

NUCLEAR REGULATORY COMMISSION

[Docket No. 50-271; NRC-2016-0017]

Entergy Nuclear Operations, Inc.

Vermont Yankee Nuclear Power Station

AGENCY: Nuclear Regulatory Commission.

ACTION: Exemption; issuance.

SUMMARY: The U.S. Nuclear Regulatory Commission (NRC) is issuing an exemption from the requirement to maintain a specified level of onsite property damage insurance in response to a request from Entergy Nuclear Operations, Inc. (ENO or the licensee) dated April 17, 2014. The exemption would permit Vermont Yankee Nuclear Power Station (VY) to reduce its onsite insurance from \$1.06 billion to \$50 million.

DATE: April 25, 2016

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FOR FURTHER INFORMATION CONTACT: Jack D. Parrott, Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001; telephone: 301-415-6634, e-mail: Jack.Parrott@nrc.gov.

SUPPLEMENTARY INFORMATION:

I. Background

The VY site is a single unit facility located near the town of Vernon, Vermont. The site is situated in Windham County on the western shore of the Connecticut River, immediately upstream of the Vernon Hydroelectric Station. The VY facility employs a General Electric boiling water reactor nuclear steam supply system licensed to generate 1,912 megawatts thermal. The boiling water reactor and supporting facilities are owned and operated by Entergy

Vermont Yankee, a subsidiary of ENO. The licensee, ENO, is the holder of Renewed Facility Operating License No. DPR-28. The license provides, among other things, that the facility is subject to all rules, regulations, and orders of the NRC now or hereafter in effect.

By letter dated September 23, 2013 (ADAMS Accession No. ML13273A204), ENO submitted a notification to the NRC indicating that it would permanently shut down VY in the fourth calendar quarter of 2014. On December 29, 2014, ENO permanently ceased power operations at VY. On January 12, 2015, ENO certified that it had permanently defueled the VY reactor vessel and placed the fuel in the spent fuel pool (SFP) (ADAMS Accession No. ML15013A426). Accordingly, pursuant to § 50.82(a)(2) of title 10 of the Code of Federal Regulations (10 CFR), the VY renewed facility operating license no longer authorized operation of the reactor or emplacement or retention of fuel in the reactor vessel. However, the licensee is still authorized to possess and store irradiated nuclear fuel. Irradiated fuel is currently being stored onsite in a SFP and independent spent fuel storage installation dry casks.

II. Request/Action

Under 10 CFR 50.12, "Specific exemptions," ENO has requested an exemption from 10 CFR 50.54(w)(1) by letter dated April 17, 2014 (ADAMS Accession No. ML14111A401). The exemption from the requirements of 10 CFR 50.54(w)(1) would permit ENO to reduce its onsite property damage insurance from \$1.06 billion to \$50 million.

The regulation in 10 CFR 50.54(w)(1) requires each licensee to have and maintain onsite property damage insurance to stabilize and decontaminate the reactor and reactor site in the event of an accident. The onsite insurance coverage must be either \$1.06 billion or whatever amount of insurance is generally available from private sources (whichever is less).

The licensee states that the risk of an accident at a permanently shutdown and defueled reactor is much less than the risk from an operating power reactor. In addition, since reactor operation is no longer authorized at VY, there are no events that would require the stabilization of reactor conditions after an accident. Similarly, the risk of an accident that would result in significant onsite contamination at VY is also much lower than the risk of such an event at operating reactors. Therefore, ENO is requesting an exemption from 10 CFR 50.54(w)(1), effective April 15, 2016, that would permit a reduction in its onsite property damage insurance from \$1.06 billion to \$50 million, commensurate with the reduced risk of an accident at the permanently shutdown and defueled VY reactor.

III. Discussion

In accordance with 10 CFR 50.12, the Commission may, upon application by any interested person or upon its own initiative, grant exemptions from the requirements of 10 CFR part 50 when 1) the exemptions are authorized by law, will not present an undue risk to the public health or safety, and are consistent with the common defense and security; and 2) any of the special circumstances listed in 10 CFR 50.12(a)(2) are present.

The financial protection limits of 10 CFR 50.54(w)(1) were established after the Three Mile Island accident, out of concern that licensees may be unable to financially cover onsite cleanup costs, in the event of a major nuclear accident. The specified \$1.06 billion coverage amount requirement was developed based on an analysis of an accident at a nuclear reactor operating at power, resulting in a large fission product release and requiring significant resource expenditures to stabilize the reactor conditions and ultimately decontaminate and cleanup the site (similar to the stabilization and cleanup activities at the Fukushima Daiichi nuclear power facility following the damage from a severe earthquake and tsunami).

