From: Diane Screnci RI
To: Karl Farrar
Date: 3/16/04 8:04AM
Subject: Fwd: Vermont PSB Order on VY EPU

Diane Screnci
Public Affairs Officer
USNRC, RI
610/337-5330

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From: Rick Ennis
To: A. Randolph Blough; Allen Howe; Anthony McMurtray; Beth Sienel; Brian Holian; Brian Sheron; Cliff Anderson; Darrell Roberts; David Pelton; Donald Florek; Eric Leeds; Hubert J. Miller; Tad Marsh; William Ruland
Date: 3/16/04 5:26AM
Subject: Vermont PSB Order on VY EPU

The Vermont Public Service Board (PSB) issued their order yesterday ruling on the Vermont Yankee EPU amendment request. The PSB ruled in favor of the uprate, however, the approval is based on the condition that the NRC perform an Independednt Safety Assessment (ISA). I've attached a copy of the PSB press release and order that I got off their website. See the last 3 pages of the order for a letter to Chairman Diaz with the specifics regarding the request for an ISA.

Based on the PSB action there are several issues we need to discuss:

[redacted]

Suggest a phone call betweeen HQ and Region I sometime today if possible.

Thanks,

Rick
301-415-1420

CC: Diane Screnci; Linda Portner; Neil Sheehan; Scott Burnell; Thomas Madden

Vermont Public Service Board • 112 State Street, Drawer 20 • Montpelier, VT 05620-2701

BOARD AUTHORIZES UPRATE CONSTRUCTION AT VERMONT YANKEE; CONDITIONS HIGHER OUTPUT ON INDEPENDENT ENGINEERING ASSESSMENT AND FINANCIAL SHIELD

Montpelier, Vermont — March 15, 2004

The Vermont Public Service Board today authorized Entergy Nuclear Vermont Yankee, during Vermont Yankee's next refueling outage (expected in April 2004), to perform physical changes which are designed to allow it to increase power output by up to 20 percent. The Board found that the uprate, with appropriate conditions, would promote the general good of the state by providing additional power to New England's power grid and economic benefits to Vermont. However, several conditions must be met prior to actually increasing power output. In the two most significant of these, the Board (1) requests that the federal Nuclear Regulatory Commission conduct an independent engineering assessment of Vermont Yankee and (2) requires Entergy to provide assurances that ratepayers will be protected from financial harm if output is reduced because Vermont Yankee exhausts its storage capacity more swiftly as a result of the uprate.

Vermont Yankee is the largest generating source in the state of Vermont, producing approximately 510 MW of power. Through a Power Purchase Agreement between Entergy and two Vermont utilities, Green Mountain Power Corporation and Central Vermont Public Service Corporation, Vermont Yankee now provides about one-third of the electric power in the state of Vermont. Entergy, which acquired Vermont Yankee a year and a half ago, sought approval from the Board to increase the power output through what is generally referred to as an "extended power uprate." Entergy would then sell the additional power within the New England wholesale power market.

The Board found that the proposed uprate would benefit the state, if several conditions are met. As proposed, the uprate posed financial risks to Vermont ratepayers that could result in the costs of the uprate exceeding the benefits. In particular, the physical modifications to Vermont Yankee and operation at higher power levels raise the potential for increased outage frequency and duration. Increased outage time, the Board found, could require the Vermont utilities to purchase replacement power at prices that might be in excess of those that they otherwise would have paid for power from Vermont Yankee. These higher costs might be passed on to Vermont ratepayers.

The Board found that a proposed ratepayer protection plan was an important step towards limiting economic harm to Vermonters, but concluded that it was necessary to obtain greater assurances that Vermont Yankee would run reliably. In a letter today, the Board asks the NRC to conduct an independent engineering assessment (augmenting the NRC's upcoming safety analyses) as part of its evaluation of Entergy's proposed uprate.

Vermont Yankee's uprated operation would use fuel faster and, thus, more quickly exhaust its currently authorized capacity to store spent fuel. The Board is requiring Entergy, before operating at increased power levels, to provide assurances that Vermont utilities and ratepayers would be shielded from potentially higher replacement power costs if output is reduced because Vermont Yankee exhausts its storage capacity more swiftly as a result of the uprate.

The Board's Order also accepted, with one modification, a settlement agreement between Entergy and the Department of Public Service under which Entergy agreed to make financial payments to the state. As proposed, the payments would have been directed to three specified funds. The Board concluded that the

payments directly address the statutory standard of "economic benefit to the state." However, based upon its precedents, the Board could not approve the commitment of money to specific funds unless there was a clearer nexus between those funds and either parties directly affected by the proposal, or matters within the Board's jurisdiction. As a result, the Board directed that any such money from Entergy be paid to the state general fund for distribution as determined by the Legislature and the Governor.

Several other important conditions are specified in the Board's decision and summarized in its introduction and ordering clauses.

For more information contact: Susan M. Hudson, Clerk of the Board
(802) 828-2358

STATE OF VERMONT
PUBLIC SERVICE BOARD

Docket No. 6812

Petition of Entergy Nuclear Vermont Yankee, LLC and Entergy Nuclear Operations, Inc., for a certificate of public good to modify certain generation facilities at the Vermont Yankee Nuclear Power Station in order to increase the Station's generation output	)))))	Hearings at Montpelier, Vermont *See Appendix B*

Order entered: 3/15/2004

PRESENT: Michael H. Dworkin, Board Chairman
David C. Coen, Board Member
John D. Burke, Board Member

APPEARANCES: *See Appendix A*

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I. INTRODUCTION

On February 21, 2003, Entergy Nuclear Vermont Yankee, LLC, and Entergy Nuclear Operations, Inc.,[1] requested approval from the Vermont Public Service Board ("Board") to make physical modifications to the Vermont Yankee Nuclear Power Station ("Vermont Yankee" or the "Station"). The proposed modifications would enable Entergy to increase the power output of Vermont Yankee by up to 20 percent, to a total output of approximately 620 MW.[2] On November 5, 2003, Entergy amended its request to also seek approval of a Memorandum of Understanding[3] with the Vermont Department of Public Service ("Department" or "DPS"), under which the Department agrees to support the power uprate and Entergy commits to pay approximately $6 million of payments to the state of Vermont and establish some protection for ratepayers in the event that the uprate reduces the reliability of Vermont Yankee.[4]

The proposal, in essence, anticipates two kinds of approvals: first, to physically make identified engineering changes at the plant; and, second, to later operate the plant at increased power. The first requires approval from this Board, the second requires approval by the federal Nuclear Regulatory Commission ("NRC") and other entities and, as a condition of today's Order, cannot occur before the conditions that we set out below are met. The NRC will conduct a detailed assessment of the safety of Vermont Yankee with the uprate — an area of responsibility

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1. Entergy Nuclear Vermont Yankee is the owner of the Vermont Yankee Nuclear Power Station. Its affiliate, Entergy Nuclear Operations, is the operator. In this Order we refer to them jointly as "Entergy."

2. The modification of a nuclear plant to increase its power output is generally referred to as a "power uprate."

3. The Memorandum of Understanding ("MOU") was entered into the record as exhibit DPS-WKS-12. Our citations refer to it as the MOU, rather than the exhibit number.

4. The economic value of the Memorandum of Understanding represents a legitimate effort by the Department and Entergy to provide an economic benefit to the state; although it must be weighed against other factors in this case. The Department states that the total package of benefits under the Memorandum of Understanding to the State of Vermont is approximately $20 million. DPS Brief at 1. This overstates the actual benefits, both because it confuses total nominal payments with net present value and because it erroneously counts as a "benefit" what is actually merely an offset of additional power costs. As this Order discusses, the evidence presented by the Department shows that the actual net present value benefits arising from the Department's settlement are approximately $7.7 million: $1.6 million of additional tax revenue and approximately $6.1 million in contributions by Entergy to the state benefit funds. One of the other asserted benefits, a power contract with Vermont Electric Cooperative, is not contingent upon the uprate. Another asserted benefit, $4.5 million in ratepayer protections, does not provide incremental benefits. Rather, the ratepayer protection proposals merely offset any increased costs to Vermont from additional outages and only accrues to the benefit of the state's utilities and ratepayers if they incur such additional costs.

assigned to it, and not to this Board, by federal law.[5] Crucially, the NRC and Board reviews differ in timing as well as focus. Under Vermont law, Entergy may not modify Vermont Yankee until the Board approves the modification pursuant to 30 V.S.A. § 248. By contrast, the NRC does not conduct a prior review of the changes to the Station. Instead, the NRC review will occur while and after Entergy physically modifies the Station to enable the power uprate, but prior to actual operation of the modified plant for increased output. The difference in the timing means that this Board must necessarily decide whether to authorize the on-site engineering work without the benefit of seeing the results of the engineering and safety review that the NRC will conduct; however, (because of conditions we specify today) we can and will see the results of the NRC's analyses before allowing actual operation at increased power levels.

In this Order, the Board grants Entergy's petition, subject to several conditions that Entergy must meet before Vermont Yankee can operate at an increased power output. We authorize Entergy (at its own financial risk) to make the physical modifications to Vermont Yankee at the present time (although Entergy must amend its proposal in one respect). However, we do not authorize Entergy to increase the power output from Vermont Yankee until such time as it has fulfilled all of the conditions we impose. If, but only if, those conditions are met, the Board finds that the uprate of Vermont Yankee, as supplemented by the agreements set out in the Memorandum of Understanding will promote the general good of the state of Vermont. As conditioned in this Order, the power uprate of Vermont Yankee should have minimal additional adverse impacts, while at the same time providing additional energy to the region and economic benefits to the state of Vermont.

The uprate is not without financial risks to Vermont ratepayers — risks that could result in costs of the uprate exceeding the benefits. In particular, physical modifications to Vermont Yankee and operation at higher power levels raise the potential for increased outage frequency

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5. Docket 6545, Order of 6/13/02 at 15, fn. 25. As we pointed out in that docket:

> The Board does not have direct jurisdiction over radiological safety at Vermont Yankee. Rather, these issues are within the purview of the Nuclear Regulatory Commission. The Board retains authority to regulate the economic implications of safety. *Pacific Gas and Electric Company v. State Energy Resources Conservation and Development Commission*, 461 U.S. 190, 207–208 (1983).

and duration. Since Vermont's two largest electric utilities — Green Mountain Power Corporation ("Green Mountain") and Central Vermont Public Service Corporation ("Central Vermont") — purchase approximately one-third of their power from Vermont Yankee, such outages may require these utilities to purchase replacement power at prices that might be in excess of those that they otherwise would have paid for power from Vermont Yankee. Vermont ratepayers could incur these increased replacement power costs, if the Board permitted the Vermont utilities to increase rates to cover those costs.

To their credit, Entergy and the Department have worked out a two-tiered ratepayer protection mechanism that will mitigate the effects of an uprate-caused outage in the first three years after the physical changes to the Station. This ratepayer protection proposal does not, however, eliminate the outage risks. Nor have Entergy and the Department addressed the fact that the uprate will accelerate the time at which Vermont Yankee exhausts the capacity of the pool in which it stores spent nuclear fuel rods. Entergy anticipates asking the Board to authorize Entergy to store the excess spent fuel on-site in dry casks.[6] Unless the Board approves such a request, Vermont ratepayers would again be exposed to potentially expensive replacement power costs due to the earlier exhaustion of spent fuel pool capacity.

To address fully these concerns, we find that the uprate promotes the general good only if we include the following conditions in the Certificate of Public Good:

- Prior to operating at increased generating capacity, the Board finds it essential that the federal NRC conduct an independent engineering assessment of Vermont Yankee, consisting of a vertical slice of four systems. This assessment is necessary to verify that Vermont Yankee will continue to operate reliably at the higher temperatures and flows following the uprate, so that Vermont ratepayers do not lose the value of electrical energy they now purchase from Vermont Yankee pursuant to the Power Purchase Agreement. The Board will make a request to the NRC to conduct such a review.[7] The Board will retain jurisdiction to make

6. Tr. 3/5/03 at 27 (Franklin); tr. 1/15/04 at 89 (Thayer)(CHAIRMAN DWORKIN: I think we have established that whatever status in terms of newspapers there's no doubt that Entergy intends to seek review from this Board and would not proceed with dry cask storage [without] such approval; is that right? MR. THAYER: That is right.)

7. The Board specifically addressed the possibility of this condition with Entergy and other witnesses throughout this proceeding. Entergy accepted the basic concept of an independent review, although not all of the elements that we set out today:

(continued...)

modifications to this Order based upon the results of the NRC's assessment and Entergy's plant changes (if needed).

- The Board concludes that the payments by Entergy as part of the Memorandum of Understanding provide the primary economic benefit to the State of Vermont from the uprate. However, as we have found in the past, we can only authorize payments for specific uses such as those proposed by the Department and Entergy when the proponents demonstrate a nexus between the payments and the harms to be addressed.[8] As the parties have not demonstrated any such connection in this proceeding, we direct that all such moneys paid by Entergy shall be sent to the general fund, rather than the funds specified in the Memorandum of Understanding. Like all other moneys in the general fund, the funds will be distributed as the general assembly and the governor shall determine.

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7. (...continued)

CHAIRMAN DWORKIN: . . . I take it that your position is that as to safety you will do everything you can to get it right, but that if people are worried about an independent review on top of that the NRC provides the independent look?

MR. THAYER: Yes, and I think I would like to make one more distinction with your permission. That is in the case of power uprate it's been recognized that it's a change that touches a lot of systems and a lot of attributes of a plant. So in power uprate the NRC takes the extra step of having their own advisory committee review their own staff's conclusions prior to making a full recommendation to the commission. So they recognize as a step or as a process which merits an additional independent step to verify that the right processes were used, the right conclusions were drawn, and we have a safety conclusion that is, that is an extremely high degree of confidence and reliability.

CHAIRMAN DWORKIN: If your assumption is the NRC will do that, is there any reason this Board should not write a letter to the NRC saying we expect them to do that and we hope they will do that and we'll be relying upon them doing that?

MR. THAYER: That would be -- if you had any question about that, I would encourage you to do that.

CHAIRMAN DWORKIN: Let me move one notch up the meter. What if we were to say that our order would -- assuming we thought everything else had been met and we decided to approve it, we would say that order would be either -- would not go into effect until or it will be conditioned on getting a response from the NRC saying they would do that?

MR. THAYER: That would be perfectly acceptable.

Tr. 9/15/03 at 158–160 (Thayer). Our reliance upon the NRC to conduct the independent assessment is also consistent with the recommendations of New England Coalition's ("NEC") witnesses. Lochbaum pf. 12/18/03 at 8–9; tr. 1/13/04 at 168 (NEC witness Blanch); tr. 9/17/03 at 192–193 (NEC witness Gunderson). *See also*, tr. 1/13/04 at 119 (Lochbaum).

8. Our ruling is not based upon a determination that the uses of the funds proposed by the parties are without merit. In fact, legislative appropriation of money for the purposes set out in the Memorandum of Understanding may be desirable. Rather, we conclude that we should defer to the usual legislative budget process because the parties have proposed uses of the funds that bear only the most tangential relationship to the impacts of the proposed uprate and that are unrelated to matters within our jurisdiction.

- The issue of dry cask storage is not before the Board in this proceeding and the Board has no basis on which to conclude that dry cask storage is or is not consistent with the requirements of 30 V.S.A. § 248. However, the evidence demonstrates that the uprate could accelerate the exhaustion of spent fuel storage capabilities by eighteen months. If dry cask storage is not authorized, the uprate's effect on the remaining capacity of the spent fuel pool could significantly increase costs to Vermont ratepayers through additional replacement power costs. In order to ensure that the Board can evaluate dry cask storage on its own merits, we find that Entergy must provide assurances that Vermont ratepayers will be held harmless from incremental replacement power costs arising from the uprate if Entergy must reduce power or shutdown early because of lack of spent fuel storage caused by the uprate.
- The power uprate increases the possibility of unplanned outages or reduced power output due to the need to comply with state and federally mandated limits on fenceline radiation doses. In order to ensure that ratepayers do not experience excessive replacement power costs due to such outages, we find that Entergy must provide assurances that Vermont ratepayers will be held harmless from incremental replacement power costs arising from outages or power derates necessary to comply with these radiation standards.
- As Entergy agreed during the evidentiary hearings, Entergy may not engage in below-market-price sales of power from Vermont Yankee to Entergy affiliates as a means of avoiding or reducing the payments to the state of Vermont under the Memorandum of Understanding.
- Entergy must install in the cooling towers the 200-hp fans that it originally proposed instead of the 125-hp fans in the modified proposal. Entergy's own witness cited these higher capacity fans as appropriate to mitigate the aesthetic impacts of the additional heat dissipated by the cooling towers following the uprate.
- Consistent with Entergy's description of its current operating practices, in the event of a waste-heat cooling system malfunction, Entergy shall reduce power at a rate of at least 10 percent per minute until the cooling water discharge returns to and remains within the National Pollutant Discharge Elimination System ("NPDES") permitted temperature limits.
- Entergy has committed to perform all of the transmission upgrades requested by the Independent System Operator New England ("ISO New England"). This Order is conditioned upon Entergy actually performing those upgrades when required.
- Entergy shall fully restore all areas of the site disrupted by Entergy's site preparation for the temporary buildings that occurred without prior Board approval. Entergy shall inform the Board when the site restoration is complete.

II. Overview of Proposed Uprate

Vermont Yankee is a boiling water reactor that is licensed by the NRC to operate at a reactor power level that presently generates, on a net basis, approximately 510 megawatts ("MW") of electric power depending on seasonal variations. Under favorable conditions, Vermont Yankee currently generates up to 530 MW; under less favorable conditions it generates 495 MW.[9] Two Vermont utilities, Green Mountain and Central Vermont, purchase 55 percent of the output of Vermont Yankee (approximately 300 MW).[10]

The NRC has permitted other nuclear plants to increase their power output by changing certain measurement techniques, instrumentation setpoints, or by modifying plant equipment. The nuclear industry classifies power uprates into three categories: (1) measurement uncertainty recapture power uprates (generally less than 2 percent); (2) stretch power uprates (approximately 5 percent); and (3) extended power uprates ("EPUs") (larger power increases, ranging as high as 20 percent).[11] EPUs usually require significant modifications to major balance-of-plant equipment such as the high pressure turbines, condensate pumps and motors, main generators, and/or transformers.[12] Between November 21, 2001, and May, 2002, eight boiling water reactor plants at five sites received approval from the NRC to implement an EPU of between 13 and 20 percent.[13]

Entergy now seeks approval for an extended power uprate that would permit it to increase the power output of Vermont Yankee by approximately 20 percent. This would allow Entergy to increase the Station's gross generation output by up to 110 MW, for a total plant output of approximately 620 MW. Significantly, the proposed uprate would impose no direct monetary

9. Thayer pf. 2/21/03 at 2–3.
10. Exh. DPS-3.
11. Sherman pf. 5/9/03 at 4–5.
12. *Id* at 5/9/03 at 5.
13. *Id.*

costs on the state of Vermont or its residents; Entergy will bear the entire risk of the capital investment required for the uprate.[14]

The proposed extended power uprate would increase the output of Vermont Yankee by increasing the reactor core temperature and the resulting increase in the amount of steam that passes to the turbine/generator.[15] This extended power uprate would be achieved by loading more "active" fuel around the sides of the core. The highest fuel temperature in the center would remain the same, but the temperature nearer to the sides of the core would be greater. The result is a higher core temperature and more power production.[16] Importantly, for Entergy's EPU, reactor pressure would remain at its current operating values; however, steam and feedwater flow through the reactor would be increased to create the additional power. Equipment throughout the Station would be modified to use the higher heat to create the additional steam and feedwater flow and to recover the additional energy from these higher flow rates.[17]

The modifications to Vermont Yankee necessary to implement the uprate involve the replacement or upgrade of selected Station equipment with equipment capable of handling the increased power output.[18] Entergy also proposes to modify the existing cooling towers to increase their cooling capability. Entergy had originally intended to install new 200-hp fan motors to replace the existing 125-hp motors. During the initial hearings in this proceeding (June 2003), Entergy notified the Board that it had changed its proposal so it now proposes to replace the existing 125-hp motors with high efficiency 125-hp motors.[19]

None of the modifications planned by Entergy would significantly affect the physical layout of Vermont Yankee, nor would any permanent structures be built outside of existing building footprints.[20] The power uprate would not require any increase in the size of the diesel generators used for emergency electrical power for the facility, or any modifications to water

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14. Lesser pf. 2/21/03 at 25.
15. Thayer pf. 2/21/03 at 6.
16. Sherman pf. 5/9/03 at 6.
17. Exh. EN-JKT-10; Sherman pf. 5/9/03 at 3–4.
18. Exh. EN-JKT-10.
19. Tr. 6/16/03 at 33–34 (Thayer). As we explain in this Order, we require the 200 hp fan motors.
20. Thayer pf. 2/21/03 at 6.

intake or discharge structures on the bank of the Connecticut River.[21] The primary outside work in connection with the uprate has already occurred. In October, 2002, Entergy replaced the main transformer that connects the generator output to the transmission system in the transformer area west of the turbine building (for reliability reasons as well as to increase capacity).[22] The Board authorized this replacement by Order issued under Section 248(k) on September 25, 2002, in Docket 6757. The new transformer is rated higher than the old transformer — 675 MVA versus 650 MVA. The higher-rating transformer is necessary to accommodate the uprate and increase Vermont Yankee's reliability.[23]

The uprate will occur in two phases. Entergy anticipates performing most of the physical modifications to Vermont Yankee during the refueling outage that is scheduled for the spring of 2004. After the NRC reviews the physical modifications and approves the uprate, Entergy would increase Station output by 70–80 MW.[24] Following the fall 2005 outage and NRC approval of additional analyses, Entergy would increase output by the remaining 30–40 MW.[25]

Entergy also submitted an application to the Vermont Agency of Natural Resources ("ANR") to amend Entergy's current NPDES Permit for Vermont Yankee's discharge into the Connecticut River. The amendment sought is for approval for a one-degree-Fahrenheit increase to the summer thermal discharge limits. The modification of the NPDES permit is not required for the power uprate; however, if ANR does not modify the NPDES permit, Entergy will need to use the cooling towers more frequently.[26]

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21. Schuyler pf. 2/21/03 at 5.

22. Entergy also proposes modifications to transmission facilities in the switchyard and has filed a separate petition under Section 248(j); these proposed changes will be addressed in separate proceedings.

23. Schuyler pf. 2/21/03 at 4; exh. EN-SAS-3; Thayer pf. 2/21/03 at 11–12.

24. Originally, Entergy's goal was to complete the uprate and make additional power available during the third quarter of 2004, or as soon as Entergy obtained approval from the NRC. Because the NRC found Entergy's application to be lacking in certain components, Entergy now asserts that the uprate power would be available by March of 2005. Thayer pf. 2/21/03 at 10; exh. DPS-19; tr. 1/13/04 at 61 (Sherman).

25. Thayer pf. 2/21/03 at 10. The precise output of Vermont Yankee after uprate will not be known until an extensive installation and testing program is completed following the two phases of uprate. Additionally, the NRC review of the uprate will be comprehensive and may result in an uprate less than the 20 percent requested. Thayer pf. 2/21/03 at 5; Sherman pf. 5/9/03 at 8.

26. Thayer pf. 2/21/03 at 9, 13.

In addition to a Certificate of Public Good from the Board, Entergy must obtain approval from ISO New England, the Federal Energy Regulatory Commission ("FERC"), and the NRC before operating at higher output.[27] The ISO New England review examines the impact of the additional generation at Vermont Yankee on the region's transmission system and identifies changes that are necessary to accommodate the increased power. Entergy then has the choice of making the requested changes or operating at a lower output.[28] FERC must approve an amendment to the Interconnection Agreement between the Vermont Electric Power Company, Inc., and Entergy to increase the permitted generating capacity.[29]

The NRC will conduct an in-depth analysis of the proposed uprate, focused on ensuring that Vermont Yankee will continue to operate safely following the power uprate. Entergy has filed its application with the NRC; the NRC accepted that filing as complete as of January 31, 2004, and set a target of one year for completion of the review.[30]

An important factor, affecting much of the substance and timing of this case, is that (unlike Vermont law) the NRC does not require Entergy to obtain prior approval of the physical modifications to Vermont Yankee. Instead, Entergy makes the physical changes first; the NRC then reviews the changes and determines whether (and to what degree) Entergy will be permitted to increase the thermal output of the reactor. The timing difference between the NRC and the Vermont processes means that the Board does not have the option to defer action on Entergy's petitions until the NRC's assessment of Vermont Yankee.[31] This means that we do not have the **prior** ability to rely upon the NRC's considerable resources and expertise in assessing the potential effect of the uprate on the reliability of Vermont Yankee. Because we conclude that a

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27. *Id.*

28. As we discuss below, ISO New England has identified numerous modifications. Entergy has stated that it will make all of the requested changes and has filed a separate petition under Section 248(j) for the transmission upgrades needed in the Vermont Yankee switchyard.

29. Thayer pf. 2/21/03 at 7.

30. Entergy letter of 2/25/04 from Gary Franklin, Esq., to Susan M. Hudson (attaching NRC letter dated 2/20/04 to Michael Kansler).

31. Entergy would be in an untenable Catch-22 situation were we to adopt such a course. Entergy would be unable to obtain NRC review because Entergy had not yet made the physical changes to the plant (because of Section 248's prohibition on site preparation and construction without prior Board approval), while at the same time Entergy could not obtain Board approval because we had chosen to wait and rely upon the NRC's review.

more complete analysis of Vermont Yankee's reliability after the proposed uprate is essential, we are explicitly requesting that the NRC's review of the power uprate be sufficiently extensive to assure us that Vermont Yankee will operate reliably following the uprate.

Because of the difference in timing between our review under Vermont law and the NRC's review, Entergy recognized that under some circumstances, the Board could consider issuing a Certificate of Public Good that authorized Entergy to make the physical modifications on the schedule it requested, but deferred approval to operate at the higher power output until receipt of a favorable response from the NRC.[32] Under this proposal, Entergy would assume the financial risk that may arise from having made the physical modifications before the NRC responded.[33] Our Order today accepts the "two-phase" concept recognized by Entergy, although we make the approval to operate at higher power contingent upon the NRC's independent engineering assessment rather than a letter on the scope of review as proposed by Mr. Thayer.

During the course of this proceeding, Entergy modified its proposal by entering into the Memorandum of Understanding with the Department. In that agreement, Entergy committed to pay money into a state benefits fund. The money deposited in the state benefits fund would then be used to fund economic development ($200,000), support low-income heating fuel assistance (up to $250,000 per year), and fund the Governor's Clean and Clear Water Initiative directed primarily to improving Lake Champlain's water quality (approximately $600,000 per year). These figures are based upon current projections, but the actual amount may vary significantly. Entergy also committed to a two-tiered ratepayer protection mechanism, lasting three years, that would provide compensation (up to defined limits) to Green Mountain and Central Vermont in the event of an uprate-related outage or reduction in power output.

Entergy also modified its proposal to request approval of the construction of two temporary buildings to make changes to the turbine. Entergy subsequently stated that it did not

32. Thayer pf. 11/5/03 at 14–15.

33. Financial risk exists already due to the NRC's requirement that Entergy physically modify the plant before full review of the uprate.

seek approval for the buildings.[34] Therefore, we consider Entergy's request for permission to construct the buildings to be withdrawn.

III. PROCEDURAL HISTORY

On February 21, 2003, Entergy filed its Petition for a Certificate of Public Good pursuant to 30 V.S.A. § 248, asking the Board to approve modifications to Vermont Yankee to increase the power output by as much as 20 percent.[35]

The Board opened this investigation to consider the request and convened a prehearing conference on March 5, 2003, at which time we set a schedule for this Docket. In addition to the Department and ANR, both statutory parties, three other parties intervened: the New England Coalition ("NEC"); the Connecticut River Watershed Council ("CRWC"); and the Windham Regional Planning Commission ("WRPC"). As a result of, and in reliance upon, the representation made by Entergy that it would not seek approval of dry cask storage in this Docket, the Conservation Law Foundation decided not to intervene.

On April 29, 2003, the Board conducted a public hearing at the Vernon Elementary School in Vernon, Vermont. It held technical hearings as duly noticed and scheduled on June 16, 17, and 19, 2003, on September 15, 16, and 17, 2003, and on October 16 and 17, 2003.

On October 8, 2003, the Board substantially modified the schedule for the remainder of the proceeding. We did this in response to on-going concerns about the discovery process, having found that Entergy had not met its obligation to provide timely and complete discovery responses to NEC. In addition, we determined that parties needed an opportunity to respond to a new proposal by Entergy that modified its initial position.

On November 5, 2003, the Department and Entergy filed a Memorandum of Understanding, accompanied by supporting testimony, that resolved their differences and recommended the issuance of a Certificate of Public Good. Also on November 5, 2003, Entergy

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34. Letter of 2/10/04 from Victoria J. Brown, Counsel for Entergy, to Clerk of Board. Entergy's withdrawal of this request does not resolve all of the issues. A Hearing Officer will, in a subsequent recommendation to the Board, address what, if any, sanctions may be appropriate for the site preparation for the temporary building that occurred without the required prior Board approval.

35. See Appendix C for a more fully-detailed description of the procedural history.

sought approval to erect two temporary facilities to house the Station's generator rotor during its re-insulation, as part of the uprate modifications. After the Board-appointed Hearing Officer conducted a prehearing conference on November 20, 2003, and two public hearings on December 12, 2003, and January 8, 2004, Entergy withdrew its temporary building application.

The Board continued the final set of technical hearings in this investigation beginning January 12, 2004. Those hearings ran for four days and culminated on January 15, 2004. Subsequent to the close of hearings, several parties filed procedural motions and requests for the Board to take administrative notice of certain documents; we addressed such outstanding motions in a separate Order on Post-Hearing filings issued March 15, 2004.

