

## **U.S.-Origin Nuclear Material Removal Program-17027**

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### **ABSTRACT**

The United States (U.S.) Department of Energy (DOE) Office of Material Management and Minimization (M<sup>3</sup>) U.S.-Origin Nuclear Material Removal program, also known as the Foreign Research Reactor Spent Nuclear Fuel Acceptance Program (FRR SNF AP), was established by the U.S. Department of Energy in May 1996. The program's mission provides a disposition pathway for certain U.S. origin spent nuclear fuel and weapons-grade nuclear material. The program concluded on May 12, 2016. Irradiation must have been stopped by this date to remain eligible for return. An additional three year window is allowed for fuel cooldown and transportation of SNF elements. The end of this shipping window is May 12, 2019. This paper provides an update on recent program accomplishments, current program initiatives, and future activities.

### **INTRODUCTION**

The National Nuclear Security Administration (NNSA) Office of Material Management and Minimization (M<sup>3</sup>) U.S.-Origin Nuclear Material Removal Program (Program), also known as the Foreign Research Reactor Spent Nuclear Fuel Acceptance Program (FRR SNF AP), supports permanent threat reduction by eliminating stockpiles of excess weapons-usable nuclear materials located at civilian sites throughout the world. M<sup>3</sup> has played a critical role in fulfilling commitments under the Joint Statement on Nuclear Security Cooperation agreed to by the U.S. and Russian presidents at Bratislava in 2005, and directly supported President Obama's commitment to secure all high priority nuclear materials worldwide within four years. This four-year effort successfully concluded at the end of 2013. To date, M<sup>3</sup> has repatriated 1,340 kilograms of highly enriched uranium (HEU) and 3760 kilograms of low enriched uranium (LEU) to the United States. This paper outlines the Program's history, various issues surrounding the Program's execution, and lessons learned from recent shipments that may affect foreign research reactor spent nuclear fuel (SNF) projects. In addition, the paper describes current M<sup>3</sup> efforts to advance the goals of the Program, highlighted by continuing efforts to work with foreign research reactors to ship eligible materials as early as possible.

Although the four-year effort officially concluded in 2013 and the Program was largely successful, more work remains ahead. As the Program approaches the termination date of the three-year window to allow fuel cooldown and transportation, M<sup>3</sup> is committed to working with all reactor operators or facilities with eligible HEU spent nuclear fuel or other eligible HEU materials to provide for safe removal and disposition activities.

## **PROGRAM HISTORY AND ACCOMPLISHMENTS**

The Program, now in its twentieth year, has successfully completed seventy-nine (79) shipments to date, safely and securely. Thirty-two (32) countries have participated, returning a total of 9862 spent nuclear fuel elements to the U.S. for management at Department of Energy (DOE) sites in South Carolina, Tennessee and Idaho. Sixty-five (65) of the shipments contained aluminum-based SNF placed into storage at the Savannah River Site (SRS) in South Carolina. Ten shipments consisted of Training, Research, Isotopes, General Atomics (TRIGA) type fuel placed into storage at the Idaho National Laboratory (INL). The remaining four shipments were sent to the Y-12 National Security Complex because the fuel was fresh or slightly irradiated and eligible for receipt at that facility, enabling more efficient disposition.

## **CONTRACTUAL REQUIREMENTS**

### **Contract Implementation**

DOE enters into a contract with each reactor operator that intends to return SNF or other materials to the U.S. Reactor operators must contact the Program office to negotiate a contract to authorize participation. Basic contract language has changed over the twenty year life of the program. However, these contract language changes have no significant effect on the contract and shipping project implementation.

### **Public Disclosure of Shipment Information**

It is very important that the contracting parties clearly understand all provisions in the contract. Contract requirements are usually reviewed in detail prior to the first shipment. As time passes and personnel change, some understanding may be lost, so it is very important for facilities to review the contract and ask questions if there is any doubt about contractual obligations. Compliance with all contract requirements must be maintained.

One very important article in the contract which has been misunderstood in the past covers public disclosure of shipping plans, shipment information or the individual details comprising such plans or information. Any such disclosure must comply with limitations required by U.S. Government regulations and IAEA Information Circulars, primarily the U.S. Code 10 CFR § 73.22(a)(2)(ii), 10 CFR § 73.21(b), and IAEA INFCIRC 225 Rev. 5. This means that information regarding dates and/or schedules, and any other information about the contents of the shipment, cannot be published or publicly released until 10 days after the shipment has arrived at its final destination in the U.S., unless permission is granted in advance in writing. Shipment information must only be revealed to those who have a legitimate need to know in order to support shipment activities. Information on security measures should never be publically released or published. Compliance with this contractual requirement is an important obligation to ensure safety and security for any shipment activity. DOE considers premature release of this information a violation of the contract. The inappropriate release of shipment information poses an unwarranted security risk and could make the shipment vulnerable to bad actors. It would also violate U.S.

Nuclear Regulatory Commission (NRC) regulations under which all shipments are authorized.

