STATE OF VERMONT

PUBLIC SERVICE BOARD

Petition of Entergy Nuclear Vermont Yankee, LLC, and Entergy Nuclear Operations, Inc., for amendment of their certificates of public good and other approvals required under 10 V.S.A. §§ 6501-6504 and 30 V.S.A. §§ 231(a), 248 & 254, for authority to continue after March 21, 2012, operation of the Vermont Yankee Nuclear Power Station, including the storage of spent-nuclear fuel	)	Docket No. 7440

SUMMARY OF PREFILED TESTIMONY OF DR. RICHARD K. LESTER RESPONDING TO THE DEPARTMENT OF PUBLIC SERVICE'S PUBLIC-ENGAGEMENT REPORT

Dr. Lester responds to Department of Public Service witness Mullett's testimony on the period during which spent fuel will be on-site at the Vermont Yankee Nuclear Power Station (the "VY Station") as well as Entergy VY's responsibility for spent-fuel management. Dr. Lester addresses the federal government's unqualified obligation to take title to and store spent fuel, the view of the MIT report he co-authored that this responsibility should be fulfilled by centralized, interim storage facilities and the long-term capability of dry-cask-storage technology to store spent fuel at the VY Station and at such facilities.

STATE OF VERMONT

PUBLIC SERVICE BOARD

Petition of Entergy Nuclear Vermont Yankee, LLC, and Entergy Nuclear Operations, Inc., for amendment of their certificates of public good and other approvals required under 10 V.S.A. §§ 6501-6504 and 30 V.S.A. §§ 231(a), 248 & 254, for authority to continue after March 21, 2012, operation of the Vermont Yankee Nuclear Power Station, including the storage of spent-nuclear fuel	)))))))	Docket No. 7440

PREFILED TESTIMONY OF DR. RICHARD K. LESTER RESPONDING TO THE DEPARTMENT OF PUBLIC SERVICE'S PUBLIC-ENGAGEMENT REPORT

I. INTRODUCTION AND OVERVIEW

Q1. State your name and occupation.

A1. Richard K. Lester.

Q2. Are you the same Richard K. Lester who prefiled testimony for Entergy VY in this docket?

A2. Yes.

Q3. What is the purpose of your testimony?

A3. Entergy VY has asked me to respond to the prefiled testimony of Mr. Michael A. Mullett, filed on November 14, 2008, on spent-fuel management. Specifically, I will address the federal government's responsibilities for ownership, storage and disposal of spent-nuclear fuel and my view, as documented in an MIT report, on the need to develop consolidated, interim storage facilities to enable the federal government to fulfill its obligations. Also,

I will address dry-cask storage, which can contain spent-nuclear fuel securely for many decades and potentially for much longer.

II. RESPONSIBILITY FOR SPENT-NUCLEAR FUEL

Q4. Who owns and is responsible for the disposal of spent-nuclear fuel?

A4. Under the Atomic Energy Act, as amended, responsibility for final disposition of spent fuel (or reprocessed, high-level waste) lies with the federal government. This responsibility was re-affirmed in the Nuclear Waste Policy Act of 1982 (or "NWPA"), the first comprehensive piece of federal legislation to address the issue of high-level waste disposal and has since repeatedly been re-affirmed in federal statutes, regulations and presidential policy statements.

The NWPA also established a mechanism by which nuclear utilities pay the proceeds from a user fee, set initially at one tenth of one cent per kilowatt-hour of nuclear-generated electricity, into a Treasury account (the Nuclear Waste Fund) to cover the costs of final, high-level-waste-disposal facilities as well as monitored, retrievable storage and test and evaluation facilities to be constructed by the federal government.

The Act further authorized the Department of Energy (or "DOE") to enter into contracts with nuclear utilities for the acceptance and disposal of their spent fuel. Under the terms of the Standard Contracts that were subsequently executed with all of the nation's nuclear utilities, the DOE, in return for the contract-holder's payments into the Nuclear Waste

Fund, agreed to take title to and dispose of the contract-holder's spent fuel as promptly as possible once a nuclear-waste repository was operational, beginning no later than 1998. This date was based on the expectation of when the nation's first repository would be operating. The NWPA further stipulated that primary responsibility for managing the spent fuel at commercial nuclear-power sites would rest with nuclear-plant owners and operators.

Q5. Why hasn't the DOE removed the spent-nuclear fuel from the nuclear plants?

A5. The subsequent delays in establishing a geologic, high-level-waste repository at Yucca Mountain meant that the DOE did not perform its contractual obligation to begin removing spent fuel from power-reactor sites in 1998. Nearly 70 lawsuits have since been filed by utilities against the U.S. Government, claiming damages associated with the unmet contractual obligations. DOE officials have estimated the federal government's potential liability at about $7 billion, assuming that the Yucca Mountain repository were to begin operation in 2017.

