

March 23, 2015

MEMORANDUM TO: Anthony Hsia, Deputy Director  
Division of Spent Fuel management  
Office of Nuclear Material Safety  
and Safeguards

FROM: Chris Allen, Project Manager /RA/  
Spent Fuel Licensing Branch  
Division of Spent Fuel management  
Office of Nuclear Material Safety  
and Safeguards

SUBJECT: SUMMARY OF FEBRUARY 25, 2015, MEETING WITH DEPARTMENT  
OF ENERGY AND NATIONAL LABORATORIES TO DISCUSS  
DEPARTMENT OF ENERGY FUNDED RESEARCH RELATED TO  
THE STORAGE AND TRANSPORTATION OF USED NUCLEAR FUEL  
(TAC NO. LA0135)

Background.

On February 25, 2015, a category 2 public meeting occurred at the Three White Flint Building in Rockville, Maryland between the Department of Energy (DOE) staff, National Laboratory staff, and U.S. Nuclear Regulatory Commission (NRC) staff to discuss DOE funded research related to the storage and transportation of used nuclear fuel. Regulatory commitments were not made at the meeting. The list of meeting attendees is Enclosure 1. The discussion followed the agenda provided in Enclosure 2.

Discussion.

DOE stated that, although they were looking at the issue of gas diffusion and mixing, they were still evaluating a path forward and were not prepared to discuss the issue at this time. Next, DOE discussed the selection of "sister rods" for a confirmatory data project. DOE stated that 25 "sister rods" would be shipped from North Anna to the Idaho National Laboratory (INL) in early 2016. Of the 25 "sister rods," nine with M5 cladding had been chosen and placed into a container in the North Anna spent fuel pool. In addition, approximately 14 fuel rods with Zirlo cladding and a variety of fuel rods with Zircaloy-4 cladding had been chosen as potential "sister rods," but they had not been loaded into the container in the North Anna spent fuel pool. To ensure the "sister rods" would accurately reflect the cladding condition of fuel rods loaded into the storage cask for the high burnup storage demonstration project, DOE was working with the shipping cask vendor to verify the vacuum drying operations associated with loading the cask would not alter the hydrogen absorbed by the cladding. DOE intends to heat treat the "sister rods" to replicate, as much as possible, the changes experienced by fuel rods in the high burnup demonstration project storage cask during the loading, drying and storage processes. DOE will then analyze the heat treated "sister rods" to obtain data about changes in material properties during cask loading operations. When the NRC made inquiries about the operational history of the "sister rods," DOE provided the non-proprietary information it had available. When the NRC asked where the "sister rods" would be stored at INL, they were informed a hot cell with an inert

environment would be used. The NRC also inquired about the possibility of obtaining data during transport of the "sister rods" to INL. DOE said obtaining information from the cask internals was not possible, but information from sensors on the cask trailer might be possible.

The high burnup demonstration project storage cask has penetrations through which thermocouples will be inserted. These thermocouples will be used to obtain temperature data inside the cask during storage. DOE wants this information to evaluate the precision of their computer code analysis results as well as to refine both their computer codes and thermal models. Since this information would also be useful to both the NRC and industry for the same reasons, the NRC asked if a copy of the data could possibly be provided. The NRC emphasized that this information would prove useful to applicants seeking renewal of both licenses and certificates of compliance for storing high burnup fuel. The NRC also asked if temperature data would also be obtained during the loading and drying processes as well as storage. DOE replied that, although they had only planned on obtaining temperature data during storage, obtaining temperatures during loading and drying might be possible. Pacific Northwest National Laboratory (PNNL) requested guidance from the NRC on acceptable levels of uncertainty in model development. The NRC responded that acceptable levels of uncertainty varied between the technical disciplines and referred PNNL to publicly available guidance documents. The NRC also commented that extremely large uncertainties could be indicative of problems with the solution method.

Next, DOE discussed strength tests being conducted on various types of fuel cladding. They discussed tests on Boiling Water Reactor Zircaloy-2 fuel cladding as well as Pressurized Water Reactor M5, Zirlo and Zircaloy-4 fuel cladding. DOE reported the tests showed that the fuel cladding behaved as expected, and DOE identified factors such as pellet length, pellet-clad-interaction, burnup, hydride content and fuel rod condition which affected the test results. DOE also stated that, when the tests were performed on fragmented fuel, the fuel did not break apart further. They also stated that, on the few occasions when the fuel cladding failed, very little material was released. On this matter, the NRC pointed out that respirable radioactive material is not visible. Subsequent discussion brought out the fact that rods tested by DOE were not pressurized and this could have an impact on the amount of material released. The NRC asked if fuel with reoriented hydrides had been tested, and DOE responded that such tests had not yet been performed. At this juncture, the meeting was suspended for lunch.

After lunch, the meeting resumed with a discussion of stress corrosion cracking in stainless steel canisters. DOE discussed planned testing of a welded stainless steel canister mockup. The NRC inquired about the information that would be obtained from testing. DOE responded the data would serve either as a benchmark or a validation of models being used. DOE also explained the welds and weld heat affected zones of the mockup could also be used to investigate material sensitization and microstructural changes due to the welding process. The NRC asked if the planned measurements would be used to show that residual stresses present after the welding process was completed were small enough to be considered unimportant. DOE responded that was not the intent of the test, but that the tests might be able to provide information about this. The NRC also asked if the weld data obtained could be applied to the different welding processes utilized by industry. Although this question was briefly discussed, the issue was not resolved. Next, DOE discussed their evaluations of pitting corrosion due to salt deposition. Their data indicated that pitting corrosion was influenced not only by the amount of salt deposited, but also on the type of salt deposited; i.e., marine salt, ammonium salts, ammonium and sodium chloride salt combination, etc. Their current tests utilized mostly ammonium and sodium chloride salts, but DOE was striving to utilize marine salts at realistic temperatures and humidities. When the NRC asked what type of steel was used in the tests,

DOE responded 316L stainless steel was utilized initially, but later, 303 stainless steel was employed because it had a faster reaction rate. The NRC also inquired about the use of data from studies by both the Electric Power Research Institute (EPRI) and Sandia National Laboratory (SNL) on deposition samples obtained from three independent spent fuel storage installations. A response to the questions was deferred because not all of the results had been published.

