January 14, 2016

MEMORANDUM TO: Michele Sampson, Acting Deputy Director
Division of Spent Fuel Management
Office of Nuclear Material Safety
and Safeguards

FROM: Norma Garcia Santos, Project Manager /RA/
Spent Fuel Licensing Branch
Division of Spent Fuel Management
Office of Nuclear Material Safety
and Safeguards

SUBJECT: SUMMARY OF DECEMBER 10, 2015, PRE-APPLICATION MEETING WITH ENERGY SOLUTIONS TO DISCUSS CHANGES ASSOCIATED WITH THE MODEL NO. MIDUS PACKAGE AMENDMENT REQUEST

Background

A pre-application meeting was held on December 10, 2015, in Rockville, Maryland, at the request of EnergySolutions (the applicant) to discuss changes to the Model No. MIDUS package. EnergySolutions seeks to add irradiated molybdenum in a solid form as authorized contents and change the specification of the depleted uranium used as a material of construction of a package component.

The meeting notice was added in the Agencywide Documents Access and Management System (ADAMS) on November 13, 2015 (ADAMS Accession No. ML15317A024). The meeting attendees' list and agenda can be found in Enclosures 1 and 2, respectively. The public version of EnergySolutions presentation slides are located in ADAMS Accession No. ML15342A327. NorthStar presentation contained sensitive-copyright material and it was withheld from public disclosure.

Discussion

EnergySolutions (the applicant) request includes adding enriched Molybdenum in a solid form as authorized contents to the Model No. MIDUS. The applicant and the user determined that the Model No. MIDUS was the best alternative for transporting solid enriched molybdenum from its facility. The applicant mentioned that there are currently 30 MIDUS shipments every week transporting Molybdenum in liquid form.

The user is NorthStar, who plans producing molybdenum-99 (^{99}Mo) in the United States (U.S.), which is the parent isotope for meta technetium-99 (^{99m}Tc), a widely used medical isotope. The user mentioned that ^{99m}Tc currently accounted for 75% of "all diagnostic radionuclide-based test." NorthStar process includes pressing solid enriched molybdenum into a "chip" shape form and transporting it in the Model No. MIDUS. NorthStar would provide a plastic "basket" with

enriched molybdenum enclosed in aluminum cylinders. The aluminum cylinders are of different diameters, depending on the size of the molybdenum "chips." The user brought a model of the model No. MIDUS, "basket," and the proposed contents to support its discussion.

The applicant mentioned that, based on the national need and that some of the foreign suppliers are shutting down their reactors for production of ^{99}Mo, it is requesting approval of the revision of the MIDUS package by August 2016. The applicant expects to submit the application for the proposed changes to the MIDUS package in February 2016. The applicant also informed the staff that it would be building the MIDUS package at risk if it does not receive approval by August 2016. The following sections provide a summary of the information discussed during this meeting.

A. National Need

The applicant mentioned that this request fits the national need of ^{99}Mo, since the current U.S. Administration is supporting initiatives for domestically produce ^{99}Mo. The U.S. consumes about 50% of the worldwide supply of ^{99}Mo, but the U.S. only produces a small fraction of it. Therefore, the U.S. highly depends on foreign countries for the supply of ^{99}Mo. The applicant mentioned some countries and corresponding targets used to produce ^{99}Mo. The table below includes some of the countries discussed at the meeting.

Country (Reactor)	Target	Estimated Worldwide Supply
Canada	---	5% [a]
France (OSIRIS)	---	40% [b]
South Africa	Low Enriched Uranium	---
South Africa (NTP)	Mix of High-Enriched Uranium and Low-Enriched Uranium	---
Netherlands	Patent	---
Poland (MARIA)	---	---

[a] Loses its license in October 2016.
[b] Shuts down by the end of calendar year 2016.

The user mentioned that Canada and France produce 60% of the ^{99}Mo used in the U.S. The production of ^{99}Mo must be continuous (i.e., 24 hours a day, 7 days a week, and 365 days a year). Currently, all material comes to the U.S. by air.

