

Challenges and Achievements

Shipment of 255 DIDO Fuel Elements to the Savannah River Site to Empty the Storage and Reactor Pools at Risoe National Laboratory

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Introduction

The DR-3 reactor, owned and operated by the Danish National Laboratory, was built in the late 1950's and initiated operation in January 1960. At that time the DR-1 and DR-2 reactors were already in operation. The main purpose of Danish research reactor DR-3 was material and fuel testing. Until 1989 the reactor utilized HEU fuel elements. Conversion to the LEU fuel cycle was accomplished in 1990.

DOE restarted the return program for Foreign Research Reactor fuel elements to the United States in 1994. From that time, through 1998, three IUO4 casks (one cask in 1994) operated by Transnucleaire (now named Cogema Logistics, ACL) were used to transport Risoe's fuel to the Savannah River Site (SRS) near Aiken, SC in the USA. In 1999, Risoe elected to issue a request for proposal to transport DR-3 DIDO fuel elements to SRS with a new licensed cask designed to replace the IUO4 cask. ACL was awarded the contract to transport the irradiated fuel from DR-3 to SRS for the remainder of the FRR Fuel Return program (2009).

However, on September 28, 2000, the Board of Governors of Risoe National Laboratory decided to shut down the Danish research reactor of DR3. There had been technical problems (corrosion on the aluminum reactor tank) and, due to anticipated increasing operational expenses, the Board elected to close the reactor facility. Shortly thereafter,

the Danish Government asked the National Laboratory to empty the reactor and its storage pools containing a total of 255 Dido irradiated fuel elements and ship them to Savannah River Site. At that time, ACL was in the process of licensing the new TN-MTR package in the USA. The early shut down of the DR-3 reactor and resultant new shipping schedule was not compatible with ACL's equipment and licensing schedule for the cask.

Shipment Preparations

After some discussion between Risoe National Laboratory and ACL in early 2001, the decision was reached to ship all of the DR-3 fuel no later than June 2002. Since ACL had teamed with NAC on several, very successful transportation projects (i.e. Portugal, Italy, Taiwan, and Austria shipments), NAC was then contacted to discuss of the best way to optimize both companies' resources to achieve Risoe's goal of June 2002. Consequently, ACL and NAC proposed to perform the shipment in two phases in accordance with DOE's return program schedule:

- A first shipment of 2 NAC-LWT casks containing 84 fuel elements during the second half of 2001.
- A second (and last) shipment of 3 NAC-LWT casks and 1 TN-MTR cask containing a total of 171 fuel elements during the second quarter of 2002.

To meet this schedule ACL and NAC needed to resolve some technical issues in a time frame of less than 12 months:

- ACL needed to revise the design of the TN-MTR52 basket, obtain the French license, obtain the Danish and US validations for this new design, and then modify the TN-MTR52 basket to comply with this new design consisting of adding aluminum sleeves in the lodgment of the basket.
- NAC needed to design and license both the DIDO fuel and a new basket design in the US, obtain the license validation in Denmark, and then fabricate and test the new DIDO baskets prior to mobilizing for the first shipment in the fall of 2001.

NAC received the amended US certificate of compliance with the DIDO fuel elements contents in September 2001 and then received the Danish validation one month later. In order to meet Risoe's needs, NAC had made a decision to fabricate two sets of DIDO baskets in parallel with the licensing effort. The fabrication effort was completed within 3 months after contract signing – a few days after the license had been received from the NRC. NAC's dry transfer equipment was tested with the new baskets, and then the NAC team was mobilized to the Risoe facility just in time to perform the first shipment. A third set of DIDO baskets was fabricated to support the second shipment.

ACL received the French license for their newly designed basket, the TN 52 S, on 12 April 2001. The corresponding Danish validation was received on January 24, 2002 and the US validation on March 25, 2002.

The First Shipment

While NAC and ACL were making preparations to support the shipments, Risoe was making final preparations to receive and load the NAC-LWT cask in support of the

second shipment. Since the NAC-LWT had never been used to transport fuel from DR-3, great care was taken to insure the cask and transportation operations at Risoe went safely and smoothly. Additionally, the Transportation Manager at Risoe was new and never had the opportunity to experience a similar transportation project. In order to facilitate the teamwork necessary for a success, weekly conference calls were held between NAC, ACL and the Risoe technical and transportation team to discuss and coordinate all of the actions to be accomplished by each of the parties.

