

EFFORTS TO SAVE ^{244}Pu IN MARK 18A TARGETS FOR USE IN INTERNATIONAL SAFEGUARDS MEASUREMENTS

STEVEN A. GOLDBERG

U.S. Dept. of Energy, New Brunswick Laboratory, Argonne, IL, USA

JOHN CAPPIS

Los Alamos National Laboratory, Los Alamos, NM, USA

STEPHANIE CLARKE, ROBERT WHITESEL

National Nuclear Security Administration, Office of Arms Control and Nonproliferation,
Washington, D.C. USA

The Office of Arms Control and Nonproliferation and the Office of Security and Emergency Operations are working collaboratively to evaluate the disposition of a large quantity of the ^{244}Pu isotope contained in 65 Mark 18A targets at the Savannah River Site (SRS). ^{244}Pu is used as a standard reference material for plutonium analytical measurements required for both domestic and international safeguards. ^{244}Pu is particularly valuable for high accuracy measurements of plutonium in small samples containing trace quantities of plutonium (environmental analysis) and for measurements of material through-put in bulk processing facilities handling large volumes of plutonium and plutonium-bearing materials.

In October 2000, an assessment team was tasked by the U.S. Department of Energy (DOE) Under Secretary to evaluate pathways and costs for the chemical separation and isotopic enrichment of the ^{244}Pu identified in the targets. Even though the target materials have recently been designated as a National Resource, they are scheduled for waste disposal unless funds can be identified and assigned to the project. Background information on the Mark 18A targets and a review of the assessment process are presented below to inform other organizations and governments of current efforts to examine potential disposition options and to solicit international cooperation for the extraction of the ^{244}Pu .

BACKGROUND

The United States possesses the bulk of the world's supply of the rare isotope ^{244}Pu . This isotope was produced by extremely long neutron irradiation of ^{242}Pu in a high-flux reactor during experiments used primarily to create isotopes of medical interest. In its separated enriched form, ^{244}Pu is regarded as the most accurate and desirable spike for safeguards, forensics, and environmental analysis of plutonium, allowing the simultaneous measurement of a sample for isotopic abundances and elemental concentration. Such measurements are a critical component of Strengthened Safeguards protocols to verify undeclared activities and materials.

Current supplies of enriched ^{244}Pu are considered to be insufficient for long-term safeguards measurement activities. Approximately 20 grams of ^{244}Pu reside in the highly irradiated Mark 18A targets. The material in the targets must be chemically separated and isotopically enriched before the ^{244}Pu can be used for safeguards analyses.

The Mark 18A targets are presently slated for disposal by the U.S. DOE unless funds and resources can be identified for the separation of the ^{244}Pu . The cost may exceed several tens of millions of dollars, and the time available to secure this funding is limited. A DOE/NNSA assessment team has been tasked to provide an options paper describing various recovery approaches and associated cost estimates and to contact other organizations and governments that also have an interest in retaining the ^{244}Pu to determine whether they would be willing to collaborate in the process to retain the ^{244}Pu material.

REVIEW OF THE ASSESSMENT PROCESS

At the direction of the DOE Nuclear Materials Council (NMC) in November 1999, the Office of Nuclear Energy, Science and Technology (NE) and the Office of Science (SC) conducted a review of the need for the various nuclides contained in the Mark 18A targets. The Office of Environmental Management (EM) was concurrently tasked to assemble additional information regarding the costs, timing, risks and benefits of the various options for management of the Mark 18A Am/Cm/Pu materials. NE and SC concluded that “the Am/Cm at Savannah River (SR) cannot be economically processed, enriched, and sold by the Department of Energy for isotope sales nor is it needed for science. The material is neither needed nor is retention economically justifiable from a programmatic perspective.”

Based on an analysis provided by the New Brunswick Laboratory (NBL), the Office of Security and Emergency Operations (SO) subsequently informed the NMC that the United States would risk losing measurement capabilities that are essential for maintaining an active safeguards posture in current and future world affairs if the Mark 18A targets were to be disposed of without separation and recovery of the ^{244}Pu and other high-Z isotopes. SO indicated that no other isotopic material can perform the unique function of ^{244}Pu in high accuracy measurements of plutonium for both safeguards and environmental analyses. Accordingly, SO recommended that DOE retain the Mark 18A target materials, designate them as a National Resource, and fund the separation of ^{244}Pu and other high-Z isotopes from the targets.

The Office of Defense Nuclear Nonproliferation (NN) joined SO and took a lead role in the effort to provide information, as requested by the NMC, to justify keeping the ^{244}Pu and to develop a path forward that offers the potential for accomplishing this goal. NN and SO are reviewing multiple options, including the possibility of using new isotope production techniques. If separation and enrichment are assessed to be viable approaches, NN and SO will seek the requisite funding. Among the options for management of the Mark 18A target materials are target preparation/vitrification in facilities at SRS, and separation and enrichment (electromagnetic and reactor-based) at Oak Ridge. If funds cannot be obtained, then EM would proceed with a disposal alternative.