IV. POSITIONS OF THE PARTIES AND CONCERNS OF THE PUBLIC

A. Positions of the Parties

The parties in this case include the Petitioners, the Department, the Vermont Agency of Natural Resources ("ANR"), the WRPC and the CRWC. Of the six, five participated actively in this investigation.[36]

The Petitioners urge the Board to approve their Petition for a Certificate of Public Good. According to Entergy, the centerpiece of its proposal is Section 248 criterion (b)(4), which requires this Board to find that the project will result in an economic benefit to the State and its residents. Entergy argues that the proposed power uprate will provide monetary benefits in the form of increased tax revenue to the State, a favorable power contract with one of the State's utilities, and (pursuant to the Memorandum of Understanding) a stream of payments to the State under a revenue-sharing arrangement. Entergy contends that the uprate avoids significant societal costs by avoiding air emissions from other fossil generating units that would otherwise provide the power. They further maintain that the uprate will provide an additional significant benefit that has not been quantified: by improving the economic viability of Vermont Yankee, the proposed uprate increases the likelihood that Vermont Yankee will remain operational at least through the end of its current license term, thus providing economic benefits to the southern

36. One of the six, the ANR, participated through its fellow state agency, the Department.

Vermont area in the form of high-paying jobs, as well as the continued availability of reasonably-priced power under the existing Power Purchase Agreement between Entergy and Vermont Yankee Nuclear Power Corporation ("VYNPC").

The Department contends that the proposed transaction, as amended by the MOU, satisfies the criteria of 30 V.S.A. § 248 and should be approved. It argues that ratepayers are protected from financial harm in the event of an uprate-related outage when energy prices are high. According to the Department, an economic benefit would flow to the state and its residents in excess of $15 million, and Entergy would continue to be a productive contributor to the southeastern Vermont economy and to the base load power needs of the region.

NEC argues that the Board should deny Entergy's application because it fails to meet the criteria of 30 V.S.A. § 248. Additionally, NEC asks that, if the Board does not deny Entergy's petition outright, the Board should withhold a decision on the Certificate of Public Good until the NRC issues a decision on Entergy's Extended Power Uprate license amendment and until such time as an NRC Independent Safety Assessment (or its equivalent) is performed. Furthermore, NEC asks that the Board order the safety assessment be preceded by an Entergy-conducted examination of Vermont Yankee to verify and certify that Vermont Yankee is in full compliance with its design basis and with all contemporary NRC safety criteria, and that the Independent Safety Assessment then focus on four selected safety systems that would be directly affected by, or related to, the uprate. Moreover, NEC asks that the Board order that a safety and reliability assessment review team of no less than six knowledgeable individuals be formed that would include a representation of one or more NEC-designated experts, and that Entergy fund the review team.

CRWC takes the position that the proposed uprate at Vermont Yankee could result in a potentially undue adverse impact on the natural environment of the Connecticut River in the form of fish and wildlife habitat loss. CRWC argues that the Board, in order to prevent undue adverse impact on the river in the event of a cooling system malfunction, should require Entergy to reduce waste heat by reducing the power output of the plant by 10 percent per minute as necessary. It further argues that the MOU between Entergy and the Department should be amended to (a) require the funds deposited in the Environmental Benefit Fund ("EBF") to be

used to address problems in the Connecticut River Watershed rather than Lake Champlain, (b) require a more representative advisory Board than that proposed, and (c) allow the Vermont Community Foundation ("VCF") or similar entity to serve as the fiduciary for the EBF, similar to the arrangement in the Deerfield River Settlement Agreement, thereby eliminating any likelihood of the Vermont Legislature redirecting the use of the funds.

The WRPC has taken positions on two discrete issues. First, with respect to an Independent Safety Assessment, the WRPC asks the Board to recognize that the public would be reassured by a safety assessment, and that the NRC would see efficiencies in future reviews from making such an effort now. Second, the WRPC asks that the Board order that the Environmental Benefit Fund be structured in a similar manner to the Fifteen-Mile Falls Settlement Agreement, although focused on the reach of the Connecticut River from White River Junction to the Massachusetts border. The WRPC argues that the Board need not find that the proposed uprate would result in environmental impacts that require mitigation. Instead, the WRPC argues that, because Vermont Yankee has for so long benefitted from its use of the Connecticut River, fairness dictates that an environmental benefit fund should be directed to the Connecticut River watershed.

B. Public Comments

In addition to hearing from formal parties in this Docket, the Board also conducted a public hearing in order to gather information and opinion from the public at large.[37] The public hearing took place at the Vernon Elementary School in Vernon, Vermont, on April 29, 2003. Numerous members of the public attended the public hearing and have also submitted comments by mail or e-mail. To date, there have been more than 350 public comments submitted.[38]

The public concerns with approval of Entergy's proposal fall into the following categories:

37. Two additional public hearings were held regarding the then-proposed temporary buildings.
38. The comments are in a public file at the Public Service Board for review by anyone upon request.

- Safety issues: Commenters expressed general concerns about safety, the adequacy of emergency planning, and the potential for emissions and other risks associated with Vermont Yankee's age;
- Independent Safety Assessment: Many persons stated that the Board should require an independent safety assessment of Vermont Yankee before proceeding;
- Concerns about the payments Entergy will make to the state of Vermont as part of the Memorandum of Understanding: Some characterized them as a "bribe" or "pay-off;"
- The economic benefits of the Entergy-DPS Memorandum of Understanding: Several persons stated that the proposed power uprate did not provide an economic benefit to the state;
- Environmental effects: Members of the public stated that the uprate would increase the thermal discharge to the Connecticut River, adversely affect the stream flow, and lead to larger and more frequent cooling tower plumes;
- Reliability of Vermont Yankee post-uprate: Commenters stated that the uprate would adversely affect the reliability of Vermont Yankee;
- Increase in nuclear waste: Many people expressed concern that the uprate would lead to an increase in nuclear waste from the Station; and
- Alternative sources of energy: Commenters observed that the uprate represented bad energy policy, recommending that the state instead cultivate alternative sources of energy.

We address the primary concerns raised by the public below, in Section VI of this Order.

V. SECTION 248

Entergy's Petition for uprate seeks Board approval under 30 V.S.A. § 248, which provides that a company, as defined in 30 V.S.A. § 201 (Entergy is such a company), may not begin site preparation for or construction of any electric generation facility, until it has sought and obtained Board approval. Such approval must be based on affirmative findings that the facility will promote the public good, whereupon the Board will issue a certificate to that effect. Section 248 applies to the uprate, inasmuch as the modifications it will require are clearly beyond "replacement of existing facilities with equivalent facilities in the usual course of business"

which are exempted, but rather are intended to allow Vermont Yankee to increase its power output.[39]

Section 248(b) sets out several criteria upon which the Board must base its determination that the uprate will promote the general good of the state. The following section discusses each of these criteria.

A. Orderly Development of the Region [30 V.S.A. § 248(b)(1)]

1. Findings

1. The changes proposed will not adversely affect the orderly development of the region. *See* findings 2 to 9, below.

2. The Vernon Town Plan provides guidance to promote the consistency of decisions made at the local, regional and state level with the values and goals expressed in the Plan. It specifically cites Vermont Yankee's contribution to the community's tax base and its provision of varied employment opportunities as being largely responsible for Vernon's rural independence and self-sufficiency. Thayer pf. 2/21/03 at 18.

3. The Vernon Town Plan contains the following specific policies and recommendations:

- Balanced economic development will be pursued to provide long-range economic benefits including stable employment opportunities for town residents and an adequate local tax base;
- Any effort which directly or indirectly accelerates economic growth should be consistent with local and regional objectives;
- All industry, commerce and institutions must adequately control their waste, relate satisfactorily to existing land uses, minimize increases in traffic congestion, avoid contributing to sprawl or strip development or detracting from the rural character of the town, and account to the town for both direct and indirect municipal costs.

39. Entergy recognized the statutory mandate previously when it agreed in Docket 6545 that it would request and obtain a Certificate of Public Good before it would implement an uprate. *See*, for example, Docket 6545, tr. 4/1/02 at 160 (Wells).

Id.

4. The proposed uprate is consistent with the town policies listed above. The project takes advantage of an existing land use without any direct cost to the Town of Vernon while providing long-range economic benefits to the Town in terms of contribution to the Town's tax base and provisions of jobs. *Id.*

5. The Town of Vernon Select Board and the Vernon Planning Commission have voted unanimously in favor of the power uprate project. Both bodies have issued letters stating that Entergy's plans do not adversely affect the orderly development of the region or unduly impact municipal services. *Id.* at 19; exh. EN-JKT-9.

6. The Windham Regional Plan provides guidance for change in the region with primary emphasis on major projects of regional importance. The Plan acknowledges the significant role that Vermont Yankee plays as one of the County's largest employers and in serving the equivalent of 33 percent of Vermont's annual electrical requirements. Thayer pf. 2/21/03 at 19.

7. The Windham Regional Plan encourages businesses that offer stable, year-round employment with competitive wages, skills-training programs, and other benefits that contribute to the quality of life for all workers. *Id.*

8. Approval of the uprate would be consistent with that goal by enhancing Entergy VY's financial capabilities and ensuring it will remain a viable business in Windham County. *Id.*

9. The WRPC has not taken a position in support of or in opposition to the overall issue of a power uprate. Matteau pf. 12/8/03 at 4; tr. 1/13/04 at 208 (Matteau).

2. Discussion

Section 248(b)(1) requires (in relevant part) that this Board find as follows:

> With respect to an in-state facility, will not unduly interfere with the orderly development of the region with due consideration having been given to the recommendations of the municipal and regional planning commissions, the recommendations of the municipal legislative bodies, and the land conservation measures contained in the plan of any affected municipality.

The Department and Entergy both maintain that the proposed power uprate meets the standard in this subsection of Section 248. These parties cite to portions of the Vernon Town

Plan and the Windham Regional Plan, asserting that the proposed uprate is consistent with these plans. In addition, they note that the Town of Vernon has actively indicated its support.[40] No party argues that the Board should reach a different conclusion.

We conclude that the proposed uprate of Vermont Yankee will not unduly interfere with the orderly development of the region. It will have minimal impact outside the immediate area of Vermont Yankee. In addition, as shown by the findings above, it is consistent with the relevant town and regional plans.

B. Needed for Present and Future Demand for Service [30 V.S.A. § 248(b)(2)]

1. Findings

10. The proposed uprate is needed to meet the present and future demand for service which could not otherwise be provided in a more cost effective manner through energy conservation programs and measures and energy-efficiency and load management measures. *See* findings 11 to 14, below.

11. Because Vermont Yankee is a merchant plant, ratepayers and consumers are not exposed to investment risk from the proposed uprate modifications. Sherman pf. 5/9/03 at 19.

12. The production and sale of additional electricity generated by the power uprate into the wholesale market will exert downward pressure on wholesale market prices in New England, which will benefit all electricity consumers in the region.[41] Lesser pf. 2/21/03 at 9.

13. The variable costs associated with uprate energy will be less than $5/MWh (*i.e.*, ½ cent/kWh) which is low enough to indicate that the uprate power will routinely be chosen for dispatch by buyers and dispatchers in the New England wholesale markets. Therefore, there is a

40. Exh. EN-JKT-9.

41. It is not clear, however, that the uprate power will literally increase energy supplies in New England. Instead, it is more likely that the additional 110 MW of power will displace other planned generation sources in the region which would have been priced higher. Tr. 10/17/03 at 35–38 (Lamont).

reasonable likelihood of providing energy at market prices which will result in the uprate power being used. Sherman pf. 5/9/03 at 21.

14. The demand that the uprate power will serve cannot be met more cost-effectively through demand-side management measures. *Id* at 20–21.

2. Discussion

Section 248(b)(2) of Title 30 requires that the Board find that the proposed project:

> is required to meet the need for present and future demand for service which could not otherwise be provided in a more cost effective manner through energy conservation programs and measures and energy-efficiency and load management measures, including but not limited to those developed pursuant to the provisions of sections 209(d), 218c, and 218(b) of this title.

Entergy argues that Vermont Yankee is a merchant plant that will not supply power to Vermont directly, but rather will sell its power through the wholesale market. As a result, Entergy asserts, the "need" criteria of Section 248(b)(2) does not apply. The Department also relies upon the fact that Vermont Yankee is a merchant plant, although the Department also asserts that the uprate is consistent with the intent of Section 248(b)(2). According to the Department, the proposed uprate will make additional power available to Vermont through the New England power market, with no investment risk and minimal environmental impact. This, argues the Department, meets the intent of Section 248(b)(2). In contrast, NEC says that the power is not needed to meet Vermont loads, implying that, therefore, the requirements of this section are not met.

Vermont Yankee sells the existing output of Vermont Yankee to the former owners of the Station through a Purchase Power Agreement. Vermont Yankee may sell the additional power arising from the uprate to any purchaser within New England either through bilateral contractual arrangements or through spot sales in the wholesale power market. At the present time, Vermont Yankee has not committed to sell the uprate power to Vermont utilities (with the exception of a

small purchase by the Vermont Electric Cooperative) or to other entities.[42] Nor is there any evidence that additional power from Vermont Yankee is needed to serve additional load in the state of Vermont. Thus, the proposed uprate of Vermont Yankee is not required for the purpose of serving load within the state of Vermont.

As we explained in Docket 6545, however, this Board has also recognized that regional needs can meet the statutory test. We stated at that time:

> "the general good of the state" standard includes a recognition of the value to Vermont of the benefits to the entire New England Power Pool, from which Vermont purchases much of its power and upon which Vermont depends for reliability.[43]

Similarly, the Board concluded in Dockets 4622/4724 that the construction of a transmission interconnection between Hydro-Québec and the New England Power Pool met the criteria of Section 248(b)(2), noting that "[a]s a state, we must bear a reasonable proportion of the region's responsibility in the provision of power."[44] We also recognized that the state of Vermont would have future needs for power that may be served as a result of the construction of the electric transmission line. In Docket 5323, we issued a Certificate of Public Good to Arrowhead Cogeneration Company, L.P., to construct a gas-fired generation facility. In that case, the entire output of the facility would be sold out-of-state, and there was no expectation that Vermont utilities would purchase the power in the future. Nonetheless, the Board concluded that the project met the need criterion, finding that the project promoted the general good.[45]

We reach the same conclusion here. Vermont Yankee will sell the additional uprate power to serve regional needs for electrical service. The evidence suggests that, as it is baseload power, it is likely to be dispatched on a regular basis, providing service to customers in New England. Moreover, Vermont Yankee also will serve future load in Vermont and the rest of New England. And, with the conditions set out in this Order, Vermont ratepayers will face no

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42. Green Mountain and Central Vermont retain a right to first negotiation for a share of the uprate power, although they have waived that right for 20 MW of capacity. Exhs. EN-CCW-4 and 5.

43. Docket 6545, Order of 6/13/02 at 106.

44. Dockets 4622/4724, Order of 2/25/83 at 18 (discussing HV/DC transmission line across northeastern Vermont).

45. Docket 5323, Order of 9/27/89 at finding 139.

financial risk from the proposed uprate. The investment in the upgrade is borne by Entergy. The evidence also suggests the demand that the uprate power will serve cannot be met more cost effectively through demand-side management measures.[46]

C. System Stability and Reliability [30 V.S.A. § 248(b)(3)]

1. Findings

15. With the conditions set out in Finding 19, below, the proposed uprate will not have an adverse impact on system reliability and stability. *See* findings 16 to 20, below.

16. Before it can implement power uprate, Entergy must establish to the satisfaction of ISO New England that the transmission grid is capable of handling the additional power. Thayer pf. 2/21/03 at 20.

17. On October 7, 2003, ISO New England completed its "Vermont Yankee Uprate System Impact Study" ("Study"). Exh. EN-JKT-11.

18. As a result of the Study, ISO New England found that Entergy's plans for the uprate would not have a significant adverse effect on the reliability of the system, subject to the satisfaction of ten specific conditions. Exh. EN-JKT-12.

19. Entergy agrees to perform all of the uprate-related transmission upgrades that ISO New England has identified in its letter of October 8, 2003 (exh. EN-JKT-12), subject to any modifications or amendments made by ISO New England. The specific conditions set out by ISO New England (which we adopt herein) are the following:

> a. The Project having the net ratings of 641.5 MW at 20° F and 50° F and 634.5 MW at 90° F; a gross maximum plant rating of 667 MW; and a gross reactive capability, under full output conditions, of 100 MVAr leading and 150 MVAr lagging.
>
> b. Increasing the pre-contingency MVA rating on the Vermont Yankee - Northfield 345 kV Line (Section 381) from the current rating of 869 MVA to a minimum rating of 1075 MVA by replacing the limiting line relay equipment.

46. Sherman pf. 5/9/03 at 21–22.

c. Increasing the post-contingency MVA rating on the Ascutney - Coolidge 115 KV Line from the current LTE rating of 205 MVA to 240 MVA by replacing approximately 25 feet of the limiting riser conductor.

d. Adding one bank of 30 MVAr switched capacitors and two banks of 15 MVAr switched capacitors at the Vermont Yankee 115 kV switchyard. The 30 MVAr bank should be connected such that it trips with the autotransformer. The 15 MVAr banks should be connected to the 115 kV bus such that they are available with the autotransformer out of service.[47]

e. Providing a second primary protection scheme on Vermont Yankee north bus to achieve acceptable performance in response to a normal contingency fault.

f. Adding a second primary protection scheme on the Vermont Yankee GSU to achieve acceptable performance in response to a normal contingency fault.

g. Upgrading the Vermont Yankee 381 Breaker to an IPT breaker.

h. Adding out-of-step protection on the Vermont Yankee generator to ensure acceptable performance in response to several extreme contingencies.

i. Completing any additional transmission modifications required for the proposed uprate that may result from the development of any or all of the "Relevant Queued Resources" to the extent required under ISO New England's Subordinate 18.4 Application Policy. These Relevant Queued Resources include:

Berwick Energy Center
UAE Tewksbury
Neptune Phase 3 Boston Import
Neptune Phase 7 Wyman Export
Mystic 4, 5, 6 Conversion
Millstone Unit No. 3 Power Uprate projects

j. The approval, under Section 18.4 of the restated NEPOOL Agreement, of the modified excitation system model parameters for the Millstone Point Unit 3 generator that were included in the stability analysis for the uprate or the installation of any additional transmission modifications that may be required as the result of those parameters being further modified to attain such approval.

MOU at Attachment D; Thayer pf. 11/5/03 at 9; tr. 1/15/04 at 97 (Thayer).

20. Entergy will pay the cost of the ISO New England identified transmission upgrades. Thayer pf. 11/5/03 at 8.

47. Per ISO New England's requirements, this is to be done in 2005. Tr. 1/15/04 at 98–99 (Thayer).

2. Discussion

Section 248(b)(3) requires that we find that the uprate "will not adversely affect system stability and reliability." Entergy relies primarily upon analysis performed by ISO New England of the effects that Vermont Yankee's proposed uprate might have on the New England transmission system. ISO New England concluded that, subject to Entergy's satisfaction of specific conditions, the proposed uprate would not result in any significant adverse effects on the New England transmission system. Entergy has agreed to perform, and pay for, all the system upgrades that ISO New England specified as necessary to ensure that the uprate results in no adverse effect on the transmission system. We expressly rely upon this representation, which relates to both the reliability and the economic benefit (248(b)(4)) criteria. We thus conclude that, subject to Vermont Yankee's performance of the conditions specified in ISO New England's letter of October 8, 2003, the proposed uprate will have no adverse impact on system reliability and stability.[48]

D. Economic Benefit to the State [30 V.S.A. § 248(b)(4)]

1. Economic Benefits

To satisfy the criterion of 30 V.S.A. § 248(b)(4), we must find that the uprate "will result in an economic benefit to the state and its residents." Entergy and the Department, both in the Memorandum of Understanding and generally, identify benefits to the state from the uprate which they assert will exceed its costs. We address each of these claimed economic benefits

48. We recognize that NEC has, essentially, argued that, due to questions of the reliability of an uprate at the Vermont Yankee station, the Board cannot make a positive finding with respect to this criterion and the stability and reliability of the system. We are not persuaded by NEC's position. The Vermont Supreme Court has concluded that a finding of "absolute" reliability is not necessary under this statute. Instead, the Board need only find that there will be no "adverse effect on the reliability of the system." *See In re Petition of Twenty-Four Vermont Utilities*, 159 Vt. 339 (1992). Moreover, NEC's reliability claims relate not to the reliability of the electrical system, but to Vermont Yankee itself. Thus, we can (and do) consider the substance of those arguments in our appraisal of economic benefit. NEC has not shown any adverse impact of the uprate on the electrical system.

below.[49] In the following sections, we analyze the potential benefits of the uprate and then weigh the costs. We note, as the Department points out, that the law does not set out how much economic benefit there should be, but rather simply directs that there be an economic benefit. As we discuss below (in Part V.D.3), we find that the proposed uprate will provide a net economic benefit to the state only if we adopt several conditions necessary to ensure that potential costs do not exceed expected benefits.

a. VEC Contracts

(1) Findings

21. An affiliate of Entergy, Entergy Nuclear Generation Corporation, entered into an agreement to sell 10 MW from its Pilgrim Nuclear Power Station to Vermont Electric Cooperative ("VEC") commencing January 1, 2004. When the uprate power becomes available from Vermont Yankee, the agreement to sell from the Pilgrim Station terminates and a second agreement between VEC and Entergy Vermont Yankee ("ENVY") becomes effective and remains in effect until December 31, 2006. If the uprate is not implemented, ENVY will continue to supply power from the Pilgrim Station until December 31, 2006. Wells pf. 9/26/03 at 1–2; exhs. EN-CCW-1 and EN-CCW-2.

22. The VEC agreements are unit-contingent for up to 10 MW. The price for power in the contract is below that of the Power Purchase Agreement with VYNPC and below the September 2003 Power Price Forecast issued by the Department. Wells pf. 9/26/03 at 2–3.

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49. One feature of the MOU, the "Ratepayer Protection Plan," is discussed below in section V.D.2, as it is not a direct benefit, but rather a cost-mitigating measure. Often in this proceeding the Department and Entergy have included the availability of this $4.5 million of "outage protection" as a significant portion of a total, $20 million, claimed economic benefit under § 248(b)(4). (*See, for example,* Department Initial Brief at 1.) We do not find this to be the case. Rather, the $4.5 million, or more likely a portion thereof, simply provides a (capped) offset to Central Vermont and Green Mountain for costs that they would incur in the event of an uprate-caused outage at times when market prices exceed the Power Purchase Agreement prices. It is clearly erroneous and misleading to tout this as a benefit to the state and its residents that will result from the uprate. Moreover, the $4.5 million is actually double-counted by the Department in arriving at a $20 million benefit, because if the Ratepayer Protection Plan were triggered, no payments would be made to the Benefit Funds for the duration of such an outage.

23. Entergy has committed to supplying VEC the power from its Pilgrim Station for the entire contract term (through December 31, 2006) if the uprate is not approved for Vermont Yankee. Tr. 1/14/04 at 72 (Thayer).

24. VEC will pay for delivery from the unit (Pilgrim or Vermont Yankee) to the New England Power Pool Transmission Facilities. Exhs. EN-CCW-1 and EN-CCW-2.

25. If VEC takes power from Vermont Yankee instead of Pilgrim, there will be a reduction in transmission costs. Tr. 1/14/04 at 72 (Thayer).

(2) Discussion re: VEC Contracts

Entergy entered into two agreements to sell up to 10 MW of power to VEC for a three-year period beginning January 1, 2004. The contracts are for unit-contingent power,[50] at a price below the VYNPC Power Purchase Agreement price, and below the Department's most recent (2003) price forecast. The Department and Entergy contend that these contracts represent a net present value benefit of the uprate of between $1.0 million to $1.6 million, based on a capacity factor of 92 percent in 2004 and 2005 (outage years) and 97 percent in 2006 (non-outage year). We accept that a below-market price contract with VEC is beneficial to the state. However, this benefit will occur irrespective of any uprate at Vermont Yankee; Entergy has committed to provide the power whether or not the uprate occurs. Accordingly, we conclude that the VEC contracts are not a direct benefit that will inure from an uprate.[51] We might well rule that a benefit to a subset of "the state and its residents" would meet the § 248(b)(4) standard; however, unless such a contract were directly tied (in a "but-for" way) to the granting of a petition, it is unclear that it would meet the economic benefit criterion.

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50. The VEC contract is described as unit-contingent, as opposed to a firm power contract. If the uprate does not occur, the contract is contingent upon the Pilgrim Station's operation, not Vermont Yankee's. If the uprate occurs, the power will be provided from Vermont Yankee and thus will be contingent on Vermont Yankee's operation.

51. We recognize one small benefit of the VEC contracts that does derive from the uprate. Purchases from Pilgrim or Vermont Yankee are affected by transmission system losses. Such losses will be lower if the power is provided from Vermont Yankee. The evidence does not demonstrate the magnitude of the savings, but we would expect them to be very small, particularly in relation to the other costs and benefits we discuss here. Tr. 1/14/04 at 72 (Thayer).

b. Tax Benefits

(1) Findings

26. The 2003 Vermont General Assembly recently revised the state's tax law, which now provides for a tax assessment of Vermont Yankee based on generation output, instead of the value of its assets. 32 V.S.A. § 8661.

27. Entergy pays state taxes based on a three-year average of the Station's net output. Thus, the exact amount of incremental revenue to the State due to the uprate would be dependent on the operation of the Station, as reflected by capacity factor. Greene pf. 7/2/03 at 8–9.

28. Over the past ten years, Vermont Yankee's capacity factors have been 85 percent in refueling outage years and 98 percent in non-outage years. Using these capacity factors, the tax benefits resulting from the uprate are projected to be approximately $1.6 million on a net present value basis. Sherman supp.surr.pf. 9/26/03 at 3.

29. Using Vermont Yankee's actual capacity factors over the most recent three years, *i.e.*, 92 percent for outage years and 97 percent for non-outage years, the potential tax benefit due to the proposed uprate would be approximately $2,636,000 (net present value), assuming NRC approval as of October 2004. Sherman pf. 11/5/03 at 5; exh. DPS-WKS-13.

30. If NRC approval is delayed until April 1, 2005, the net-present-value potential tax benefit from the higher capacity factors would be $2,548,573. Exh. DPS-WKS-13-rev.

31. Increased tax generation revenue is directly dependent upon increased power output from the uprate. Sherman pf. 8/19/03 at 19, 22; Sherman pf. 9/26/03 at 4.

32. If Vermont Yankee's capacity factor is less than projected, the tax benefits will be reduced accordingly.[52]

(2) Discussion re: Tax Benefits

52. In this Order we identify several different ways in which power output may be less than expected. These include accelerated exhaustion of spent fuel storage capacity, increased outages or derates due to reliability concerns, the uprate modifications themselves, the need to meet fenceline radiation standards, and increased cooling tower use. (*See* Section V.D.2, below.)

Entergy asserts that a second economic benefit from the uprate would be increased taxes paid to the state by Entergy. In 2003, the state adopted a tax system for Vermont Yankee that is based upon the station's generation output. Simply put, the more power Entergy produces from Vermont Yankee, the more it will pay in state taxes.

The Department estimates that if Vermont Yankee generates uprate power as planned through the end of its licence, the potential benefit to the State of Vermont is $1.6 to $2.6 million, depending upon the capacity-factor assumptions. Vermont Yankee's historic ten-year average capacity factor has been 85 percent for outage years and 98 percent for non-outage years. The increased taxes resulting from the uprate would be approximately $1.6 million on a net-present-value basis. Using capacity factors of 92 percent in outage years and 97 percent in non-outage years (which reflect Vermont Yankee's last three years), the increased taxes would be between $550,000 to $600,000 per year, which produces a net-present-value near $2.6 million.

We conclude that increased tax revenue represents a likely economic benefit of the proposed uprate. We find it is reasonable, however, to rely upon the more conservative estimate of capacity factors for two reasons. First, Vermont Yankee is about to undergo physical plant changes, which have the potential to lead to more outages or reduced power output. This would reduce the tax revenues. Second, we find use of the longer, ten-year average to be a better predictor of future performance. The last three years have shown excellent performance, but there is no certainty that it will continue.

While we find these added tax revenues to be a benefit, they are not certain. As explained in section V.D.2., below, if Entergy exhausts the spent fuel storage capacity and dry cask storage is not approved, Entergy will be forced either to reduce the Vermont Yankee power output, or shut down the plant prior to the end of its current license term (2012). Any decrease or early cessation of uprate power will reduce tax revenue benefits accordingly, because the incremental tax revenue is directly tied to the production and sale of uprate power. Were this to occur one year earlier than now planned, the net-present-value tax revenue benefit from uprate power would be reduced to approximately $900,000 (closure in 2010); closing in 2007 or 2008 (whether because of exhaustion of storage capacity or for other reasons) would have an even greater reduction in predicted benefits.

c. Memorandum of Understanding — State Benefit Funds

(1) Findings

33. The Memorandum of Understanding between Entergy and the Department creates a mechanism by which Entergy will share a portion of its uprate-related revenues with the State of Vermont. The Memorandum of Understanding sets a strike price for each calendar year until 2012, prices that are lower than those in the current Power Purchase Agreement with VYNPC.[53] If Entergy sells uprate power at a price above the strike price, at the end of the calendar year Entergy will pay the State half of the weighted average revenue per MWH generated during the calendar year in excess of the specific strike price applicable to that year for twenty percent of the uprate power sold by ENVY in each hour.[54] MOU at § 2; Thayer pf. 11/5/03 at 2-3.

34. Any reduction (derate) of the amount of uprate power would reduce the amounts of payments commensurately. Entergy has no obligation to make any payments for any hour during which Vermont Yankee operates at less than fifty percent of its then seasonal claimed capability for all or a portion of such hour. MOU at § 2.

35. The Memorandum of Understanding provides that the revenue sharing on the uprate power will commence on the date the NRC approves the uprate. *Id.*

36. The Memorandum of Understanding provides that the money collected by the State from the revenue-sharing mechanism on uprate power should be used to fund two public-benefit funds: the Environmental Benefit Fund and the Low Income Benefit Fund. *Id* at § 1.

37. Under the Memorandum of Understanding, $250,000 of the revenue sharing funds (or the entire amount if less than $250,000 is available) would be used in the Low Income Benefit Fund. This money would be used by the Warmth program for emergency assistance to prevent loss of energy services to low-income Vermonters during the winter months. The maximum

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53. The strike price is $11/MWh less than the Power Purchase Agreement price each year, or $31.80, $28.50, $28.00, $29.00, $30.00, $31.00, $32.00, $33.00, and $34.00, for 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, and 2012, respectively. We note that it is incorrect to describe the payments as representing 10 percent of Entergy's revenue on uprate power. Rather, the payments represent 10 percent of the difference between the sales price and the strike price.

