

**UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION**

Before the Atomic Safety and Licensing Board

In the Matter of)		
)	Docket No.	72-10-ISFSI-2
Northern States Power Co.)		
)		
(Prairie Island Nuclear Generating Plant,)	ASLBP No.	12-922-01 ISFSI-MLR
Independent Spent Fuel Storage Installation)))		BRD01

DECLARATION OF JOHN T. GREEVES

1. My name is John T. Greeves. I am currently an environmental and regulatory consultant. The Prairie Island Indian Community in the State of Minnesota has retained me as a consultant with respect to the above-captioned proceeding. I hold a Bachelor of Science in Civil Engineering from the University of Maryland. I have also engaged in graduate studies in groundwater analysis at the University of Maryland and business management at Golden State University.

2. I have forty years of nuclear safety experience, including: senior level management of licensing, inspection, construction and regulation development applied to management and disposal of low level and high-level nuclear waste, including the management of spent fuel storage; licensing of nuclear fuel cycle facilities; and siting, design, construction and decommissioning of nuclear reactors.

3. My activities and experiences include managing and participating in:
- a. Development of the NRC's regulatory program for disposal of spent fuel and high-level waste, including regulation development and interactions with US DOE; principal manager in charge of the Yucca Mountain Project and development of the NRC's high-level waste disposal regulation, 10 CFR Part 63;
 - b. Development of the NRC's activities required under the Low-Level Radioactive Waste policy Amendments Act of 1985, including development of NRC's Standard Review Plan for LLW license applications;

- c. Development of the NRC's decommissioning program for complex facilities including nuclear reactors, large materials facilities, both Title I (DOE) and Title II commercial uranium recovery mill tailings sites; and
- d. Coordination with federal and state representatives under the West Valley Demonstration Act (WVDA), regarding removal of high level waste and decontamination and decommissioning of the site.

4. I retired from the United States Nuclear Regulatory Commission (NRC) in 2004 after 30 years of Federal Service. Since 2004, I have been a consultant to industry and government entities on environmental risk management and regulatory issues, including as a subject matter expert consultant for the United States Department of Energy (DOE). Since 2012, I have provided consultation on matters related to design, licensing, siting, and transportation of spent fuel.

5. My career at the NRC included a broad range of positions of increasing responsibility covering most aspects of the NRC's program for licensing, inspection, and regulation to assure safety and quality associated with the management, treatment, and commercial disposal of low-level nuclear waste (LLW), high level waste disposal (HLW) and material facility and power reactor decommissioning.

6. From 1995 until my retirement in 2004, I served as the NRC's Director of Division of Waste Management and Environmental Protection. In that position, I directed the NRC's program for licensing, inspection, and regulation to assure safety and quality associated with the management, treatment, and commercial disposal of LLW, HLW and material facility and power reactor decommissioning. I developed, implemented, and evaluated safety and environmental policies and long-range goals for these activities. I was responsible for developing the regulations and NRC staff review plans for the Yucca Mountain project and the NRC staff review plans for complex decommissioning activities including Nuclear Reactors.

These responsibilities included determining whether license applications met regulatory requirements.

7. From 1993-1995, I served as the Director of Division of Low Level Waste Management and Decommissioning. In that position, I directed the NRC's waste management program for licensing, inspection, and regulation to assure safety for medical, industrial and fuel cycle regulated facilities. I also developed and implemented safety and inspection policies and long-range goals for these activities.

8. From 1987-1993, I directed the NRC's program for licensing, inspection, and regulation to assure safety and quality associated with the management, treatment, and commercial disposal of LLW, Uranium Recovery (UR) mill tailings sites remediation, material facility and power reactor decommissioning. I coordinated within NRC so that consistent criteria were developed for acceptable radioactive waste disposal, UR activities, and decommissioning.

9. From 1980-87, as manager of the NRC's Engineering Branch, I was responsible for all engineering support for both the High Level Waste Program and the Low Level Waste programs required by the Low Level Waste Amendments Act of 1985 and the Nuclear Waste Policy Act of 1982. I was responsible for developing, implementing, and evaluating safety and environmental policies and long-range goals for these activities.

10. From 1974-1980, I conducted NRC's civil engineering reviews of new applications for construction of nuclear power plants and conducted inspections of existing power plants and plants under construction.

11. Prior to joining the AEC/NRC in 1974, I worked for Bechtel Power Corporation on the design and construction of nuclear power plants, dams and other large construction projects.

12. I have also served on a number of national and international panels regarding waste management activities. I Co-Chaired the U.S. Interagency Steering Committee on Radiation Standards (ISCORS) from 1995 to 2004. I was the U.S. Government's representative to the IAEA Waste Safety Standards Committee (WASSC), and have participated extensively in the development of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management. I served as the NRC management representative to the first Joint Convention review meeting in Vienna Austria (November 2003). I have also consulted for numerous foreign governments including: Canada, France, Japan, Romania, Ukraine, Russia, China, Spain, Italy, United Kingdom, Germany, South Africa, Philippines and Mexico.