In their discussion of normal conditions of transport loading, DOE identified that they were proceeding on a dual path. First, they would be performing shaker tests to simulate normal conditions of transport in a laboratory environment. Second, they hoped to obtain actual data on the loads experienced by fuel rods during rail transport of spent fuel casks similar to an earlier study for cask transport by truck. They were preparing requests for quotes on the cost to rent a generic railcar, transport cask and shipping cradle. DOE planned to place dummy fuel rods, loaded with either lead rope or tungsten pellets in order to mimic the weight of uranium dioxide, into the representative transport cask. Strain gauges and accelerometers would be attached to the dummy fuel rods at different locations in order to obtain data. After the business portion of the meeting was concluded, the public was given the opportunity to ask questions. No questions were asked, and the meeting was adjourned.

TAC No. LA0135

Enclosures: 1. Attendees  
2. Agenda

DOE responded 316L stainless steel was utilized initially, but later, 303 stainless steel was employed because it had a faster reaction rate. The NRC also inquired about the use of data from studies by both the Electric Power Research Institute (EPRI) and Sandia National Laboratory (SNL) on deposition samples obtained from three independent spent fuel storage installations. A response to the questions was deferred because not all of the results had been published.

In their discussion of normal conditions of transport loading, DOE identified that they were proceeding on a dual path. First, they would be performing shaker tests to simulate normal conditions of transport in a laboratory environment. Second, they hoped to obtain actual data on the loads experienced by fuel rods during rail transport of spent fuel casks similar to an earlier study for cask transport by truck. They were preparing requests for quotes on the cost to rent a generic railcar, transport cask and shipping cradle. DOE planned to place dummy fuel rods, loaded with either lead rope or tungsten pellets in order to mimic the weight of uranium dioxide, into the representative transport cask. Strain gauges and accelerometers would be attached to the dummy fuel rods at different locations in order to obtain data. After the business portion of the meeting was concluded, the public was given the opportunity to ask questions. No questions were asked, and the meeting was adjourned.

TAC No. LA0135

Enclosures: 1. Attendees  
2. Agenda

Distribution: NRC Attendees           DMarcano  
Filename: G:\SFST\Allen\Part 72\Meeting Summary.docx

**ADAMS P8 Accession No.: ML15082A346**

<b>OFC:</b>	SFM		SFM		SFM	
<b>NAME:</b>	WAllen		WWheatley		MSampson	
<b>DATE:</b>	03/13/15		03/18/15		03/23/15	

C=Without attachment/enclosure E=With attachment/enclosure N=No copy

**OFFICIAL RECORD COPY**

MEETING ATTENDEES

Public Meeting with Department of Energy and National Laboratories to Discuss DOE Funded Research Related to the Storage and Transportation of Used Nuclear Fuel

February 25, 2015

Mark Lombard	NRC	Ned Larson	DOE
Anthony Hsia	NRC	William Boyle	DOE
Michele Sampson	NRC	Kenneth Sorenson	SNL
Meraj Rahimi	NRC	Sylvia Saltstein	SNL
Christian Araguas	NRC	Brady Hanson	PNNL
James Rubenstone	NRC	Steve Marschman	INL
John-Chau Nguyen	NRC	John Scaglione	Oak Ridge National Laboratory
Chris Allen	NRC	Christine Stockman	SNL via teleconference
Robert Einziger	NRC	Yung Liu	Argonne National Laboratory via teleconference
Darrell Dunn	NRC	Mike Billone	Argonne National Laboratory via teleconference
Jorge Solis	NRC	Zenghu Han	Argonne National Laboratory via teleconference
Fon-Chieh (Jimmy) Chang via teleconference	NRC	John Kessler	EPRI
Donald Chung	NRC	Keith Waldrop	EPRI
Shadi Ghayeb	NRC	Kristopher Cummings	Nuclear Energy Institute
Gordon Bjorkman	NRC	Rod McCollum	Nuclear Energy Institute
Yawar Farat	NRC	Kimberly Manzione	Holtec International via teleconference
Jorge Solis	NRC	Ruth Thomas	Public Citizen
John Wise	NRC		

## Agenda

Public Meeting with Department of Energy and National Laboratories to Discuss DOE Funded Research Related to the Storage and Transportation of Used Nuclear Fuel

February 25, 2015  
10:30 AM – 5:00 PM\*\*

10:30 AM- 12:30 PM	Welcome, introductions, and meeting objectives (NRC, DOE, All)  Gas diffusion/mixing in storage systems  Sister rod selection Confirmatory Data Project
12:30 PM- 1:30 PM	Break
1:30 PM- 4:30 PM	Thermocouple data plans for the Confirmatory Data Project  Cyclic Integrated Reversible-bending Fatigue Tester (CIRFT),  SS Canister Stress Corrosion Cracking  Normal Conditions of Transport Loadings
4:30 PM- 5:00 PM	Public comments and wrap up

\*\* Approximate time