54. Under the MOU, the price of uprate power is determined based upon the price Entergy actually receives for the power. MOU at § 3.

Low Income Benefit funds available over the life of the agreement would be $2.0 million (in nominal dollars). *Id*; Frankel pf. 11/5/03 at 3; exh. DPS-DLF-1Rev.

38. After the first $250,000 of the revenue-sharing funds are distributed to the Low Income Benefit Fund each year the agreement is in effect, the remainder of the revenue-sharing funds would be allocated to the Environmental Benefit Fund. The Environmental Benefit Fund would be used to improve water quality in certain waterways of Vermont, by supporting the Clean and Clear Water Initiative. MOU at § 1; Frankel pf. 11/5/03 at 3-4; exh. DPS-DFL-5Rev.

39. In addition to the revenue-sharing fund, the Memorandum of Understanding provides that Entergy will make a one-time payment of $200,000 to the State within ninety (90) days of Board approval of the Memorandum of Understanding, for the Entergy Fund for Economic Benefit. MOU at § 1; Frankel pf. 11/5/03 at 5.

40. Assuming that the uprate is implemented beginning April 1, 2005, based on higher capacity factors of 92 percent for outage years and 97 percent for non-outage years, and power sales at the prices set out in the Department's market price forecast, the payments from Entergy to the State would have a value of $6,082,238 in monthly net-present-value dollars.[55] Exh. DPS-DLF-6.

41. Any of the following circumstances could lead to a reduction or elimination of the payments by Entergy: unplanned outages; spent fuel pool capacity shortage (such as due to the inability of Entergy to obtain approval for dry cask storage); derate pending NRC approval of the modification; cooling tower derate; derate to maintain fenceline radiation dose limit; or NRC approval for less than a 20 percent uprate.[56] Sherman pf. 5/9/03 at 8, 13.

(2) Discussion re: State Benefit Funds

The largest economic benefit to the State from the uprate would be the payment of money by Entergy to the State of Vermont for certain designated uses. Specifically, the Memorandum

55. The Department did not provide an estimate of revenues at the ten-year average capacity factors that we find to be a better predictor.

56. Each of these possible events (except the last) also raises possible costs to the state. We discuss each one individually in Section V.D.2, below.

of Understanding proposes that if Entergy sells uprate power above a strike price, Entergy will pay 10 percent of these revenues to the State.

Under the Memorandum of Understanding, these payments will be distributed to three specific funds: a Low Income Benefit Fund; an Environmental Benefit Fund; and an Entergy Fund for Economic Benefit. (The latter is a one-time payment made by Entergy, within 90 days of Board approval of the Memorandum of Understanding, to the Vermont Department of Commerce and Economic Development.) The Low Income and Environmental Benefit Funds would receive payments based upon a percentage of the revenues Entergy receives above the strike price for uprate power. First, $250,000 per year would be paid into the Low Income Benefit Fund, with any remaining money each year paid to the Environmental Benefit Fund. The Department, based on its market price forecasts and the same capacity factors it used to calculate tax benefits, estimates that the net-present-value benefit to the state from payments to the three funds is $6.1 million.

These payments represent a meaningful economic benefit for the State and its residents under Section 248(b)(4).[57] The payments reflect a measurable increase to the value of the uprate. However, the magnitude of this benefit is not fixed. Except for the one-time payment of $200,000 (within 90 days of Board approval of the Memorandum of Understanding) to the Entergy Fund for Economic Benefit, the payments are dependent upon a complex revenue sharing formula driven by the amount and price of uprate power sold by Entergy (which we presume will approximate market prices). If market prices exceed the Department's current forecast, Vermont will receive greater benefits. Conversely, lower market prices will reduce or even eliminate the payments. The estimates of the amounts potentially available for the State Benefit Funds are based on the Department's forecasts of wholesale electricity prices through 2012. The strike prices on which the revenue-sharing calculations are based rely upon the same forecast. Additionally, there is a large potential variation in the timing and amounts of any such payments, if and when they occur. This variability exists because the revenue-sharing payments

57. The use of these funds is discussed separately, in Section V.D.3, below.

are wholly contingent upon uprate power being sold, and at prices higher than the established strike prices, and because recent history has shown great volatility in wholesale electricity prices.

The estimated benefits would also be reduced if the NRC ultimately approves an uprate of less than 20 percent, since ongoing payments to the State are based on uprate output.[58] In addition, all outages, planned or unplanned, will affect payments to the State, reducing those payments if the outages lead to capacity factors lower than those assumed in the Department's calculations. Moreover, the Memorandum of Understanding provides that:

> Entergy VY shall have no obligation to make contributions with respect to any hour, nor shall such hour be included in any calculations, during which VYNPS operates at less than fifty (50%) percent of its then seasonal claimed capability for all or a portion of such hour.

This means that if Entergy, for whatever reason, reduces Vermont Yankee's output, payments to the Benefit Funds would decrease. If Entergy reduces output below 50 percent for any hour (such as due to an unplanned outage or derate), the payments would be reduced commensurately. More significantly, if Entergy shuts down Vermont Yankee before 2012, payments to the State Benefit Funds would end.

The Department's estimates assume that Vermont Yankee will operate as planned through 2012. However, as we discuss in section V.D.2 below, operation at proposed uprate levels means that Vermont Yankee would exhaust its currently authorized spent fuel storage space approximately 18 months earlier than without an uprate. In this event, payments to the State Benefit Funds (and, also, any incremental tax revenue) could cease by the fall of 2008, if not earlier. Were this to occur, the net-present-value of payments from uprate power to the State Benefit Funds would be reduced to approximately $3.2 million.

d. Avoided Air Emissions

(1) Findings

58. The Department states that, if the NRC were to approve an uprate of less than 20 percent, the Department would recalculate the estimated benefits shown in exh. DPS-DLF-5Rev, based on the level the NRC approves, and would submit, to the Board and the parties, revised estimates of the amounts to be paid. Department Initial Brief at 33. It is unclear, however, what actions the Department thinks that the Board or the parties could take at that point.

42. Air emissions from power plants contain certain pollutants, even after the treatment by air pollution equipment. These pollutants impose negative impacts on human health and the environment, often at no cost to the power plant that produces the emissions. These impacts impose costs upon society that are generally referred to as "externalities." Greene pf. 7/02/03 at 13.

43. The generation of power from nuclear fuel also produces external costs to society. Exhs. DPS-WKS-5, DPS-WKS-6, DPS-WKS-7, DPS-WKS-8, and DPS-WKS-9; Thayer pf. 2/21/03 at 16.

44. Avoiding air emissions from power plants is beneficial. Sherman pf. 8/19/03 at 20.

45. The radiological and other negative impacts from the nuclear fuel cycle offset any benefits from avoided air emissions. However, that "offset" is not readily quantifiable. *Id.*

46. The major societal externalities from nuclear and fossil fuel generation of electricity (*i.e.*, global warming, air pollution, releases from uranium mining, and fossil fuel effects in the nuclear fuel cycle) affect society in general rather than Vermonters specifically. These uncertain externalities are not an appropriate basis to demonstrate an economic benefit to the state and its residents under Section 248(b)(4). Sherman pf. 8/19/03 at 19.

(2) Discussion re: Avoided Air Emissions

Entergy contends that the uprate of Vermont Yankee will produce significant economic benefits by avoiding air emissions from fossil fuel-burning power plants that would be used to serve the New England grid in the absence of uprate power from Vermont Yankee. The Department counters that the benefits of reduced air emissions are offset by the cost of societal externalities of the nuclear fuel cycle.[59]

We agree with Entergy that the displacement of fossil fuel-burning power plants is a benefit to the state of Vermont. We have consistently found that the greenhouse gas and other air

59. "An externality exists where some negative or positive impact is generated by an economic activity and imposed upon third parties, and where the impact is not priced in the market place. A societal externality is one imposed on a large segment of society, or society in general, such as the postulated health effects of global warming or the postulated health effects of radon released from mill tailings from uranium mining." Sherman surr.pf. 8/19/03 at 8.

emissions from these plants impose societal costs and we have required that these added societal costs be recognized when evaluating resource acquisition decisions (including whether demand-side management measures may be more cost effect). Moreover, some of these societal costs have a direct effect upon Vermont. Thus, we find an economic benefit from generating power from sources that do not burn fossil fuels.

At the same time, we recognize that nuclear power plants have externalities associated with the production of power. These arise both in the process of obtaining and refining the nuclear fuel and in the disposal of radioactive waste. As the Department points out, there is no agreed-upon methodology for determining the externalities associated with nuclear waste, although studies have suggested that they may be similar in magnitude to those arising from fossil-fuel burning.[60] We conclude that it is reasonable to assume that the two sets of externalities (*i.e.*, fossil fuel-related and nuclear-related) are roughly equivalent.[61] Thus, we do not assign a monetary value to the proposed uprate for a reduction in the use of fossil fuels.

e. Non-Monetary Benefits

Entergy and the Department submit that the uprate would provide various non-monetary benefits to the State. Primary among these is the expectation that the uprate would improve the overall profitability of Vermont Yankee, and as a result, Entergy would be less likely to close Vermont Yankee prior to the expiration of its license in 2012. The attendant benefits that this scenario assumes include stable baseload energy at the favorable prices set out in the Power Purchase Agreement, and steady, high paying year-round jobs in southeastern Vermont.[62] If all goes well at Vermont Yankee through 2012, these benefits should be realized. However, if we recognize these benefits in our decision, we must also weigh them against both the probability of their occurrence and the corresponding non-monetary costs if all does not go well with the uprate. Because an uprate adds a measurable degree of uncertainty to the future operation of Vermont Yankee, we must discount the value of these non-monetary benefits commensurately.

60. *See* generally, Sherman pf. 8/19/03.
61. Tr. 6/17/03 at 180–181 (Sherman); *see also*, Sherman pf. 8/19/03 at 18.
62. Lesser pf. 2/21/03 at 5.

Another non-quantifiable benefit of the proposed uprate is the possibility that Green Mountain and Central Vermont can negotiate favorably-priced agreements to purchase part of the additional uprate power. Under the settlement in Docket 6545 between Entergy and the Department, Entergy will provide the previous owners of Vermont Yankee (including these two utilities) an exclusive right to negotiate for 30 days to purchase the uprate power before Entergy negotiates with other companies. At this stage, it is unclear what, if any, financial value the Vermont utilities will derive from the exclusive negotiation right, but the option does provide some additional value.[63]

Finally, the proposed uprate will impose no direct monetary costs on the State of Vermont or its residents; Entergy will bear the entire risk of the capital investment required for the uprate.[64]

2. Costs of Power Uprate

In addition to the benefits of the proposed power uprate, described above, the modifications to Vermont Yankee to increase its power output entails certain costs. Some of these are reasonably quantifiable, such as loss of power output due to a cooling tower derate; others are more difficult to accurately measure, such as the potential increases in costs if the uprate leads to additional outages that require Vermont utilities to purchase high cost replacement power; nonetheless, these risks are real. In this section, we assess potential costs arising from the proposed uprate.

a. Loss of Benefit of Power Purchase Agreement

(1) Findings

(a) The Power Purchase Agreement

47. The previous owners of Vermont Yankee, including Green Mountain and Central Vermont, purchase power from Entergy under the Power Purchase Agreement. Exh. DPS-13.

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63. Green Mountain and Central Vermont have voluntarily waived their right to negotiate first for 20 MW of the uprate power, but still retain their rights with respect to the remaining portion of the power. See, exhs. EN-CCW-4 and EN-CCW-5. (Green Mountain and Central Vermont would have had the option to negotiate for 55 percent of whatever power output increase the uprate produces.)

64. Lesser pf. 2/21/03 at 25.

48. The Power Purchase Agreement is a unit-contingent contract. Wells pf. 7/2/03 at 3.

49. Pursuant to Article III, Section (c) of the Power Purchase Agreement, Entergy's obligation is to provide power to VYNPC only when Vermont Yankee is producing power. If for any reason Vermont Yankee is not producing power, Entergy has no obligation to obtain replacement power or otherwise indemnify VYNPC. *Id.* at 4.

50. Because of the structure of the Power Purchase Agreement, the cost risk associated with the purchase of replacement power at prices potentially higher than the Power Purchase Agreement is on Vermont utilities and Vermont consumers. Sherman pf. 8/19/03 at 22; exh. DPS-3.

51. The cost of replacement power would most likely be defined by market prices since uprate-related outages would most likely be unplanned. Sherman pf. 8/19/03 at 22.

52. If, after the uprate, Vermont Yankee reduces its power output, the reduction in output would apply to purchases under the Power Purchase Agreement as well as to uprate power. Tr. 1/15/04 at 219–220 (Sherman); exh. DPS-3 (Section 8).

(b) Risks of Increased Outages Following Uprate

53. Historically, Vermont Yankee has had a very good reliability record. Over the past ten years, its capacity factor has been 85 percent in outage years and 98 percent in non-outage years. Tr. 6/19/03 at 192 (Sherman); Sherman supp.surr.pf. 9/26/03 at 3.

54. In the period 2000 to 2002, Vermont Yankee's capacity factor was approximately 93.1 percent, higher than the 10-year average of 89.1 percent. Greene pf. at 9.

55. Modification of Vermont Yankee creates an increased possibility of outages (primarily due to the break-in period) in which there is a reduction in reliability. Tr. 6/19/03 at 168 (Sherman).

56. Plants which have implemented 20 percent power uprates have experienced forced outages and power reductions as a result of the modifications made for power uprate. Sherman pf. 5/9/03 at 14.

57. The modifications for the power uprate are extensive and have the possibility of extending either the 2004 or 2005 refueling outages. *Id.*

58. Eight nuclear plants have undergone extended power uprates of 17 percent or greater. Two of these, the Quad Cities Units 1 and 2, have experienced extended outages as well as periods of derates. Exh. EN-JKT-7; Sherman pf. 11/5/03 at 8; tr. 6/19/03 at 191.

59. Quad Cities 2 has experienced 42 days of uprate-related outages, along with additional lost generation through a period of derating. Sherman pf. 8/19/03 at 22.

60. The cost risk for Vermonters occurs from having to purchase replacement power at prices potentially higher than those set out in the Power Purchase Agreement. The cost of this replacement power would most likely be defined by market prices since uprate-related outages would most likely be unplanned. *Id.*

61. Market prices are expected to exceed the prices in the Power Purchase Agreement for the remaining operating life of Vermont Yankee. Exh. DPS-DFL-4.

62. The major reliability effects associated with uprate or major plant changes, inputting major equipment, are likely to occur within the first eighteen months. Two operating cycles, or 3 years, is a good surrogate for when the highest percentage of run-in problems occur.[65] Tr. 1/15/04 at 222 (Sherman).

(c) The Ratepayer Protection Proposals

63. Pursuant to the Memorandum of Understanding, Entergy will provide two tiers of outage protection for ratepayers for three years following uprate against power uprate-related outages if the market is unfavorable. MOU at § 3.

64. Both tiers of protection provide reimbursement to Green Mountain and Central Vermont for the difference between (1) the price these utilities would have to pay to purchase its expected allotment during an outage or power reduction, and (2) the price the two utilities would have

65. We note, however, that the operating history of nuclear plants that have undergone extended power uprates of the magnitude proposed by Entergy provides little predictive power about long-term outage risks. The earliest extended uprates at 17 percent or higher — which are the only ones close to Entergy's proposed power uprate — took place only late in 2001. Exh. EN-JKT-7. Thus, the first nuclear plant to uprate to this level has been operating for less than three years and the others have even less experience. This means that there is not an operating history demonstrating that larger extended power uprates do not create increased reliability risks over the long term. Tr. 1/15/04 at 179–181 (Sherman).

received this power under the Power Purchase Agreement had Vermont Yankee not experienced the outage or power reduction. Sherman pf. 11/5/03 at 6.

65. The ratepayer protection mechanisms will apply to all replacement energy (which is defined to mean power not delivered to the utilities as their full Vermont Yankee entitlement), regardless of whether that energy is needed to serve native loads or whether the utilities actually purchase replacement energy. Thus, the outage protection will cover both replacement power costs directly incurred by the Vermont utilities to serve Vermont load due to uprate-related outages and derates and to lost profits on Vermont Yankee power which Vermont utilities would otherwise have purchased under the Power Purchase Agreement and could resell on the wholesale market. MOU at § 3.

66. In the first tier of protection, Entergy is responsible for reimbursing Central Vermont and Green Mountain for any net loss incurred because of Entergy's failure to deliver the utilities' full allotment of energy under the Power Purchase Agreement due to uprate-related reasons. *Id.*

67. The first tier of ratepayer outage protection provides protection to ratepayers up to $1.5 million. MOU, Attachment A at 2–3; Sherman pf. 11/5/03 at 6.

68. The second tier of outage protection provides for additional protection in high energy market conditions in the event of an uprate-related outage. If energy prices are greater than $55.47 in 2004, $50.11 in 2005, $52.73 in 2006, and $55.34 in 2007, Entergy will pay the two Vermont utilities for excess replacement power costs for their allotment of energy from Vermont Yankee above these prices over the three-year term. MOU at § 3c; Sherman pf. 11/5/03 at 7.

69. Under the Memorandum of Understanding, both ratepayer protections will not apply to the same period. Tr. 1/15/04 at 113–114 (Thayer); MOU at ¶ 3c; tr. 1/15/04 at 226 (Sherman).

70. The ratepayer protection proposals call for a review of costs at the end of six periods consisting of six months each. If at the end of each period the utilities have incurred replacement power costs due to uprate-related outages or derates that exceed what they would have paid under the Power Purchase Agreement, then Entergy will reimburse those costs up to a cap of $250,000 for the first tier and $500,000 for the second tier per each six-month period. If the amounts owed to the utilities exceed the cap for the period, the excess will be carried forward to the next six-month period, with a total cap for the three-year period of $1.5 million for both utilities for

the first tier and an additional $3 million for the high-cost protection. Wells pf. 9/26/03 at 4–5; MOU, Attachment A at 2–3.

71. If, as a result of uprate-related outages or derates, the utilities pay less for replacement power than they would have paid under the Power Purchase Agreement, those savings are netted against any costs incurred during the relevant six-month period. Such savings are also carried forward to subsequent periods to net against further outage- or derate-related costs incurred in subsequent periods. In no event will the utilities have to pay any amounts to Entergy. Savings will merely net out costs. *Id.*

72. If the cap in any six-month period for either mechanism is not used, it also carries forward to subsequent periods.[66] Tr. 1/15/04 at 244 (Thayer).

73. If an outage occurs during the period that the ratepayer protection proposals are in effect, Entergy will bear the burden of demonstrating that the outage is not uprate-related. Tr. 1/15/04 at 119–121 (Thayer).

74. Under the ratepayer protection mechanisms, if disputes occur relating to the ratepayer protection proposals, the Vermont utilities and Entergy will each appoint one representative to attempt to resolve the dispute. After 30 days, either party may petition the Board for relief.[67] MOU at § 3.

75. In exchange for the lower-tier ratepayer protection proposal, Green Mountain and Central Vermont partially waived their right to a period of exclusive first negotiations to purchase the uprate power.[68] Wells pf. 9/26/03 at 6; exhs. EN-CCW-4 and 5.

(d) Post Modification/Pre-Uprate Derate

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66. Although the two ratepayer protection proposals refer to amounts available each six months, because unreimbursed replacement power costs, replacement power cost savings, and the unused portion of the amounts made available each six months carry forward to subsequent periods, the net effect is that the six-month periods are for accounting purposes only. Entergy's commitment is $1.5 million under the first tier protection and $3.0 million under the second tier protection.

67. The dispute resolution defined in the Memorandum of Understanding and in this finding will apply rather than the one set out in the Ratepayer Protection Proposal (exh. CCW-3) itself. Tr. 1/15/04 at 111 (Brown).

68. Central Vermont waived its right to purchase up to 12.75 MW. Exh. EN-CCW-4. Green Mountain waived its right to purchase up to 7.25 MW. Exh. EN-CCW-5.

76. A derate of as much as 20 MW may occur during the period after the uprate modifications have been made and prior to operating at uprate conditions. This impact occurs because the efficiency of the new high pressure turbine goes down at lower thermal conditions. Tr. 1/15/04 at 52–53 (Thayer).

77. Once the NRC approves the power uprate, the Station would gradually be taken back to its present electrical rating and then go up another 70–80 MWs in the first step of the power uprate increase. *Id.* at 55–56 (Thayer).

78. To the extent that there is a 20 MW difference in Station output during the cycle after the uprate modifications are made but prior to NRC approval of the uprate, the output available to the Vermont utilities under the Power Purchase Agreement would be reduced by approximately 10–12 megawatts. *Id.* at 57 (Thayer).

79. If the derate lasted from May 2004 (the end of the refueling outage) until the end of February 2005, the effect of this reduction on Vermont utilities would be approximately $155,000, assuming market prices tracked the Department's price forecast. If market prices were higher or if the NRC did not authorize Entergy to increase the thermal output of the reactor by the beginning of March 2005, the effect would be greater, perhaps significantly so. Exh. DPS-23.

80. If the cost of replacement power for 10–12 MW exceeded the prices in the Power Purchase Agreement, the proposed Ratepayer Protection plan would cover the differential up to the maximum dollar amounts and for the first 3 years. Tr. 1/15/04 at 58 (Thayer).

81. The equipment in the Station now is optimized for operation at current power levels. Similarly, the new and modified turbine is optimized for operation at projected power output under the uprate scenario. It is less efficient, however, at existing power levels. Tr. 1/15/04 at 52–59 (Thayer). Should the NRC not approve the power uprate application, Entergy would further modify the new high pressure turbine to replace the first stage nozzle to get back on the efficiency curve for that machine to recover the lost megawatts, thereby eliminating further exposure to the Vermont utilities resulting from reduced efficiency of the high pressure turbine. Tr. 1/15/04 at 59–60 (Thayer).

(2) Discussion

Green Mountain and Central Vermont now purchase approximately 300 MW of capacity — and approximately one-third of their energy needs — from Vermont Yankee under the terms of the Purchase Power Agreement entered into as part of the sale of the Station to Entergy in 2002. One of the primary benefits of the Power Purchase Agreement is the pricing structure.[69] It provides a fixed price, which shields Green Mountain and Central Vermont from higher market prices. Beginning in November 2005, this fixed price is coupled with a low-market-adjuster that takes effect if market prices are lower than the specified fixed price to lower the price to approximately market price plus 5 percent.

The Power Purchase Agreement, however, is not a firm contract, but rather is unit-specific; if Vermont Yankee does not run, the two Vermont utilities receive no power.[70] Similarly, if Vermont Yankee operates at less than full power, the Vermont utilities' share of the output is reduced proportionately. Under either of these reduced power scenarios, Green Mountain and Central Vermont may need to seek replacement power in the wholesale energy market.

The potential need to purchase replacement power exposes the Vermont utilities to financial risk. If an outage or derate (*i.e.*, power reduction) occurs during periods in which the wholesale price of electricity to replace the lost power exceeds the prices in the Power Purchase Agreement, the Vermont utilities, and potentially Vermont ratepayers, would incur higher costs for a significant amount of power.[71] This risk associated with replacement power during outage periods is not new; unplanned outages during the time when Green Mountain and Central Vermont owned Vermont Yankee also required the companies to obtain replacement power. The risk associated with replacement power was mitigated by the fact that, historically, Vermont

69. Docket 6545, Order of 6/13/02 at 45–46.

70. The unit-specific nature of the contract was part of the overall agreement between the owners of Vermont Yankee and Entergy at the time of the sale. The previous owners had the option to pursue a firm power contract at a lower sale price, but elected not to do so. Wells pf. 7/2/03 at 3.

71. The Department's market price forecast projects that this will occur through most of the term of the Power Purchase Agreement, which is why that agreement is beneficial. Exh. DPS-DFL-4; MOU at 2–3 (the Strike Price in the Memorandum of Understanding is $11/MWh below the price in the Power Purchase Agreement for the same period.)

Yankee has had one of the best operating histories in the nuclear industry.[72] This favorable operating history means that replacement power has been needed primarily during refueling outages, which allows the Vermont utilities to plan for it and make advanced arrangements.

All parties agree that with the power uprate, the risk of prolonged or more frequent outages increases. They differ as to the magnitude of that risk.[73] This added outage risk could, in turn, require Vermont utilities to purchase replacement power at times when they would not need to do so if the uprate did not occur. The uprate thus adds to the financial risk of Vermont ratepayers arising from unplanned or extended outages.

To mitigate this financial risk, Entergy has proposed two ratepayer protection mechanisms, each of which has a three-year duration commencing at the time Entergy makes the physical changes to Vermont Yankee (planned for the Spring 2004). The first mechanism, styled the Ratepayer Protection Proposal, specifies that if Green Mountain and Central Vermont incur replacement power costs in excess of the Power Purchase Agreement prices due to uprate-related outages, Entergy will reimburse them for up to $250,000 for each six-month period.[74] The total payments over the three-year term of the proposal are capped at $1.5 million.[75] In each period, added replacement power costs are netted against any savings the Vermont utilities may experience due to replacement power costs that are below the Power Purchase Agreement prices. Unreimbursed replacement power expenses, unused portions of the 6-month cap, and any net savings from low replacement power costs all carry forward to subsequent 6-month periods.[76]

The second tier of protection applies when the market price of replacement power is more than $10 above the DPS market price forecast for that year. This "High Energy Price" mechanism works the same as the Ratepayer Protection Proposal, except that the available dollar

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72. Sherman 12/26/03 pf. at 20.

73. As expressed by an Entergy witness: "[h]istorical evidence suggests that the implementation of major plant changes that some design, installation, or operating issues arise that result in slightly reduced reliability during the early stages of implementation." Burns pf. 7/2/03 at 29.

74. Exh. EN-CCW-3. The $250,000 is split between Central Vermont ($159,000) and Green Mountain ($91,000). *Id.* at 2.

75. *Id.*

76. Essentially, the Ratepayer Protection Proposal represents a 3-year, $1.5 million guarantee, with 6-month accounting periods.

amounts and caps on total payments are doubled.[77] Under both plans, the burden of demonstrating that an outage is not uprate-related rests on Entergy.[78] In addition, the outage protection plans define replacement power to mean any power not delivered to the utilities as their full allotment of energy under the Power Purchase Agreement. Thus, any net loss incurred as a result of the reduced power delivery is covered by the ratepayer protections, even if that energy is not required to serve native loads.[79]

As part of our evaluation of whether the uprate provides an economic benefit to the state of Vermont, the question the Board must consider is how much of a cost, if any, future outages may cause Vermont ratepayers. This requires us to consider the likelihood of outages, the magnitude of the financial risk, and the adequacy of Entergy's proposed mechanisms to protect Vermont ratepayers.

NEC asserts that complex nuclear plants, like Vermont Yankee, experience more outages as they near the end of their intended life, which NEC defines as the end of its operating license in 2012. According to NEC, plants exhibit a "bathtub" effect,[80] with more outages at the beginning of the life and at the end, and more stable operating performance in between. The result, argues NEC, is a large increase in the likelihood of outages, first, as a result of physical modifications that are more likely to suffer failure because of their newness, and second, because the modifications are being made to a plant that is aging, nearing the end of its originally planned life, and more likely to have failures anyway.

Entergy argues that the likelihood of outages is relatively small. According to Entergy, while there is some validity to the concept of the "bathtub" effect, the Vermont Yankee situation does not raise that concern. Entergy cites first to the fact that it has a routine maintenance and

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77. The two mechanisms are structured so that only one applies at a time. If the market price meets the threshold for the High Energy Price mechanism, only that plan applies. Tr. 1/15/04 at 113–114 (Thayer).

78. Tr. 1/15/04 at 119–121 (Thayer).

79. MOU at § 3. This provision is important, particularly for Central Vermont which presently makes profits by reselling excess energy.

80. The "bathtub" effect refers to a behavior pattern of major mechanical systems. New systems break more frequently as they go through the initial break-in period. Older components break more frequently as they age, due to long-term wear. The middle-aged systems tend to be most reliable. This behavior pattern applies even to well-maintained complex systems. Gunderson 5/15/03 pf. at 6; exh. NEC-1.

replacement program; this program shows that the plant shows no sign of increased outage risk as it nears the end of its originally planned life. Entergy points to the increased performance record over the recent past for a plant that already had a reliable performance history as proof that its program is working. In addition, Entergy says that it extensively tests new components to minimize the potential for early failure. Also, Entergy puts forward the fact that other boiling water reactors have successfully performed uprates, although Entergy acknowledges that two of these nuclear plants have had some additional outages that were attributable to the power uprate at those plants. Finally, Entergy says that two ratepayer protection mechanisms will reimburse Green Mountain and Central Vermont for certain increased replacement power costs during the first three years following the physical plant modifications for the uprate.

The Department raises concerns about the potential for outages, but agrees with Entergy that the ratepayer protection proposals in the Memorandum of Understanding adequately address this issue. The Department asserts that these proposals will cover the likely range of additional replacement power costs if an outage were to occur. The Department also notes that, since Vermont Yankee is a merchant plant, Entergy has a strong interest in maintaining a high level of reliability since a failure to operate means a loss of revenues.

As we stated above, there is no dispute that some increased outage risk exists.[81] We do not, however, find that the evidence supports the conclusion urged upon us by NEC: that the "bathtub" effect means that outages are more likely in future years and that, therefore, the reliability of Vermont Yankee would be compromised by the uprate simply because of the age of the nuclear plant. The specific instances cited by NEC do not convince us that Vermont Yankee has aged to the point that more frequent outages are inevitable. In each of the cases cited, it appears that Entergy's program of replacing equipment as it wears so as to avoid equipment failure functions reasonably. The effect of this regular maintenance is that while the plant as a whole is aging, the bulk of the individual components have varying ages.[82] As a result, we thus

81. Burns pf. 7/2/03 at 31–34; Sherman pf. 5/9/03 at 14; Gunderson pf. 5/15/03 at 6.

82. Burns pf. 7/2/03 at 37. Obviously, certain plant components (such as the reactor containment vessel) have remain unchanged. No evidence demonstrates that these components are nearing failure.

see no evidence that the power plant as a whole will experience the end of life characteristics of the "bathtub" curve.[83]

Moreover, Vermont Yankee has more than thirty years of operating history. This has not led to more frequent outages as the aging analysis advanced by NEC might suggest. Instead, recent performance has exceeded the long-term capacity factors for the Station. Arguably, Vermont Yankee could be near the end of the "good performance" period anticipated by the bathtub effect. But no party has presented evidence to support such a conclusion and to indicate that Vermont Yankee is about to reach worsening performance patterns.