Q6. In the worst-case scenario, what if the Yucca Mountain project does not go forward?

A6. If the Yucca Mountain project does not go forward, DOE will need an alternative strategy that will enable it to fulfill its statutory mandate to provide for the disposal of all commercial and DOE spent fuel and high-level waste as well as its contractual obligations to take title to commercial spent fuel and transfer it from commercial, nuclear-power sites.

An important intermediate strategy will be to develop federal facilities for centralized, interim storage of significant quantities of spent fuel over an extended period. Such facilities, which from a technical perspective could be operational in ten to fifteen years, will be necessary if the DOE is to limit its exposure to rapidly mounting damage claims from utilities under the Standard Contracts.

By enabling DOE to take title to commercial spent fuel, such facilities may also effectively allow nuclear-power utilities to decouple their operations from the long-term, spent-fuel-management concern and hence remove a potential obstacle to the siting of new nuclear-power plants. Congressional appropriations committees have recently called for the establishment of consolidated, spent-fuel-storage facilities for these and other reasons.[1]

In fact, most spent fuel that is destined for final disposal will as a practical matter be stored above ground for several decades. While storage at reactor sites will be feasible for some of this spent fuel even over a period of several decades, in other cases centralized storage facilities will be needed. In its 2003 report, the MIT study group on the Future of Nuclear Power called for the replacement of the current, *ad hoc* approach to

[1] See H.R. Rep. no. 109-474 at 103-104 (2006) (accompanying Energy and Water Development Appropriations Bill, 2007); S. Rep. no. 109-274 at 126-127 (2006) (accompanying Energy and Water Development Appropriations Bill, 2007).

storage of spent fuel at reactor sites with a national network of centralized facilities for storing spent fuel for several decades.[2] Such a strategy would, according to the report:

* provide greater flexibility in the event of delays in repository development;
* allow a deliberate approach to disposal and create opportunities to benefit from future advances in relevant science and technology;
* provide greater logistical flexibility, with centralized buffer storage capacity facilitating the balancing of short and long-term storage requirements, and enabling the optimization of logistics, pre-processing, and packaging operations;
* create additional flexibility in repository design, since the spent fuel would be older and cooler at the time of emplacement in the repository; and
* potentially reduce the total number of repositories required.

A further reason for creating centralized storage facilities is to keep open the option to reprocess spent fuel at a later date, without actually having to reprocess now.

Q7. Mr. Mullett has expressed concern in his testimony about funding issues connected to the management of spent fuel generated by the Vermont Yankee Nuclear Power Station (or "VY Station") in light of DOE's failure to meet its statutory and contractual obligations

[2] *The Future of Nuclear Power*, Massachusetts Institute of Technology (2003) (see Exhibit EN-RKL-1 for an Executive Summary excerpt from this study).

and the associated uncertainties regarding the disposal of spent-nuclear waste. How do you respond to those concerns?

A7. I have not conducted an analysis of Entergy VY's plans or funding sources for the interim storage of spent-nuclear fuel, as that subject is within the knowledge and expertise of other Entergy VY witnesses. What I can say is that the ultimate responsibility for storage and disposal of spent nuclear fuel rests with the federal government, both through on-going oversight by the Nuclear Regulatory Commission of the operations and financial capabilities of commercial-nuclear operators such as Entergy VY and, as addressed previously in my testimony, the legal obligation of the DOE to accept and dispose of high-level nuclear wastes. In other words, I cannot conceive of a scenario under the present regulatory scheme in which the State of Vermont or local governments in Vermont would have any liability or responsibility for the storage or disposal of spent-nuclear fuel generated at the VY Station.

III. Containment of Spent Fuel in Dry Cask Storage

Q8. Mr. Mullet testifies that "most commercial spent fuel is being stored in steel-lined, water-filled pools below ground-level at the site of the generating reactor. However, a smaller but increasing amount of spent fuel is being stored in heavy, thick-walled metal or concrete casks above-ground on pads at reactor sites." Briefly explain your understanding of these two types of storage.

A8. Before explaining, I would like to clarify that it is my understanding that the VY Station water-filled pool is above-ground.

When spent-fuel assemblies are discharged from a power reactor, the high heat-generation rate requires that they be stored in water-filled pools adjacent to the reactor vessel. Most commercial spent fuel in the U.S. remains in pool storage today. After several years of pool storage, however, the heat-generation rate has decayed to the point that the assemblies can be transferred to air-cooled dry casks.

Federal consolidated, spent-fuel-storage facilities will likely use the same basic dry-cask-storage technology as is used today at nuclear-reactor sites. The fuel assemblies are stored in massive cylindrical casks made of either reinforced concrete or metal.