Once all operational procedures and transportation protocols were in place, the NAC team mobilized to the Risoe site. A team consisting of two NAC field engineers was dispatched to Denmark. After unpacking the ancillary cask equipment and NAC's dry fuel transfer system, the first cask was placed into the pool. To insure proper cask loading, a complete dry run was performed using an empty DIDO fuel basket. This test was successfully completed and actual fuel loading operations were initiated. Over the next two weeks, a total of twelve fuel baskets, each containing seven DIDO fuel elements, were transferred into two NAC-LWT casks.

Once loading was completed and the casks had been prepared for shipment, the transport operations were started. Risoe was responsible for transportation of the loaded casks from the site to the port of Esbjerg located on the west coast of Denmark. The port of Esbjerg had been utilized in the past for irradiated MTR fuel shipments from Denmark and Germany. A representative of the Danish Competent Authority was present at the Risoe site to ensure of the compliance of transport documents and radiological level of the casks with the regulations. As was the case for the entire shipment, the transportation operations in Denmark were successfully completed on schedule. The ocean portion of this shipment was performed using a two years old vessel, the *Fret Moselle*, operated under contract to ACL. This INF-2 spent fuel shipment was the first one performed by the *Fret Moselle*. Special attention was paid to coordination with both Danish and US officials to insure the initial acceptability and approval for this vessel for this type of shipment. The ocean transportation, as well as the US land transportation operations performed by NAC, were carried out in very successful manner.

The Second Shipment

While the first shipment was being conducted, NAC was making preparations for the second one. A third set of DIDO fuel baskets were fabricated and tested. ACL received the validations for the TN-MTR cask in both the US and in Denmark. ACL also worked closely with Risoe to insure the cask loading operations would be performed flawlessly. The *Sea Bird*, an INF-2 certified vessel owned and operated by the Danish company Poulsen Shipping, was selected for the second ocean shipment. As the *Sea Bird* had already performed INF-2 spent fuel shipments from Denmark and to the Charleston Naval Weapons Station, vessel certification and acceptability was not an issue.

The second series of cask loading operations using three NAC-LWT casks were performed as originally scheduled without problem. The loading of the TN-MTR was performed in a conventional manner, in the DR-3 pool underwater. TN-MTR cask operations at Risoe included the loading of 51 fuel elements and were completed in 5 days with the assistance of one ACL representative supporting Risoe personnel. This effort was also completed on schedule without incident.

One of the goals of the Foreign Research Reactor Fuel Return Program is to minimize the total number of shipments of SNF to the US, whenever possible, by including the maximum amount of fuel on each shipment. Consequently, agreement was reached between two German research reactors (Garching and Julich), Studsvik, Risoe and the US Department of Energy to add five more casks to this shipment. A one-month delay was instituted to make the necessary coordination and transportation arrangements. This minor schedule perturbation was still compatible with Risoe National Laboratory's schedule commitment to the Danish government.

The final spent fuel shipment from Risoe National Laboratory departed the site at 1 PM on June 3, 2002. Just before departure, a dozen DR-3 employees came out to the parking lot watch the convoy leaving the site. A little bit of history was accompanying this shipment. Despite the satisfaction of having safely accomplished the operations to defuel the reactor, it was a sad day for most and an emotional day for all.

The *Sea Bird* had already picked up one cask from Sweden - and the three casks from Germany were shipped by truck to Esbjerg. The complex European transportation logistics effort culminated at the Port of Esbjerg with the on-schedule arrival the vessel from Sweden, the casks from Germany and the casks from Risoe. With all eight casks safely on board, the *Sea Bird* departed Denmark and arrived safely at the CNWS on June 18, 2002. The casks were off-loaded at the dock and then transported to SRS by train on the same day.

Summary

The successful completion of these shipments accomplished secure and safe spent fuel transport operations as originally scheduled by Risoe. In order to meet the needs of Risoe, these shipments required the close cooperation and teamwork between Risoe National Laboratory, ACL, NAC, the US Department of Energy, and Westinghouse Savannah River Company. ACL and NAC International personnel worked closely with the Risoe team over the twelve-month during of the project. Completion of the work and the delivery of the second shipment ended the weekly conversations, but certainly did not end the relationships between the people on the team.

The DR-3 reactor's future is now going forward with the decommissioning process. A decommissioning plan will be presented to the Danish Government in early 2003 to authorize the budget and start the decommissioning activities.