Further, The Convention on the Physical Protection of Nuclear Material, entered into by states which support the Program, requires that each state protect the confidentiality of this information. The ability to continue the Program is contingent upon our customers implementing the agreed upon information security requirements. As a result, the reactor operators should coordinate with participating organizations, governmental and nongovernmental, to ensure all persons and entities that receive shipment information understand they are affirmatively obligated to maintain confidentiality until the material arrives at its final destination.

An improper release of shipment information could affect DOE's decision to issue the "Authorization to Ship" which allows a shipment to depart a facility or reactor site. If the shipment is allowed to proceed, a heightened security posture or other mitigating actions may be required, resulting in a delay. However, if the information release is deemed to create too large a risk, the Program can cancel the shipment altogether, pursuant to the excused performance section of the contract.

### **Revised Fee Policy**

DOE is continuing to try to keep the reactor operator's cost to participate in the Program as low as possible, however, because of the increase in operational costs of receiving and managing SNF, on January 31, 2012 DOE issued the **Revised Fee Policy for Acceptance of Foreign Research Reactor Spent Nuclear Fuel From High-Income Economy Countries** (77 FR §4807). This was the first fee increase since the fee policy was established in 1996.

A synopsis of the revision:

- The first phase took effect January 31, 2012; and the fee for receipt of LEU fuel increased from no higher than \$3,750 per kg of total mass to \$5,625 USD per kg of total mass. The fee for SNF shipments containing HEU remains at no higher than \$4,500 USD per kg of total mass.
- DOE also implemented a new minimum fee of \$200,000 USD per shipment of any type and amount of eligible SNF to reflect a minimum cost of providing acceptance services, this fee took effect January 31, 2012.
- The fee for return of TRIGA fuel will be the same as that of aluminum based fuel.
- The second phase was automatically implemented on January 1, 2014 and the fee for the receipt of LEU fuel was increased from \$5,625 USD per kg of total mass to \$7,500 USD per kg of total mass and for HEU fuel, the fee for the receipt of HEU fuel was increased from no higher than \$4,500 USD per kg of total mass to \$6,750 USD per kg of total mass.
- The third phase was implemented automatically on January 1, 2016, and the fee for the receipt of HEU fuel increased from \$6,750 per kg of total mass to \$9,000 USD per kg of total mass.

The current fees are based on the fee structure in effect as of January 1, 2016. Reactor operators and Program participants should carefully review the Revised

Fee Policy to determine the effects of this revision. If you have any questions, please contact the Program office.

### **Focus on Advance Planning**

M<sup>3</sup> focuses on the early planning and deliberate implementation of SNF shipments to the U.S. in support of worldwide nuclear nonproliferation efforts. Shipments involve many different logistical challenges and early planning mitigates the risk of unanticipated issues delaying a shipment schedule. With the expiration of the program (May 12, 2016), and the end of the cooldown and shipping window (May 12, 2019) rapidly approaching a reactor operator considering participation in the Program should commence advance planning as soon as possible. The importance of communication and coordination with M<sup>3</sup> and the receiving site cannot be over-emphasized.

### **Shipment Scheduling**

M<sup>3</sup> must clearly understand the intentions of all reactor operators so that shipment planning can be well integrated and supported. To ensure that shipments adhere to agreed-upon schedules, it is imperative that the required fuel data be submitted as early as possible. This allows adequate time for the receiving site to perform necessary safety reviews and prepare for receipt and storage of the material. Early availability of this data is also essential for use in verifying transport package license requirements or providing sufficient time to submit a license amendment, when required. Budget limitations have been known to challenge implementation of shipping plans for our customers. Similarly, the DOE receiving facilities are facing ever increasing challenges in providing resources to receive material, particularly when shipping plans are not well known. It is anticipated that these funding challenges will continue to threaten DOE's receipt capability and capacity.

At the request of many foreign research reactors, the Program was extended in 2004 to allow time for further development of LEU fuels and planning for back end solutions in the fuel cycle. The extension was granted for the benefit of research reactors in justifiable need of relief. However, some foreign research reactors are now cancelling or rescheduling shipments to defer costs, which was not the intent of the extension. These delays negatively impact DOE's ability to maintain a regular schedule of operations and adequate resources for the receipt facilities. Thus, M<sup>3</sup> strongly encourages reactor operators to continue shipping as early as possible and maintain original schedules where possible.

M<sup>3</sup> currently anticipates a large number of shipments near the end of the policy period. If too many shipments are deferred until the end of the policy period, DOE may be required to exercise its authority under the contracts to limit receipts to those specific customers it deems have the greatest need. This is particularly important to reactor operators that only have LEU fuel remaining and reactor operators that are limited in their selection of an appropriate transport package or cask. It is expected that some packages may have limited availability during these last few years of the Program.