Q9. Describe the containment of spent fuel in dry-storage casks.

A9. The radiation shielding provided by the thick walls of the cask reduces the surface dose rate, and the casks are designed to withstand credible accidents, security threats or natural disturbances without releasing radionuclides.[3]

Spent fuel is loaded into multi-purpose canisters which are then placed into concrete overpacks to provide additional shielding. The multi-purpose canister is sealed in the handling facility and loaded into its concrete overpack and is then transported to its field-storage location where it is placed onto a reinforced concrete pad. The casks are designed

[3] I should make clear that although I am familiar with the Holtec HI-STORM 100 system used by the VY Station to store its spent fuel, I am speaking generally about the use and capabilities of dry-cask-storage systems. I understand that other Entergy VY witnesses can more directly address the capabilities of the Holtec HI-STORM 100 system.

to ensure that the temperature of the fuel does not rise to a level at which the integrity of the fuel or the fuel cladding would be degraded. In all cases, the cooling mechanisms are passive.

There is a broad consensus within the scientific and technical community that dry casks can contain spent-nuclear fuel securely for many decades and potentially for much longer.[4] A recent report by the American Physical Society concluded that cask replacement could further extend the storage lifetime and hence that "there are no technical barriers to the safe and secure interim storage of spent fuel as long as adequate resources and attention are devoted to maintaining the storage facilities."[5] The cost and effort required for routine monitoring and maintenance of dry-cask-storage facilities is modest. It is also noteworthy that several countries with nuclear-power programs that plan eventually to dispose of their spent fuel in geologic repositories have yet to identify a site plan to store their spent fuel in dry storage facilities for an indeterminate period until the repository is ready.

Q10. What is a reasonable range of time based on which the Board may conclude that DOE will begin to transfer spent fuel off-site?

---

[4] See, for example, US. Nuclear Regulatory Commission, "Waste Confidence Decision Update", *Federal Register*, Vol.73, No.97, p.59551, 9 October 2008; Nuclear Energy Study Group of the American Physical Society, "Consolidated Interim Storage of Commercial Spent Nuclear Fuel: A Technical and Programmatic Assessment", February 2007; MIT Study Group, *The Future of Nuclear Power*, 2003; Keystone Center, Nuclear Power Join Fact-Finding, June 2007.

[5] *Consolidated Interim Storage of Commercial Spent Nuclear Fuel: A Technical and Programmatic Assessment*, Nuclear Energy Study Group of the American Physical Society, APS Discussion Paper, American Physical Society Panel on Public Affairs, February 2007.

A10. I understand that in an earlier docket the Board found that centralized-storage facilities would likely be established to store spent fuel on an interim basis and that it was reasonable to conclude that spent fuel would be removed from the Vermont Yankee Nuclear Power Station by 2082. The DOE does not currently have plans in place for removal of the spent fuel from the VY Station if the Yucca Mountain repository does not go forward. The most likely path in that case is for the Federal government to remove commercial spent fuel to centralized, interim-storage facilities. Also in that case, the government will begin a search for alternative high-level, waste-disposal facilities, as required by statute.

There is no certainty as to when these events might occur, but the date of 2082 for the removal of VY spent fuel appears pessimistic for several reasons. It seems reasonable to assume, as does the Nuclear Regulatory Commission's recent Waste Confidence Decision Update, that a final decision on whether or not the Yucca Mountain repository site can begin accepting waste would be made no later than 2025. If that decision turned out to be negative, and if, furthermore, no action had been taken in the meantime to proceed with the development of federal centralized storage facilities, from a technical perspective it might then be expected to take another ten to fifteen years to establish such facilities. (In part because of the rapidly increasing financial liability that would be faced by the Department of Energy in such a scenario, it seems unlikely that the government would wait so long before moving to create centralized storage capacity.)

The time required to locate, license and construct an alternative, final disposal facility would likely be longer than ten to fifteen years. The estimate of twenty-five to thirty-five years suggested in the Waste Confidence Decision Update seems reasonable, taking into account previous experience as well as the need to establish societal and political acceptance as well as technical feasibility. This in turn implies that in such a scenario a substitute for the Yucca Mountain repository would be ready to begin accepting spent fuel in the 2050-2060 timeframe.

Thus, although there is no certainty as to what will happen if the Yucca Mountain repository does not go forward, it seems likely that even in this case the federal government would transfer the VY fuel off-site well before the 2082 date identified by the Board in the earlier docket.

Finally, it is important to note that even if the transfer did not occur any earlier and the fuel was required to stay on-site until this date, there is a broad scientific consensus that secure storage in dry-cask facilities would be technically straightforward over such a period.

Q11. Does that conclude your testimony?

A11. Yes, at this time.