Spent-fuel MCO processing performing as expected

Michele Gerber, *Fluor Hanford*

Fluor Hanford SNF Project employees Doyle Hunter (left) and Terry Watson check out a gas sampling cart assembly shortly after delivery of the equipment to the Canister Storage Building in 1999.

The first gas sample taken from a Multi-Canister Overpack holding Hanford's dried spent nuclear fuel demonstrated that the processes yielded the expected results after more than a year of storage. The Spent Nuclear Fuel Project's first gas sampling effort showed oxygen levels well below the permissible limit, which also confirmed that the MCOs are maintaining safe dry-storage conditions.

"This news is fantastic," said Frank Moore, process control engineer for Fluor Hanford. "The sample results showed us that the MCOs are performing effectively as compared to the models and calculations used in setting safe-storage parameters. It's important that we sample internal gases because these MCOs are the first containers of their kind to hold fuel of this type in dry storage anywhere in the world. The data that we received provided reassurance on every gas constituent."

Oxygen levels low

In late January, a team at the SNF Project's Canister Storage Building drew the first gas sample from the first MCO that had been placed in dry storage in a tube below the facility in December 2000. After 13 months of storage, the oxygen level in the sample was less than 0.001 percent. Standards set by safety analysts who designed the project allow for oxygen levels up to 1.6 percent. So the actual oxygen levels were more than 1,000 times below allowable levels.

"The low oxygen level indicates that MCO chemistry predictions are conservative and there is no appreciable leakage through the mechanical seal at the top of the MCO," explained Doug Black, Fluor Hanford cognizant engineer at the Canister Storage Building. "Oxygen levels need to stay low to prevent any reaction with hydrogen. The presence of excess oxygen could lead to undesirable conditions inside the MCO."

The recent sample also checked nitrogen, hydrogen, helium, carbon dioxide, krypton and xenon levels in the gas taken from the MCO. All sample values were as expected or better than expected.

MCO sampling plan

SNF Project plans call for sampling six of the nearly 400 MCOs that will be placed in dry storage in tubes below the CSB in the next few years. The six MCOs to be sampled will contain a wide variety of fuel types and fuel conditions. The first to be sampled contained intact N-Reactor fuel with no scrap pieces.

Later sampling will include MCOs containing some scrap, fuel with differing plutonium contents, and some single-pass reactor fuel. The sampling will take place at staggered intervals that will stretch out through 2005.

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Spent-fuel MCO processing performing as expected, cont.

The first MCO that was sampled in January will be sampled again in approximately one year. All MCOs are equipped with a unique magnetic couple device to allow for monitoring of gross gas pressure levels if there are any indications that internal pressure may be building. Pressure changes could indicate unfavorable gas reactions inside an MCO.

A complicated process

The first sampling success this winter verified more than just the safe storage conditions of the MCOs. It also verified that the complex sampling equipment worked as predicted. Mike Klem, a COGEMA Engineering principal engineer working on the CSB sampling team, described the complexity of the sampling process.

First, the MCO Handling Machine, called the MHM, withdraws the designated MCO from its storage tube and places it in a sample pit below the floor of the Canister Storage Building. A specially designed sampling hood then is placed over the MCO, and a sample cart is connected to a port in the top of the MCO via hoses. The sample cart and hoses are purged with helium to remove air from the sample cart system. After a vacuum is drawn on the sample system, a control sample is withdrawn into a steel container and sent to a Pacific Northwest National Laboratory facility.

After PNNL verifies the constituents of the control sample, the actual MCO gas sample is withdrawn and sent to the same laboratory. The sampling apparatus has two HEPA filters (high-efficiency particulate air filters), and the CSB itself has another set of HEPA filtration devices. So the atmosphere in and around the facility is protected from any inadvertent gas release.

“PNNL really gave us terrific support,” said Klem. “Their turnaround time was extremely fast, even though some of this work occurred late at night. I can’t say enough about the teamwork and professionalism they showed.”

Klem also praised the skill of the CSB nuclear chemical operators who moved the MCO into the sampling pit and took the samples. “The sampling process takes only a small amount of gas,” he explained, “but it involves several steps and operations. Likewise, we couldn’t have succeeded in obtaining and using the prototypical sampling apparatus without excellent support from procedure writing, quality assurance, purchasing and maintenance.”

Covers to be welded

Beginning in early 2003, the SNF Project will begin to weld the cover caps onto the MCOs in storage. Before being welded, the MCOs are stored with mechanically sealed shield plugs in the CSB’s storage tubes. The welded seals will offer a better margin of safety in long-term storage because the seals will give the MCOs a greater ability to withstand pressure build-up from any unexpected reactions. The welding operations are expected to be completed in 2005.

The Department of Energy’s long-term plan for the MCOs calls for storage at a national repository. Drying and moving the MCOs to the CSB from the K Basins near the Columbia River is part of a plan by the DOE Richland Operations Office to consolidate wastes and special nuclear materials in Hanford’s central plateau.

Thus far, 47 MCOs have been moved to the CSB, and all of the spent nuclear fuel is scheduled to be out of the K Basins by July 31, 2004. ■