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Savannah River Site's H-Canyon Facility: Impacts of Foreign Obligations on Special Nuclear Material Disposition

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ABSTRACT

The US has a non-proliferation policy to receive foreign and domestic research reactor returns of spent fuel materials of US origin. These spent fuel materials are returned to the Department of Energy (DOE) and placed in storage in the L-area spent fuel basin at the Savannah River Site (SRS). The foreign research reactor returns fall subject to the 123 agreements for peaceful cooperation. These "123 agreements" are named after section 123 of the Atomic Energy Act of 1954 and govern the conditions of nuclear cooperation with foreign partners. The SRS management of these foreign obligations while planning material disposition paths can be a challenge.

INTRODUCTION AND BACKGROUND

Section 123 "*Cooperation with Other Nations*" of the Atomic Energy Act of 1954 states "no cooperation with any nation, group of nations or regional defense organizations...shall be undertaken until a proposed agreement for cooperation has been submitted to the President..." The Agreements for Peaceful Nuclear Cooperation with participating countries are brokered for the United States (US) by the Department of State. These agreements, "123 Agreements", lay out the terms and scope for the cooperation of peaceful uses of special nuclear materials (SNM) and equipment. This paper will focus on the obligated SNM. Foreign research reactor spent fuels are returned to the US as part of the global threat reduction initiative (GTRI). These special nuclear materials returning from participating countries fall subject to these 123 Agreements, and are therefore called "obligated" material. Table 1 shows the countries with which the US has these peaceful use agreements and their associated codes for tracking.

Australia (31) Canada (32) Euratom* (33) Japan (34) China (35)
Switzerland (37) Argentina (38) Brazil (39) Chile (40)

*Euratom is comprised of the following 27 member states: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Ireland, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Sweden, and the United Kingdom

The materials covered in these agreements are subject to obligation tracking and reporting. All facilities, both government and commercial, must be able to track and report on their obligated materials. The Department of Energy (DOE) and the Nuclear

Regulatory Commission (NRC) use the Nuclear Materials Management and Safeguards System (NMMSS) to input the SNM obligations as the materials are received into the US, track the material to specific facilities, and issue the formal reports. Each facility handling the obligated SNM must balance their obligations with the NMMSS on an annual basis.

HANDLING OBLIGATION REQUIREMENTS

“Peaceful Use” of these materials means the materials cannot be used for nuclear weapon production and in some agreements cannot be used for any military purpose. Therefore these materials are used in nuclear reactor fuel fabrication for use in power generating reactors.

Tracking the obligations through the fuel cycle and from facility to facility is accomplished by submitting detailed transaction/obligation information to NMMSS using the DOE/NRC Transaction Form 741, and Material Balance Form 742, part B. Item level tracking of these obligations is not required, but each facility must have enough SNM inventory to ensure the obligations are fulfilled. Therefore material obligations can be transferred from site to site without physical material movements provided the receiving site has the equivalent inventory quantity and type to cover the obligation.

These material quantities are tracked throughout the entire fuel process. If materials from multiple countries are comingled, then the obligations on the resulting material becomes a layered obligation and continues to be tracked using a new combined country code. This can become very tedious.

Site to site obligation “flag” transfers do not have to be approved prior to movement provided the two facilities agree. However, processing of the obligated materials requires prior notification to the Department of State.

OBLIGATION REQUIREMENTS AT SAVANNAH RIVER SITE

The US has a non-proliferation policy to receive foreign and domestic research reactor returns of spent fuel materials of US origin. These spent fuel materials are returned to the Department of Energy (DOE) and placed in storage in the L-area spent fuel basin at the Savannah River Site (SRS).

