheless feel that we need help regarding this situation and guidance with respect to what our further action on the conversion effort should be. We recognize that a resolution to this problem may well require input from DOE, NRC, GA and others, but since our current funding for this effort is through your office we felt that it would be appropriate to formally make you aware of our concerns.

After you have evaluated our dilemma, we would be pleased to answer any questions you may have or to work with you in any other way. Also, we regret having to raise this matter, but we will appreciate any suggestions or help you can give us.

Yours sincerely,



A. G. Johnson
Director

dd:doddrefuelin:stephens.1

c: General Atomics-
Junaid Razvi/Bill Whittemore
McClellan AFB-Wade Richards
ODOE-David Stewart-Smith
Oregon State University-Brian Dodd
Texas A & M-Warren D. Reece
University of Wisconsin-R. J. Cashwell
Washington State-Gerald E. Tripard
USNRC-Al Adams