13. I have reviewed Northern States Power Company, a Minnesota Corporation, d/b/a Xcel Energy's ("NSPM") application for renewal of its license to operate the Prairie Island Independent Spent Fuel Storage Installation ("PI ISFSI"). In my opinion, and as I explain more fully below, NSPM has failed to adequately address and provide for the safe performance of spent fuel, particularly the high burn-up spent fuel, under the longer term, up to 40 years, dry storage conditions that are proposed in the license renewal application. The potential effects of longer term storage on high burnup spent fuel ("HBF") storage performance are uncertain and must be better understood and predicted before storage for a period beyond 20 years is authorized.

14. NSPM's application does not demonstrate that structures, systems, and components important to safety will continue to perform their intended function for the requested 40 year period of extended operation.

15. Compliance with the temperature limits listed in Interim Staff Guidance 11 (“ISG-11”) will not necessarily prevent degradation due to cladding creep and hydriding. There is no guarantee that compliance with ISG-11 will prevent degradation during any period of HBF storage. I note that ISG-11 is not a regulation. NRC staff established ISG-11, Rev. 3, over a decade ago in 2003. At that time, renewal periods were limited to 20 years. Staff expected that spent fuel would be transferred timely to Yucca Mountain for disposal. Forty year renewal periods for HBF were not considered. NRC staff recently indicated that ISG-11 was based on low burnup fuel (“LBF”) demonstrations. *See* Meeting Transcript of Metallurgy and Reactor Fuels Subcommittee, Advisory Committee on Reactor Safeguards, U.S. Nuclear Regulatory Commission (Apr. 8, 2015) (Enclosure 1) at 114, lines 8-9. The guidance contained in ISG-11, Rev. 3 was based on short term laboratory tests and analysis that may not be applicable to the storage of HBF. ISG-11 also was predicated on storage being dry. Robert Einziger from the U.S. Nuclear Waste Technical Review Board (NWTRB) stated “there has been no experimental evidence confirming that the drying criteria actually gets the cask dry.” Enclosure 1 at 135, lines 21-24. He continued: “If it’s not dry then there [are] other mechanisms of degradation that one has to at least analyze and take into consideration.” Enclosure 1 at 137, lines 16-18.

16. NSPM is attempting to rely on a speculative research plan through the proposed Department of Energy Cask Demonstration Project (“Demonstration Project”) that does not provide adequate assurance that the research can be conducted technically, within permitted constraints and in a timely manner. The NRC staff referred to some activities as “experiments” in a recent ACRS meeting. Enclosure 1 at 130, line 12; 269, slide 8; 274, slide 13. There are a number of barriers to completing the needed research that require additional licensing, funding, construction, instrumentation, and settlement negotiations with states.

17. The proposed high burnup Demonstration Project, to be conducted by the Electric Power Research Institute (EPRI), is aimed to better understand the effects of HBF aging on dry storage cask systems and to support DOE's ongoing research and development to advance understanding of the long-term aging of spent fuel. There is a need for this demonstration and associated documentation.

18. In its draft ISG-24, NRC staff recognized that a confirmatory basis, which includes documenting information over a similar length of time available for low burnup, does not exist for HBF. *See* Draft Interim Staff Guidance-24, Rev. 0, at 1 (Adams Accession # ML13056A516) (Enclosure 2) at 1, ¶ 4, lines 1-2. Staff noted in draft ISG-24 that data supporting readily retrievable storage of HBF beyond 20 years is not presently available for the time periods used to support retrievability and storage of LBF. *Id.* These statements were deleted from the final version of the guidance without adequate explanation.

19. By embracing NSPM's reliance on the Demonstration Project, NRC staff would be relying on a licensee commitment to obtain data from a surrogate research program on HBF that is not yet designed or licensed to assure retrievability of HBF durations beyond 20 years. Without data on HBF over an adequate length of time (as is available for LBF), adequate assurance for retrievability of HBF does not exist.

20. NSPM's HBF Aging Management Program ("AMP") discussion is not adequate to demonstrate that structures, systems, and components important to safety will continue to perform their intended function for the requested 40 year period. There are a number of difficulties in demonstrating that HBF will continue to perform its intended function for the requested 40 year period. The recent Advisory Committee on Reactor Safeguards meeting highlighted these issues. There are a number of statements by NRC staff that indicate the staff

does not know how it is going to inspect, enforce, and implement the industry proposed “Toll Gate” approach. Enclosure 1 at 62/line 9; 101, lines 7-12; 174, lines 9-16.

