LOW ENRICHMENT FUEL CONVERSION
FOR IOWA STATE UNIVERSITY

Final Report
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I. INTRODUCTION

The UTR-10 research and teaching reactor at Iowa State University (ISU) has been converted from high-enriched fuel (HEU) to low-enriched fuel (LEU) under Grant No. DE-FG702-87ER75360 from the Department of Energy (DOE). The original contract period was August 1, 1987 to July 31, 1989. The contract was extended to February 28, 1991 without additional funding. Because of delays in receiving the LEU fuel and the requirement for disassembly of the HEU assemblies, the contract was renewed first through May 31, 1992, then through May 31, 1993 with additional funding, and then again through July 31, 1994 with no additional funding. In mid-August the BMI cask was delivered to Iowa State. We are currently preparing to ship the HEU fuel when NRC license amendments for the cask are approved.

2. STATUS OF THE PROJECT

The LEU fuel was received as fuel plates and hardware. The fuel plates were assembled into assemblies and inserted into the UTR-10. The reactor was then brought to criticality on the LEU fuel. The HEU fuel assemblies were removed from the reactor, the assemblies were dismantled, and the fuel plates stored in the UTR-10 fuel storage pit.

We expect to ship the HEU fuel plates in late calendar year 1996. We originally expected to ship the HEU fuel to the fuel reprocessing facility operated by Westinghouse Idaho Nuclear Company, Inc. The requirements imposed on the fuel shipment made it literally impossible to ship the fuel to that facility. Therefore, we entered negotiations with the Savannah River Laboratory, intending to ship the HEU fuel to that facility. The tentative dates for shipment are mid-October and early November 1996.

The LEU fuel was loaded into the UTR-10 reactor during the summer of 1991. We performed the critical experiments, and the reactor went critical on August 14, 1991. Subsequent to the criticality and during reactor physics testing, we experienced fuel cladding darkening and fuel lifting pin cracking. Both of these problems have been addressed and corrected. However, we have a cladding observation program in progress to ensure that there is no further deterioration of the cladding.

Our irradiated HEU fuel assemblies were successfully dismantled into fuel plates and hardware. The plates are being stored in the fuel storage pit. The hardware has been shipped to an appropriate low-level waste disposal site. We dismantled the assemblies to ensure that the fuel plates will fit into the 6M shipping container. We designed a fuel plate holding fixture for the container. We planned to complete the shipment of this fuel to an appropriate facility by the end of the current contracting period.

During our current contract negotiations with the Savannah River Laboratory, however, it became obvious that we would not be able to ship the fuel by the end of the current contract period on July 31, 1994. Originally, when we contacted the laboratory for possible receipt of the fuel, they assured us that there would be no problem completing the shipment before the end of the contract period. However, as the negotiations continued, it became apparent that we would not complete the process by the expected time. We are currently planning to ship the plates while not under contract with the DOE.

During the dismantling of the HEU fuel assemblies, we had an excellently trained staff and were praised by the Nuclear Regulatory Commission (NRC) for our procedures, especially for the low-radiation exposures during the process. This process did not just happen; it was a result of well-developed procedures and many practice sessions with a dummy fuel assembly.

Our HEU fuel will be shipped in two separate shipments to Savannah River Laboratory using the BMI cask. Our fuel has been out of the core for about 70 months, and we have a good estimate of the fuel radioactivity.

We have campus constraints that also must be considered before our fuel can be shipped. In order to load our fuel, we expect that a major campus student/pedestrian walkway and university street will need to be closed. Therefore, we would like to ship fuel during semester breaks or the summer, when there is low student activity.

We completed several activities under this contract. We inventoried the HEU spent fuel plates and removed all dummy fuel plates. The core excess reactivity configuration was achieved with the LEU fuel. We measured the fuel mass reactivity coefficient. Additional physics parameters, such as rod worth, scram times, shutdown margin, thermal power, beta to lifetime ratio, and moderator temperature reactivity coefficient, were measured. We completed the flux mapping experiments and performed nuclear instrumentation calibrations. We continually monitored cladding samples to ensure that cladding performed adequately.