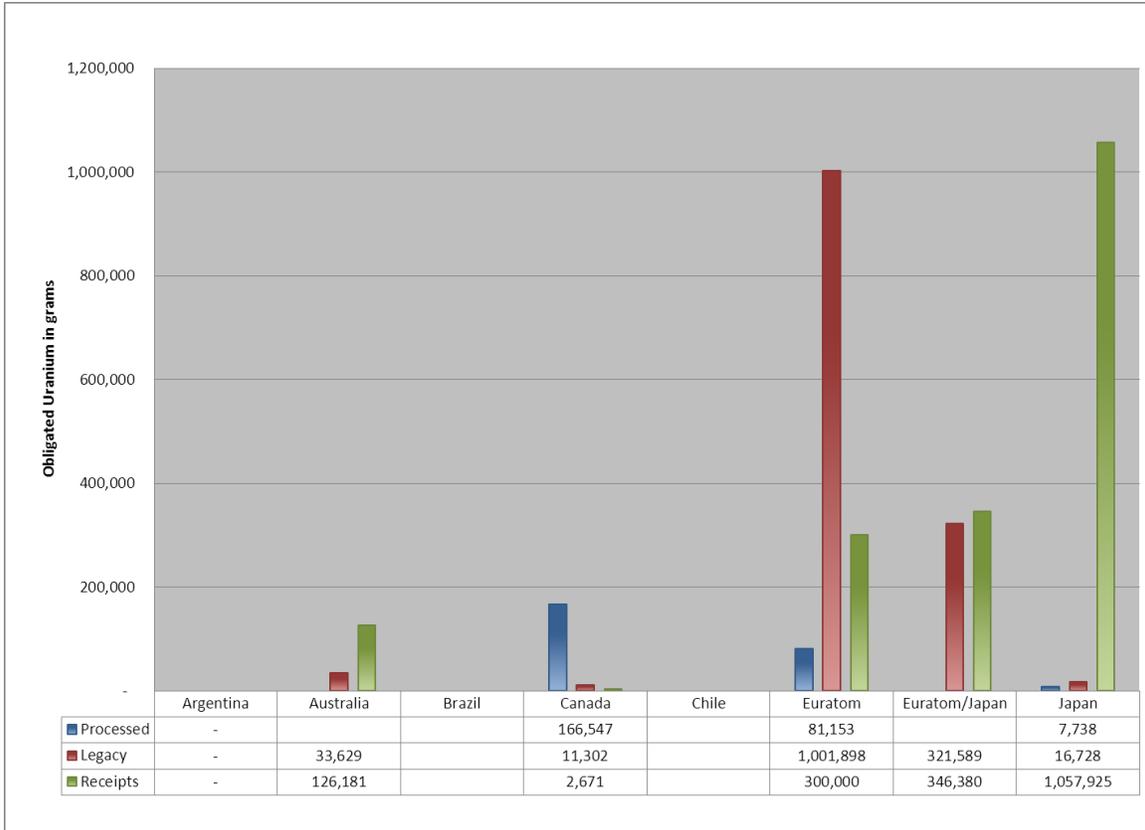
Item level tracking of obligated material is not required. But as a practical way to manage the materials, SRS began tracking obligations on an item level in 2003. Prior to the requirement for SRS to track obligations, some obligated materials were processed in the 1980s. In order to cover the processed obligations, SRS received permission to substitute domestic research reactor (DRR) fuels of similar quantity and type.

SRS has received several transfers of other sites’ obligation flags. SRS has received uranium flags from Y-12 at Oak Ridge, TN. The distribution of obligated enriched

uranium at SRS is shown in Figure 1. The total amount of obligated materials in this inventory at SRS is approximately 4.5 MT. The percent of total are Euratom (54.0%), Japan (23.8%), Euratom/Japan (14.7%), Canada (3.9%) and Australia (3.5%). There are no enriched uranium obligations for Argentina, Brazil and Chile at SRS.

Receipts Fuels (post-FY03 closing and Y-12 transfer) are 61.5%, Legacy Fuels (pre-FY03 closing) are 32.9% and Processed Fuels are 5.6% of the obligated total.