21. NSPM’s AMP contains a series of “Toll Gates,” but I have significant doubt that all the necessary formal evaluations of data will be performed at the times specified by the toll gates. In addition, there is nothing in the industry toll gate proposal that addresses the quality, standard, or thoroughness of the NRC toll gate assessment.

22. The NRC has stated that it needs to obtain clear acceptance criteria and clear guidance for its regional inspectors as well as other inspectors in order to ensure adequate observation of activities. Enclosure 1 at 174, lines 9-16. The NRC has acknowledged it is in the “infancy” of developing this material. *Id.* A “Toll Gate” approach is not an acceptable substitute for a formal license review under these circumstances. It is speculative as to whether data will be available at the proposed “Toll Gates” to demonstrate that structures, systems, and components important to safety continue to perform their intended function for NSPM’s requested 40 year period of extended storage.

23. ACRS Committee member Gordon R. Skillman suggested that there really ought to be a “hard stop” for the first tollgate. Enclosure 1 at 163, line 2. I agree there should be a hard stop and a renewal review should be conducted. Under these speculative conditions, the learning AMP/toll gate approach is no substitute for the rigorous evaluation required under a license renewal review.

24. Addressing the AMP criterion in NUREG–1927 (March 2011) does not ensure the safety and ready retrieval of HBF during storage up to 40 years. NUREG–1927 was not developed to support license renewal periods beyond 20 years. NUREG-1927 is also currently under significant revision and has not been published for public review. NRC staff determined a

need to update guidance after a review of current applications revealed inadequate aging management reviews, lack of detail in AMPs, and insufficient guidance. Enclosure 1 at 227-38, 262-276; Ricardo Torres, “NUREG-1927, Rev. 1 Standard Review Plan for Renewal of 10 CFR 72 Specific Licenses and Certificates of Compliance,” Division of Spent Fuel Management, U.S. Nuclear Regulatory Commission, Regulatory Conference (November 2014) (Enclosure 8). Revisions are likely to address the potential degradation of HBF due to aging during storage, subsequent handling, and transportation. As acknowledged by NRC staff, guidance with respect to storage of HBF remains in its early stages. Enclosure 1 at 174, lines 9-16. A number of NRC guidance documents are still in preparation, including: 1) Responding to Industry Proposals (NEI 14-03); 2) revisions to NUREG 1927; 3) Issue a final HBF Regulatory Issue Summary (RIS); 4) Issue HBF Consequence Analyses; 5) Complete technical report on monitoring of dry cask storage systems (DCSS); 6) Complete a technical report on stress analysis of fuel cladding in DCSS and 7) Engagement of ASME Code Committee on Renewal licensing. Enclosure 1 at 227-38, 262-276; Enclosure 8. In fact, the NRC Learning AMP on HBF does not contain consensus based standards, criteria, or references such as those used in other AMPs (e.g., Concrete Degradation and Stress Corrosion Cracking).

25. The Demonstration Project plan is not sufficient to gather data to confirm compliance with ISG-11 for more than 20 years and monitor the condition of the loaded fuel. In order to proceed with the Demonstration Project, the TN-32 lid will have to be modified under NRC license conditions to allow insertion of temperature probes inside the cask, and cask cavity gas samples will have to be obtained. Researchers must examine some representative spent fuel rods before test fuel rods are placed in the cask to determine the changes that occur over long-term storage. As noted in the test plans, after storage for a decade, the cask and HBF will have

to be shipped offsite for detailed examination. There are no facilities currently available for such examinations. The license for the North Anna Power Station must be amended to permit loading of high burnup fuel in a TN-32 bolted lid cask. The license must also include requirements to avoid unmonitored release of radionuclides into the atmosphere. No license application has been filed to my knowledge.

26. Furthermore, there is no guarantee that the gas sampling necessary to gather data can be performed safely. Obtaining samples will be difficult once the cask has been moved onto the ISFSI pad. EPRI has stated it will continue to investigate and evaluate methods for performing gas sampling for the storage period. Nonetheless, there is no guarantee that sampling methods can be licensed, funded, and deployed without creating undue risk. Obtaining intended data from the Demonstration Project is entirely conditional. This is a hope and not a fact, as recognized by ACRS member Ronald G. Ballinger when he remarked that “the wish is not always the deed.” Enclosure 1 at 63, lines 24-25.

27. The Demonstration Project does not contain specific regulatory requirements or criteria. It proposes (1) monitoring of the interior of the cask for various gases, moisture, and oxygen; and (2) taking periodic samples throughout the storage period. Reporting cavity gas pressure or gas sampling on a quarterly basis is not included in the EPRI’s test plan. *See* High Burnup Dry Storage Cask Research and Development Project, Final Test Plan, Electric Power Research Institute (Contract No.: DE-NE-0000593), February 27, 2014 (NSPM Enclosure 4 to Terry A. Pickens Declaration).