B. Technical Discussion

The applicant discussed examples of the process for producing ^{99}Mo in the U.S. Figures 1 and 2 include a summary of these examples. Figure 1 includes the chemical forms resulting when enriching natural molybdenum, which is currently used in the U.S. Figure 2 includes a graphical representation of the process proposed by the user for producing and transporting Molybdenum irradiated (enriched) targets. The applicant pointed out that it would buy Molybdenum enriched at 98 weight percent (wt. %) of Molybdenum-98 (^{98}Mo) from Russia, since that is the only source available at this time.

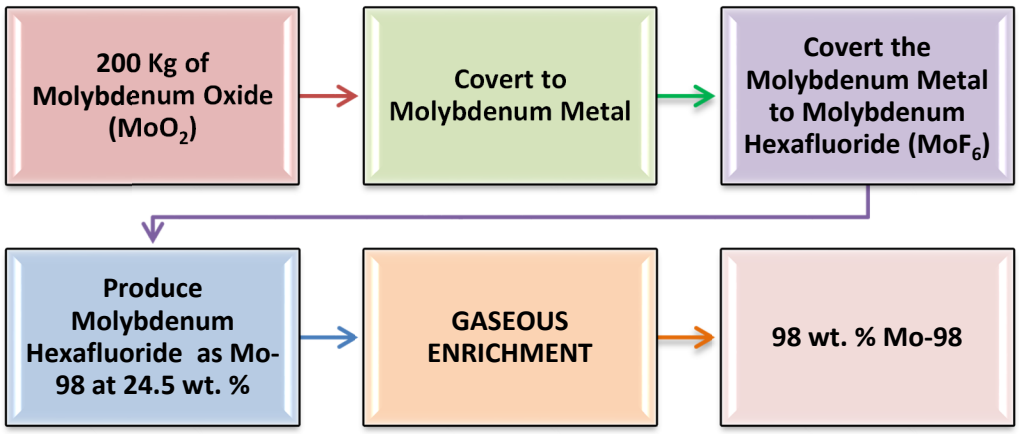

Figure 1. Graphical representation of the process for enriching natural molybdenum up to 98 wt. % ^{98}Mo.

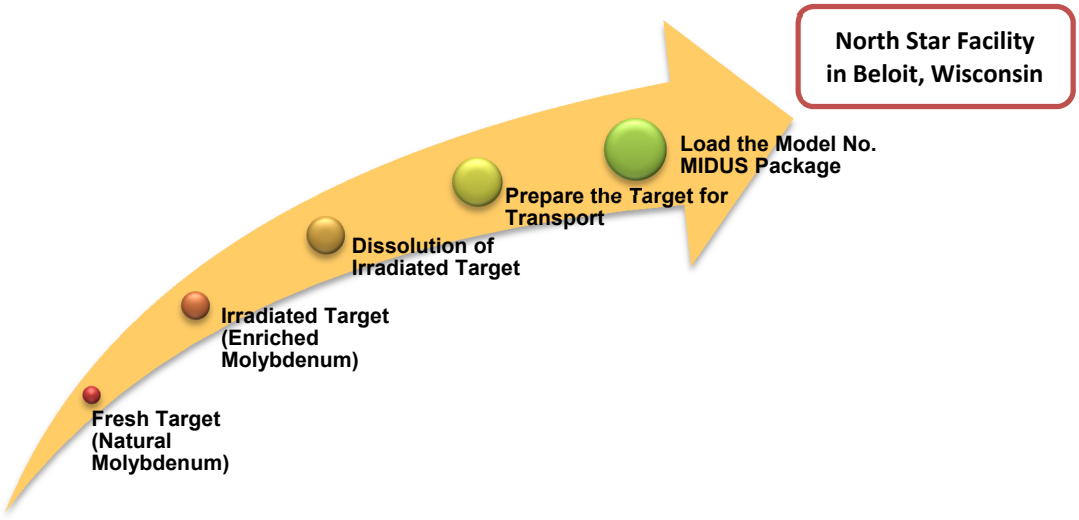

Figure 2. Graphical representation of process proposed by the user for producing and transporting Molybdenum irradiated (enriched) targets.