At the same time, the evidence does not support the conclusion that the ratepayers are adequately shielded from the risks of increased costs that would arise from more frequent or prolonged outages that are reasonably foreseeable after the uprate. Entergy and the Department rely primarily on Vermont Yankee's historical operating characteristics and the experience at other nuclear facilities to support their assertion that the risks of added or prolonged outages or derates are limited. They note, correctly, that other boiling water reactors have successfully performed uprates of a comparable magnitude.[84] However, it is also clear that several of the facilities that have undergone uprates have experienced outages or derates due to the uprates.[85] One of the plants — Quad Cities 2 — has experienced as much as 42 days of outages as well as power derates during other periods.[86]

Moreover, the experience at other plants has several limitations. First, there are only eight nuclear plants that have undergone uprates at 17 percent or greater and only three at the 20 percent level that Entergy seeks permission to conduct at Vermont Yankee.[87] Second, the oldest

83. Tr. 9/15/03 at 233–234 (Burns); tr. 1/14/04 at 146 (Thayer).

84. Exh. EN-JKT-7. The bulk of the evidence presented initially by Entergy concerning uprates at other nuclear plants had little probative value; it included many plants that had not undergone power uprates of comparable size to that contemplated at Vermont Yankee. Subsequent analysis from Dr. Burns (Burns pf. 7/2/03 at 33) still included extended power uprates of 13 percent in the analysis, even though Entergy did not show that these had impacts on the nuclear plants comparable to those arising from a 20 percent uprate.

85. Burns pf. 7/2/03 at 33.

86. Sherman pf. 9/26/03 at 4.

87. Exh. EN-JKT-7.

of the uprates took place less than three years ago.[88] The relative newness of the comparable power uprates means that the operating history at the higher uprate temperatures is limited and provides little guidance on the long-term risks arising from the uprate.

Compounding these considerations is the fact that the experience at other nuclear plants does not demonstrate that Vermont Yankee will have a similar experience. The evidence presented by Entergy and the Department relies largely on Vermont Yankee's favorable past operating experience to show that future performance will be similar and on an assumption that the post-uprate Vermont Yankee performance will be similar to that of other nuclear plants. What is probative of future performance, however, is engineering information related to Vermont Yankee's specific characteristics, such as the condition of each system and an evaluation of whether and how those systems will be affected by the uprate.[89] Entergy did not offer such evidence.

Given the absence of plant-specific facts, the evidence presented by Entergy does not allow us to reach a conclusion as to the magnitude of the outage risk. Entergy's empirical analysis of the outage risk — which shows the average outage rate for the nuclear industry as a whole[90] — has minimal predictive value for Vermont Yankee. On the one hand, Vermont Yankee could experience no increased outage rate, as have several other nuclear plants that have performed power uprates. Conversely, Vermont Yankee could have an operating history similar to Quad Cities 2 (which has had 42 days of outages as well as periods of derates) or even worse. Nothing in the evidentiary record provides the Board any meaningful guidance on this point.

The likelihood of outages is, nonetheless, a significant consideration facing us. The risks of more frequent or prolonged outages due to the uprate translate directly into potentially

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88. *Id.*

89. Much of this information has been provided by Entergy to the NRC for its review of safety systems. We have no reason to get involved in the NRC's safety review as that issue is clearly within their jurisdictional purview. The same information and in-depth evaluation of the systems at Vermont Yankee is equally relevant to plant reliability. For this reason, and because of the significantly greater expertise in reviewing nuclear plant engineering possessed by the NRC, we will request that the NRC provide a detailed assessment of Vermont Yankee as part of its review. This will provide greater certainty that Vermont Yankee will operate reliably.

90. We note that Entergy's statistical analysis also materially understates the relevant outage probability as well. It includes nuclear plants that had uprates at less than 17 percent and counts plants before they made the physical changes necessary for the extended power uprate. Burns 7/2/03 pf. at 33; tr. 9/15/03 at 239–242 (Burns).

significant increased financial risks to Vermont ratepayers.[91] As the Department recognized, a 30-day outage could result in additional replacement power costs with a net present value of $5 million if the replacement power costs were $70/MWh.[92] Sixty days of outages under such circumstances would double the exposure to a net present value of approximately $10 million.[93] If Vermont Yankee experienced an outage history similar to Quad Cities 2, at these levels of replacement power costs, the additional cost to Vermonters would exceed $7.5 million on a net present value basis. Obviously, if the additional outage periods occurred at times of lower market prices, this financial exposure would be reduced. In fact, if market prices were below the prices in the Power Purchase Agreement, Vermont utilities and ratepayers would benefit from increased outages. By contrast, if an outage occurred during periods when replacement costs were even higher (such as occurred for a period in January 2004), the economic risk to the state of Vermont would be even greater.

The ratepayer protection mechanisms mitigate, but do not eliminate, these financial risks. The two tiers of protection will reimburse the Vermont utilities for up to $4.5 million of reimbursement for uprate-related outages that force Vermont utilities to purchase expensive replacement power. For example, if the outages occurred during periods in which the price of replacement power mirrored the Department's market price forecast, the mechanisms would cover extended outage periods.[94]

Nonetheless, the ratepayer protections have significant limitations. The payments under the proposals are capped at $4.5 million. Second, they apply only during the first three years following the physical changes to Vermont Yankee to accommodate the uprate and must be

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91. Neither Green Mountain nor Central Vermont, who purchase approximately one-third of their power from Vermont Yankee chose to intervene or present evidence on these financial risks. Given the apparent risk that the power uprate poses to their Power Purchase Agreement purchases, we find their decision not to participate perplexing, particularly since it is not certain that additional replacement power costs would be passed on directly to their ratepayers. However, even if we barred the utilities from collecting the added replacement power costs in rates, the level of economic risks to the public remains because since a failure to collect those costs directly could affect the company's financial health or risk profile. This could have an indirect adverse effect on ratepayers.

92. Sherman pf. 9/26/03 at 4.

93. *Id.*

94. Sherman pf. 11/5/03 at 7–8. The Department estimates that the ratepayer protections could cover 30-day outages occurring in each of the years that they apply.

directly related to the uprate. Both tiers of the ratepayer protection proposal may be adequate to reimburse Vermont utilities for excess replacement power costs under the scenarios put forward by the Department (*i.e.*, outages in the first three years at prices reasonably close to the Department's market price forecast). If we were able to accept these scenarios as the likely range of increased outage risks, we could find the ratepayer protections to be sufficient. However, the evidence does not permit us to conclude that these scenarios adequately bound the risk to Vermont.

In addition, we note that a portion of the funds available under the ratepayer protection proposal will likely be used during the first year, even before the actual increase in power output occurs. After Entergy performs the physical changes to Vermont Yankee, the Station will run less efficiently until such time as the power output is increased.[95] This could lead to a derate of up to 20 MW. At the Department's estimate of market price forecasts, the derate will have a financial effect of approximately $155,000,[96] for which Vermont utilities will be compensated under the ratepayer protection mechanism, thus reducing the amount available for outage reimbursement. Again, higher market prices could further erode the ratepayer protections available for uprate-related outages or derates (rather than loss of output due to Entergy's delay in getting complete information to the NRC).

Entergy also argues that the Board should not consider the potential added replacement power that may arise from an uprate as a cost. According to Entergy, the purchasers of power from Vermont Yankee knew of the potential for an uprate and, in the Power Purchase Agreement, negotiated an arrangement in which they would receive no power from Vermont Yankee any time that the Station did not operate. Entergy suggests that since the Vermont utilities knowingly took the risk, there is no cost.

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95. The equipment in the Station now is optimized for operation at current power levels. Similarly, the new and modified turbine is optimized for operation at projected power output under the uprate scenario. It is less efficient, however, at existing power levels. Tr. 1/15/04 at 52–59 (Thayer).

96. Exh. DPS-23. Higher replacement power costs will mean that the financial impact is greater, perhaps significantly so. For example, if market prices were 20 percent higher than forecast by the Department, the financial effect of the power derate could be as much as $723 thousand higher, which would reduce the value of the ratepayer protection proposals from $4.5 million to $3.8 million. *Id.*

Entergy's argument is unpersuasive. One can search at length through the Power Purchase Agreement and find no text stating that the Agreement constitutes pre-approval of some not-yet-filed application for an unspecified power uprate of unknown risks, elements, or scale. Moreover, we cannot accept the proposition that any conceivable set of private negotiations amongst some parties in Docket 6545 created any right to preclude *other* parties from raising or this Board from considering, issues relevant to the statutory criteria specified in Vermont law.[97] Certainly, the Power Purchase Agreement did place much of the market risk of outages upon Vermont utilities; however, that is precisely *why* we must, in this proceeding, treat Etnergy's proposed *change* in that risk-profile as a potential cost in our cost-benefit analysis. Thus, the risk allocation does not lead to the conclusion put forth by Entergy. Rather, it means that in making our decision on whether the uprate promotes the general good of the state, we start from the premise that Vermont utilities and ratepayers bear the risk that outages may occur and the costs that flow from such outages.

One other aspect of the ratepayer protection mechanisms may also affect Vermont utilities. Under the Memorandum of Understanding in Docket 6545 (the sale of Vermont Yankee), Entergy agreed to provide VYNPC with a right to a 30-day period of exclusive negotiations for the uprate power. Vermont utilities, as 55 percent owners of VYNPC, would have had the option to negotiate first for the purchase of a meaningful block of power. As part of the ratepayer protection proposals, Green Mountain and Central Vermont waived their right for this initial negotiation period for 20 MW of the uprate power. No party, including the two Vermont companies, presented evidence on the value that these utilities had ceded. As a result, we have no basis to conclude whether the effect of this waiver is or is not material. We note, however, that to the extent that the initial negotiation period could have yielded more favorable power purchases than Green Mountain and Central Vermont could have obtained on the open market, the waiver imposes another cost associated with the future reliability of Vermont Yankee.

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97. *See* generally, Docket 6867, Order of 12/22/03 at 20–21 (citing *In re Allied Power and Light Company*, 132 Vt. 354, 362 (1974).

We recognize that in Docket 6545, we have assigned some value to the concept of power uprate. In fact, in that docket, we viewed the potential for power uprate as a positive aspect of VYNPC *retaining* ownership of the Station, stating that it could increase the value of Vermont Yankee.[98] These statements may have suggested to parties that the Board recognized potential value in a power uprate.

The proposal now before us, however, has several significant differences from the concepts that we examined in Docket 6545. Specifically, it is much larger and with very different engineering risks. As we found in Docket 6545, a 5 percent uprate was reasonably attainable. In addition, we observed that an uprate as large as 13 percent "may be feasible in engineering terms over a 4 to 5 year time frame," although it was uncertain that it would occur. Our Order also concluded that "a smaller [than 20 percent] figure is likely to be the engineering limit at a plant as old as Vermont Yankee."[99] The situation now before us is clearly very different. In addition, the net benefits to the state are far different. Here, we find risks that could well exceed the uprate's estimated benefits to ratepayers (which we find to be at best $7.6 million). By contrast, Docket 6545's discussion of a retention-scenario considered a net present value benefit for Vermonters in a range between $39 and $59 million. That scale of benefit for ratepayers, and that less aggressive engineering approach, together differ greatly from the risk profile and cost-benefit balance now before us.

In summary, we find that because the Power Purchase Agreement assigns the risk of obtaining replacement power in the event of an outage or derate to the purchasers of Vermont Yankee power, it creates a potential cost. The parties have shown that, depending upon the duration of such an outage and the potential replacement power costs, the financial effect could be significant. On the record before us, we have insufficient basis in the record to conclude that Vermont Yankee will maintain a reliable operating history, so that the ratepayer protection plans would be adequate to compensate Vermont utilities and ratepayers in the event of uprate-related outages or derates.

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98. Docket 6545, Order of 6/13/02 at 62.
99. *Id.* at 61.

b. Accelerated Exhaustion of Storage Capacity

(1) Findings

82. With or without power uprate, Vermont Yankee will exhaust the capacity of its spent fuel pool and will not be able to operate through the end of its current license (March 2012) without implementing dry cask storage or finding another location to store spent fuel rods. Tr. 9/15/03 at 166–168 (Thayer); tr. 1/15/04 at 208–209 (Thayer).

83. Under the current discharge rate for fuel, Vermont Yankee can operate to the Fall 2008 refueling outage before exhausting its full-core discharge capability and reaching the capacity of the spent fuel pool. Thayer pf. 2/21/03 at 15; exh. EN-JKT-6.

84. If authorization for dry cask storage were not granted, Vermont Yankee would cease operations up to 18 months sooner with power uprate than without it. Thayer pf. 2/21/03 at 15; exh. EN-JKT-6.

85. If replacement power prices for the specific 18-month period are higher than the Power Purchase Agreement, there would be a cost created by power uprate. Costs associated with plant closure 18 months earlier due to disapproval of dry cask storage depend on the assessment of probability of not implementing additional outage, the time permanent closure would occur, and the market prices at the time of closure. Sherman pf. 5/9/03 at 15–16; tr. 10/17/03 at 193 (Sherman); tr. 1/15/04 at 90, 160 (Thayer).

86. Assuming prices at the level forecast by the Department, the cost to Vermont utilities and ratepayers of closing 18 months earlier could be as high as $15 million on a net present value basis. Using the Department's high and low price forecast, the potential costs to Vermont ratepayers range from $2.8 million to $21 million (on a net present value basis). Higher market prices would mean that this potential exposure is even greater. Exh. DPS-14; tr. 10/17/03 at 192 (Sherman).

87. Vermont Yankee could alter its future fuel cycles or run the cycles at a lower power level reducing any impact resulting from a denial of dry fuel storage. Such a power management will also entail the possibility of additional replacement power costs for Vermont utilities. Tr. 1/15/04 at 160–161 (Thayer) and 213 (Sherman); Sherman pf. 1/13/04 at 4.

88. Entergy intends to seek approval from the Board for dry cask storage and will not proceed with dry cask storage absent such approval. Entergy has committed to the Vermont utilities affected by the Power Purchase Agreement to apply for dry fuel storage early enough so that the utilities would have ample advance notice, up to two years, of the future of the continued operation of the plant post 2007. Tr. 1/15/04 at 86, 92–93 (Thayer).

89. It may be possible for Entergy to employ measures other than dry cask storage to create the necessary spent fuel storage capacity and therefore to continue operations. Sherman pf. 5/9/03 at 15.

90. The NRC allows licensees to use the space reserved for full core offload. If this were the case, Vermont Yankee could operate until the end of its license and not shut down prematurely. However, because of the need to preserve transfer capability in spent fuel pool, Vermont Yankee could not actually operate to this date, but would need to close several fuel cycles earlier. Sherman pf. 1/13/04 at 4; Letter of 2/9/04 from Department Counsel Sarah Hofmann to the Clerk of the Board.

91. Five nuclear plants — Columbia Generating Station in Washington State, Arkansas Nuclear One Unit One, in Arkansas, the Oyster Creek station in New Jersey, the Fitzpatrick plant in New York, and the Duane Arnold plant in Iowa — have used some or all of their full core offload capability. Two other plants — the Hope Creek plant in New Jersey and the Cooper Station in Nebraska — may need to use that capability. Tr. 1/14/04 at 76 (Thayer); tr. 1/15/04 at 85 (Thayer).

(2) Discussion

The fuel rods that power Vermont Yankee have a limited operating life. At the present time, Vermont Yankee has a refueling outage every eighteen months, at which time about one-third of the fuel rods are replaced.[100] The rods that have been removed from the reactor vessel are stored in the spent fuel pool. The spent fuel pool is not a permanent storage location, but was

100. Tr. 1/14/04 at 74 (Thayer).

intended to provide storage until the rods could be transported to a permanent storage facility for high-level radioactive waste to be developed by the federal government.

As a result of delays in the establishment of a permanent high-level waste repository, the fuel rods removed from the reactor continue to be stored in the spent fuel pool. The capacity of the pool, however, is nearly exhausted. Entergy states that "Vermont Yankee can operate to the Fall 2008 refueling outage before exhausting its full-core discharge capability and reaching the capacity of the spent fuel pool."[101] The implementation of the power uprate will cause Entergy to accelerate the time at which the capacity of the spent fuel pool is exhausted by one cycle (*i.e.*, by Spring 2007).[102] If Entergy desired to maintain the capability of full-core discharge, failure to achieve dry cask storage would lead to a shutdown of Vermont Yankee at that time.[103]

The Department and Entergy both assert that dry cask storage is not, and should not, be a consideration in this case. Entergy stated at the outset of this proceeding that it was not requesting the Board to rule on the issue of dry cask storage, but would instead pursue such permission in a separate proceeding.[104] Both parties also argue that the Board can adequately consider the issues surrounding dry cask storage in such a separate proceeding. Further, they argue that it would be illogical to deny this uprate petition because of the **possibility** that the Board would later find that dry cask storage does not promote the public good.

We agree with the Department and Entergy that the issue of dry cask storage is not before us. Moreover, we intend to make no ruling in this proceeding that would affect our ability to

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101. Thayer pf. 2/21/03 at 15. Full-core discharge capability refers to the ability of the plant operator to remove all of the fuel rods from the reactor vessel and place them in the spent fuel pool. Full core discharge capability is not a safety issue and is not required as a condition of the NRC operating license. Tr. 6/16/03 at 170 (Thayer). Instead, it is an operational issue, allowing Entergy to offload the core to do work in the reactor vessel. Tr. 1/14/04 at 77 (Thayer). Loss of full-core discharge capability does create the risk that, if an event required removal of all fuel rods for repair, Vermont Yankee may need to shut-down permanently since it could not off-load the fuel to conduct the repairs.

102. Thayer pf. 2/21/03 at 15.

103. Even if Entergy elects not to maintain full-core discharge capability, it still must maintain a certain amount of extra capacity in the spent fuel pool. Letter of 2/9/04 from Department Counsel Sarah Hofmann to Clerk of the Board. Thus, in the absence of dry cask storage, Entergy could run one extra fuel cycle (eighteen months) if Entergy elected not to maintain the ability to remove all of the fuel from the reactor. The uprate has the effect of accelerating this date by one refueling cycle in either scenario.

104. Tr. 3/5/03 at 27 (Franklin).

fully and fairly evaluate the issue when and if Entergy chooses to seek such permission from the Board. Not only do we have no evidence on the relative merits of dry cask storage, but it would also be unfair to other parties and potential parties to rule upon the issue considering Entergy's clear statement at the outset that dry cask storage would not be a part of this case.

This determination does not mean that the accelerated exhaustion of the spent fuel pool is not relevant, however. The evidence clearly demonstrates that the Department's and Entergy's assertions that the uprate provides a net economic benefit to the state of Vermont rely upon the assumption that Entergy will receive such approval. In the absence of evidence demonstrating that dry cask storage is in the best interest of the people of Vermont, such an assumption is unwarranted.

As explained above, the two largest Vermont utilities now purchase about 300 MW of power from Vermont Yankee under the Power Purchase Agreement. If dry cask storage is not authorized,[105] the evidence before us demonstrates that, unless Vermont Yankee can find another location to store the spent nuclear fuel, Vermont Yankee will be forced to either shut down eighteen months early or reduce power output to prolong its operating life for the extra eighteen months.[106] Under either scenario, Vermont utilities would lose some or all of the benefits of the Power Purchase Agreement during the period of derate or early closure. Such loss of the Power Purchase Agreement would, like an unplanned outage, require them to obtain replacement power, perhaps at prices that greatly exceed the fixed prices in that Agreement. For example, the Department demonstrated that closure one cycle early could have a net present value cost to Vermonters of $15 million if the replacement power costs were at the level forecast by the

105. Approval is required under 30 V.S.A. § 248. If 10 V.S.A. § 6501 applies, Entergy would need approval under that section as well.

106. The evidence shows that, at expected fuel usage, Vermont Yankee would need to shut down eighteen months early. Thayer pf. 2/21/03 at 15. Entergy and Department witnesses testified that it was possible to manage the fuel usage to prolong operation. However, that "solution" would not reduce risk to Vermont because a reduction in the fuel usage (and thus the heat generated by the fuel) would have the effect of reducing output and, such reductions would come with reductions in power delivered to Vermont utilities. Tr. 1/15/04 at 160–161 (Thayer) and at 213 (Sherman); Sherman pf. 1/13/04 at 4.

Department.[107] Using the Department's high and low market price forecasts, the additional replacement power costs range from $2.8 to $21 million.[108] Quite obviously, if market price trends prove to by higher, the replacement power costs would be still greater (the converse is also true; if market prices were lower than the prices in the Power Purchase Agreement, Vermont utilities may even derive savings). If Entergy knows in advance that it has no more storage capability for spent fuels, it may be able to reduce power output over a period of time to prolong operation. This power reduction will affect Vermont purchases. Thus, the cost impact may be mitigated from the levels forecast by the Department, but may, nonetheless, be significant.[109]

The evidence clearly indicates that the uprate has the potential to impose costs upon Vermont.[110] We, therefore, find that the uprate is likely to produce additional costs if we deny a future request for permission to implement dry fuel storage, perhaps very significant costs. Conversely, the uprate would impose no additional replacement power costs if we were to approve such a petition in the future. Thus, determining the degree to which the uprate imposes additional costs essentially requires us to either decide the dry cask issue now (weighing the costs and benefits of such an action) or to assess the likelihood that we would issue such an approval. There is no evidence in the record, however, to support any finding on this issue. As a result, we cannot accurately quantify the costs to Vermont of the uprate due to the accelerated need for dry cask storage. As we explain below, because these costs could be significant, we find that we must condition our approval of the uprate on assurances from Entergy that Vermont utilities will be held harmless from additional replacement power costs that occur because Entergy does not obtain the necessary approvals for dry cask storage.

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107. Exh. DPS-14. The Department has attempted to argue that this exhibit, which the Department prepared and filed prior to entering into the Memorandum of Understanding, carries little weight. However, the Department presented no facts to support this assertion. In fact, Mr. Sherman made clear in testimony before the exhibit was filed that the calculations reasonably represent the assumption that Vermont Yankee would shut down one fuel cycle early. Tr. 10/17/03 at 192–196 (Sherman).

108. *Id.*

109. No party presented evidence on the precise amount of power output reduction would occur if Entergy tried to manage its fuel use in this manner, or over what period of time.

110. Sherman 9/26/03 pf. at 5.

We also reject the argument put forward by the Department and Entergy that future review of dry cask storage is adequate. We agree that we can (and will, if requested) make such a determination later. However, if we were to approve the uprate now, we will have affected that decision by significantly altering the costs to Vermont of denying dry cask storage in the future (adding essentially $15 million in replacement power costs to the economic cost of denying dry cask storage). As discussed, the parties here have presented no evidence that would allow us to make any assessment of the reasonableness of dry cask storage and, indeed, there may be a necessary legislative role in that decision as well. In such circumstances, we cannot reasonably accept the Department's and Entergy's argument that we should treat the uprate as without potential costs.

c. Cooling Tower Derates

(1) Findings

92. Under the existing NPDES Permit it is estimated that the Station would have to be derated post-uprate for a total of 274 hours per year should the existing 125-hp cooling tower fan motors remain in place. Exh. EN-DEY-6, Table 5.2-1.

93. Using 200 horse power fans in the cooling towers would reduce the estimated derate hours to a total of 114 hours under the same conditions. *Id.*

94. Replacement of the existing 125-hp motors with high efficiency 125-hp motors and higher efficiency fan blades, as proposed by Entergy, would also reduce the extent of the derate. Tr. 1/15/04 at 82 (Thayer).

95. A derate of 274 hours approximates to an annual loss of almost 10,000 MWh. Exh. EN-DEY-6, Table 5.2-2.

96. Assuming a cost of $70 per MWh, the net present value of such derates is approximately $500,000.[111] Sherman 9/26/03 pf. at 4–5.

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111. Mr. Sherman's testimony states that the net present value of the derate of 274 hours would be $408,577. Sherman 9/26/03 pf. at 5. However, his testimony states that he assumed 8000 lost MWhs per year. Mr. Yasi's testimony states that the lost MWhs per year would be closer to 10,000, or 25 percent higher than assumed by Mr. Sherman. Exh. EN-DEY-6, Table 5.2-2. This produces a result of $500,000.

97. Should Entergy's application for an amendment to its NPDES Permit be granted, the possibility of derate as a result of cooling tower performance would be further mitigated. Yasi 7/2/03 pf. at 2; exh. EN-DEY-6, Table 5.2-1.

(2) Discussion

Vermont Yankee produces power by heating the water in its reactor water system and passing the resulting steam through the high pressure turbine. The uprate will increase the temperature of the reactor water and will increase the rate of steam flow. Vermont Yankee uses its circulating water system to condense the reactor steam back to water after the steam drives the turbines.[112] The circulating water is either discharged back to the Connecticut River (from which it is drawn) or circulated through the cooling towers to dissipate the heat. Discharges to the Connecticut River are limited by Vermont Yankee's NPDES permit. Because of the increased heat generated by the reactor and the NPDES permit limits, the uprate will cause increased use of the cooling towers.

Under certain river flow and temperature conditions, the increased heat will create back pressure in the condensors.[113] This increased back pressure requires Vermont Yankee to reduce the power output. Such power derates exist today,[114] but the power uprate will increase the frequency of the derate. If Vermont Yankee continued to use the existing 125-hp fans, the Station would be derated for approximately 274 additional hours.[115] An upgrade to high-efficiency fans as proposed by Entergy would allow additional dissipation of heat and reduce the number of derate hours. Similarly, use of the 200-hp fans originally proposed (and, as we

112. Thayer 2/21/03 pf. at 5. The circulating water system does not come in contact with the reactor water or any radioactive material.

113. Tr. 9/16/03 at 80–81 (Yasi).

114. Tr. 9/16/03 at 121–122 (Yasi).

115. Exh. EN-DEY-6, Table 5.2-1

discuss below, we require in this Order), would reduce the number of derate hours to approximately 114.[116]

The power derate that results from this chain of events creates an additional cost of the uprate. Using the 274-hour estimate developed by Entergy and a $70/MWh replacement power cost, the financial effect could be as high as $500,000.[117] Replacing the existing fans with the 200-hp fans that we require today reduces the potential impact by approximately 60 percent.[118] Accordingly, the expected financial cost from the power uprate is $200,000 (on a net present value basis).

d. Increased Decommissioning Costs

(1) Findings

98. Any additional decommissioning costs resulting from power uprate would be insignificant compared to the overall decommissioning amount of over $620 million (in 2001 dollars) that will be required with or without uprate. Thayer pf. 1/14/04 at 1; exh. DPS-13.

99. The primary cost driver for decommissioning is the labor component which will not be impacted by power uprate. Tr. 1/14/04 at 110–111 (Thayer).

100. Costs related to site restoration and fuel management will remain unchanged due to power uprate. Thayer pf. 1/14/04 at 2.

101. Although more spent fuel will be created, spent fuel and its disposal are ultimately the responsibility of the U.S. Department of Energy and not Entergy. Sherman pf. 1/13/04 at 5.

102. The uprate will require the use of additional dry casks. These will add approximately $3 million to the decommissioning costs. Gunderson pf. 1/2/04 at 22–23.

(2) Discussion

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116. *Id.* According to Vermont Yankee, the estimated number of derate hours is based on conservative assumptions and represents a bounding analysis when considering the impact of the use of either the existing 125-hp motors or new 200-hp motors. Tr. 9/16/03 at 81 (Yasi).

117. At prices near to the Department's forecast, this cost would be less.

118. The 114 hours of derate with the 200-hp fans is 40 percent of the 274 hours with existing fans.

Prior to the sale of Vermont Yankee to Entergy, VYNPC had responsibility for contributing to the fund to be used for the eventual decommissioning of Vermont Yankee. Its owners, including Green Mountain and Central Vermont, passed these costs on to ratepayers through the retail electric rates. One valuable component of the sale to Entergy was the transfer of the responsibility for funding decommissioning from VYNPC and its owners to Entergy.[119] At the same time, we recognized the possibility that ratepayers had paid significant amounts into the decommissioning fund. As a result, we directed that 55 percent of any decommissioning funds remaining after the completion of decommissioning should be returned to Green Mountain and Central Vermont.[120]

NEC argues that the uprate will increase the costs of decommissioning Vermont Yankee in the future. Among these costs are an additional $3 million in costs associated with decommissioning additional dry casks that will be needed because of the uprate. This, asserts, NEC, imposes additional costs on Vermont ratepayers because it decreases the excess amounts that would otherwise be returned as required by the Board's Order. Entergy concedes that the additional dry casks will increase decommissioning costs, although it considers these added costs *de minimis* in the context of the overall costs of decommissioning. Otherwise, Entergy disagrees with NEC's assertions, arguing that the uprate will not actually increase the costs of decommissioning. The Department supports Entergy's claim that the increased decommissioning costs are not significant. The Department also argues that this Board should assign little weight to the likelihood that excess decommissioning funds will occur.

We accept the concept that the additional need for dry cask storage (if approved) will increase decommissioning costs. Current estimates are that the increase (in present value terms) would be approximately $3 million. The evidence does not, however, persuade us that other

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119. Entergy received a $310 million decommissioning fund, which had been provided by ratepayers. At the same time, Entergy assumed a decommissioning obligation estimated to cost approximately $620 million (in 2001 dollars). Entergy assumed investment risks associated with increasing the fund to meet decommissioning needs. Sherman pf. 1/13/04 at 5–6.