28. NRC staff has acknowledged the difficulty of implementing a research program in a sealed system such as the one proposed for the Demonstration Project. *See* Alexander Velazquez-Lozada, “Extended Storage & Beyond,” Presentation at U.S. Nuclear Regulatory

Commission INMM Spent Fuel Seminar 2015 (January 13, 2015) (Enclosure 3). The NRC has neither approved nor reviewed processes for safely monitoring fuel temperature, moisture, or gas composition, under the proposed conditions of the Demonstration Project.

29. NSP proposes that the Demonstration Project cask will remain in storage at the North Anna ISFSI for at least ten years before being transported to some facility capable of handling the HBF in dry conditions for necessary testing. This is a proposal and not a fact. It is based on a speculative, currently unsettled and necessarily evolving research plan that does not provide adequate assurance that the research can be timely conducted in a technically acceptable manner and adequately inspected and documented within permitted constraints. The Federal Government identified the need for such a HBF program over a decade ago and it still has not been implemented. *See* M. A. McKinnon & M. E. Cunningham, United States Department of Energy, Dry Storage Demonstration for High Burnup Spent Nuclear Fuel—Feasibility Study (August 2003) (Enclosure 4) at v. There are a number of unresolved barriers to completing the research proposed in the Demonstration Project that require additional licensing, funding, construction, instrumentation, and settlement negotiations with states.

30. The physical examination of the HBF cladding that will be required to obtain relevant data will be very difficult given the lack of any research facility that can accept the proposed storage configuration for testing and evaluation similar to that which was done for LBF. *See* Dry Cask Storage Characterization Project-Phase 1: CASTOR V/21 Cask Opening and Examination, at 1 (September 2001) (ADAMS Accession. No. ML013020363). A federal facility at the Idaho National Laboratory is being assessed for the capability to handle the Demonstration Project casks, but feasibility studies and conceptual design studies have not been completed and federal funding has not been authorized. Further, the United States Government

is not in compliance with the 1995 Settlement Agreement for waste removal at the Idaho site. *See* Settlement Agreement regarding Spent Nuclear Fuel between State of Idaho, the U.S. Dep't of Energy, and the U.S. Dep't of the Navy (Oct. 17, 1995) (Enclosure 5); Letter from Ernest J. Moniz, United States Secretary of Energy, to C.L. "Butch" Otter, Governor of Idaho (Dec. 31, 2014) (Enclosure 6); Letter from C.L. "Butch" Otter, Governor of Idaho, to Ernest J. Moniz, United States Secretary of Energy (Jan. 8, 2015) (Enclosure 7). As a result, the United States Government must renegotiate a difficult consent agreement with the state of Idaho before it will be permitted to send Demonstration Project casks to the Idaho site. Permits to transfer such fuel to Idaho have not been secured to my knowledge and obtaining such permits will be difficult considering the limits under the current consent agreement. There is no assurance that physical examination of the HBF and, as a corollary, the Demonstration Project as a whole, can be conducted as planned.

31. NRC staff approved the Calvert Cliffs Nuclear Power Plant ISFSI renewed license, which includes a high burnup AMP that relies on the Demonstration Project. However, the storage system at Calvert Cliffs is materially different from the system at the PI ISFSI. The Calvert cliffs HBF Dry Storage Canisters (DSCs) are loaded in horizontal storage modules, include different cladding, and have different histories. The HBF issues raised herein apparently were not specifically investigated in the Calvert Cliffs renewal.

32. NSPM has failed to adequately address and provide for the safe performance of spent fuel, particularly the high burnup spent fuel, under the longer term (up to 40 additional years) dry storage conditions that are proposed in this license renewal application. NSPM has not demonstrated minimization of post-operational safety problems with respect to the removal of HBF from storage after 40 years. NSP has not demonstrated that that HBF storage can be

designed to allow ready retrieval of the spent fuel from the storage system for further processing or disposal. The potential effects of longer term storage on HBF storage performance is uncertain and must be better understood and demonstrated before storage beyond 20 years is authorized.

33. The basis that LBF (≤ 45 GWd/MTU) will maintain its integrity in dry cask storage over extended time periods was provided in NUREG/CR-6745, and NUREG/CR-6831. A confirmatory basis, which includes information over a similar length of the time available for LBF, does not exist for HBF. Enclosure 2 at 1, ¶ 4, lines 1-2.

I declare under penalty of perjury that the foregoing is true and correct.

Executed this 27th day of April, 2015, at Frederick, Maryland.

/Executed by John T. Greeves in Accord with 10 C.F.R. 2.304(d)/

John T. Greeves
209 Rockwell Terrace
Frederick, MD 21701
Phone: 301-452-3511
Email: greevesj@aol.com

State of Maryland
County of Frederick