July 29, 2002

MEMORANDUM TO: Chairman Meserve
Commissioner Dicus
Commissioner Diaz
Commissioner McGaffigan

FROM: Janice Dunn Lee, Director ***/RA/***
Office of International Programs

SUBJECT: PERIODIC INFORMATION ON COOPERATION BETWEEN THE U.S. AND ARGENTINA ON THE DEVELOPMENT OF L0W-ENRICHED URANIUM (LEU) FUEL AND TARGETS FOR RESEARCH REACTORS

This paper provides a status report on U.S.-Argentina cooperation in the Reduced Enrichment for Research and Test Reactors (RERTR) program and related activities. It is submitted in response to SRM-S98-023, dated March 11, 1998. The last update was provided to the Commission in July 2001. This is the fourth paper on this subject and OIP will continue to provide this paper unless otherwise instructed by the Commission.

Molybdenum-99 (Mo-99) Production

This project has two components intended to develop an economic, high-purity Mo-99 product from LEU targets. The first, conceived as a near-term, interim solution, substitutes a high-density LEU uranium-aluminide (UAl2) dispersion fuel target plate for Argentina's similar highly-enriched uranium (HEU) aluminum alloy target, enabling Argentina to use its current chemical separation technology. The initial attempt in August 1999 by the Argentine National Atomic Energy Commission (CNEA) to process an irradiated aluminide plate fabricated in Argentina resulted in only partial digestion of the plate, with only 50% of the Mo-99 being recovered. During 2000, the CNEA found that annealing the finished target plate to convert UAl2 to the UAl3 and UAl4 compounds present in the HEU target solved the problem. Confirmation tests, scheduled for November-December 2001, were postponed due to an unplanned outage of the RA-3 reactor. The tests have now been rescheduled. It is believed that this LEU target, which contains 27% more U-235 than the current HEU target, will allow the CNEA to produce Mo-99 using LEU when its current supply of HEU is exhausted.

The second component is a three-year effort to develop the LEU uranium-metal-foil target for the RA-3 reactor and to modify the chemical process to dissolve and separate the Mo-99. Such a target can contain more than six times the U-235 of the current HEU target and will allow the CNEA to meet its projected demand for Mo-99. Tests of such targets, fabricated by Argonne National Laboratory (ANL) and irradiated in the RA-3 reactor in a rig designed and built by the CNEA, were successfully carried out in December 2000 and May 2001. The unplanned outage

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of the RA-3 mentioned above and the financial situation in Argentina have caused the schedule to slip during the past year. However, ANL did provide on-site assistance to the CNEA to implement LEU-foil fabrication. At ANL, a production-scale digester has been designed, fabricated, and tested, and work continues to optimize the chemical process and adapt it to production scale. A third target/process test in Argentina is planned for October-November 2002.

LEU Fuel Development

This project has three components. The first was originally conceived as a two-year effort to develop the ANL DART code for dispersion fuel modeling to run on a parallel- processing computer. During a visit of the ANL developer of the code to Argentina in October 1999, it was decided to shift the near-term emphasis of the code work to producing a version for personal computers, since that version will be more accessible to possible near-term users. This code, named FASTDART, is a simplified version of DART. The Argentines have coupled it to a user-friendly input/output graphic user interface named DARTGATE. The original goal of adapting DART to parallel processing has been abandoned. During the past year, the CNEA has added a thermal-hydraulic capability to FASTDART to enable it to simulate the changing thermal conditions within the fuel meat during irradiation. This version of FASTDART is called DART-THERMAL. The CNEA plans to add a one-dimensional, steady-state stress calculation to DART-THERMAL in the near term and then to implement a three-dimensional stress calculation, both for steady-state and transient conditions.

The second part is a two-year effort to find the cause of a fission-product leak that occurred during the irradiation of an Argentine silicide test fuel element in the RA-3 reactor. This will help qualify Argentina as an LEU silicide fuel fabricator. During August 2000 the fuel element was disassembled and a series of nondestructive examinations were performed on the fuel plates. The source of the fission-product leak was easily identified. The CNEA received permission in October 2000 to destructively examine the plates. The CNEA, with ANL participation, carried out the first destructive examinations during December 2001. A final set of examinations will be carried out jointly during the last half of 2002, completing this project.

The proposed third part of the project, expected to be formalized soon, is the development and qualification of U-Mo dispersion fuel. The CNEA has made significant progress in developing a method to produce U-Mo powder during the past two years. The CNEA will join the RERTR program's U-Mo fuel element qualification irradiations in the HFR-Petten (the Netherlands) by fabricating two 7-gU/cm3 elements and by providing partial funding for those irradiations. This will be the highest-density element to be irradiated in the near-term RERTR program effort. Arrangements are being made for ANL to ship required quantities of LEU metal and LEU-Mo powder to the CNEA. The element is expected to be completed by early CY 2003. This ambitious collaboration between ANL and the CNEA will qualify the CNEA as a fabricator of U-Mo fuel and significantly enhance the RERTR program's effort to qualify the U-Mo fuel.

Spent Fuel Return

Under the Department of Energy's Foreign Research Reactor Spent Nuclear Fuel Acceptance Program, spent fuel containing U.S.-enriched uranium from research reactors in 41 countries is eligible for shipment to the United States for management and disposition. Spent fuel from

three research reactors in Argentina (RA-2, RA-3, and, possibly, RA-6) is eligible for shipment under this program. A shipment of 207 spent assemblies containing HEU fuel from the RA-3 reactor was received at the Savannah River Site in January 2001. This shipment included all RA-3 research reactor fuel containing HEU of U.S. origin.

The Argentine CNEA is considering upgrading the power level of the RA-6 reactor in Bariloche. If it decides to do so, the RA-6 reactor would be converted to LEU fuel and the existing HEU fuel would be shipped back to the U.S.

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