June 24, 2008

MEMORANDUM TO: Margie Kotzalas, Chief
MOX Branch
Division of Fuel Cycle Safety
and Safeguards
Office of Nuclear Material Safety
and Safeguards

THRU: Yawar Faraz, Senior Project Manager **/RA/**
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FROM: Jonathan De Jesus, General Engineer **/RA/**
MOX Branch
Division of Fuel Cycle Safety
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SUBJECT: APRIL 30, 2008, COUPLED END-TO-END DEMONSTRATION PROJECT AT OAK RIDGE NATIONAL LABORATORY TRIP REPORT

Purpose

The purpose of this visit was for the Nuclear Regulatory Commission (NRC) staff to tour the Department of Energy's (DOE's) laboratory scale Coupled End-to-End (CETE) spent nuclear fuel (SNF) aqueous separations demonstration of Global Nuclear Energy Partnership (GNEP) technologies at the Oak Ridge National Laboratory (ORNL).

Summary

On April 30, 2008, Yawar Faraz, Jonathan DeJesus, Margie Kotzalas, Kelli Markham, and Cinthya Roman of the MOX Branch in the Division of Fuel Cycle Safety and Safeguards in the Office of Nuclear Material Safety and Safeguards and Philip Reed of the Office of Nuclear Regulatory Research toured the DOE's laboratory scale CETE SNF aqueous separations demonstration at ORNL. Specifically, the staff visited the Irradiated Fuels Examination Laboratory, the Experimental Gas Cooled Reactor Building, and the Radiochemical Engineering Development Center. The trip was funded by DOE under an interagency agreement with the NRC.

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CETE Project

The day started with a presentation from Julie Simpson. Ms. Simpson discussed the ongoing work in support of NRC programs at the ORNL. Following Ms. Simpson, Dr. Jeffrey Binder, project manager of the CETE Demonstration, provided an overview of the CETE Demonstration project.

The first facility toured was the Irradiated Fuels Examination Laboratory. Chuck Baldwin, alongside with Dr. Binder, showed the NRC staff a SNF rod analyzer, chopper and voloxidizer. The voloxidizer is a rotary furnace that receives the chopped fuel. Inside, the fuel segments are heated in oxygen and the UO_2 SNF pellets are oxidized forming U_3O_8 powder. The process is able to remove volatile fission products such as tritium. Tritium needs to be removed from the SNF before the aqueous treatment to minimize the amount of clean up and recycle needed for the aqueous process solutions (with tritiated water) in the plant. This will lead to process waste minimization.

The next facility toured was the Experimental Gas Cooled Reactor Building. Thomas Burgess provided an overview of the Consolidated Fuel Reprocessing Program and conducted the tour of the facility.

At the Radiochemical Engineering Development Center, Ben Jubin showed the NRC staff a laboratory scale off-gas treatment system. It was noted that in the case of ORNL there are two off-gas treatment systems because the voloxidizer and the dissolver are in two different locations, but for a full-scale facility these two off-gas systems will likely be combined into one system. The off-gas treatment systems trap released radionuclides such as tritium, iodine-129, carbon-14 and krypton-85.

Kevin Felker, the lead for the solvent extraction campaign, provided a tour of the solvent extraction process in the hot cells. During the tour, the ORNL staff showed a video of the entire separations process conducted in three banks of mixer settlers. In the A Bank U, Tc, Pu and Np, are extracted from the 8 Molar nitric acid solution into the organic phase while the Am, Cm and the rest of the fission products end up in the raffinate. In the B Bank known as the Partial Partition Stage, 0.2 Molar nitric acid and hydroxylamine nitrate (HAN) are used to extract part of the U with Pu and Np in the aqueous phase while the rest of the U and Pu and Tc go into the raffinate. In the C Bank known as the Strip section, U and Tc are extracted. In the video, the separation of phases could be observed clearly with the organic phase on top of the aqueous phase and how the uranium was stripped from the organic phase. ORNL staff is capable of running additional aqueous separation strategies from the one described above in their facilities. The day concluded with a presentation of the Dresden Fuel Processing Campaign Results by Kevin Felker and a presentation from Emory Collins about the regulatory implications and lessons learned from activities associated with the CETE.

Enclosure: Meeting Agenda

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