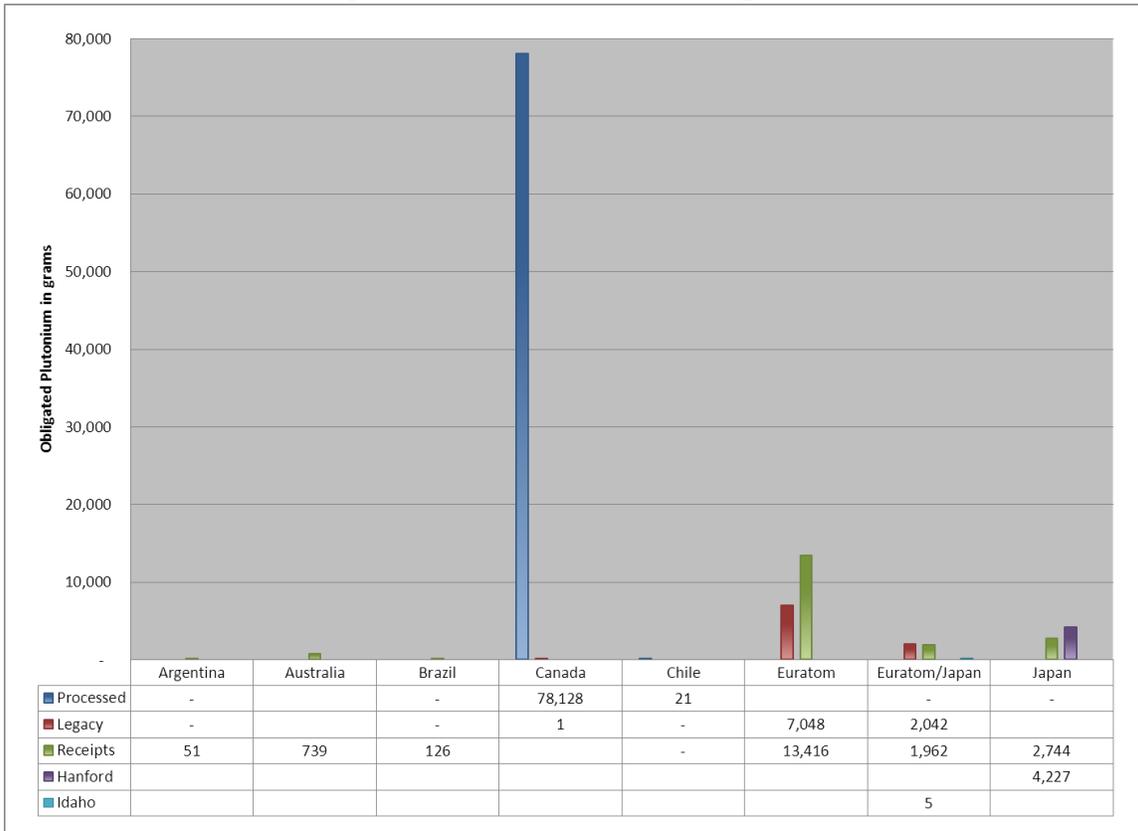
Figure 1 – SRS Enriched Uranium Obligations



SRS also received plutonium flags from Hanford, WA and Idaho. The distribution of obligated plutonium at SRS is shown in Figure 2. The total amount of obligated materials in inventory at SRS is approximately 100 kgs. The percent of total are Canada (72.7%), Euratom (16.2%), Japan (6.5%), Euratom/Japan (3.7%), Australia (0.7%), Brazil (0.1%), Argentina (0.1%) and Chile (<0.1%).

Processed Fuels are 72.7%, Receipts Fuels (post-FY03 closing and Y-12 transfer) are 14.2%, and Legacy Fuels (pre-FY03 closing) are 9.2% of the obligated total. Obligations for fuels from other sites, Hanford and Idaho, are 3.9% of the obligated total.

Figure 2 – SRS Plutonium Obligations



DISPOSITION OF SNM AT SAVANNAH RIVER SITE

In April 2013, DOE issued an amended Record of Decision (ROD) which allows a limited amount of the SNF from L-basin to be dissolved and processed through H Canyon at the SRS. To achieve efficient dissolution rates, the SNF will be mixed and matched in various dissolver batches to get the proper processing concentrations and enrichments. During processing of this material through H Canyon, the highly enriched uranium (HEU) will be extracted, while the other fission products, including any plutonium, will be discarded as high level waste to the H Tank Farm. The fission product waste in the tank farm will be transferred to the Defense Waste Processing Facility where it will be encapsulated into a borosilicate glass matrix making it practically irrecoverable. Any plutonium obligations on this material will be requested to be terminated.

The extracted HEU will be processed through additional mixer-settler banks in order to remove further impurities from the uranium. Once the uranium meets specifications, the HEU material is down blended with Natural Uranium (NU) resulting in low enriched uranium (LEU) product. The LEU will then be transported to a fuel fabrication facility to be manufactured into fuel rods for energy producing nuclear reactors. The obligations

associated with the original HEU will be transferred to the receiving fuel fabrication facility.

As shown previously, the enriched uranium in some of the SNF inventory has associated foreign obligation flags as does the NU used as the down blend diluent. These obligations will become very hard to track due to the need to mix and match materials for processing. With the layering of obligations, there is the potential for tracking codes SRS is required to follow to increase exponentially, not to mention the tracking through the fuel fabrication process.

CONCLUSION

Tracking special nuclear materials is necessary to ensure peace is maintained throughout our world, and to keep checks and balances on our other countries. But there has to come a point where the material becomes unusable for building a nuclear device that the obligations can be terminated saving the time, money and effort spent tracking it.