120. Docket 6545, Order of 6/13/02 at 37. Our original Order required the return of all excess funds. Entergy and VYNPC subsequently worked out an arrangement in which the full return of funds applied only to a percentage of the fund that reflected the ownership share of the two Vermont utilities. We accepted this resolution. Order of 7/26/02 at 5.

aspects of the decommissioning costs will increase. For example, the uprate is expected to increase the amount of radiation in the Station. However, it will not change the components of the Station that are exposed to radiation, nor, in large part, the costs associated with disposal of that waste.[121]

Even the $3 million in additional decommissioning costs does not necessarily reflect costs to Vermont ratepayers. First, under our prior decision, only 55 percent of the excess decommissioning funds revert to Vermont customers which would make the effect on Vermont $1.65 million. Moreover, there is significant uncertainty as to whether an excess will exist at all. As we found in Docket 6545, based upon current projections of decommissioning costs and fund growth, an excess appears unlikely. For these reasons, we recognize a potential cost as high as $1.65 million, but we significantly discount the likelihood that the excess will occur at all.[122]

e. Transmission Costs due to Locational Marginal Pricing

(1) Findings

103. The uprate will add 120 MW of power at the Vermont Yankee node of ISO-New England's Standard Market Design. Sherman 5/9/03 pf. at 16.

104. ISO-New England used a system of Locational Marginal Prices ("LMP") to determine prices to be paid for generation and costs to be paid by load. The LMP represents the marginal costs of serving an additional increment of load at any given location. LMP's are calculated every 5 minutes for each of the 700+ nodes at which power is supplied or used in New England. Lamont pf. 8/19/03 at 2.

105. Generators are paid the LMP for the node at which their energy is delivered. Load pays a zonal price. *Id.* at 3.

106. The addition of generation at a node will cause the LMP of that node to decrease. *Id.*

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121. Tr. 1/14/04 at 91–96 (Thayer).

122. Subsequent to hearings, newspaper articles attributed to the Department legislative testimony in which the Department stated that the decommissioning fund had grown much more than previously anticipated, which would have the effect of greatly increasing the likelihood of excess funds later. The Department informed the Board that its testimony to the legislature had been in error and that the growth of the decommissioning fund had been much more modest. Letter of 2/6/04 from Department Counsel Sarah Hofmann to Clerk of the Board.

107. The Power Purchase Agreement with Entergy specifies a price to be paid by the recipients of the power for the power delivered to the Vermont Yankee node. When the LMP decreases, the value for the entire output of Vermont Yankee is decreased — not just the uprate power. In effect the power purchased under the Power Purchase Agreement will be worth less. *Id.* at 3–4.

108. The cost impact of LMP is not certain, but is likely to be in the hundreds of thousands of dollars per year. Tr. 10/17/03 at 40–41 (Lamont).

(2) Discussion

Power sold from Vermont Yankee to the Vermont utilities under the Power Purchase Agreement, although set up as a fixed price contract, in fact is subject to adjustment under the Standard Market Design Pricing system that is used by ISO New England. ISO New England uses a system of Locational Marginal Prices which adjusts the prices of power sales and purchases to take into account congestion in the electric transmission system. In addition, the prices are adjusted to take into account losses. Under the LMP system, generators are paid for the LMP at the node in which the energy is delivered to the transmission system. At the same time, purchasers of energy must pay prices based upon the zone in which the power is delivered to the customer's utility.[123]

The effect of this system is that it will affect the value of the power generated by Vermont Yankee, including the existing purchases under the Power Purchase Agreement. The evidence in the record does not yield an accurate calculation. However, the Department estimated that it was likely to have a negative effect on Vermont utilities that could range in the several hundreds of dollars annually.[124] We accept this analysis, which has a cost impact of approximately one-half of the value of the incremental tax revenue. Therefore, we have used an estimate of $0.8 million for the financial cost associated with LMP (which is 50 percent of the net present value of the tax revenue we found above).

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123. Lamont pf. 8/19/03 at 3. The entire state of Vermont is a single zone. Nodes are smaller geographic regions.

124. Tr. 10/17/03 at 40–42 (Lamont). Entergy declined to present a more precise calculation.

f. Power Derate Due to Radiation

(1) Findings

109. The current Vermont limit for fence line dose of direct gamma radiation is 20 millirems ("mr") per year. This is an accumulated dose for a year, not an average. Department of Health Regulations, Part 5, Chapter 3, 5-305 (B)(1)(e); tr. 9/15/03 at 79 (Thayer).

110. There are monitoring devices around the perimeter of the plant that are read on a monthly basis. These are read to determine compliance with the law. Tr. 9/15/03 at 81 and 84 (Thayer).

111. Vermont Yankee has operated within the 20 mr per year limit. In fact, the plant has been operated considerably below that limit. The uprate was designed to stay within that limit. Tr. 6/16/03 at 133 (Thayer).

112. Power uprate will increase fence line radiation dose by a maximum of 3.6 mr per year. Thayer pf. 7/2/03 at 7.

113. The incremental increase of 3.6 mr per year is a conservative estimate, and actual radiation levels are expected to increase by less. *Id.*

114. If the radiation dose at the fence were to approach Vermont's regulatory requirements, Entergy would shield the sources as necessary or reduce power to ensure compliance. Thayer pf. 1/14/04 at 2; tr. 9/15/03 at 178 (Thayer).

115. The uprate will not affect Entergy's commitment to meet the 20 mr standard for offsite release of radiation contained in the current Vermont Department of Health Regulations. However, there remains a chance that a reduction in power output might be necessary in order to meet that standard. Thayer pf. 2/21/03 at 16–17.

116. Spent nuclear fuel stored on-site in dry casks is not expected to significantly increase the fenceline radiation doses. Thayer surr.pf. 1/14/04 at 2; tr. 1/15/04 at 79–81 (Thayer).

(2) Discussion

The NRC and the State of Vermont have both established limits on the amount of radiation released by Vermont Yankee. The Department of Health limits the fence line dose of direct gamma radiation to 20 mr per year, which reflects an accumulated dose, not an average.[125] The NRC standard is slightly less stringent.[126]

Vermont Yankee has met both the Vermont and NRC standards to date. The uprate will increase the radiation emanating from the Station by about 3.6 mr per year.[127] Even with this increase, Entergy expects to be able to operate Vermont Yankee within the regulatory limits. However, the uprate will have the effect of reducing the margin between the normal radiation levels and the state and federal limits.[128] This increases the possibility that either fluctuations in radiation emissions or other events could occur that would cause Entergy to exceed the radiation limits. In these cases, Entergy would be required to either cease operation or reduce power output to ensure that it remained in compliance with the state and federal requirements.

The evidence does not permit us to determine the likelihood that fenceline radiation doses limits will be exceeded. At the same time, the reduced margin increases the risk.[129] As with the other outage risks that we have addressed in this section, derate of Vermont Yankee would require Vermont utilities to purchase replacement power, perhaps at prices well in excess of those set out in the Power Purchase Agreement. It is also clear that this risk exists throughout the remaining term of the Power Purchase Agreement. Thus, while derates in the first three years might trigger compensation for Vermont utilities under the ratepayer protection proposal, derates in the remaining years would not be covered.

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125. Department of Health Regulations, Part 5, Chapter 3, 5-305 (B)(1)(e).

126. Both standards place significant limitations on radiation. An exposure of 20 mr per year is much less than the normal background radiation experienced by residents of the state. Auxier pf. 7/2/03 at 3.

127. Thayer pf. 7/2/03 at 7.

128. *Id.*

129. NEC testified that the advent of dry cask storage would greatly increase this likelihood. However, this analysis appeared to be based upon incorrect assumptions as to radiation emissions from dry casks. Thayer surr.pf. 1/14/04 at 2; tr. 1/15/04 at 79–81 (Thayer). Accordingly, we are not prepared to reach the conclusion urged by NEC.

3. Weighing of Benefits and Costs

In the previous two sections, we analyzed the benefits and costs of the proposed uprate. Briefly, we find the following economic benefits from the proposed uprate (expressed in net present value terms).

Tax Revenue	$1.6 million
Payments to State of Vermont	$6.1 million
Total	$7.7 million[130]

Weighed against these benefits are the following costs (expressed in net present value terms).

	As Proposed	As Conditioned
Financial costs from outages	Unknown	Reduced by independent assessment and largely covered by Ratepayer Protection Plan
Financial costs if accelerated exhaustion of spent fuel pool capacity is not offset by future authorization for dry cask storage	$2.8 to $21 million; best estimate as $15 million	None
Cooling Tower Derate	$0.2 million	$0.2 million
Decommissioning costs	less than $1.65 million	less than $1.65 million
Locational Marginal Pricing	$0.8 million	$0.8 million
Total	up to $2.65 million, plus unknown storage or power-reduction-related costs	approximately $2.65 million

130. As we discussed above, the uprate will increase the rate at which Vermont Yankee consumes the fuel rods in its core and, thus, accelerate the pace at which those fuel rods, once spent, are sent to storage. This could cause Entergy to exhaust the spent fuel capacity. If this occurs and Entergy can find no alternative means of storing this waste, it will be necessary either to reduce output significantly or to close Vermont Yankee early. If so, the tax benefits and payments to the state, which are based upon the sale of uprate power, would decline significantly, to $3.2 million.

These tables demonstrate the significant uncertainties about the expected net economic value of the proposal before us. The most noteworthy of these relate to the financial risks associated with additional outages and the possibility that Vermont Yankee will more quickly exhaust its spent fuel storage capacity in the future due to the uprate. The question of whether the uprate provides an economic benefit to the state of Vermont depends in large part upon how we quantify these significant risk factors, which arise directly from the uprate. It also depends upon the assumption that the payments from Entergy arising from the Memorandum of Understanding will occur in the amounts predicted by Entergy and the Department. The incremental economic benefits that the uprate is expected to produce, which we estimate to be approximately $7.7 million, are likely to be achieved if few prolonged outages or power reductions occur, but could be offset by economic costs of (1) prolonged outages at times of high market power costs, (2) Entergy's failure to have adequate storage space, or (3) affiliate sales at below market prices that reduce the level of payments to the state.

The evidence, however, does not allow us to decide this now. For that reason, we find that we can only approve the requested power uprate if we adopt conditions that will ensure that the expected benefits are likely to occur. This requires us also to assure that the costs associated with reliability and the accelerated exhaustion of spent fuel pool capacity, coupled with consequences if Entergy does not secure approval for dry cask storage, do not cause the costs to the state of Vermont to exceed the benefits.[131] Therefore, we find the conditions set out in the following sections to be necessary.

a. Independent Engineering Assessment

131. We recognize that the level of assurances of reliability that we find essential here may appear to be greater than we have demanded previously when considering new power sources. Two significant differences compel this result. First, Vermont utilities are not receiving power from the uprate that is needed to serve Vermont load. Thus, the benefits of the proposed power uprate, while positive, are not as substantial as in other cases in which the alternative may have been more expensive power supply options. Higher benefits are more likely to lead to a net benefit for the project as a whole, even taking into account risk factors. Second, and more important, any increase in outage time will require Vermont's two largest utilities to seek replacement power for approximately one-third of their supply at potentially high replacement power costs. This risk factor is quite significant and requires us to seek greater assurances that the benefits Vermont now derives under the Power Purchase Agreement are not lost because of the uprate.

(1) Findings

117. A vertical slice review is an integrated, in-depth examination on all aspects of a system. The focused examination allows for the identification of cause and effect relationships that other reviews may not detect. Lochbaum 12/18/03 pf. at 7.

118. A vertical slice review of two safety systems and two Maintenance Rule, non-safety systems potentially affected by the uprate would help ensure reliability. *Id.* at 9

119. An independent review means that the persons conducting the review have had no significant or recent regulatory oversight of Vermont Yankee. Tr. 1/13/04 at 91–92 (Lochbaum); exh. NEC-DL-3.

(2) Discussion

The Department and Entergy both asserted that the ratepayer protection plans would adequately cover the likely scenarios. As noted above, the record only partially supports that conclusion. Neither the Department nor Entergy presented the most probitive facts — an engineering assessment of Vermont Yankee itself, taking into consideration the particular operating characteristics and components and the manner in which the uprate may affect the safety and reliability of those components. This seems particularly significant because we were presented with evidence showing that 4 out of 8 plants with uprates of 17.5 percent or more experienced outages or power reduction.[132] NEC argues that we could obtain such data by asking the NRC to conduct an independent safety assessment, similar to that performed at Maine Yankee.[133] This review, suggests NEC, would encompass both safety and non-safety systems and would enable us to better assess the future reliability of Vermont Yankee. Entergy and the Department respond (1) that safety is an NRC concern, not for this Board and (2) a study like that at Maine Yankee need not be mandated because the NRC has now modified its procedures to provide a similar level of confidence without requiring special procedures.

132. Burns pf. 7/2/03 at 33.

133. Many members of the public echoed these comments.

We accept the fact that this Board does not have jurisdiction over safety issues; however, in this case, reliability issues are also present and there is no doubt that the NRC's safety assessment could materially reduce the reliability concerns that we otherwise face on the record before us. We also recognize that the NRC has incorporated into its uprate review process much of what had previously been embodied in such independent assessments. The NRC reviews also now incorporate an additional level of critical review from the Advisory Committee on Reactor Safety ("ACRS").

The record shows that, while the present NRC review procedures for power uprates are extensive, the best means to obtain the necessary information on reliability is an independent engineering assessment of Vermont Yankee. The record also shows that all witnesses, including NEC's,[134] acknowledged that, from a practical perspective, the NRC is best equipped to conduct the necessary review. Therefore, as a condition of our Order, we will request the NRC to conduct an independent assessment of Vermont Yankee.[135] We will ask that the independent safety assessment incorporate the following features:

- It should be independent in the same sense as the independent safety assessment of Maine Yankee, *i.e.*, it should be performed by experts "who were independent of any recent or significant regulatory oversight responsibility" related to Vermont Yankee.[136]
- The assessment should consist of a vertical slice review of two safety-related systems and two Maintenance Rule, non-safety systems affected by the uprate. This review should be conducted at a level of effort suggested by NEC's witness Lochbaum (*i.e.*, approximately four weeks of work by four).[137] The vertical slice review — which is a focused examination on the design, construction, operation, maintenance and other aspects of a single system — will provide a valuable check

134. *See* tr. 1/13/04 at 168 (NEC witness Blanch); tr. 9/17/03 at 192–193 (NEC witness Gunderson). *See also*, tr. 1/13/04 at 119 (Lochbaum).

135. Because of the changes in the NRC review process that we outlined above, we do not expect that an independent engineering assessment would require an onerous level of additional work.

136. Exh. NEC-DL-3 at 1 (Independent Safety Assessment of Maine Yankee Atomic Power Company, U.S. Nucelar Regulatory Commission, October 1996). We will also encourage the NRC to facilitate participation by the state representatives, consistent with NRC policy and past practices.

137. Lochbaum pf. 12/18/03 at 8–9; tr. 1/13/04 at 100, 110–111 (Lochbaum).

of the reliability of the systems that are reviewed and allow for correction of any problems.[138]

- The independent engineering assessment should be reviewed by the ACRS in the context of their evaluation of the power uprate.

The Board will retain jurisdiction to make modifications to today's Order, based upon the results of the NRC's assessment and Entergy's plant changes (if needed).

Accelerated Exhaustion of Spent Fuel Pool Capacity

As we have explained above, the Petitioners argue that the accelerated exhaustion of spent fuel pool capacity from the uprate causes no additional costs; they state that we should not — and need not — consider this potential cost because Entergy has not yet filed an application for dry cask storage which will resolve the shortage of spent fuel pool capacity. This argument might be persuasive **if** the Department and Entergy had not based their financial estimates upon the assumption that Vermont Yankee's power output will not be impaired for lack of storage. Unfortunately for the persuasiveness of the argument that we can ignore the dry cask issue now, the Department and Entergy **did** base their calculations of net financial benefit to the state upon the assumption of unrestricted output by Vermont Yankee for the remaining term of the Power Purchase Agreement. Thus, their assertion depends upon the assumption that Entergy will receive all necessary regulatory approvals (although they presented no evidence on which we can conclude that dry cask storage will be authorized) and that, therefore, the costs of accelerated closure or a prolonged derate to extend the operating life will not occur.

We conclude that, given the absence of such evidence, we must impose conditions that ensure that the benefits that Entergy asks us to rely upon will exist whether or not Entergy subsequently receives approval for dry fuel storage.[139] Simply put, the record clearly shows that such costs could readily be twice as high as the otherwise expected "economic benefit to the

138. The testimony showed that the NRC has scheduled a vertical slice review of two systems for August, although it was not clear whether the planned level of review was consistent with that set out above. It may be appropriate to combine the assessment that we request with that effort.

139. This conclusion is consistent with the original recommendation of the Department. Sherman pf. 5/9/03 at 16.

state" from the current proposal.[140] Thus, we direct Entergy to provide assurances that ratepayers will not experience replacement power costs due to the uprate if Entergy is not authorized to implement dry cask storage or cannot find another means to store the spent fuel. This condition ensures that ratepayers face no added risk if Entergy is unable to obtain approval for dry cask storage. It also will allow the Board to fully and fairly evaluate the merits of dry cask storage without the added consideration that, because of the uprate, failure to approve the storage in the future would lead to $15 million in additional costs for Vermont utilities.[141]

We do not define the form of the assurances that Entergy must provide. It is possible that Entergy and the Department will seek to modify the Memorandum of Understanding and/or the ratepayer protection plan. Alternatively, the parties could enter into a wholly different arrangement. At this time, we only mandate that Entergy develop a mechanism to assure that Vermont utilities and ratepayers will be held harmless from the uprate-related cost impacts of the accelerated exhaustion of spent fuel pool capacity; we will leave the form of the assurances to Entergy and will review their adequacy when Entergy submits its compliance filing. Entergy shall file its proposed assurances within 30 days of this Order.

Affiliate Sales

The primary economic benefit to the state from the uprate is the payments from Entergy pursuant to the Memorandum of Understanding. As we explained above, the payments from Entergy are based upon the price at which Entergy sells the uprate power and the strike price (which is the Department's price forecast minus $11/MWh). This benefit would be reduced, perhaps significantly, if Entergy sold the uprate power at prices below the market rates. Normally, Entergy would have no incentive to do so as the profit on the uprate power greatly exceeds the payments to the state under the Memorandum of Understanding.[142] The possibility exists, however, that Entergy could sell the power to an affiliate at below market prices. The

140. *See* findings and discussion above in Section V.D.2.b.

141. Thayer pf. 7/2/03 at 6; exh. DPS-14.

142. Sherman pf. 5/9/03 at 21 (citing a cost of power production at 2 cents/kWh); exh. DPS-DFL-4 (market price forecast).

affiliate could then resell it at market rates, so that Entergy as a corporation received the expected profit. At the same time, the benefit to the state of Vermont would be lessened as the Memorandum of Understanding bases the payments upon the sale from Vermont Yankee.

During the hearings, Entergy stated that it would have no objection to restricting below-market-price sales to affiliates.[143] The Department concurred that such a condition would be consistent with the intent of the parties.[144] Accordingly, we require Entergy and the Department to modify provisions of the Memorandum of Understanding relating to payments to the state Benefit Funds to protect the state against the potential for a below cost sale to an affiliate. The condition should be consistent with the following:

> Entergy may not engage in below-market-price sales of power from Vermont Yankee to Entergy affiliates as a means of avoiding or reducing the payments to the state of Vermont under the Memorandum of Understanding.

Power Reductions Due to Radiation Limits

We concluded above that the evidence in the record did not permit us to determine the likelihood of power derates necessary to ensure compliance with the state and federal standards for fenceline radiation exposure. In order to ensure that Vermont utilities and ratepayers are not harmed by such outages or derates, we will require Entergy to provide assurances similar to those applicable to accelerated depletion of the spent fuel pool capacity. Specifically , Entergy shall ensure that Vermont ratepayers will be held harmless from incremental replacement power costs arising from the power outages or derates necessary to comply with the Vermont Department of Health and NRC radiation standards.[145]

Conclusion

With the conditions set out above, we find that the proposed uprate will provide an economic benefit to the state of Vermont, satisfying the requirements of § 248(b)(4). In reaching

143. Tr. 1/15/04 at 107–108, 244 (Thayer).
144. *Id.* at 227–228 (Sherman).
145. The ratepayer protection proposals cover a portion of this risk.

this conclusion, we expressly rely upon the Memorandum of Understanding and Entergy's commitments to make payments to the state.

In addition to approving the Memorandum of Understanding, the Department asks the Board to approve the proposed State Benefit Funds. The Department states that the Board may grant such approval based upon 30 V.S.A. § 9 and 32 V.S.A. § 585(b). Section 9 of Title 30 states that:

> The board shall have the powers of a court of record in the determination and adjudication of all matters over which it is given jurisdiction. It may render judgments, make orders and decrees, and enforce the same by any suitable process issuable by courts in this state.

Section 585(b) of Title 32 authorizes the Commissioner of Finance and Management to establish a special fund "to account for and manage such proceeds as those of court settlements." The Department views the Memorandum of Understanding as a court settlement, which would authorize the creation of the special funds. The Department contends that the proposed State Benefit Funds are equivalent to those the Board has previously established in prior Orders.[146]

CRWC and WRPC recommended against approval of the three specific funds that make up the State Benefit Funds. Instead, these parties proposed that the Board direct the payments from Entergy to environmental projects in Southeastern Vermont; they argued that such use of funds is more appropriate because of the nexus between Vermont Yankee and its impacts upon the local environment.

Through the Memorandum of Understanding, Entergy and the Department have proposed a use of funds for programs that are likely to provide benefits to Vermont. For example, the Low Income Benefit Fund will help qualified persons to obtain heating fuel during winter periods. The alternative uses of the payment proposed by CRWC and WRPC also are likely to provide benefits to the eco-systems in Southeastern Vermont. Notwithstanding the merits of such

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146. *Petition of the Department of Public Service for Investigation of and Sanctions Against MCI WorldCom, Inc Under 30 V.S.A. § 208a*, Docket 6331, Order of 9/13/01; *Petition of the Department of Public Service for Sanctions Against Business Discount Plan, Inc., Under 30 V.S.A. § 30 And 231 For Violation of Board Rule 4.700*, Docket 6067, Order of 5/5/00; *and Petition of the Department of Public Service for Investigation Into the Business Practices of, and Sanctions Against, Gateway Cablevision Corporation, and for an Order Directing Gateway to Show Cause Why its Certificate of Public Good Should Not Be Revoked*, Docket 6670, Order of 5/9/03.

programs, however, we find that we cannot approve the specific use of funds proposed by the Department and Entergy.

In Docket 6331, we considered the use of directing settlement proceeds to a particular use. We observed that:

> We are hesitant to get into substantive analysis of who may or may not be proper recipients of such funds. However, we cannot avoid the responsibility to make at least a prima facie determination that the funds will be used in a way that benefits Vermont ratepayers and that the choice of a recipient organization is consistent with that goal.[147]

At that time, we set up specific criteria that parties needed to address when proposing a charitable appointment as part of a settlement. These criteria are as follows:

- the characteristics of the appointee, including its mission, the nature of its work, how it is managed, and the status of its other funding sources;
- the degree of similarity between (i) the beneficiaries of that organization's work, and (ii) the characteristics of the actual and potential customers affected by a regulated company's allegedly improper behavior;
- the purposes of the settlement funds and the likely outcomes; and
- the manner in which the effectiveness of the expenditures will be evaluated and reported.[148]

We found that these criteria were necessary to assure that there was "a predictable, comprehensible and publicly explainable process for the selection of recipients" as well as a mechanism by which the Board and Department could "jointly oversee the effective expenditure of such appointed funds."[149] Through the requirement of a demonstration of the linkage between the beneficiaries and the affected customers, the criteria also provide a framework for determining whether the proposed payments bore a relationship to the harm or whether they represent generalized payments. This distinction is important as it helps guide the determination

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147. Docket 6331, Order of 9/13/01 at 35.

148. *Id.* at 36. In that proceeding, we focused upon charitable appointments (*i.e.*, donations or grants), but the same considerations apply as well to any settlement that involves the payment of money other than to a party who has been harmed.

149. *Id.*

of whether the Board should decide the use of the moneys or should defer to the legislature and Governor to allocate priorities through the normal appropriation process.[150]

In the past, the Board has approved payments either to provide remediation, or to recognize additional benefits that are directly related to utility operations. For example, in several dockets, we have approved proposals that facilitated the employment of distance learning networks. These systems provide educational systems; but more importantly, they use the telecommunications and cable infrastructure over which we have jurisdiction as the mechanism for providing those benefits. Thus it was appropriate for this Board to make the decision rather than deferring to the legislature.

In this case, the parties have demonstrated at best a very generalized linkage between the impact of the proposed uprate and the proposed use of the funds. The Department asserts only that the primary impact of the uprate is financial (affecting most of the state's ratepayers), so a use of the funds that benefits the state generally is adequate. We find this argument unpersuasive. We recognize that the uprate may have financial costs for Vermont ratepayers. The Ratepayer Protection Plan that we approve directly relates to the element of those costs that are likely to emerge in utility rates. In contrast, however, the payments to the specific funds under the Memorandum of Understanding do not serve to redress these impacts. They also do not provide any specific benefits to the area directly affected by the power generation from Vermont Yankee. Rather, the funds are directed to statewide goals that are unrelated to the financial impacts cited by the Department and to matters within the Board's purview. Under these circumstances, we decline to approve a specific use of funds. Instead, we defer that decision to the normal appropriation process.

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150. The policy judgment on the use of state money is allocated as a matter of law to the state legislature, subject to approval by the Governor. These branches of government are best equipped to, and most experienced with, balancing the interests of the people of the state in allocating financial resources. However, state law allocates certain responsibilities related to utilities to this Board and, when there is a demonstrated nexus with matters under our jurisdiction, we will exercise those responsibilities. The criteria we adopted previously and apply today respect this allocation of responsibility. We decline to resolve the uses of funds that are not related closely to our statutory duties.

Accordingly, as a condition of our approval of the Memorandum of Understanding and our granting a Certificate of Public Good, we require that all such funds as described in the Memorandum of Understanding shall be paid to the state general fund, for the General Assembly and Governor to appropriate in a manner as they determine will benefit the state and its residents. Specifically, we do not authorize the establishment of special funds, or authorize payments from uprate-related revenues be paid to existing funds.

E. Aesthetics, Historic Sites and Water Purity, the Natural Environment and Public Health and Safety [30 V.S.A. § 248(b)(5)]

1. Findings

120. Subject to the conditions set out below, the proposed uprate will not have an undue adverse effect on aesthetics, historic sites, water purity, the natural environment, and the public health and safety. This finding is supported by findings 121–235, below, which are based on the criteria specified in 10 V.S.A. §§1424a(d) and 6086(a)(1)–(8), and 9(K).

a. Outstanding Resource Waters [10 V.S.A. § 1424a(d)]

121. The project is located on the Connecticut River, which has not been designated an outstanding resource water by the Vermont Water Resources Board, and which thus does not implicate this part of criterion (b)(5). Schuyler pf. 2/21/03 at 34; exh. EN-SAS-22.

b. Air Pollution [10 V.S.A. § 6086(a)(1)]

122. The proposed power uprate will not result in undue air pollution. This finding is supported by findings 123 through 127, below.

123. Vermont Yankee is a Registered Source as defined by 5-801 of the Vermont Air Pollution Control Regulations ("Vermont Air Regulations"), which means that it emits, or has the potential to emit, air contaminants that, in total, amount to more than five (5) tons per year. Vermont Yankee is also an Indirect Source as defined by 5-101 of the Vermont Air Regulations. Schuyler pf. 2/21/03 at 6–7.

124. The Vermont Air Regulations do not require a New Source Construction and Operating Permit or an Indirect Source Permit for the uprate. *Id.*

125. The threshold for treatment as a Major Stationary Source, which would require a permit for construction or modification, is allowable emissions greater than 50 tons per year of one or more criteria air contaminants. *Id.*

126. Vermont Yankee produces less than 10 tons per year of criteria pollutants. The proposed uprate will result in no physical modification or operational changes that would cause the quantity of allowable emissions from Vermont Yankee to increase. Accordingly, a New Source Construction or Operating Permit is not required. *Id.*

127. The cooling tower modifications associated with the uprate will result in a sound level increase of less than one decibel, which should not be noticeable. Exh. DEY-2R at 2.

128. In addition to creating vapor plumes, the cooling towers emit what is referred to as "drift," *i.e.*, water droplets too heavy to remain a part of the plume. Drift drops onto the area surrounding the cooling towers. Depending on where they land, when water droplets in the drift drop out of the air, they could alight on the river, paved surfaces or the ground. Tr. 6/17/03 at 14–16 (Schuyler).

Discussion

NEC has alleged that the uprate will result in air pollution from Vermont Yankee's cooling towers' vapor plumes and drift. Because NEC argues that the air pollution is the result of Entergy's water system treatment, and the chemicals that Entergy uses in its service water system, we discuss these issues in the section entitled discharge below at section V.E.2.a.

c. Water Pollution

129. The proposed power uprate will not result in undue water pollution. This finding is supported by findings 130 through 157, below.

(1) Headwaters [10 V.S.A. § 6086(a)(1)(A)]

130. Vermont Yankee is located on the Connecticut River in Vernon, Vermont, at an elevation of 260 feet. The facility is in the developed area of the Town of Vernon and the site itself has already been developed for the nuclear power plant. At this point the watershed is not

characterized by steep slopes, or shallow soils. The drainage area is greater than 20 square miles, and the elevation is less than 1,500 feet. It is not in the watershed for a surface water designated as a public water supply, and is not in a significant aquifer recharge area. Schuyler pf. 2/21/03 at 10; *see* exh. EN-SAS-2, Site Location Map.

131. The project site does not qualify as a headwaters area as defined in 10 V.S.A. § 6086(a)(1)(A), and, therefore, does not implicate this part of criterion (b)(5). Schuyler pf. 2/21/03 at 10.

(2) Waste Disposal [10 V.S.A. § 6086(a)(1)(B)]

132. The proposed project will meet all applicable Department of Environmental Conservation regulations regarding the disposal of wastes to protect the groundwater and surface water resources and public health. Schuyler pf. 2/21/03 at 10–17.

(a) Wastewater

133. Vermont Yankee uses three different water systems for normal operation: the reactor water system; the circulating water system; and the service water system. Thayer pf. 2/21/03 at 3–4.