## **Cask License Review**

M<sup>3</sup> enjoys an excellent working relationship with the NRC and makes every effort to respect this relationship by ensuring that cask license applications are timely and complete. M<sup>3</sup> meets regularly with the NRC to discuss planned shipments and to forecast the support required to meet the needs of the Program and our customers. Because there are limited NRC resources for review of cask licenses, customers must ensure adequate time is available for the application preparation process, the NRC's review of the application, and final approval of cask licenses.

## **Insurance Issues**

Insurance issues have recently become a recurring problem for reactor operators in high-income economy countries participating in joint shipments. A high-income economy is based on the most current edition of The World Bank Development Report (The Report) at the time the contract between the foreign research reactor operator and DOE is signed.

The reactor operators are sometimes required to have overlapping insurance coverage with different requirements for minimum coverage. Reactor operators entering into a joint shipment can sometimes coordinate when obtaining nuclear liability insurance from the same pool or under a joint contract. It is important to plan early and determine how to provide the required coverage in the least expensive manner. Reactor operators should be conscious of this potential problem and budget for any added insurance costs that cannot be mitigated.

## **Title Transfer Location**

Title transfer from the reactor operator and DOE is normally conducted at the U.S. port upon off-loading of the authorized material. The Secretary of Energy has authorized the NNSA Administrator to consider, on a case-by-case basis, whether it is in the best interest of the U.S. to take title to certain SNF and target material before it reaches the port of entry into the U.S.

In order to be considered for title transfer at an earlier point, M<sup>3</sup> must provide the NNSA Administrator with sufficient evidence to prove the need exists to grant formal approval to accept title. In these cases the title transfer location would be specified in the contract with the affected reactor operator. In order to extend the United States' Price-Anderson Amendment Act nuclear liability indemnification, DOE is also required to control and manage the carrier of the U.S. titled material.

## **Efforts to Improve and Accelerate**

M<sup>3</sup> and reactor operators need to work together to schedule shipments as soon as possible to optimize shipment efficiency over the few remaining years of the Program. Countries interested in participating in the Program should express interest now so fuel and reactor facility assessments can be scheduled and shipment dates can be entered into the forecast.

Decreasing resources and coordination requirements with other government agencies are limiting DOE's capability to support accelerated schedules, as the

expiration of the cooldown and shipping window is rapidly approaching. M<sup>3</sup> may not be able to accommodate a large number of requests at the end of the Program, particularly from geographically isolated regions.

### **Gap Material Acceptance**

The Gap Materials Program is another M<sup>3</sup> program that facilitates the disposition of high risk, vulnerable nuclear material not covered by other removal efforts. M<sup>3</sup>'s first priority in each case will be to find a viable commercial disposition pathway before considering sending the material to the U.S. The materials could include:

- U.S.-Origin HEU spent or fresh nuclear fuel not covered by the existing U.S.-Origin fuel return program,
- Non-U.S.-Origin and non-Russian-Origin HEU materials, or
- Separated plutonium.

The NNSA Administrator approved a revised Record of Decision (74 FR 4173, January 23, 2009) permitting M<sup>3</sup> to transport up to one metric ton of HEU SNF (Gap Material SNF) from foreign research reactor locations to the U.S. and safely store this Gap material at a DOE site pending disposition. This Gap material must meet the following criteria to be eligible for return to the U.S.:

- The material must pose a threat to national security;
- The material must be susceptible to use in an improvised nuclear device;
- The material must present a high risk of terrorist threat;
- The material must have no other reasonable pathway to assure security from theft or diversion;
- The material must meet Savannah River Site (SRS) acceptance criteria; and
- There must be adequate storage capacity at SRS.

Since the program began in 2006, M<sup>3</sup> has removed more than 2,500 kg of Gap material from 16 countries around the world.

### **Material Disposition**

The DOE Office of Environmental Management (DOE-EM), which previously managed the Program, is currently reviewing final disposition options for repatriated spent nuclear fuel. As originally intended in the DOE Programmatic Spent Nuclear Fuel Environmental Impact Statement and associated Records of Decision, M<sup>3</sup> currently transports all aluminum clad spent fuel to DOE's SRS for interim storage, while stainless steel clad fuel, such as TRIGA fuel, is transported to INL. However, INL is currently unable to receive TRIGA fuel with the possibility the prohibition will extend through the end of 2017 or longer. A small amount of unirradiated and very lightly irradiated fuel is sometimes shipped directly to the Y-12 National Nuclear Security Complex for disposition.

## **CONCLUSION**

M<sup>3</sup> remains committed to supporting U.S. and international nonproliferation goals while helping the world benefit from the safe use of modern nuclear technology. The M<sup>3</sup> U.S.-Origin Nuclear Material Removal Program aims to accept all eligible HEU nuclear materials and strongly encourages reactor operators to work closely with technical points-of-contact to ensure shipping schedules are accurate and achievable.

M<sup>3</sup> remains willing to accept LEU nuclear material as DOE facilities are able to support receiving this material. M<sup>3</sup> continues to support the needs of the foreign research reactor community and is always available to meet interested parties to discuss the Program.