February 15, 1983

Mr. Dan Hirsch
Committee to Bridge the Gap
1637 Butter Avenue, #203
Los Angeles, CA 90025

In the Matter of
THE REGENTS OF THE UNIVERSITY OF CALIFORNIA
(UCLA Research Reactor)
Docket No. 50-142
(Proposed Renewal of Facility License)

Dear Dan:

I have recently obtained the enclosed letter from Argonne National Laboratory which explains that low enriched fuel plates appropriate for the UCLA reactor are still under development and testing in the Department of Energy's program, and thus not presently available for use. The approximate cost of the fuel is also indicated.

For your information, you should note that the Commission has not yet established a policy or rulemaking proceeding regarding replacement of HEU with LEU fuel in use in research and test reactors. This matter is presently the subject of a study and recommendation paper by the Commission's Office of Policy Evaluation. The Commission does, of course, confer with the Department of State, the Department of Energy and the International Atomic Energy Agency in developing policies and regulations concerning implementation of the Nuclear Nonproliferation Act of 1978.

Sincerely,

/s/

Colleen P. Woodhead
Counsel for NRC Staff

Enclosure: As stated

cc w/ encl.: Service List

D507

OFC	:OELD	:OELD	:	:	:	:	:
NAME	:CWoodhead:pl	:SGoldberg	:	:	:	:	:
DATE	:2/15/83	:2/15/83	:	:	:	:	:

ARGONNE NATIONAL LABORATORY
9700 South Cass Avenue, Argonne, Illinois 60439
Telephone 312/972- 6758

February 7, 1983

Dr. K. L. Mattern
U.S. Department of Energy
Division of LMFBR Fuel Cycle Projects
Washington, D.C. 20545

Dear Dr. Mattern:

Subject: Technical Evaluation - Potential Convertibility of the UCLA R1 Reactor from HEU (93%) to LEU (<20%) Fuel

Introduction

The UCLA R1 is a light-water-moderated, graphite reflected, Argonaut-type research reactor located on the campus of the University of California at Los Angeles. The reactor facilities have been utilized since 1963 for both education and research by faculty, students, and other researchers. The reactor has a normal maximum power level of 100 kW and, on the average, is operated for about 200 full power hours per year.

Current Fuel Loading

The reactor core consists of 24 fuel elements, each of which has 11 flat fueled plates containing a total of 140 g ^{235}U. The fuel meat in each plate is an alloy of 93% enriched uranium and aluminum. The density of ^{235}U in the fuel meat is 0.41 g/cm^3.

Required Uranium Density With LEU Fuel

Based on calculations performed at ANL for an IAEA generic MTR-type reactor (not an Argonaut), it is estimated that the ^{235}U density in LEU fuel meat would need to be increased by approximately 15% in order to maintain the same excess reactivity as the current HEU core. This implies that the required LEU density would need to be about 2.4 g/cm^3. No changes would be required in the dimensions of the current fuel plates and no changes would likely be required in the current reactor cooling system.

Status of LEU Fuel Development and Demonstration

Since 1979, the Reduced Enrichment for Research and Test Reactors (RERTR) Program has been developing aluminide (UAl_x-Al), oxide (U_3O_8-Al), and silicide (U_3Si-Al) dispersion fuels containing high uranium densities. The development and irradiation testing of small plates containing aluminide fuel with up to 2.3 g U/cm^3 and oxide fuel with up to 3.1 g U/cm^3 have been completed. Work on silicide fuels with 3.6-7.0 g U/cm^3 is continuing. The appropriate candidate fuel for potential use in the UCLA R1 reactor is the oxide fuel.

Demonstration burnup tests on full-size fuel elements containing LEU oxide fuel with 2.1-2.9 g U/cm^3 are currently in progress in three reactors in Europe and in the ORR reactor at ORNL. Burnup tests with LEU oxide fuel and 3.2 g U/cm^3 are expected to begin in the ORR around March 1983. All of these full-size elements were fabricated by CERCA in France and by NUKEM in the Federal Republic of Germany.

The post-irradiation-examination data necessary to support licensing requirements for routine use of LEU oxide fuel in reactors which attain high ^{235}U burnup (50-60%) is expected to be available around the end of 1984. However, for reactors such as the UCLA R1 which attain only low ^{235}U burnup (<5%) in fuel which would have a moderate uranium density (~2.4 g/cm^3), sufficient data to support licensing requirements is expected to be available around the end of 1983.

Current Inventory and New Fuel Needs

In 1960, 29 HEU fuel elements were fabricated for use in the reactor. The reactor attained full power operation at 100 kW in October 1963. Twenty-four of the original elements are currently in the core and 5 were shipped off-site as spent fuel. Thus, over the past 20 years, the reactor has utilized 5 fuel elements. In other words, on the average, the reactor needs one new fuel element about every four years.

In 1970, 24 additional HEU fuel elements were fabricated for the reactor. Nine of these are currently onsite, 10 have been shipped to ORNL for storage, and 5 were shipped to the University of Florida for use in its Argonaut reactor.

Thus, if the reactor were operated as it has been for the past 20 years, the 9 elements currently onsite would assure normal operation for the next 36 years, or until 2019. If the ten elements were shipped back from ORNL, the reactor would have sufficient fuel until the year 2059.

Estimated Fuel Costs

If the reactor were to continue operation using its current inventory of HEU fuel, no new fuel would need to be fabricated over its lifetime.

A replacement core using LEU oxide fuel in 24 elements with the same geometry as the current HEU elements is estimated to cost about $250,000. Several spare elements would be needed as well.

The reactor could also use TRIGA LEU fuel in a rodded geometry. The estimated cost of a core of this fuel is about $350,000. Other modifications would also likely to be required and the total cost would be higher.

Conclusion

The UCLA R1 reactor is a candidate for conversion from the use of HEU uranium-aluminum alloy fuel to the use of LEU oxide fuel with a uranium density of about 2.4 g/cm^3. Sufficient data to support licensing requirements for use of this fuel with low ^{235}U burnup is expected to be available around the end of 1983.

Twenty-four of the original 29 HEU fuel elements fabricated for the reactor in 1960 are currently in the core. Over the past 20 years, the reactor has required one new fuel element about every four years. Nine fresh HEU elements are presently onsite and these would assure normal operation at a maximum power of 100 kW for about 36 years, or until 2019. Ten additional fresh HEU elements which are being stored at ORNL would assure normal operation for about 40 additional years, or until the year 2059. Thus, the reactor would not need additional HEU fuel fabricated over its lifetime.

A replacement core using LEU oxide fuel in 24 elements with the same plate-type geometry as the current HEU elements is estimated to cost about $250,000. A replacement core using TRIGA LEU fuel in a rodded-type geometry is estimated to cost about $350,000. However, use of rodded-type TRIGA fuel may require modifications to the core and could result in higher costs.

Sincerely,

J. E. Matos
Generic Studies Coordinator
RERTR Program

JEM:cs

Approved:

A. Travelli
RERTR Program Manager

cc: J. Dardis, DOS
H. Schechter, NRC