134. The reactor water system, which makes up the steam in the reactor to drive the turbines, is recirculated in a closed loop throughout the reactor's primary system, never coming in contact with other water sources. *Id.*

135. The circulating water system draws river water into Vermont Yankee, pumps it through the main condenser to condense reactor steam back to water and discharges the water to either the cooling towers, the river, or both. *Id.*

136. The service water system also draws water from the river, uses the water for cooling equipment throughout Vermont Yankee, and then mixes it with the circulating water system. *Id.*

137. There are four sources of wastewater discharge from Vermont Yankee. Wastewater that is discharged directly to the Connecticut River consists of three waste streams: (1) the main condenser cooling (circulating) water discharge; (2) the service water system discharge; and (3) stormwater discharge. Schuyler pf. 2/21/03 at 14.

138. The three direct wastewater discharges are governed by Vermont Yankee's NPDES Discharge Permit #3-1199 ("NPDES permit"). Exh. EN-SAS-4; Schuyler pf. 2/21/03 at 14.

139. The fourth source of wastewater discharge is domestic sewerage from the facility that is discharged to septic systems. This discharge is governed by Vermont Yankee's Indirect Discharge Permit ID-9-0036-1A. *Id.*; exh. EN-SAS-6.

(i) Circulating and Service Water Discharges

140. The discharge of heated water by Vermont Yankee is limited by its NPDES permit. This permit was most recently renewed on May 14, 2002. Prior to that, Vermont Yankee had been operating under the same thermal limits for 12 years (since 1991). DeWald pf. 9/26/03 at 1–2.

141. The NPDES contains temperature standards designed to protect water quality and biological communities. Schuyler pf. 2/21/03 at 12.

142. The discharge of biocides such as chlorine which is added to the circulating water to prevent fouling of the condenser tubes, is also governed by the NPDES permit. *Id.*

143. In order for the ANR to issue an NPDES permit, it must find "that the discharge: (1) will not significantly alter the aquatic biota in the receiving waters; (2) will not pose more than a negligible risk to public health; (3) will be consistent with existing and potential beneficial uses of the waters; and (4) will not cause a violation of water quality standards." *Id.*, quoting 10 V.S.A. § 1259(e).

144. If operated in full compliance with the discharge limits of its current NPDES permit, the proposed power uprate will cause no undue adverse effect on surface water quality. Schuyler pf. 2/21/03 at 11.

145. In order to provide its operators with added operational flexibility, Entergy has applied for an amendment to the thermal discharge limits of Vermont Yankee's NPDES permit. This application is currently pending before the ANR and seeks a modification to the summer thermal discharge limits that apply during the period between May 15 to October 15. DeWald pf. 9/26/03 at 4; tr. 10/16/03 at 145–46 (DeWald).

146. The proposed permit amendment would allow Vermont Yankee to decrease the use of its cooling towers at the power uprate level if necessary. A decrease in cooling tower use could result in a corresponding decrease in the evaporation of water in the cooling system, and a decrease in the potential for visible plumes from the cooling tower. Such a decrease in cooling tower use can also be expected to result in an increase in the power that Entergy would have available to sell. Thayer pf. 2/21/03 at 13–14.

147. The NPDES permit amendment process does not involve any analysis of the reliability of Vermont Yankee's waste heat cooling system equipment or the equipment's capacity in the event of a shut down. Tr. 1/16/03 at 40 (Deen).

148. In the case of a malfunctioning cooling tower system, the NPDES permit allows Entergy 24 hours to shutdown. *Id.*

149. Entergy has adopted a voluntary internal plan for shutting down the Vermont Yankee plant in an orderly manner that takes less time than the 24-hour period allowed in the NPDES permit. Entergy's voluntary internal plan for shutting down the plant provides for depowering at a rate of 10 percent of power per minute until the cooling water discharge returns to and remains within the NPDES permitted temperature limits. Tr. 1/16/04 at 88–90 (Deen); exh. CRWC-5.

150. The micro-organisms in the Connecticut River create a coating on the inside of the service water pipes at Vermont Yankee. By closing off the system outlet to the river, and running in closed cycle, Entergy cleans the pipes at Vermont Yankee through what has been referred to in this investigation as a chlorination process or the use of biocides. Tr. 6/19/03 at 145 (Thayer).

151. Entergy adds chemicals to Vermont Yankee's service water for purposes of treatment only 1 hour per week. Thayer pf. 1/22/04 at 3; *see also* tr. 6/17/03 at 15–16 (Schuyler).

152. When Vermont Yankee chemically treats its service water, it stays on closed cycle until the treatment chemical dissipates. Once it has, then Vermont Yankee opens the system back up to the river. Tr. 6/19/03 at 145 (Thayer).

153. In addition to creating vapor plumes, the cooling towers emit what is referred to as "drift," *i.e.*, water droplets too heavy to stay airborne. Drift drops onto the area surrounding the cooling towers. Depending on where they land, when water droplets in the drift drop out of the

air, they could alight on the river, on paved surfaces or into the ground. Tr. 6/17/03 at 14–16 (Schuyler).

154. All water treatment chemicals used by Entergy at Vermont Yankee are listed at page 8 of Vermont Yankee's NPDES permit. Chlorine and bromine are the primary chemicals associated with biocides and water treatment used by Entergy in the service water system at Vermont Yankee. *Id.*

155. Because the chemicals that are used in the service water system are actually consumed doing their work as a biocide or as a water conditioner, there is little likelihood that their presence, if any, would be detectible in the drift. The NPDES permit controlling the biocides that Entergy applies to its service water system call for no detection. *Id.* at 11.

156. If there is particulate matter resulting from the combination of the biocides and the material that it combines with, this material would settle out in the silt in the cooling tower. If there is dissolved matter in the drift, it would be an insignificant amount. *Id.*

(ii) Discussion re: Discharges

Thermal Discharges

Entergy holds an NPDES permit that ensures compliance with applicable laws and regulations including Vermont's Water Quality Standards.[151] Entergy is obligated to stay within its permitted discharge limits, and has stated that it intends to do so. Entergy argues (1) that its compliance with applicable environmental regulations and permits creates a rebuttable presumption of satisfaction of the environmental criteria of Section 248, and (2) that its NPDES permit is among those permits which are entitled to that presumption of compliance when entered into the record.

CRWC asks the Board to make three changes with respect to Entergy's discharge into the Connecticut River and its NPDES permit.[152] In general, Entergy argues that its NPDES permit

151. Exh. ENTERGY-SAS-4.

152. CRWC also urges the Board to reconsider the appropriateness of the Environmental Benefit Fund proposed by Entergy and the Department. This is discussed above at Section V.D.3.

controls here and that the Board need go no further in regulating discharges from Vermont Yankee.

Entergy is correct that the Board has afforded environmental permits a presumption; the Board has regularly relied on environmental permits issued by other agencies as *prima facie* evidence of compliance with the environmental criteria of Section 248. However, this presumption is rebuttable. Here, CRWC and NEC have raised concerns with regard to the extent to which Vermont Yankee's NPDES permit and Vermont air regulations apply to this project and to Vermont Yankee's practices. We first examine CRWC's concerns then those raised by NEC.

First, CRWC asks that the Board recognize that the NPDES permit does not fully cover the potential environmental damage that could result in the case of a cooling system malfunction. More specifically, CRWC argues that, in the case where Vermont Yankee experiences a waste heat cooling system malfunction, Vermont Yankee's NPDES permit allows it 24 hours to shut down. During this time, says CRWC, unnecessary adverse effects on water quality due to thermal discharge could result. CRWC has asked the Board to condition Entergy's Certificate of Public Good in this docket on "Entergy's ceasing to discharge any 'once through' cooling water in as short a period of time as is possible under the best technology ENVY can employ."[153] CRWC notes that Entergy has voluntarily developed an internal plan to mitigate its thermal discharges in a matter of minutes rather than hours, as provided for under its NPDES permit.[154]

Entergy has already voluntarily developed a cooling water shut-down plan. Entergy has also indicated that it can shut down Vermont Yankee in an orderly manner at a rate of 10-percent of power per minute in the case of a malfunction of the cooling system.[155] Thus, the record is clear that Vermont Yankee in this context is able to reduce power production at a significantly faster rate than required under its NPDES permit. By bringing this information into the record, CRWC has adduced evidence sufficient to support a finding contrary to the effect of the

153. CRWC Brief at 6.
154. Tr. 1/16/04 at 88–90 (Deen); exh. CRWC-5.
155. CRWC Reply Brief at 2.

presumption. Once such evidence is introduced, the presumption entirely disappears and has no further effect.[156]

Entergy disagrees and has several responses to CRWC's position. First, it states that there is no evidence that a catastrophic failure of the cooling system is more likely after uprate than under existing conditions. Thus, says Entergy, the concern is not related to uprate. We disagree. Entergy has recognized concerns over plant reliability associated with uprate. Entergy is correct that the potential effect on the river of a cooling system failure is not new, but the uprate has the effect of increasing the risk of equipment failure. Since the cooling system has been modified for the uprate, there is an increased likelihood that a cooling system failure could occur and that it could be related to the uprate-related improvements.

Next, Entergy argues that the NPDES permit's 24-hour shutdown period was included after "significant discussion," implying that ANR, as it consulted in the past on the NPDES permit, already covered this ground. This may be so. However, at this point, the discussion that went into developing the NPDES permit is less important than some evidentiary demonstration by Entergy that the 24-hour shut-down window in the NPDES permit is superior to the shorter voluntarily-developed time frame.

We conclude that requiring Entergy, in the case of a cooling system malfunction, to depower at a rate of 10 percent of power per minute until the cooling water discharge returns to and remains within the NPDES permitted temperature limits, is a reasonable condition to impose on Entergy's proposed uprate, and hereby do so. This standard will help ensure that this project avoids any undue adverse impact on water quality and biological communities in the Connecticut River that might result in this narrow context. Entergy has shown that it has a voluntary plan that meets this standard. Thus, these benefits can be secured with little effort on Entergy's part.

Second, CRWC has asked that the Board require Entergy to develop for Board approval a plan for the upgrade of Vermont Yankee's waste heat cooling system to establish that it is of

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156. On the other hand, the Vermont Rules of Evidence make clear that, at least as a general proposition, Vermont adheres to the 'bursting bubble' concept of rebuttable presumptions, that is, whenever evidence sufficient to put a presumed fact in issue has been adduced by the party against whom the presumption operates, the presumption entirely disappears and is of no evidentiary significance, with the burden of persuasion resting where it was at the beginning of the litigation. *See* Docket 5030, Order of 2/18/86 at 13.

sufficient capacity and reliability to fully protect the Connecticut River. CRWC has also asked that we require Entergy to conduct a full assessment on the upgrade for the waste heat cooling system before actual power production can be increased.

We decline to impose these conditions. CRWC has presented no evidence that causes us to question the capability of the cooling system to handle that increased waste heat on a normal basis. Moreover, Entergy has demonstrated that its cooling system upgrades should be able to accommodate Vermont Yankee's needs under uprate conditions, and that if the cooling system does not function reliably — for purposes of thermal discharge to the Connecticut River — Entergy will have to reduce power, according to its internally-developed plan, until cooling water discharge returns to and remains within the NPDES permitted temperature limits.

Third, CRWC has also asked that the Board require that Entergy not raise the ambient water temperature beyond 88 degrees Fahrenheit at any point within the Connecticut River. We decline to approve this request. CRWC has not presented sufficient evidence to call into question the validity of limits set in the NPDES permit. Therefore, we defer to the expertise of the ANR which has responsibility for issuing NPDES permits and find that CRWC has not rebutted the NPDES permit limit as prima facie evidence that the discharge will not harm the environment.

Fourth, CRWC, like WRPC has also asked that we modify the Entergy/Department MOU in order for the EBF to be used solely for mitigation and enhancement activities in the Connecticut River Watershed. As explained more fully at section V.D.3., we decline to impose this condition.

The Use of Biocides

NEC has argued that while Entergy has an NPDES permit that allows Entergy to discharge circulating water, some of this liquid is then released from Vermont Yankee's cooling towers into the air. According to NEC, Entergy does not have an air pollution permit for this, and furthermore Entergy has not analyzed any effects that its emissions of glutaraldehyde, or the resulting combinations of this chemical with other water treatment chemicals, may have upon the environment. According to NEC:

> At the permitted pipe discharge, some glutaraldehyde survives intact and is diluted to licensed discharge levels. It follows, therefore, that some level of glutaraldehyde is also discharged from the cooling towers as drift, except Vermont Yankee does not hold a discharge permit for this discharge point. This unmeasured, unanalyzed, discharge from the cooling tower is a hazard to human health, migratory waterfowl, nesting protected species, and the environment generally.[157]

Entergy disagrees with NEC, due in part to what Entergy says is NEC's mischaracterization of Vermont law, and the record in this Docket. First, Entergy maintains that it is not required to obtain an air permit for this activity. Entergy states that it is a registered air source with ANR and that according to the appropriate regulations, Entergy's emissions of glutaraldehyde are far below the licensing threshold for such a substance. Second, Entergy maintains that there is no evidence to support NEC's contention that significant amounts of glutaraldehyde will be released into the air or that glutaraldehyde will be used at the same time that chlorine and bromine compounds are used.[158] Entergy argues that NEC has not shown that Entergy's use of these chemicals will result in any harmful byproduct. Instead, according to Entergy, the record demonstrates that these chemicals are highly diluted and consumed as they perform their function.

There is no evidence in this Docket indicating that Entergy's use of chemical biocides in its cooling system at Vermont Yankee causes any undue air emissions. First, the record demonstrates that NEC's allegation that Entergy is discharging air pollutants without the appropriate permit is unsupported by the record in this Docket. As indicated in Finding 123 above, Vermont Yankee is a registered air source with the Agency of Natural Resources. According to the State's Air Pollution Control Regulations that apply to Hazardous Ambient Air Standards, (Subchapter X, Appendix C, "regulations"), glutaraldehyde is classified as a "category 3 emission." Under the regulations, the amount of glutaraldehyde that Vermont Yankee would need to emit in the air in order to become subject to a glutaraldehyde limit would be 324 pounds over an eight-hour period. The record is abundantly clear that this chemical, and the others used

157. NEC Brief at 8–9.

158. Entergy adds that, in fact, that is not the case.

in the service water system at Vermont Yankee, are highly diluted and consumed in the process.[159] Furthermore, because the chemicals that are used in the service water system are actually consumed doing their work, there is little likelihood that their presence, if any, would be detectible in the drift.[160]

Second, we are not convinced by NEC's argument that Vermont Yankee's cooling tower drift will contain significant amounts of glutaraldehyde, or that this chemical will combine with others to cause environmental harm. While NEC's question of Entergy witness Schuyler raised the issue, NEC presented no evidence in support of its contention.

Nor did NEC otherwise demonstrate that Entergy's water treatment activities are, somehow, inappropriate because they employ a combination of chemicals in the Vermont Yankee service water system. While NEC's questioning of Entergy witness Schuyler suggested this, the witness responded that the chemicals are used in amounts that result in their being consumed as part of the treatment process. When asked whether the witness could quantify the deposition of chemical additives in the cooling tower water that might be transported in the cooling tower drift, the witness responded:

> No, I cannot because the chemicals that are used in the system are actually consumed. That's the purpose of using the chemicals. So most of the chemical and ideally if everything is working righ as a water condition, so it would not be possible to quantify what would be in the drift because presumably it's nil." [161]

Moreover, when questioned further as to the possibility of the biocides and the material that they combine with in the closed cycle becoming particulate matter that might be emitted into the air in the cooling tower drift, the witness indicated that this would be unlikely. Instead, she stated that it would "settle out in the silt in the cooling tower."[162] In closing, the witness concluded that the amount of cooling tower drift to contain biocides is insignificant and negligible.

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159. *See* findings 151–157, above.

160. *Id.*

161. Tr. 6/17/03 at 19 (Schuyler). The witness added that Entergy's NPDES permit controlling the biocides that Entergy applies to its service water system call for "no detection." *Id.*

162. *Id.*

In conclusion, we have heard no testimony nor read any evidence in the record that would support NEC's argument that Entergy's use (or its combined use) of particular service water chemicals will result in a hazard to human health, migratory waterfowl, nesting protected species, and the environment generally. Instead, we conclude that this will cause no undue harm.

(iii) Stormwater Discharge

157. The developed area of Vermont Yankee is served by a storm sewer system that discharges into the Connecticut River and is also governed by the NPDES permit. The project does not require amendment of the NPDES permit for changes to the stormwater discharge system. Schuyler pf. 2/21/03 at 13.

158. The uprate project does not require a Construction Site Runoff General Permit. *Id.*

159. A temporary Pollution or Discharge permit will not be required by this project. No construction will occur in or adjacent to surface waters ". . . that may result in unavoidable short term non-compliance with the turbidity or aquatic biota, wildlife, and aquatic habitat criteria." (Vermont Water Quality Standards, Section 2-03, B. 1.) Therefore, a temporary pollution or discharge permit will not be required. *Id.* at 14.

(iv) Domestic Sewage Discharge

160. Sanitary wastewater and laboratory wastewater from the facility are discharged to six on-site septic systems. These septic systems are covered by Vermont Indirect Discharge Permit ID-9-0036-1A (Exhibit EN-SAS-6), which permits a discharge of up to 26,297 gallons per day of wastewater during maintenance outages. This total capacity is sufficient to accommodate the temporary increase in workers required during Station shutdowns; however, the use of some of the individual systems may need to be regulated during the power uprate construction period so that the individual systems are not over-taxed. The septage from these septic systems is a solid waste that is managed on-site. *Id.*

(b) Solid Waste

161. The solids from the septic system are managed by land application on-site according to the conditions in the Indirect Discharge Permit (exh. EN-SAS-6), the Vermont Solid Waste Management Facility Certification #F9906-A1 (exh. EN-SAS-8), and VY NRC Offsite Dose Calculation Manual, Appendix I, (exh. EN-SAS-9). Two areas have been approved for land application, the North Field and the South Field. (See the Sludge and Silt Disposal Areas, exh. EN-SAS-10). A monitoring program is in place for the land application areas. Schuyler pf. 2/21/03 at 15.

162. Silt from the cooling towers accumulates in a basin under the west cooling tower. The basin is cleaned out once per operating cycle, and the silt is spread on the same fields that are used for the septic systems. The source of the silt is suspended solids in the cooling water taken from the river and solids from the cooling towers that wash into the basin. The amount of silt deposited in the basin may increase if more river water passes through the cooling towers. *Id.*

163. Vermont Yankee has the capacity to continue land application of septage and cooling tower silt. The facility has been operating using only the 1.9-acre south field for land application of all of Vermont Yankee's cooling tower silt and other waste soils. This field is certified to receive 55,100 gallons of solids per year. The 7.4-acre north field is certified for 214,600 gallons per year. The septage volumes per refueling cycle would remain essentially the same because no increase in the work force is expected except for the short duration of the uprate construction. *Id.* at 16.

164. Whether Vermont Yankee continues to operate under its current NPDES permit, or its thermal limit is amended, the amount of cooling tower silt it generates could increase. *Id.* at 16.

165. Vermont Yankee has sufficient capacity to continue the land application of septage and cooling tower silt. It has a 1.9-acre field certified for the application of over 55,000 gallons per year, and a 7.4-acre field certified for over 214,000 gallons per year. *Id.*

166. Construction debris from the cooling tower upgrade will be taken to the Brattleboro transfer station and disposed of at a licensed solid waste landfill. *Id.* at 17.

(c) Radioactive Waste

167. The increase in condensate flow rates associated with the uprate will require additional resin to be used to continually purify the water entering the reactor. As a result, two or three additional shipments of low level radioactive waste will be shipped from the Vermont Yankee site each year. Thayer pf. 2/21/03 at 16.

168. Entergy will handle the additional low level waste in the same way it currently handles low level waste, by shipping it to an approved low level waste disposal facility outside Vermont. *Id.*

169. Entergy will remove four feedwater heaters and the high pressure turbine components, consisting of one rotor and six sets of diaphragms, from the site after the outage. These are slightly contaminated pieces of equipment that will be changed out during the outage. A contract was issued on December 31, 2003, with an end date of October 31, 2004, to complete the removal of this equipment. Thayer pf. 1/13/04 at 2.

Discussion

Under 10 V.S.A. § 6086a, no land use permit can be issued for a development that develops low-level nuclear waste unless the project can demonstrate that it has access to a low-level nuclear waste disposal facility and that the facility is expected to have sufficient capacity for the waste. Entergy expects to continue to handle any additional low-level waste in the same way it currently handles such waste by shipping it to an approved low level waste disposal facility outside Vermont. Entergy has contracted for the removal by the fall of 2004, of the low-level waste it has identified as resulting from the uprate proposal.

Entergy must notify the Board if it no longer has access to a low-level nuclear waste disposal facility or if the facility is no longer expected to have sufficient capacity for the waste. On the basis of this condition, we conclude that the proposed uprate will not cause any adverse effects with regard to the disposal of Vermont Yankee's low-level radioactive waste.[163]

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163. NEC has argued that, due to the uprate, Vermont Yankee will be generating such a large amount of new low-level waste that the Board must assume that some of this will be added to radioactively contaminated soils, silt, and sludge now disposed of on site and under an NRC disposal permit. We are not persuaded. Entergy has committed to remove the low-level waste associated with the uprate, and will be held to that standard pursuant to

(continued...)

(d) Hazardous Waste[164]

170. Vermont Yankee is registered as a Large Quantity Generator under the Vermont Hazardous Waste Management Regulations, Section 7-308. Schuyler pf. 2/21/03 at 17.

171. Hazardous waste may be stored temporarily on-site up to 90 days, as permitted by Vermont Hazardous Waste Regulations. *Id.* at 18.

172. Asbestos and lead-based paint are the two types of hazardous waste that have been identified as part of the proposed uprate. The initial removal of an estimated 600 cubic feet of asbestos will be required during the power uprate. Asbestos covers stator bars in the Main Generator. It will be removed and then replaced. Four asbestos-insulated feedwater heaters that are also painted with lead-based paint will be replaced during the power uprate project. These heaters will be encapsulated and removed. *Id.*; exh. EN-SAS-11.

173. An additional 150 pounds of non-friable asbestos waste will be produced due to project modification involving the generator motor. Schuyler pf. 11/5/03 at 8.

174. A new main transformer was installed during the re-fueling outage in Fall 2002. At that time the spill containment system was modified to accommodate the increased volume of dielectric fluid in the new transformer. The Spill Prevention Control and Countermeasure Plan for the facility has been revised to include the new main transformer. Exh. EN-SAS-12; Schuyler pf. 2/21/03 at 18–19.

175. Entergy contracts with licensed hazardous waste disposal firms to have the wastes disposed of at a certified hazardous waste disposal facility. All asbestos and lead abatement will be completed by certified asbestos and lead-based paint abatement contractors. All asbestos containing wastes will be disposed of at a landfill licensed for asbestos waste. *Id.* at 18; exh. EN-SAS-11.

(3) Water Conservation [10 V.S.A. § 6086(a)(1)(C)]

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163. (...continued)
this Order.

164. This section discusses hazardous waste other than radioactive waste (which is addressed in the preceding section).

176. Water is used to produce steam, to condense steam, and to cool process equipment during the generation of electricity. It is also used in the heating systems for some buildings, and to provide potable water and domestic wastewater disposal for Station employees. Water sources for Vermont Yankee are the Connecticut River and on-site groundwater wells. Schuyler pf. 2/21/03 at 19.

177. Use of the cooling towers results in evaporative loss of water taken from the Connecticut River. Given the existing thermal discharge limits in Vermont Yankee's existing NPDES permit, the evaporative water loss due to cooling tower operation can be expected to increase after uprate. If the NPDES permit amendment is granted to change the thermal discharge conditions as requested, the cooling towers could be operated less, thus mitigating the potential increase in evaporative loss. *Id.*

178. The Vermont Water Quality Standards require that all uses of water be supported by the streamflow. The Water Quality Standards employ a stream flow protection guideline of no more than 5 percent diminished flow at the stream flow rate contained in the Vermont Water Quality Standards at Section 3-01, B. 1. *Id.* at 20.

179. The worst case for evaporative loss under either set of permit conditions would occur if the weather conditions for the highest evaporation rate coincided with a river flow of 1250 cfs, the minimum flow requirement for the Vernon Dam. In that case, the loss would be less than 1.5 percent of stream flow, an evaporative loss that would not be significant based upon the established flow protection guideline. *Id.*

180. The monthly average evaporation rates and corresponding water consumption rates resulting from use of the cooling towers at the uprate level either under the existing or proposed NPDES permit limits are expected to be insignificant as compared to the average river flow. Yasi pf. 2/21/03 at 3; exh. DEY-3R.

181. The normal use of water from groundwater wells will not increase as a result of the power uprate. During the 2004 planned outage period of about one month, when more workers will be on-site, there will be an increase in groundwater use. Exh. EN-SAS-7; Schuyler pf. 2/21/03 at 20.

182. The amount of well water used for make-up water for the reactor water system will not increase after the power uprate. The reactor water system is a closed system with no discharge of cooling water, so the system is as conservative of water use as is possible. *Id.*

(4) Floodways [10 V.S.A. § 6086(a)(1)(D)]

183. Vermont Yankee is located on the Connecticut River on the west side of the impoundment formed by the Vernon Dam. *Id.* at 21.

184. Entergy has proposed no changes that would divert the flow of floodwaters. *Id.*; exh. EN-SAS-13.

(5) Streams [10 V.S.A. § 6086(a)(1)(E)]

185. Vermont Yankee is located on the Connecticut River, and a small unnamed stream crosses the Entergy property to the north of Vermont Yankee. Schuyler pf. 2/21/03 at 21; exh. EN-SAS-2.

186. No construction will be required adjacent to the unnamed stream or the Connecticut River for the power uprate. Schuyler pf. 2/21/03 at 22.

187. Under the existing NPDES permit, Entergy conducts continuous monitoring of river temperature and flow upstream and downstream of the facility, water quality sampling, and ecological studies of macroinvertebrates, larval fish, and fish in the river. The purpose of this monitoring is to ensure that the discharges from Vermont Yankee authorized by the NPDES permit do not have an adverse impact on the fish and other wildlife communities in the river, and that the biological integrity of the aquatic community in the river is maintained. *Id.*

188. The annual monitoring reports are reviewed by the multi-member Environmental Advisory Committee (EAC) that has been established by the NPDES permit, and by ANR which has the regulatory authority for enforcement of the NPDES permit. As monitoring is a component of the current NPDES permit, it is expected to continue during subsequent renewals or amendments. No significant adverse impacts have been documented in this process. *Id.* at 22–23, 33–34.

(6) Shorelines [10 V.S.A. §6086(a)(1)(F)]

189. No changes will be made to intake or outlet structures on the shoreline. *Id.* at 23.

190. Vermont Yankee is a secured site, so no access to the water for recreation is provided from the property. *Id.*

191. Apart from the new capacitor banks, there will be no change to the exterior appearance of the facility as viewed from the Connecticut River. *Id.*

(7) Wetlands [10 V.S.A. § 6086(a)(1)(G)]

192. National Wetland Inventory (NWI)- mapped wetlands are present on the Entergy property north of Vermont Yankee. Exh. EN-SAS-14. Such wetlands and any wetlands hydraulically connected to NWI wetlands would be considered significant wetlands under the Rules of the Vermont Water Resources Board. Because the project will not require any new construction outside of the Vermont Yankee complex, no significant wetlands will be impacted. *Id.* at 23–24.

(8) Sufficiency of Water and Burden on Existing Water Supply [10 V.S.A. §§ 6086(a)(2) and (3)]

193. Sufficient water supply is available for the power uprate. Three water systems provide the potable water, water for heating boilers, and make-up water for the reactor water system: the Main Station Water System; the Construction Office Building System; and the Engineering Office Building System. The three systems have been granted Public Water System Permits to Operate. *Id.*; exh. EN-SAS-16.

194. Potable water demand after the power uprate is not expected to increase, and heating demand is expected to be the same. The amount of make-up water required for the reactor water system will not increase. The existing wells have enough capacity to serve the needs of the temporary workers who will be on-site for the power uprate construction. Schuyler pf. 2/21/03 at 25; exh. EN-SAS-7.

195. The uprate will not place an additional burden on the water supply for the facility or other users. Vernon Dam is located downstream of Vermont Yankee and uses river flow downstream of Vermont Yankee to generate electricity. Entergy reimburses the owner of the

Vernon Dam for water lost to evaporation, using a negotiated formula. If this practice were to continue, there would be no undue burden on the next down-stream user. Schuyler pf. 2/21/03 at 25.

(9) Soil Erosion [10 V.S.A. § 6086(a)(4)]

Findings

196. As part of its petition, Entergy determined that Vermont Yankee's generator rotor needed to be re-insulated to accommodate power uprate. In the course of developing its implementation plans, Entergy decided to perform the re-insulation on site, rather than at a remote location, as had originally been planned. Thayer pf. 11/5/03 at 10; tr.12/12/03 at 52 (Thayer).

197. To do this work on site, Entergy commenced the site preparation and installation of two temporary structures on November 10 to house the generator rotor during the outage, and a trailer to provide toilet facilities as the re-insulation is implemented. Thayer pf. 11/5/03 at 10–11.

198. Between November 10 and November 14, 2003, Entergy and its contractors removed top soil, added gravel and laid conduit sleeves under the area that would contain the concrete slab foundation for the temporary structures. Approximately 200 to 300 cubic yards of top soil was stripped from the site of the temporary structures. Approximately 1498 cubic yards of gravel was added to the site, including 586 cubic yards of bank run gravel and 912 yards of crushed gravel. Two conduit sleeves, one for a water line service and one for electrical service to the proposed bathroom trailer, were laid approximately 3 feet below grade as shown on the engineering drawing. The total area disturbed by the site preparation work was approximately 16,300 square feet. Exh. Entergy-Motion to Amend-1, Question 1R.

199. Entergy proposed that the Board condition the Certificate of Public Good approving the temporary structures on a requirement that, if the Board ultimately denied Entergy's petition to implement the uprate, Entergy would remove the structures, and the foundational pad, and that Entergy would restore the area, entirely at its own cost, ameliorating any effects of the installation of the temporary structures. *Id.*

200. Entergy's proposal involved two buildings, the larger of the two proposed structures would house the rotor during the re-insulation process. The smaller building would be used for supporting activities. The larger building would have been 150 feet long by 70 feet wide by 31 feet high and would have been constructed on a concrete slab that extends over a railroad spur. The smaller building would have been of similar construction, and would have been 40 feet by 60 feet by 18 feet. Schuyler pf. 11/5/03 at 1–2.

