December 13, 2013

U.S. Department of Energy
c/o Melissa Bates
1955 Freemont Ave., MS 1235
Idaho Falls, ID 83415

SUBJECT: DRAFT TEST PLAN FOR THE HIGH BURNUP DRY STORAGE CASK RESEARCH AND DEVELOPMENT PROJECT

Dear Ms. Bates:

On November 12, 2013, the U.S. Department of Energy (DOE) published an invitation for public comment on its "Draft Test Plan for the High Burnup Dry Storage Cask Research and Development Project" in the *Federal Register* (78 FR 67348). This letter provides the comments from the U.S. Nuclear Regulatory Commission (NRC) staff on the draft test plan that were sent by e-mail to you on December 12, 2013.

The NRC staff supports the overall goals of this project to address technical gaps regarding long term storage of spent high burnup nuclear fuel, and agrees that the results can contribute to confirming the models and assumptions used to predict behavior of such fuel during dry storage. The project can provide a test bed for determining if unforeseen and unexpected degradation mechanisms are active under normal conditions of dry storage. The information acquired in this project may also be useful to applicants for dry storage licenses and certificates of compliance to confirm their assertions regarding the safety of long term dry cask storage, and is also the focus of NRC's draft Interim Staff Guidance document, ISG-24. This ISG, which the NRC intends to issue, provides guidance to NRC staff to whether a demonstration of high burnup fuel has the necessary properties to qualify as one method an applicant may use to demonstrate compliance with applicable NRC requirements.

The NRC staff has identified several areas in which the test plan and project can be improved. The staff's concerns address three general topics:

(1) The background discussion in the test plan may incorrectly suggest that information now available is insufficient to support dry storage of spent nuclear fuel in the near term. The NRC believes information is available to support safe dry storage for extended periods.

(2) The extent and diversity of monitoring information outlined in the current plan may be less than optimal or less than is necessary to adequately confirm application safety positions.

(3) The level of detail on project implementation in the current plan appears to be too limited.

The enclosure to this letter provides more detailed staff comments in these areas as well as others.

The NRC staff appreciates DOE's efforts in soliciting public comments on the test plan, and encourages DOE to provide further opportunity to discuss the proposed project and the test plan in a public meeting in the near future so more detailed comments can be discussed.

Sincerely,

/RA/

Mark Lombard, Director
Division of Spent Fuel Storage
and Transportation
Office of Nuclear Material Safety
and Safeguards

Enclosure: Comments on the "High Burnup
Dry Storage Cask Research and
Development Project Draft Test Plan"

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Enclosure: Comments on the "High Burnup
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NRC Staff Comments on the "Draft Test Plan for the High Burnup Dry Storage Cask Research and Development Project," *Federal Register* Volume 78, p. 67348, November 12, 2013

While some general and specific comments are provided herein, the comments below are not intended to serve as U.S. Nuclear Regulatory Commission's (NRC) comprehensive assessment of the test plan, but rather to provide supporting examples from the test plan in the areas that the U.S. Nuclear Regulatory Commission (NRC) staff has identified for improvement.

NRC comments on the draft test plan are as follows:

1. The draft test plan may incorrectly suggest that information now available is insufficient to support dry storage of spent nuclear fuel (SNF) in the near term.

   Table 2-1 indicates a number of high priority gaps that the demonstration could fill. Page 2-1 states, "At present, the technical bases for very long term (beyond 60 years) wet and dry storage of high burnup SNF have not been firmly established." Section 3.6, along with Tables 3-2 and 3-3, have extensive discussions of additional work that is needed to support the project and fill gaps in multiple needs reports. This suggests that there is not sufficient information and that much more work needs to be done before long term dry storage of spent fuel can be accomplished. The NRC firmly believes this is not the case as sufficient evidence now exists that long term safe storage of spent nuclear fuel is possible, and that information gained through the demonstration project and other means will provide further confirmation of this fact.

   The purpose of the demonstration project should be to confirm, as stated above, that storage is proceeding as expected. The demonstration should also verify that nothing unexpected has occurred to effect safety of the next storage renewal period of up to 40 years.