NorthStar discussed proposed near term and long term solutions for the need of ^{99}Mo in the U.S.

1. ***Near-Term Solutions*** – Use the Missouri University research Reactor for irradiating natural molybdenum targets. This university already has a program, but the Croft packaging is the only option available for transport at this time. The target is remotely loaded to the reactor. The user should provide the quantity of molybdenum to be irradiated about 2 weeks and a half in advance.

   The staff asked if there were any neutron emitters generated during this process. The user replied that this process generates small amounts (in the micro Curies range) of Zirconium-95, Cesium-134, and Antimony. The user mentioned that it's working on alternatives for eliminating these isotopes, which is an issue when using natural molybdenum targets.

2. ***Long-Term Solution*** – Use accelerator "methodology for the production of ^{99}Mo."

The user also mentioned that irradiation of aluminum (the material of construction for the cylinders for transporting the irradiated molybdenum) may produce small amounts of Sodium-24.

NorthStar plan includes producing ^{99}Mo using all possible sources, which include:

1. Reactor-based non-low enriched uranium source
2. Low enriched uranium (reactor)
3. Accelerator-based non-uranium source
4. Reactor based non-uranium source

NorthStar mentioned that the estimated need in the U.S. of ^{99}Mo was 3,000 6D Ci, but may currently be about 2,500 6D Ci because more efficient usage. NorthStar mentioned the packages considered and pointed out that transporting the material in the MIDUS package would minimize the number of shipments established in previous Cooperative Agreements.

During the discussion, the staff mentioned that the applicant needs to clearly define the contents of the package, since North-Star would be providing the plastic "basket" and the aluminum cylinders with the irradiated molybdenum inside and not only the solid irradiated molybdenum. The applicant should analyze the appropriate content in the safety analysis, including any criticality safety analyses.

North-Star is building a new facility in Beloit, Wisconsin to produce ^{99}Mo in the U.S. The first building of the complex was finalized in May 2015 and the completion of the second building is scheduled for the second quarter of calendar year 2016. NorthStar mentioned that it may be building additional facilities in the future for producing other types of isotopes.

C. Changes to the Safety Analysis report

Besides the changes related to the proposed new content, the applicant would revise the safety analysis report for the Model No. MIDUS package to revise the material specification for depleted uranium used in the package due to material availability. The applicant mentioned that it would not take credit for the containment boundary in the containment evaluation.

Several representatives from NAC attended and participated during the meeting. Staff from headquarters also attended the meeting. No regulatory decisions were made at this meeting.

Docket No. 71-9320
TAC No. L25064

Enclosures:
1. Meeting Attendance List
2. Meeting Agenda

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Distribution:
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ADAMS P8 Package No.:
Cover Letter ADAMS P8 Accession No.:
This closes TAC No. L25064.

OFC	SFM	E	SFM		SFM	
NAME	NGarcia-Santos		DWalker		SRuffin	
DATE	1/14/2016		1/14/2016		1/9/2016	

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U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

MEETING ATTENDANCE LIST

December 10, 2015
OWFN-7-B4
9:00 a.m. – 11:00 a.m.

Name	Organization
Steven Sisley	EnergySolutions
James Harvey	NorthStar
Brandon Thomas	EnergySolutions
Arsalan Nathani	EnergySolutions
Robert Quinn	EnergySolutions
Meraj Rahimi	NRC
Daniel Forsyth	NRC
Norma Garcia Santos	NRC

Enclosure 1

CLOSED MEETING
AGENDA

Meeting between Energy*Solutions* Spent Fuel Division, and the
U.S. Nuclear Regulatory Commission
December 10, 2015
Public Meeting
9:00 am – 12:00 pm
One White Flint North 7th Floor, Room No. B4

1. Introduction.
2. Presentation of the Proposed Changes for the Model No. MIDUS.
3. Addition of authorized contents.
4. Proposed Licensing Approach.
5. Proposed Licensing Schedule.
6. Opportunity for Public Comments.
7. Closing Remarks.
8. Adjourn.

Enclosure 2