201. Entergy sought to erect the buildings prior to the Spring 2004 outage, and to take them down at the completion of power uprate; however, Entergy also planned to leave in place the slab for the larger building after power uprate. A bathroom trailer would also serve the workers in these temporary buildings. *Id.*; tr.12/12/03 at 21.

202. The temporary buildings were to be installed on a grassy, eastward-sloping area north of the parking area and west of the switchyard. Schuyler pf. 11/5/03 at 1/2; tr. 12/12/03 at 21.

203. Between November 10 and November 14, 2003, the following site preparation took place: Entergy removed top soil, added gravel and laid conduit sleeves under the area designated for the concrete slab foundation of the temporary structures. Exh. Entergy-Motion to Amend-1, Question 1R.

204. Approximately 200 to 300 cubic yards of top soil was removed from the site of the temporary structures, and trucked offsite. *Id.*

205. Approximately 1498 cubic yards of gravel were added to the site. *Id.*

206. Two conduit sleeves, one for a water line service and one for electrical service to the proposed bathroom trailer, were laid approximately 3 feet below grade as shown on the engineering drawing. The total area disturbed by the site preparation work was approximately 16,300 square feet. *Id.*

207. On November 14, 2003, a week after the site work had been undertaken, a tarpaulin was temporarily placed over the site to guard against erosion resulting from rain, and to prevent rain water from saturating the compacted gravel sub-base. *Id.*, Question 8.

208. Entergy's contractor filled in a depression at the perimeter of the site to accommodate concrete slab footing with a sandy silt material. *Id.*

209. The contractor graded, seeded and mulched the entire disturbed area, and installed erosion control and snow fences. *Id.*

210. No further work has been done since that time. *Id.*

Discussion

The record indicates that Entergy conducted site work prior to receiving Board permission to proceed with its project to prepare and develop the temporary buildings necessary to house Entergy's planned rotor rewind. In the interim, Entergy decided to have the rotor rewind conducted offsite, and thus to refrain from further construction on the site it had originally disturbed.

The record also reflects that Entergy has not completely mitigated the effects of its initial preparatory construction and infrastructure modifications on this site. We conclude, therefore, as part of the approval of Entergy's overall petition before us, that Entergy shall submit, within 30 days of the issuance of this Order, a plan and schedule for the entire and complete removal of all effects of the site preparation and associated infrastructure installation that it undertook at this part of the Vermont Yankee site to prepare for the planned rotor rewind. Such plan shall provide for the completion of this work within 61 days of issuance of this Order. It shall also contain a description of the manner in which Entergy expects to demonstrate that the entire affected site has been returned to its condition prior to the work discussed here.

Other than the soils issues related to the temporary buildings, there are no other soils issues to be considered.

d. Traffic [10 V.S.A. § 6086(a)(5)]

211. There will be no increase in the number of regular employees after the uprate, so the uprate will have no additional long-term impact on daily traffic or peak hours from employee traffic. Traffic effects can be expected in the short term, *e.g.*, during the 2004 outage. Schuyler pf. 2/21/03 at 26.

212. The 2004 outage is expected to last 30 days. Fifteen hundred employees are expected to be on-site during that time. Sixty percent of the employees are expected to work 12-hour

shifts starting between 5:30 AM and 7:30 AM, and 40 percent of the employees are expected to work 12-hour shifts starting between 5 PM and 7 PM. *Id.* at 27.

213. The site has one controlled access point on Governor Hunt Road. Exhs. EN-SAS-2 and EN-SAS-3.

214. Although the traffic delay at the intersection at the facility entrance will increase during the outage, the outage will not cause unacceptable congestion. Schuyler pf. 2/21/03 at 26–27; exh. EN-SAS-18.

215. The power uprate will generate additional truck trips at the facility. The increase in truck traffic as a result of the upgrade will be three additional low-level radioactive waste shipments per year and one additional nuclear fuel delivery per 18 months. These increases will not change the rating of the Governor Hunt Road intersection as shown in the traffic study. Exh. EN-SAS-18; Schuyler pf. 2/21/03 at 28.

216. The American Association of State Highway Transportation Officials (AASHTO) uses a letter rating from A to F to describe traffic conditions, with "A" representing no delay and "F" representing maximum delay and congestion. AASHTO recommends designing intersections such as the Vermont Yankee access to Governor Hunt Road for level-of-service from "C" to "D". *Id.* at 26–27; exh. EN-SAS-18.

217. A traffic study has been prepared by Southern Vermont Engineering Associates concluding that the level of service at the only facility entrance on Governor Hunt Road would go temporarily from "C" to "D" north of the intersection during the planned power outage in 2004. *Id.*

218. No additional parking will be required for this project. Vermont Yankee has no less than 430 parking spaces which are more than adequate for the normal workforce. During maintenance outages a temporary parking area is set-up near the cooling towers and switchyard. These areas have sufficient capacity to handle the additional workers that will be required during the uprate construction. *Id.*; Site Plan, exh. EN-SAS-3.

219. Icing on nearby roads due to cooling tower operation is not anticipated. Schuyler pf. 2/21/03 at 28.

e. Educational and Municipal Services [10 V.S.A. §§ 6086(a)(6),(7)]

220. The number of permanent employees will not change due to the uprate, so this project will not result in an increase in the school population. *Id.*

221. Although Vermont Yankee receives supplemental police protection, fire protection, and rescue service from the Town of Vernon, letters from the Vernon Planning Board and Select Board state that the proposed uprate will not overburden municipal and government services in the Town of Vernon. Exh. EN-JKT-9; Schuyler pf. 2/21/03 at 29.

222. The emergency planning standard that is used by all 104 nuclear power plants in the United States operating today was developed using guidelines from a much larger plant than Vermont Yankee. Instead of developing custom guidelines for each plant based on size, emergency planning standards are based on the largest plant which sets uniform guidelines that all plants must follow. Tr. 1/14/04 at 82 (Thayer).

223. The increase in the radiological consequences associated with the uprate fall below the NRC limits that would impact emergency planning. Tr. 1/14/04 at 17 (Resnikoff).

224. The proposed power uprate does not directly affect emergency plans and evacuation considerations. Emergency plans and evacuation considerations must be in place for the Station with its current power output and would not need to be modified as a result of the power uprate. Sherman pf. 5/9/03 at 22.

f. Discussion re: Educational and Municipal Services

NEC and many public comments have articulated concerns that an increase in power production by Vermont Yankee will affect emergency planning. As we indicated in our Order approving the sale of Vermont Yankee to Entergy, the Board does not have any jurisdiction over emergency planning.[165] In late 1979, following the Three Mile Island nuclear power plant accident that took place in March of that year, President Carter transferred the Federal lead role

165. Docket 6545, Order of 6/13/02 at 148–149.

in offsite radiological emergency planning and preparedness activities from the NRC to the Federal Emergency Management Agency ("FEMA"). FEMA has established programs designed to protect public health and safety of those living in near nuclear power plants. FEMA's work is devoted to offsite programs while onsite activities at nuclear facilities continue to be conducted under the authority of the NRC.[166]

Although we understand the importance of effective emergency planning, and certainly recognize the public's concern for this issue, we must note that no party demonstrated any connection between possible effects of the proposed uprate and emergency planning. To the contrary, the Board heard unrebutted evidence, *e.g.*, testimony by NEC witness Resnikoff, indicating that an increase in the radiological consequences of uprate alone will not impact emergency planning.[167]

With regard to educational and other municipal services, we reach our conclusion based upon the representations made by the Town of Vernon Planning Board and the Select Board. Both indicated that the proposed uprate will not overburden municipal and government services. We conclude, therefore, that the uprate will not have a negative effect upon educational and municipal services.

g. Scenic or Natural Beauty of the Area, Aesthetics; Rare and Irreplaceable Natural Areas; Necessary Wildlife Endangered Species, and Primary Agricultural Soils [10 V.S.A. § 6086 (a)(8)]

(1) Scenic or Natural Beauty, Aesthetics

225. As conditioned, and as explained below in findings 226 through 237, the proposed uprate will not have an unduly adverse impact on the scenic or natural beauty or the aesthetics of the area around Vermont Yankee.

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166. FEMA has established the Radiological Emergency Preparedness (REP) Program to (1) ensure that the public health and safety of citizens living around commercial nuclear power plants would be adequately protected in the event of a nuclear power station accident and (2) inform and educate the public about radiological emergency preparedness. FEMA's REP Program responsibilities encompass only "offsite" activities, that is state and local government emergency preparedness activities that take place beyond the nuclear power plant boundaries. http://www.fema.gov/rrr/rep/.

167. Tr. 1/14/04 at 17 (Resnikoff).

226. The most significant uprate-related changes to the aesthetics of Vermont Yankee will be those impacts associated with potentially larger cooling tower vapor plumes. Dodson pf. 2/21/03 at 2.

227. The site is located on the west shore of the impoundment of the Connecticut River that is formed by the Vernon Dam. To the north of the generating station, the property is largely undeveloped except for the power lines that run north from the generating station. To the west, the property is bordered by residential lots that front on Governor Hunt Road. An interpretive center, the Governor Hunt House, is located on the property with frontage on Governor Hunt Road. The generating station itself is fenced and access is limited to persons who work at the facility or have approved business at the facility. To the south, the property is bordered by the Vernon Dam Hydroelectric Station. Schuyler pf. 2/21/03 at 29–30; exh. EN-SAS-2.

228. Vermont Yankee includes the generating facility, cooling towers, administrative buildings, communications towers, a concrete stack, parking lots, the Vernon Dam, substation, and electric transmission lines. Beyond the Station, structures include historic and more recently-built housing in a small village, farm buildings, small highway commercial buildings, utility lines and a railroad line. Exh. EN-HLD-2 at 56.

229. The immediate area in which Vermont Yankee is located is an industrial site. The surrounding area, including the river, farmland, forested hills and historic villages is scenic. Because it is located along the river bank, Vermont Yankee is relatively easy to see. *Id.*

230. Vapor plumes are not an uncommon visual element of the Connecticut River Valley in winter, emanating historically from mills and other facilities along many areas of the river in Vermont and New Hampshire. These vapor plumes have been a factor in the traditional Connecticut River Valley visual landscape since the beginning of the industrial revolution. *Id.* at 56–57.

231. The cooling tower "plume" at Vermont Yankee is actually a collective plume comprised of 22 discrete plumes. The cooling tower is an arrangement of two lines of eleven fans, each one over 30 feet in diameter. Tr. 6/17/03 at 65 (Dodson); exh. EN-DEY-5.

232. The cooling tower plumes can be seen by travelers on Route 142 in Vermont. Local residents and visitors can easily see the plumes emanating from Vermont Yankee from all four sides of the site. Exh. EN-HLD-2 at 57.

233. For the hours when the cooling towers are in use, the existing 125 hp fan motors, would mean that the representative plumes for spring, fall, and summer after uprate are likely to be approximately 20 percent larger than the existing plumes. Vermont Yankee cooling towers have not operated in the winter since 1978, although they did operate in the winter between 1972 and 1978. However, plume sizes for winter after the uprate can be expected to be comparable in size to plumes that would occur in the spring or fall. Exh. EN-HLD-3 at 1.

234. Post-uprate plume sizes for spring, summer, and fall would be 20 percent smaller if Entergy replaced current 125-hp cooling tower fans with 200-hp fans. Post uprate winter plumes can be expected less than 20-percent of the time with these fans. Yasi pf. 2/21/03 at 3–4; exh. EN-DEY-5.

235. Uprate will have little or no impact on the quality of the cooling tower's vapor plumes, with the exception of their presence during the winter. The proposed plumes will be identical in color and density to existing plumes. Dodson pf. 2/21/03 at 2; exh. EN-HLD-2 at 56.

236. Between its initial filing in February, 2003 and the first set of hearings in June, 2003, Entergy modified its uprate proposal such that the existing 125-hp fan motors would now be replaced with high-efficiency 125-hp motors rather than the originally-proposed 200-hp motors. Tr. 6/17/03 at 74 (Yasi).

237. The use of 200-hp fans will result in post-uprate plume sizes for spring, summer, and fall being 20 percent smaller than they would be if Entergy replaced current 125-hp cooling tower fans with 125-hp high efficiency fans as it has proposed. Yasi pf. 2/21/03 at 3–4; exh. EN-DEY-5; exhs. EN-HLD-2, EN-HLD-3.

(2) Discussion re: Aesthetics

Under the *Quechee* analysis we must consider whether the visual change to the cooling tower plumes resulting from the proposed uprate will adversely impact the aesthetics of Vermont

Yankee and if so whether that impact is undue.[168] As further explained below, we conclude that, although the potential post-uprate cooling tower exhaust plumes for winter will not result in an adverse effect, the likely plumes for the rest of the year will result in an adverse effect. Furthermore, this effect in spring, summer, and fall plumes will be adverse unless Entergy mitigates it by using the 200-hp fans.

With regard to winter plumes, the evidence suggests that there will be a negligible difference between the plumes created by an uprate whether Vermont Yankee maintains its use of 125-hp fans or employs the larger 200-hp fans. Currently there are no winter plumes because the cooling towers do not operate during that part of the year. Winter plumes, however, were created and observed over twenty-five years ago, prior to 1978. The uprate will result in more winter plumes. The visual models that Entergy presented showed that the larger plumes would have a noticeable impact. However, these will likely be smaller in size to those that now exist in other times of the year. We do not find that the potential return of winter plumes to be adverse. The evidence demonstrates that, assuming the use of the existing 125-hp motors, the power uprate would result in an increase to existing plume size of 20 percent. However, based purely on the size of the increase in the plume in the spring, summer and fall seasons, we find that the uprate-related increase in plume size, assuming 125-hp fans, would be adverse.

As Entergy's witness explained, the primary mitigating step that Entergy could take to avoid this impact would be to install 200-hp instead of 125-hp fans.[169] The larger fans would dissipate the steam more quickly, thereby diminishing the size of the 22 plumes that contribute to the one large plume viewed from the surrounding area. While recognizing that there may be other mitigating measures, Entergy witness Dodson indicated (in his initial testimony) that he had considered only the use of larger fans as an appropriate mitigation:

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168. In reaching this conclusion, we have relied on the line of analysis rooted in the Environmental Board's methodology for determination of "undue" adverse effects on the aesthetics and scenic and natural beauty as outlined in the so-called Quechee Lakes decision. *Quechee Lakes Corporation*, #3WO411-EB and 3WO439-EB, dated January 13, 1986. For the applicability of that test in the context of 30 V.S.A. § 248, *see e.g.*, Docket 6792, Order of 5/16/03 at 27–28.

169. Tr. 6/17/03 at 61–62 (Chairman Dworkin/Dodson); Mr. Dodson, on rebuttal, revisited the question, but we find his original testimony more persuasive.

CHAIRMAN DWORKIN: Knowing as you do now that they propose not to take that mitigating step, how would you answer the underlying question which is whether the applicant failed to take generally available mitigating steps?

MR. DODSON: Well I would say that the larger fans are definitely a mitigating step. There are other types of mitigating steps that could be, you know, taken in terms of the way the cooling towers are operated, but the powerful one would be the larger fans.

CHAIRMAN DWORKIN: Would that lead us to say that they had failed to meet the Section 248 criteria unless they used larger fans?

MR. DODSON: I would look, you know, closely at the other mitigating steps that they are proposing.

CHAIRMAN DWORKIN: Have you?

MR. DODSON: I haven't because this change is a relatively recent one.[170]

Due to its proposal to replace the existing 125-hp fan motors with "high efficiency" 125-hp fans, Entergy argues that it has taken steps that will mitigate the impact of the uprate on the cooling tower plume. Although Entergy claims that "qualitative testimony indicates that the new 125-hp fan motors may result in smaller plumes than would result for the existing fan motors," they have not demonstrated with any certitude the relationship between their newer proposal to use high efficiency 125-hp fans and their initial proposal what would appear to be an effective mitigation strategy, *i.e.*, the use of 200-hp fans.[171] Applying the *Quechee* analysis, we conclude that Entergy's failure to take generally available mitigation steps — in this case using the originally proposed 200-hp fans — results in the likelihood that this proposal would create undue adverse effects during the spring, summer, and winter.[172]

In addition to the current request for a change to the summer thermal discharge limit in its NPDES permit, Entergy has also suggested that "should Entergy VY propose a change in the

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170. *Id.*

171. While Mr. Yasi's work in exhs. DEY-5 and DEY-5R analyzed impacts of the proposed 200-hp fan motors and existing 125-hp fan motors, he has provided no analysis of any effects of the 125-hp fans characterized as "high efficiency."

172. For purposes of evaluating a proposed land use under these criteria, an adverse impact on the environment is "undue" if (1) the project violates a clear, written community standard intended to preserve the aesthetics or scenic, natural beauty of the area, (2) the project offends the sensibilities of the average person, or (3) the applicant has failed to take generally available reasonable mitigating steps to improve the harmony of the proposed project with its surroundings. *See In re McShinsky* (1990) 153 Vt. 586.

Winter Period thermal discharge limitation in its NPDES permit," such a change would serve to mitigate winter cooling tower operation and associated plumes. Not knowing the likelihood of whether this or another amendment application will be approved, we find this suggestion too speculative and of little use in determining the likelihood of the outcome of that request on the mitigation of cooling tower plumes at Vermont Yankee. For these reasons, and in order to mitigate the aesthetic impacts of the additional heat to be dissipated by the cooling towers following the uprate, today's Order includes a condition requiring Entergy to install 22 of the originally-proposed 200-hp fans in order to mitigate the under adverse effects created by the post-uprate cooling tower plumes.

(3) Rare and Irreplaceable Natural Areas

238. The site was reviewed by the Vermont Division for Historic Preservation, which found no impact on archeological or historic sites. Schuyler pf. 2/21/03 at 30; exh. EN-SAS-19.

239. Although mapped occurrences of rare and threatened species and unique natural areas are shown on the Vermont Significant Habitat map, the Vermont Nongame and Natural Heritage Program ("Nongame and Natural Heritage Program") reviewed the project and did not find that any undue adverse impacts would occur to nongame resources or significant natural areas. Schuyler pf. 2/21/03 at 31; exhs. EN-SAS-14 and EN-SAS-20.

240. The only Vermont-protected species indicated on the Significant Habitat Map is the threatened great St. John's-Wort, a yellow-flowering plant. It has been recorded immediately above the Vernon Dam near the Vermont Yankee property boundary, so it is possible that members of this listed species could spread onto the Vermont Yankee property. Since no development is planned for this part of the property, the project would have no effect on this threatened species even if it were to occur on the Vermont Yankee property. Schuyler pf. 2/21/03 at 32.

241. The project will not affect significant wetlands, the Class 2 wetlands shown on the NWI map. Since there will not be any construction outside of the already developed Vermont Yankee complex, no impacts will occur to other wetland communities that may occur on the Vermont Yankee property. *Id.*; exh. EN-SAS-14.

(4) Necessary Wildlife Habitat and Endangered Species

242. There will be no impact on terrestrial wildlife habitat because no changes will be made to the facility footprint. Schuyler pf. 2/21/03 at 33.

243. The project has been reviewed by the Nongame and Natural Heritage Program and no concerns about impacts to endangered species have been raised. Exh. EN-SAS-20.

244. Compliance with the conditions of the current NPDES permit, the subsequent amendment allowing for an increase of one degree to thermal discharge limits, and the associated condition regarding derate and a speedy return to permitted thermal discharge limits will assure the protection of habitat values in the Connecticut River. Schuyler pf. 2/21/03 at 33–34.

g. Development Affecting Public Investments [10 V.S.A. § 6086(a)(9)(K)]

245. A public park is located to the south of the facility by the Vernon Dam fishway and the Vernon Elementary School is located on Governor Hunt Road. *Id.* at 34; Site Location Map, exh. EN-SAS-2.

246. The proposed project will have no impact on these public facilities. Schuyler pf. 2/21/03 at 34.

F. Consistency with Resource Selection/Integrated Resource Plan [30 V.S.A. § 248(b)(6)]

247. As a wholesale utility that does not distribute electricity to the public, Entergy is not required to prepare or submit for approval an integrated resource plan. Consequently, this criterion is not applicable. Thayer pf. 2/21/03 at 22.

G. Consistency with Department's 20-Year Plan

1. Findings

248. The Department issued its most-recent *Twenty-Year Plan*, nine years ago, in December, 1994. That Plan took the view that new nuclear sources were unlikely to provide a future source of power for the state. Thayer pf. 2/21/03 at 22–23.

249. The types of new nuclear sources considered in the Department's 1994 Twenty-Year Plan are limited to an entirely new nuclear plant or Vermont Yankee with a renewed license. *Id.*

250. On December 3, 2003, the Department issued a determination that this project is consistent with its 1994 Twenty-Year Plan. Exh. Entergy-14.

2. Discussion

In its 1994 Twenty-Year Plan, the Department took the view that new nuclear sources were unlikely to provide a future source of power for the state. The only "new" nuclear sources considered in that document were an entirely new nuclear plant or Vermont Yankee with a renewed license. This uprate proposal is a request for a license amendment, which the Department's Twenty-Year Plan did not consider. Thus, the changes to Vermont Yankee before us for review are not inconsistent with the Department's current Twenty-Year Plan. We conclude, therefore, as did the Department, that the proposed changes associated with the uprate are not inconsistent with the current Twenty-Year Plan.

H. Outstanding Resources Water [30 V.S.A. § 248(b)(8)]

251. Because Vermont Yankee is located on the Connecticut River, which has not been designated an outstanding resource water by the Vermont Water Resources Board, this criterion is not applicable. Schuyler pf. 2/21/03 at 34; exh. EN-SAS-22.

I. Waste to Energy [30 V.S.A. § 248(b)(9)]

252. Waste to energy facilities must demonstrate that they are included in a solid waste management plan adopted pursuant to 24 V.S.A. § 2202a. Instead of generation electricity from waste, Vermont Yankee is a nuclear fission facility whose waste streams are managed as described above at Findings 161–175, above.

J. Existing Transmission Facilities [30 V.S.A. § 248(b)(10)]

253. Improvements necessary to the existing transmission system have been identified by the ISO-New England Study in its letter to Entergy issued on October 18, 2003, as noted above at findings 15 through 20. Based on the study results, Entergy agrees to perform all the upgrades outlined by ISO New England in its letter of October 8, 2003 (exh. EN-JKT-12); tr. 1/15/04 at 97 (Thayer).

VI. RESPONSES TO PUBLIC CONCERNS

As we noted in Part IV, above, many members of the public commented on this proceeding, in public hearings, in e-mails, and in written comments. Under Vermont law, we must base our decision on evidence presented by parties in the formal hearings. However, public comments play an important role, by raising new issues or offering different perspectives that we should consider. In this case, the many thoughtful comments helped us to raise questions during the hearings and to think about the factual evidence presented by the parties. Here we address the major concerns raised by the public:

(1) Safety issues: Commenters expressed general concerns about safety, the adequacy of emergency planning, and the potential for emissions and other risks associated with Vermont Yankee's age;

(2) Independent Safety Assessment: Many persons stated that the Board should require an independent safety assessment of Vermont Yankee before proceeding;

(3) Concerns about the payments Entergy will make to the state of Vermont as part of the Memorandum of Understanding: Some characterized them as a "bribe" or "pay-off;"

(4) The economic benefits of the Entergy-DPS Memorandum of Understanding: Several persons stated that the proposed power uprate did not provide an economic benefit to the state.

(5) Environmental effects: Members of the public stated that the uprate would increase the thermal discharge to the Connecticut River, adversely affect the stream flow, and lead to larger and more frequent cooling tower plumes;

(6) Reliability of Vermont Yankee post-uprate: Commenters stated that the uprate would adversely affect the reliability of Vermont Yankee;

(7) Increase in nuclear waste: Many people expressed concern that the uprate would lead to an increase in nuclear waste from the Station; and

(8) Alternative sources of energy: Commenters observed that the uprate represented bad energy policy, recommending that the state instead cultivate alternative sources of energy.

(1) *Safety Issues*

Many commenters, and one of the parties in this case, urged the Board to disapprove power uprate at Vermont Yankee because of issues related to general concerns over nuclear safety.

(a) *Safety in General*

We begin our discussion of safety issues by reiterating observations we made on this issue in Docket 6545, our 2002 Order approving the sale of Vermont Yankee to Entergy:

> Many public comments . . . argued that the Board should order a prompt or immediate shut down of Vermont Yankee because of issues related to nuclear safety, with particular reference to radiological emissions, nuclear waste, emergency response deficiencies, potential terrorism, and the aging of the plant.
>
> We begin, but do not end, our thoughts on this issue with a pragmatic observation. To the extent that early closure might be justified for non-financial reasons, such as nuclear waste and radiological safety, we have limited authority because Congress has placed nuclear waste and safety issues with the federal Nuclear Regulatory Commission, and not with this Board. Our power over Vermont Yankee, like the NRC's power over safety issues, is limited to what is conferred by law. If we did not respect the choice of Congress in giving the NRC it's power, we would have no right to expect Vermont Yankee's owners — who ever they might be — to respond to the authority that we have been given by law. Thus, we did not take testimony upon, and we do not rule upon, the question of the safety of nuclear power as a general policy for our nation.[173]

When we considered the effect of the sale to Entergy upon safety we concluded that Entergy would run Vermont Yankee at least as safely as the previous owners. In this case, we have heard no persuasive evidence showing that Vermont Yankee is being run unsafely. If the evidence had persuaded us of serious safety problems we might not be able to take formal action,

173. Docket 6545, Order of 6/13/03 at 153.

but would have been very public in stating our concerns. The evidence before us does not lead us to that conclusion.

However, the testimony has convinced us that the uprate may affect the reliability of Vermont Yankee. Because this potential effect on reliability could have adverse financial impacts upon Vermont consumers, we find a need to ensure that an uprated Vermont Yankee will continue to produce electricity reliably. For that reason, as we explain in this Order, we have asked that the NRC conduct its safety assessment in a way that will be equivalent to an independent engineering assessment, and we condition our approval of Vermont Yankee's operation at increased power levels upon the completion of that assessment.

(b) *Emergency Planning*

Some members of the public raised questions about the adequacy of emergency planning. These are important issues. However, because of the limitations to the Board's authority, we have not considered, and cannot consider the adequacy of the emergency management plan for Vermont Yankee. In 1979, following the Three Mile Island nuclear power plant accident in Pennsylvania, President Carter transferred the Federal lead role in offsite radiological emergency planning and preparedness activities from the NRC to FEMA, the Federal Emergency Management Agency.[174] It became FEMA's role to ensure public health and safety of citizens who live offsite, *i.e.*, in the area surrounding a nuclear power plant, while the NRC onsite activities continued to be the role of the NRC. Federal preemption of state authority remained, however, except to the extent that FEMA assigned roles to local and state entities. So it is FEMA's responsibility to ensure that state and local government emergency preparedness activities take place beyond the nuclear power plant boundaries. In Vermont, this authority has not been given to this Board; instead, the primary responsibility rests with the Emergency Management Division of the Department of Public Safety.

(c) *Potential Emissions and other Risks Associated with Vermont Yankee's Age*

174. FEMA was formerly an independent agency that became part of the federal Department of Homeland Security in March 2003.

The public also commented on potential harm due to emissions from Vermont Yankee, and other risks associated with the age of Vermont Yankee. Turning first to the issue of emissions of radiation, at the present time, both the NRC and the State of Vermont have established limits on the amount of radiation that can be released by Vermont Yankee. Under state law (the stricter of the two limits), Entergy is subject to a limitation of 20 mr per year, which is measured at the fence line. Both the federal and state standards are significant limitations; an exposure of 20 mr per year is much less than the normal background radiation experienced by residents of the state.[175] In order to ensure that this limitation is met, there are monitoring devices located on the perimeter of the Vermont Yankee site which are read on a monthly basis to ensure that Entergy complies with the law. The Department of Health and NRC oversee compliance with the radiation standards.

Nothing in this case, or associated with the power uprate changes these limits or Entergy's obligations to comply with them. Entergy designed the uprate to stay within the Vermont Department of Health limit. Although fence line radiation dose under the uprate is expected to increase by a maximum of 3.6 mr per year, Entergy expects that actual annual radiation dosage measured at the fence line would increase by less. Even with this increase, Entergy expects to be able to (and must) operate Vermont Yankee within the regulatory limits. If the radiation dose at the fence were to approach Vermont's regulatory requirements, Entergy would be required to shield the sources to reduce the radiation exposure at the fence line or to immediately reduce power to ensure compliance. Our Order places conditions upon Entergy that will protect Vermont ratepayers against the economic costs of such power reductions. We cannot conclude that the small incremental increase in expected radiation from Vermont Yankee after the uprate creates cause for concern.

Other persons expressed concern over Vermont Yankee's age and ability to withstand the rigors associated with running under uprate conditions. As this Order makes clear, we take the reliability aspect of these concerns very seriously. Separate and apart from the impact upon

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175. Department of Health Regulations, Part 5, Chapter 3, 5-305 (B)(1)(e). This limitation is an accumulated dose for a year, not an average. Thus, an annual dosage of 18.6 mr that Entergy expects to be the exposure after the uprate, would only be incurred by someone who spent every minute of the entire year at the fence line.

safety, the changes have the potential to affect the reliability of Vermont Yankee. Because Entergy could not adequately assure us that an uprated Vermont Yankee would continue to operate at the expected high levels of power output upon which Vermont now relies, we have conditioned our approval of Entergy's proposed power uprate on the results of an independent engineering assessment of Vermont Yankee. This is discussed more fully in the next subsection.

(2) *Public Desire for an Independent Safety Assessment*

NEC and many commenters asked for an independent "safety" assessment of the Vermont Yankee plant, specifically raising mechanical and engineering factors relevant to safety. Commenters also cited the 1996 assessment of the Main Yankee Power Station by the NRC as a model for the assessment they believe ought to be conducted at Vermont Yankee. The condition that we set in today's Order, in large part, achieves the same results as would an independent safety assessment, although we reach that outcome because of our substantial concerns regarding reliability.