   The NRC staff suggests that:

   a. The title of the document be changed to, "Draft Test Plan for the High Burnup Fuel Performance Confirmation Project."

   b. Table 2-1 and the sentence above from page 2-1 be removed or be restated in a manner that more accurately reflects the current situation.

   c. Section 3.6, along with Tables 3-2 and 3-3, be removed and replaced with the simple statement that additional work is required to relate the results of the demonstration to other fuel types, storage systems, and storage conditions.

2. The extent and diversity of monitoring information outlined in the current plan may be less than optimal.

   The project could provide a wider array of information in a timelier manner by expanding what is monitored to determine degradation in real time. This test plan proposes only temperature monitoring over the duration of storage. Gas sampling analysis for fission gases, hydrogen, oxygen, and moisture are planned to be conducted only for the first

few weeks after loading, then possibly at the end stage before shipment. The justification for this schedule is that all the effects of drying will occur in the first few weeks and that once the interior of the cask is dry; there is no mechanism for degradation of the fuel rods. This approach to gas monitoring significantly limits the potential value of this project, and may not address the gap of 'incipient' failure of cladding listed in Table 2-1.

For example:

a. The demonstration should determine if there are any effects on the fuel rods or hydrogen buildup in the cask from radiolysis of bound water that is not removed during the drying process.

b. If a cladding breach were to occur, the time of occurrence would be unknown. Rod failures could be detected in real time with frequent gas monitoring, or at least found within certain time frames with periodic gas monitoring. If no cladding failures occurred, an argument might be made that there is no need to open the cask at 10 years, and the demonstration could continue for a longer period of time.

c. This demonstration program is designed to provide confirmatory and supporting information for current and future license renewal applications. Without gas monitoring, it will be difficult for applicants to utilize the results of the program for this purpose until the cask is transported, unloaded, and the rods are examined. Other methods may have to be used by the applicants. With gas analysis during the storage period, conclusions can be drawn on the behavior of the rods. If the applicant uses gas analysis to establish the fuel condition as part of their application, the interior of a demonstration canister or cask should at least be monitored for moisture, oxygen, and fission gas. Gas monitoring duration and frequency should be determined by analysis of the potential degradation. Gases should always be sampled before opening the canister. If the applicant claims that no galvanic degradation is feasible, yet moisture is detected in the canister after drying, moisture and hydrogen (H_2) should be monitored. The frequency of monitoring should be determined by the applicant until the moisture disappears. Gas monitoring is not expected during movement of the canister. The applicant must conduct gas analysis before and after transport if using gas analysis to show no breaches occur during transport.

d. The major purpose of this demonstration is to confirm the models that, based on short term data, predict no cladding failures will occur. Confirmation that failures do not occur is a desired result; it is not the starting assumption.

3. The level of detail on project implementation in the current plan appears to be too limited

A more complete test plan would describe and discuss many of the operational features of the project in greater detail, rather than just providing generalities. While the draft test plan explains why the project is being done and what other tests are needed, it includes relatively little detail of the actual demonstration. For example:

a. Which assemblies would be used? Where would they be placed? Where would the thermocouples be placed?

b. How would the thermocouple placement support the desired information gathering?

c. How will the thermocouples be sealed to the cask lid?

d. What strategies will be used for diversity of instrumentation to increase assurance that data will continue to be gathered throughout the demonstration period with exposure to radiation and temperatures inside the cask?

In contrast, the discussion of the characterization of the sister rods, and eventually of the test rods, is much more developed and thorough.

4. Additional comments are:

a. If the purpose of the sister rods is to establish pre-dried baseline characteristics, the process for drying sister rods should keep them at a temperature as close to the pool temperature as possible and not above the temperatures seen when the rods in the demonstration cask are dried.

b. Section 3.3.2 – how will it be determined from temperature monitoring what fraction, if any, will be prone to hydride reorientation?

c. What Quality Assurance Program will the work be performed under?

d. How will the demonstration project data be integrated or combined with theoretical results to draw conclusions on the characteristics of high burnup fuel in long term storage?