LOW ENRICHMENT FUEL CONVERSION
FOR IOWA STATE UNIVERSITY

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Progress Report
for Period July 26, 1989 - July 31, 1990

Alfred F. Rohach and Richard A. Hendrickson

Iowa State University
Ames, Iowa 50011

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ABSTRACT

Work during the reported period was centered primarily in preparation for receiving the LEU fuel and the shipping of the HEU fuel. The LEU fuel has not been received. The HEU fuel assemblies for the UTR-10 reactor will not fit into any current research reactor shipping containers; therefore, the fuel assemblies must be disassembled and the fuel shipped as fuel plates. Procedures and practices have been developed so that the fuel assemblies will be disassembled in a shielded environment.

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INTRODUCTION: Progress during the reporting period proceeded in several areas. This included answers to Nuclear Regulatory Commission questions, investigations into procedures for shipping HEU fuel, establishment of procedures for disassembling the HEU fuel, and design and construction of equipment to disassemble the HEU fuel.

NUCLEAR REGULATORY COMMISSION RESPONSE: The Safety Analysis Report Amendment and new Technical Specifications for the UTR-10 reactor were submitted to the NRC in November, 1988. The NRC reviewed the documents and requested answers to several questions. First, typographical errors in some numbers in the documents were corrected. Second, the NRC requested that reactivity be expressed in units of $\delta k/k$ instead of β . The pages of the documents including the β unit were updated. Also, the NRC requested the calculated k_{eff} for the storage pit when new fuel would be stored there. The calculated value of the multiplication factor with plates of two fuel assemblies stored per storage location, completely flooded, in an infinite array of storage tubes was 0.46. No final approval of the submitted documents and responses has been received.

SPENT FUEL TRANSPORT: Contact has been made with Idaho National Engineering Laboratory to receive the HEU fuel. Communications have been established into procedures for ultimately shipping the HEU fuel after the LEU fuel is received at Iowa State University. These communications include investigations on shipping regulations and obtaining appropriate licensed shipping containers. There currently are no licensed research reactor fuel shipping containers that can contain the fuel assemblies from the UTR-10 reactor. Therefore, the fuel assemblies must be disassembled. It has been assumed that the 6M container will be used for shipped the HEU fuel via common carrier. This container is not a shielding cask; therefore, calculations have been made to determine the number of fuel plates that can be loaded into the container so that surface dose limitations are satisfied. Further information was obtained during the summer work period and will be obtained during the fall work period in which actual fuel plates will be placed in the container and the surface dose experimentally determined. Current estimates are that the transportation container will give an attenuation factor of at least 0.5.

FUEL DISASSEMBLY: As mentioned previously, the HEU fuel assemblies must be disassembled and the fuel shipped as individual plates. In order to disassemble the fuel assemblies, several considerations are important. First, procedures and equipment have been developed such that ALARA conditions prevail. The complete disassembly process will need to be accomplished within the time frame between when the new LEU fuel is received and a commitment when to ship the HEU fuel to INEL. In the interim, the HEU fuel will be stored in the fuel storage pit, two disassembled assemblies per storage location, in the UTR-10 reactor room.

We will require that the assemblies be disassembled in a environment in which the workers are shielded from the radiation. It has been decided that the fuel assemblies will be disassembled using the fuel transfer cask for shielding during the process. The general procedures to be followed are the following:

Fuel Disassembly Procedures:

1. The transfer cask will be loaded with a fuel assembly from the reactor core or from the fuel storage pit if the fuel is already stored there.
2. The transfer cask will be situated over an empty fuel storage pit position. The cask will be lowered onto steel plates separated by lead bricks. The bricks serve as the shield as the fuel assembly bolts are removed. The bricks will have access holes between them for the tools in the disassembly process. The screw-type fasteners will be removed with specially fabricated screw drivers.
3. The fuel assembly will be lowered from inside the cask until the lower assembly bolt is lined-up with the screw driver shafts. Alignment marks will be established with the dummy fuel assembly. The lower bolts will then be removed. (The fuel assemblies have been in the reactor core since 1959, but we anticipate that the bolts are not corroded and can be removed with the screw driver. If the bolts cannot be removed this way, additional equipment will need to be developed such that the bolt heads can be drilled off.) After the lower bolts are removed the lower assembly hardware will drop through a chute into the lower storage location in the storage pit. A bag will be in this position to catch the hardware. The assembly will be lowered onto a table in the storage pit so that the top hardware can be removed.
4. The partly disassembled fuel assembly will be lowered with cask holder device such that the upper bolt fastener is in position for the screw drivers. Again, alignment will be established with the dummy fuel

assembly. The top bolt will be removed with the screw drivers. As the fuel plates break free the hardware will drop onto the support table.

5. The free fuel plates will be secured by a "catcher" wire and reattached to the top assembly holder with a metal shuttle pin. The plates will be raised back into the transfer cask, and then moved and lowered into a fuel pit storage location until shipping is facilitated. Each storage location will contain plates from two fuel assemblies (24 plates).
6. When the fuel plates are to be eventually shipped, the fuel plates will be drawn from the lower pit storage location and placed on a fuel transport holding apparatus. When sufficient plates are loaded, they are pinned in place and the apparatus is loaded into the shipping container.
7. The fuel container will be shipped when authorized.

The procedures and equipment will be tested for both a dummy fuel assembly and one test fuel assembly from the reactor core. Complete procedures for fuel removal and disassembly will be established and submitted to the Iowa State University Reactor Use Committee before the reactor core is disassembled. A test on one core fuel assembly was successful and the assembly was completely disassembled in July, 1990. Therefore, it anticipated that all other fuel assemblies can be disassembled.

REMAINING WORK: There are tasks to be performed with the new LEU fuel once it has been received at Iowa State University. The tasks are:

1. Develop procedures for fuel transport according to regulations and submit fuel details to CPP at INEL.
2. Learn how to obtain authorization to ship HEU.
3. Generate procedures for startup experiments, requalification of operators, etc.
4. Perform criticality experiments for determining the critical core configuration.
5. Verify calculated results for reactor parameters such as rod worths, shutdown margin, etc. by experimental measurements.

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