Federal law takes away our power to regulate the radiological safety of a nuclear reactor. The evidence did, however, cause us to have concerns about the long-term reliability of Vermont Yankee under uprate operating conditions, which could have significant financial consequences for the state. Vermont Yankee is the resource from which the state's two largest retail electricity providers have contracted to acquire nearly one third of their power for the next nine years. We want to ensure that it continues to be a reliable source of electricity. The reliability of Vermont Yankee has always been a Board concern, but is especially so in the case of an uprate where Vermont utilities and ratepayers face the financial risk of an outage, but do not now purchase any of the additional power output.

To satisfy ourselves that Vermonters are not exposed to these financial risks, we are asking the NRC for an independent engineering assessment of Vermont Yankee. This will serve to determine whether or not Vermont Yankee can reasonably be expected to generate power at capacity factors similar to those that have occurred in the recent past. In this Order, we require that the independent engineering assessment should be conducted at a scope and level of effort similar to that recommended by NEC's witness David Lochbaum. We also expect the NRC's

review to be "independent" both in the sense that it is conducted by experts that have not had recent or significant regulatory responsibility with respect to Vermont Yankee and in the sense that it will be "backstopped" by the Advisory Committee on Reactor Safety. It is with this condition that we conclude that approval of an uprate at Vermont Yankee should be granted. We would not approve this proposal otherwise.

(3) *The Entergy-DPS MOU is a "bribe" or "pay-off"*

On November 5, 2003, Entergy and the Department entered into a settlement agreement (the Memorandum of Understanding), under which the Department agreed to support the power uprate in exchange for approximately $6 million of payments to the state of Vermont and protections for ratepayers in the event that the uprate reduces the reliability of Vermont Yankee.

Vermont law requires that, for a project to be approved under Section 248, the Board must, among other things, determine whether the proposal provides "economic benefit to the state." We view the payments offered to the state as a legitimate step toward meeting exactly the standard specified by the legislature.

Several letters characterized the payments from Entergy as a bribe or payoff. We disagree. The 1994 Webster's New Riverside University Dictionary defines "bribe" as:

> Something, as money or a favor, offered or given to someone in a position of trust to induce him or her to act dishonestly.

Similarly, Title 13 of Vermont Statutes Annotated, Chapter 21 describes bribery as a criminal act. In fact, the definition provided in that chapter and the cases construing it would largely agree with the Webster's Dictionary definition above. There is no evidence that such illicit activity occurred here resulting in any government employees receiving any personal benefits from Entergy. As thought-provoking as we found many of the other public comments to be, we see no evidence that the comments regarding bribery are anything but baseless and inappropriate.

(4) *Economic Benefit*

Several persons questioned whether the uprate would provide an economic benefit to the state of Vermont. As the above Order makes clear, this question was one of the primary questions facing us in this Docket. We have carefully weighed both the benefits and costs. The expected economic benefits are primarily incremental tax revenue and the payments from Entergy to the state of Vermont. We balanced these against the known and potential costs that may result from the uprate. These include the risk of increased outages or reduced power production and the need to reduce power output if the uprate causes Entergy to exhaust its currently authorized storage capacity earlier.

These economic risks are significant and could cause the costs to exceed the benefits. Thus, we can conclude that the uprate and payments under the Memorandum of Understanding are likely to lead to a net economic benefit to Vermont only if we impose conditions to protect Vermont ratepayers and utilities from the potential that costs do exceed benefits. The combination of our conditions requiring an independent engineering assessment and requiring financial shields for reduced power output due to accelerated exhaustion of spent fuel pool capacity mean that the plant can operate at increased power only if it is likely to produce an economic benefit to the state.

(5) *Environmental Effects: Thermal Discharge to the Connecticut River, (b) Stream Flow, and (c) Cooling Tower Plumes*

a. Thermal Discharge

Vermont Yankee currently has an NPDES permit which allows it to discharge water used for plant cooling into the Connecticut River. Entergy has applied to the ANR for an amendment to the NPDES permit to allow it to discharge cooling system water at a temperature one degree higher than its current NPDES permit allows. Members of the public raised concerns about the negative effects on the Connecticut River from Vermont Yankee's thermal discharge, expressing fears that the uprated plant will put too much heat into the river and that this will result in damage to the ecosystem.

The uprate will increase the heat in the reactor and in the cooling water systems. This additional heat does not raise additional concerns for the Connecticut River, however. First,

Vermont Yankee's discharges to the river are regulated by an NDPES permit issued by ANR. As required by state and federal law, the limits in that permit are designed to ensure that the discharge will comply with applicable water quality criteria that protect the river from harm. We typically defer to the ANR's judgments as to the appropriate permit limits to ensure that Entergy meets the water quality criteria of Section 248. We have no basis to conclude that the limits in the existing permit are inadequate for this purpose. While the uprate may produce more heat, Entergy has the obligation to find ways to reduce that heat (such as increased use of cooling towers) in order to comply with the permit requirement.

Second, Entergy has asked ANR to allow a one degree increase in the amount of heat discharged to the river. As of the date of this Order, ANR had yet acted upon this request. We assume that ANR will grant Entergy's request only if they are satisfied that the higher temperature limit will still adequately protect the environment.

Third, we have added a condition to the existing requirements that will increase the protection for the river. Specifically, whereas the NPDES permit allows Entergy 24 hours to reduce its power production in case of a cooling system malfunction, Entergy must slow down production at a faster rate until it comes into compliance with its current thermal discharge standard. (*See* Section V.E.).

b. Water Withdrawal

Some commenters indicated concern about the potential cooling tower water withdrawal demands that might be placed on the Connecticut River stream flow due to the increased generation associated with the uprate. Based upon the evidence presented to us, we found that the increased generation associated with the uprate would not place too great a demand on the river.

Use of the cooling towers to condense steam and to cool process-equipment during the generation of electricity results in evaporative loss of water taken from the Connecticut River.

Under the Station's existing NPDES permit, the evaporative water loss due to cooling tower operation is expected to increase slightly after uprate.[176]

However, the record demonstrates that evaporation rates and corresponding water consumption rates resulting from use of the cooling towers at the uprate level (either under the existing or proposed NPDES permit limits) can be expected to be insignificant as compared to the average river flow. The worst case for evaporative loss under either set of permit conditions would occur if the weather conditions for the highest evaporation rate coincided with a river flow of 1250 cubic feet per second which is the minimum flow requirement for the Vernon Dam. In that case, the loss would be less than 1.5 percent of stream flow, significantly below the five percent limit that is explicitly allowed by current law.[177]

c. Cooling Tower Plumes

In addition to thermal discharge into the Connecticut River, Vermont Yankee's cooling system also uses cooling towers which create steam plumes when the system's fans are running. Some persons expressed concerns that the power uprate would increase the size of the cooling tower plumes, thus creating an adverse aesthetic impact.

Entergy has acknowledged that uprate conditions would result in larger plumes than are currently emitted by the cooling towers. After considering the expected increased plume size, we reached the same conclusions. The larger plumes expected in the spring, fall, and summer present an adverse aesthetic impact. We also found Entergy's efforts to mitigate these adverse aesthetic impacts to be inadequate. The evidence showed that Entergy could replace the existing fans with 200-hp fans that would provide adequate mitigation, but that Entergy had decided to replace the existing fans with high efficiency 125-hp fans instead. We found that unacceptable

176. If the NPDES permit amendment is granted to change the thermal discharge conditions as requested, the cooling towers will be operated less, thus mitigating the potential increase in evaporative loss.

177. The Vermont Water Quality Standards require that all uses of water be supported by the streamflow, and they use a streamflow protection guideline of no more than 5 percent diminished flow at the 7Q10 stream flow rate (Vermont Water Quality Standards Section 3-01, B. 1.). Thus, the additional evaporative loss due to power uprate would not be significant based on this guideline.

and have required Entergy to install the originally-proposed 200-hp fans to mitigate the aesthetic impact.

Finally, as we discussed above, we find no basis to conclude that the increase in drift arising from the power uprate will pose adverse effects upon health or the environment.

(6) *Reliability of Vermont Yankee Post-Uprate*

The public comments also raised questions about the reliability of Vermont Yankee after the uprate. As we explained above, this was a major area of concern in this proceeding. Vermont utilities now purchase nearly a third of their power from Vermont Yankee under a favorable Purchase Power Agreement entered into as part of the sale of the Station to Entergy in 2002. The agreement, however, is not a firm contract, but rather is "unit-specific." This means that, if Vermont Yankee does not run, Vermont utilities receive no power. Similarly, if Vermont Yankee operates at less than full power, the Vermont utilities' share of the output is reduced proportionately. Under either of these reduced power scenarios, Green Mountain and Central Vermont may need to seek replacement power in the wholesale energy market.

The evidence in this proceeding shows that the public is correct to have concerns over reliability. All parties, including Entergy, acknowledge that modifications to power generation facilities increase the potential for more or longer outages or reduced power output. To date, four of the eight nuclear reactors that have undergone a power uprate of 17 percent or greater have had at least some increased outage time or power reduction. One has had more than 40 days of additional outages as well as power reductions. Reduced output is possible.

In this case, it is Entergy that proposes to change the existing operations in ways that create added financial risk to Vermont utilities and ratepayers. Entergy also derives the bulk of the benefits from the power uprate. Thus, it is proper to place the burden on Entergy to ensure against those risks. Entergy has proposed outage protection plans that reduce the financial risk. However, we find these to be inadequate. Thus, to provide the state with sufficient certainty that the reliability concerns resulting from the uprate are unlikely to harm Vermont, we ask that the NRC conduct an independent engineering assessment, as we explained above.

(7) *Increase in Nuclear Waste*

Other members of the public questioned the merits of the power uprate because it would lead to an increase in nuclear waste. The power uprate will indeed have an effect upon the rate at which Vermont Yankee produces spent fuel. To enable the uprate, Entergy will put in place more fuel rods. Like all of the other fuel rods in the plant, these fuel rods will, after use, become spent nuclear fuel which Entergy must store or ship off-site. Entergy now replaces approximately one-third of the fuel rods every eighteen months, storing them in an existing spent fuel pool. Unless Entergy can find another means of storing the waste, the power uprate now has the effect of exhausting that pool's finite capacity more quickly.

Despite the fact that the power uprate increases the number of spent fuel rods produced, the uprate itself may not necessarily produce more nuclear waste in total. Entergy's current capacity to store spent nuclear fuel is finite. Once the spent fuel pool is full, Entergy must either close or find another location to store the spent nuclear fuel. Even without the uprate, a shortage of capacity in the spent fuel pool may require Vermont Yankee to materially reduce output or to close before the end of its present operating license (perhaps as early as 2008). Clearly, unless Entergy can find a way to store the additional waste, the uprate would accelerate the potential closure date.

Entergy has said that it intends to ask this Board to authorize it to employ dry cask storage at the Vermont Yankee site. Approval of dry cask storage would enable Vermont Yankee to keep operating. Because of the increased number of fuel rods, authorization of dry cask storage would lead to an increase in the total amount of spent fuel rods produced by Vermont Yankee. Thus, whether the uprate will eventually lead to more spent fuel in total depends upon our ultimate determination of whether dry cask storage promotes the general good of the state.

Currently, however, we have no proposal for such storage before us. Indeed, on the basis of Entergy's original position, we began this case by stating we would make no ruling in this proceeding that would affect our ability to fully and fairly evaluate the issue when and if Entergy

chooses to seek such permission from the Board. As a result, we can not now determine whether Entergy will or will not be forced to reduce output because of a lack of storage.

We note that the faster depletion of spent fuel capacity has financial effects. Early closure of Vermont Yankee would cause Vermont's two largest utilities to replace a substantial amount of power, at potentially higher costs. Because of this potential and because we have not yet considered the merits of authorizing dry cask storage, this Order requires Entergy to provide assurances that Vermont utilities and ratepayers will not be harmed by increased replacement power costs due to the faster exhaustion of spent fuel capacity.

On the other hand, the proposed uprate does not raise concerns for the disposal of Vermont Yankee's low-level radioactive waste. Entergy demonstrated an intent, and a capability to handle additional low-level waste in the same way it currently handles such waste; *i.e.*, shipping it to an approved low level waste disposal facility outside Vermont. Entergy has contracted for the removal by the fall of 2004, of the low-level waste it has identified as resulting from the uprate proposal.

(8) *Given Alternative Sources of Energy, granting an Uprate is bad Energy Policy*

Some commenters stated that the increase of 110 MW of generating capacity represented poor energy policy. These persons stated that the State of Vermont would be better served by increasing reliance upon alternative energy sources.

We addressed these concerns in Docket 6545, the sale of Vermont Yankee to Entergy. Our final Order in that case states that a strong energy policy rests upon diversity of resources. Our observations on the issue at that time remain valid:

> This Board has strongly encouraged increased use of renewable resources, in orders, in rules, in Federal advocacy, and in Legislative testimony.[178] We have done so largely to gain for Vermonters the benefits of diversity of resources, to lower the externalized costs of fossil fuel production, and to insulate our state from the volatility of fossil fuel

178. In January 2004, this Board filed a report with Vermont's legislature strongly urging a commitment to a state-wide renewable portfolio standard. The general assembly has not yet acted upon that recommendation. [Footnote added to quotation from Docket 6545.]

prices. For many reasons, including such efforts by the Board, Vermont now gets its power from a resource mix with extraordinarily low carbon emissions. We strongly believe that such efforts should continue.[179]

In that Docket we also considered a significant number of public comments asking the Board to close down Vermont Yankee and replace it with alternative energy sources. In response, we addressed the practical considerations of a rapid shift to more reliance upon such sources, observing that:

> This may well be appropriate at some time (and we note that the Department's long range plan recommends such action after 2012). Indeed, after prices become indexed to market prices in 2005, Vermont Yankee will face more competitive pressure from renewable resources than it does under current ownership. However, if we are to turn the idea of reliance on renewables from a dream to a reality, it is important — indeed vital — not to underestimate the magnitude of the transition.
>
> For example, Vermont Yankee's installed capacity is 90 times that of the largest wind-power project now in Vermont — Green Mountain's Searsburg wind project. Wind projects also typically run for only one-third of the hours in a year, unlike Vermont Yankee which runs almost 90 percent of the hours in a year. Thus, it would require hundreds of projects the size of Searsburg to produce the same energy output as Vermont Yankee. Those projects would also need some capability for storing power, and for releasing it in times of low production; in addition, it would be necessary to expand current transmission lines to move power from those hundreds of sites to where it is needed.
>
> Photo-voltaic (solar power) panels are also an important renewable resource. However, providing as much power as Vermont Yankee produces would require more than a thousand sites with the same acreage as exists at the Vermont Yankee site, as well as ways to store and release power, plus transmission links.
>
> Such patterns of development are not inconceivable, and they may even be desirable; but we do not believe that, as responsible stewards of the public good, we can rely on their actually being developed, constructed and installed fast enough to provide an immediate replacement for Vermont Yankee.
>
> Similarly, we have considered energy efficiency investments, which are not precisely a renewable resource, but which are a critical part of

179. Docket 6545, Order of 6/13/02 at 157–158.

> Vermont's future. Efficiency Vermont is already saving over 60 gWh per year. However, this is equal to only between one and two percent of what Vermont Yankee produces. Thus, even a strong expansion of Vermont's efficiency efforts (to or beyond current statutory limits) would not replace Vermont Yankee's 510–540 MW of power.
>
> Overall, it is clear that many years of serious effort will be necessary before replacement of Vermont Yankee's power would be possible without major new reliance on power plants fired by fossil fuels; the result would be significant increases in air pollutants such as sulfur dioxide, nitrogen oxides, particulate emissions, and greenhouse gases such as methane and carbon dioxide. As our world struggles to deal with climate change, this is an important factor.[180]

As we reviewed the uprate proposal in this Docket, and considered these comments, we reached the same conclusions that we articulated in Docket 6545. In the future, Vermont will be best served by relying upon a balanced portfolio of generation sources that is regularly reviewed, seeking to ensure that Vermonters pursue a balance of value and cost, including unpriced environmental costs, in their utility services.

VII. CONCLUSION

We find that the proposed power uprate at Vermont Yankee will promote the general good of the state if, and only if, Entergy complies with the conditions that we adopt in this Order. For the reasons set out above, we find that the proposal filed by Entergy has the potential to result in costs that exceed the benefits of the projects. We have adopted conditions, in the form of assurances from Entergy and a request that the NRC perform an independent engineering assessment of Vermont Yankee, that will greatly reduce the risks of greater costs for Vermont utilities and ratepayers. Accordingly, we authorize Entergy, at its own financial risk, to make the physical modifications at the present time, but will require that Entergy satisfy the enumerated conditions before increasing power output. Subject to the conditions specified in this Order, we find that the proposed uprate meets the statutory requirements in 30 V.S.A. § 248.

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180. *Id.* at 158–160.

To the extent the findings in this Order are inconsistent with any findings proposed by the parties, the parties' proposed findings are denied.

VIII. ORDER

IT IS HEREBY ORDERED, ADJUDGED AND DECREED by the Public Service Board of the State of Vermont that:

1. The modifications to the Vermont Yankee Nuclear Power Station ("Vermont Yankee") proposed by Entergy Nuclear Vermont Yankee, LLC, and Entergy Nuclear Operations, Inc. (collectively, "Entergy"), in accordance with the evidence and plans submitted in this proceeding, will, subject to the conditions set out in this Order, promote the general good of the State of Vermont, in accordance with 30 V.S.A. § 248, and a Certificate of Public Good to that effect shall be issued.

2. Entergy may, at its own financial risk, commence site preparation and construction of the modifications to Vermont Yankee upon issuance of this Order and the Certificate of Public Good. Prior to increasing power output at Vermont Yankee, Entergy shall meet the following conditions:

a. The Public Service Board will request that the federal Nuclear Regulatory Commission ("NRC") conduct an independent engineering assessment of Vermont Yankee (that request is set out in Appendix D to this Order). The Board will retain jurisdiction to modify this Order based upon the result of the NRC's assessment.

b. Entergy shall provide assurances that Vermont utilities and ratepayers will be held harmless from incremental replacement power costs arising from the uprate if Entergy must reduce power or shutdown because of lack of spent fuel storage caused by the uprate. Entergy shall file such assurances within 30 days of this Order.

c. Entergy shall provide assurances that Vermont utilities and ratepayers will be held harmless from incremental replacement power costs if Entergy must reduce power or shutdown in order to comply with state and federal limits on fenceline radiation doses. Entergy shall file such assurances within 30 days of this Order.

d. Entergy and the Department shall amend the Memorandum of Understanding to prohibit Entergy from engaging in below-market-price sales of power from Vermont Yankee to Entergy affiliates as a means of avoiding or reducing the payments to the state of Vermont under the Memorandum of Understanding. Entergy and the Department shall file the amendment within 30 days of this Order.

e. Entergy must install the 200-hp fans that it originally proposed in the cooling towers instead of the 125-hp fans in the modified proposal.

3. The Memorandum of Understanding dated November 5, 2003, between Entergy and the Vermont Department of Public Service ("Department") is accepted and approved, except as modified herein. Entergy and the Department shall comply with all terms of the Memorandum of Understanding, as modified by this Order.

4. All moneys paid by Entergy to the state of Vermont pursuant to the Memorandum of Understanding shall be sent to the general fund, rather than the funds specified in the Memorandum of Understanding. Like all other moneys in the general fund, the funds shall be distributed as the general assembly and the governor shall determine.

5. Entergy shall perform all of the transmission upgrades requested by the Independent System Operator New England ("ISO New England") in its letter dated October 8, 2003 (exh. EN-JKT-13). Entergy shall perform the transmission upgrades by such time as ISO New England specifies (including any changes that ISO New England subsequently makes to the deadlines). If ISO New England changes its deadlines for performing the system upgrades, Entergy shall inform the Board within 15 days of the change.

6. Consistent with Entergy's current operating practices, in the event of a waste-heat cooling system malfunction, Entergy shall reduce power at a rate of at least 10 percent per

minute until the cooling water discharge returns to and remains within the temperature limits in the National Pollutant Discharge Elimination System permit.

7. Within 60 days of this Order, Entergy shall fully restore all areas of the site disrupted by Entergy's site preparation for the temporary buildings that occurred without prior Board approval. Entergy shall inform the Board when the site restoration is complete.

8. Entergy shall notify the Board if it no longer has access to a low-level nuclear waste disposal facility or if the facility is no longer expected to have sufficient capacity for the waste.

Dated at Montpelier, Vermont, this 15th day of March, 2004.

s/Michael H. Dworkin	)	
	)	PUBLIC SERVICE
	)	
s/David C. Coen	)	BOARD
	)	
	)	OF VERMONT
s/John D. Burke	)	

OFFICE OF THE CLERK

FILED: March 15, 2004

ATTEST: s/Susan M. Hudson
Clerk of the Board

NOTICE TO READERS: This decision is subject to revision of technical errors. Readers are requested to notify the Clerk of the Board (by e-mail, telephone, or in writing) of any apparent errors, in order that any necessary corrections may be made. (E-mail address: Clerk@psb.state.vt.us)

Appeal of this decision to the Supreme Court of Vermont must be filed with the Clerk of the Board within thirty days. Appeal will not stay the effect of this Order, absent further Order by this Board or appropriate action by the Supreme Court of Vermont. Motions for reconsideration or stay, if any, must be filed with the Clerk of the Board within ten days of the date of this decision and order.

Appendix A — Parties

Vermont Department of Public Service
represented by: James Volz, Esq., Director for Public Advocacy
Sarah Hofmann, Esq.

Vermont Agency of Natural Resources
represented by: Warren Coleman, Esq.

Entergy Nuclear Vermont Yankee, LLC[181] and Entergy Nuclear Operations, Inc.
represented by: Victoria J. Brown, Esq.
Gary L. Franklin, Esq.
Barbara Ripley, Esq.
Eggleston & Cramer, Ltd.

New England Coalition
represented by: Raymond Shadis

Windham Regional Planning Commission
represented by: James Matteau, Executive Director

Connecticut River Watershed Council
represented by: David L. Deen

181. Counsel for Entergy also appeared on a limited basis for General Electric Co., Stone & Webster, Inc., Framatome ANP, Inc., and Polestar Applied Technology, Inc. in re: Discovery.

Appendix B — Schedule of Hearings

Public Hearings
Vernon, Vermont
April 29, 2003
December 12, 2003 (limited to temporary building)
January 8, 2004 (limited to temporary building

Technical Hearings
Montpelier, Vermont
June 16, 17, 19, 2003
September 15, 16, 17, 2003
October 16, 17, 2003
December 12, 2003 (limited to temporary building)
January 12, 13, 14, 15, 2004

Appendix C — Procedural History

Filing and Opening Investigation

On February 21, 2003, Entergy Nuclear Vermont Yankee, LLC ("ENVY") and Entergy Nuclear Operations, Inc. ("ENO") (hereinafter referred to jointly as "Entergy"), filed a Petition for a Certificate of Public Good ("CPG") pursuant to 30 V.S.A. § 248 asking the Vermont Public Service Board ("Board") to approve modifications to the Vermont Yankee Nuclear Power Station ("Vermont Yankee" or "Station") to allow Entergy to increase the power output of Vermont Yankee by as much as 20 percent. The Board opened this investigation shortly thereafter, conducted a prehearing conference on March 5, 2003, and set a schedule for this Docket.

Interventions and Scope

Subsequently, the New England Coalition ("NEC"), the Connecticut River Watershed Council and the Windham Regional Planning Commission intervened in this Docket. As a result of the representation made by Entergy that it would not seek approval of dry cask storage in this Docket, the Conservation Law Foundation altered its initial decision and declined to intervene.

Hearings

On April 29, 2003, the Board conducted a public hearing at the Vernon Elementary School in Vernon, Vermont. It held technical hearings as duly noticed and scheduled on June 16, 17, and 19, 2003; September 15, 16, and 17, 2003; and October 16 and 17, 2003.

Schedule Modification

On September 26, 2003, Entergy filed additional testimony that caused the Board to revisit and to modify the schedule.[182] On November 5, 2003, the Vermont Department of Public Service and Entergy entered into a Memorandum of Understanding ("MOU"). Also on November 5, 2003, Entergy sought approval to erect two temporary facilities to house the Station's generator rotor during its re-insulation as part of the uprate modifications. In response, the Board appointed a Board Hearing Officer who conducted a prehearing conference on

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182. The additional testimony included a power sales agreement between Entergy and VEC, and a proposed Ratepayer Protection Proposal, one of whose conditions was that Green Mountain Power Corporation and Central Vermont Public Service Corporation would need to reduce the amount of uprate power for which these utilities had a right of first negotiation. *See* Board Order of 10/7/03, at 14.

November 20, 2003, a technical hearing on December 12, 2003, and two public hearings on December 12, 2003, and January 8, 2004. On February 11, 2004, Entergy notified the Board that Entergy had modified its temporary building plans and withdrew its motion to amend its CPG application.

Further Hearings

The Board continued technical hearings in this investigation on January 12, 2004. Hearings ran for four days and culminated on January 15, 2004.

Post-Hearing Filing

NEC submitted ten post-record filing requests in this Docket, and the Department submitted one. These filings, and Entergy's responses to them, are addressed in our Order of March 15, 2004, in this Docket.

Appendix D – Letter to NRC

Mr. Nils J. Diaz, Chairman
United States Nuclear Regulatory Commission
11555 Rockville Pike
Rockville, MD 20852
ATTN: Document Control Desk
Washington, D.C. 20555

March 15, 2004

Subject: Vermont Public Service Board Request for Independent Engineering Assessment of Vermont Yankee Nuclear Power Station
License No. DPR -28 (Docket 50-271)
Technical Specification Proposed Change No. 263
Extended Power Uprate

Dear Chairman Diaz:

As you know, Entergy Nuclear Operations, Inc. ("Entergy"), is seeking approvals from both the United States Nuclear Regulatory Commission ("NRC") and the Vermont Public Service Board ("Board") in regard to a proposed 20 percent power uprate at the Vermont Yankee Nuclear Power Station ("Vermont Yankee"). We noted in your February 20, 2004, letter to Michael Kansler, President of Entergy, that your staff has determined that Vermont Yankee's extended power uprate ("uprate") application is now acceptable for review, and that your review is expected to be completed over the next 12 months.[183]

Entergy has also submitted a request to the Board for a Certificate of Public Good permitting Vermont Yankee to increase electrical generation by up to 20 percent. In determining whether Entergy should receive a Certificate of Public Good, the Board must consider several statutory criteria, including economic impacts upon the people of Vermont.

Because of this statutory standard, assessing the reliability effects of the proposed uprate upon Vermont Yankee's expected output is critical to our review. Very few nuclear plants (and even fewer of Vermont Yankee's age) have seen uprates in the 17–20 percent range. Among those few, reductions in output have been more than incidental. From Vermont's perspective, the proposed uprate raises serious engineering questions that only the NRC appears qualified to independently assess. Thus, we are writing to ask the NRC to augment its scheduled review of Vermont Yankee along the lines set out below.

183. Letter to Michael Kansler, President Entergy Nuclear Operations, Inc. (TAC No. MC0761).

During our investigation of Entergy's request, we heard testimony as to the need for an independent review of the proposed extended power uprate. We also heard testimony from Entergy, State officials, and advocates describing the NRC's review process, and the role of the Advisory Committee on Reactor Safety (ACRS). Testimony identified the ACRS as independent of the NRC staff who conduct the initial review of the technical aspects of the proposed changes, and the importance of an independent review of its staff's findings and conclusions.

We understand that, under certain circumstances, the NRC has agreed to sponsor a more detailed review of certain engineering aspects of a nuclear plant's operation in order to establish the effectiveness of regulatory oversight. In 1996, for example, the NRC conducted such a review at the Maine Yankee Atomic Power Station ("Maine Yankee"), where there were concerns about the analysis supporting an increase in the rated thermal power at which Maine Yankee could operate. We understand that the review undertaken at Maine Yankee was performed by a "team comprised of staff who were independent of any recent or significant regulatory oversight responsibility"[184] for Maine Yankee, and that it was coordinated with the State to facilitate participation by the State representatives consistent with NRC policy. We also recognize and greatly appreciate that the Commission has subsequently incorporated into its current uprate review process much of what was developed during the 1996 Maine Yankee assessment.

We ask that, as the NRC conducts its current uprate analysis of Vermont Yankee, it do so in a way that will provide Vermont with a level of assurance about reliability equivalent to an independent engineering assessment. Such an assessment contains the following features:

- It would be independent in the same sense as the independent safety assessment of Maine Yankee, *i.e.*, it should be performed by experts "independent of any recent or significant regulatory oversight responsibility" related to Vermont Yankee.[185]
- The assessment would be a vertical slice review of two safety-related systems and two Maintenance Rule, non-safety systems affected by the uprate. The level of effort necessary for this work has been described to us in testimony as requiring about four experts for about four weeks.[186] This will provide a valuable check of the reliability of the systems that are reviewed and allow for correction of any problems.
- The independent engineering assessment should (as we believe is expected) be reviewed by the ACRS in the context of their evaluation of the power uprate.

184. Independent Safety Assessment of Maine Yankee Atomic Power Company, U.S. Nuclear Regulatory Commission, October 1996; Vermont Public Service Board Docket No. 6812, exh. NEC-DL-3 at 1.

185. *Id.*

186. Lochbaum pf. 12/18/03 at 8–9; tr. 1/13/04 at 110–111 (Lochbaum).

We are making this unusual request of the NRC because Vermont must be reasonably assured that Vermont Yankee — a resource for which two of the state's largest retail electricity providers have contracted nearly one third of their power for the next nine years — continues to be a reliable source of electricity. While the reliability of Vermont Yankee has always been of great concern to the Board, it is especially important in the case of this proposed 20 percent extended power uprate. Thus, we request this review, as set out above, because the record presented in our proceeding strongly suggests that an uprate of the magnitude proposed here raises significant reliability issues upon which the NRC's assessment will be of extraordinarily high value.

Thank you very much for your consideration of this matter. We would welcome a response at your earliest convenience.

Sincerely,

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Michael H. Dworkin

for
Vermont Public Service Board

Michael H. Dworkin, Chairman
David C. Coen, Board Member
John D. Burke, Board Member

Cc: Mr. Ledyard B. Marsh, Director
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