These cost estimates were developed in consideration of the spectrum of postulated accidents for an operating nuclear reactor. The costs were derived from the consequences of a release of radioactive material from the reactor. Although the risk of an accident at an operating reactor is very low, the consequences can be large. In an operating plant, the high temperature and pressure of the reactor coolant system (RCS), as well as the inventory of relatively short-lived radionuclides, contribute to both the risk and consequences of an accident. With the permanent cessation of reactor operations at VY and the permanent removal of the fuel from the reactor core, such accidents are no longer possible. As a result, the reactor, RCS, and supporting systems no longer operate and, therefore, have no function as it pertains to the storage of the irradiated fuel. Hence, postulated accidents involving failure or malfunction of the reactor, RCS, or supporting systems are no longer applicable.

During reactor decommissioning, the principal radiological risks are associated with the storage of spent fuel onsite. In its April 17, 2014, exemption request, ENO describes both design-basis and beyond-design-basis events involving irradiated fuel stored in the SFP. The licensee determined that there are no applicable design-basis events at VY that could result in a radiological release exceeding the limits established by the U.S. Environmental Protection Agency (EPA) early-phase Protective Action Guidelines (PAGs) of one roentgen equivalent man (rem) at the exclusion area boundary, as a way to demonstrate that any possible radiological releases would be minimal and not require precautionary protective actions (e.g., sheltering in place or evacuation). The staff evaluated the radiological consequences associated with various decommissioning activities, and design basis accidents at VY, in consideration of VY's permanently shut down and defueled status. The possible design-basis accident scenarios at VY have greatly reduced radiological consequences. Based on its review, the staff concluded that no reasonably conceivable design-basis accident exists that could cause an offsite release greater than the EPA PAGs. The only design-basis accident that could potentially result in an

offsite radiological release at VY is a fuel handling accident (FHA). Analysis performed by the licensee concluded that 17 days after shutdown, the radiological consequence of an FHA would not exceed the limits established by the EPA PAGs at the exclusion area boundary. Based on the time that VY has been permanently shutdown (approximately 13 months), the staff determined that the possibility of an offsite radiological release from a design-basis accident that could exceed the EPA PAGs has been eliminated. The only event that has the potential to lead to a significant radiological release at a decommissioning reactor is a zirconium fire. The zirconium fire scenario is a postulated, but highly unlikely, beyond-design-basis accident scenario that involves the loss of water inventory from the SFP, resulting in a significant heat-up of the spent fuel and culminating in substantial zirconium cladding oxidation and fuel damage. The probability of a zirconium fire scenario is related to the decay heat of the irradiated fuel stored in the SFP. Therefore, the risks from a zirconium fire scenario continue to decrease as a function of the time that VY has been permanently shut down.

The NRC staff has previously authorized a lesser amount of onsite property damage insurance coverage based on this analysis of the zirconium fire risk. In SECY-96-256, "Changes to Financial Protection Requirements for Permanently Shutdown Nuclear Power Reactors, 10 CFR 50.54(w)(1) and 10 CFR 140.11," dated December 17, 1996 (ADAMS Accession No. ML15062A483), the staff recommended changes to the power reactor insurance regulations that would allow licensees to lower onsite insurance levels to \$50 million, upon demonstration that the fuel stored in the SFP can be air-cooled. In its Staff Requirements Memorandum to SECY-96-256, dated January 28, 1997 (ADAMS Accession No. ML15062A454), the Commission supported the staff's recommendation that, among other things, would allow permanently shutdown power reactor licensees to reduce commercial onsite property damage insurance coverage to \$50 million, when the licensee was able to demonstrate the technical criterion that the spent fuel could be air-cooled if the SFP was drained of water.

The staff has used this technical criterion to grant similar exemptions to other decommissioning reactors (e.g., Maine Yankee Atomic Power Station, published in the *Federal Register* on January 19, 1999 (64 FR 2920); and Zion Nuclear Power Station, published in the *Federal Register* on December 28, 1999 (64 FR 72700)). These prior exemptions were granted, based on these licensees demonstrating that the SFP could be air-cooled, consistent with the technical criterion discussed above.

In SECY-00-0145, "Integrated Rulemaking Plan for Nuclear Power Plant Decommissioning," dated June 28, 2000, and SECY-01-0100, "Policy Issues Related to Safeguards, Insurance, and Emergency Preparedness Regulations at Decommissioning Nuclear Power Plants Storing Fuel in Spent Fuel Pools," dated June 4, 2001 (ADAMS Accession Nos. ML003721626 and ML011450420, respectively), the NRC staff discussed additional information concerning SFP zirconium fire risks at decommissioning reactors and associated implications for onsite property damage insurance. Providing an analysis of when the spent fuel stored in the SFP is capable of air-cooling is one measure that can be used to demonstrate that the probability of a zirconium fire is exceedingly low. However, the staff has more recently used an additional analysis that bounds an incomplete drain down of the SFP water, or some other catastrophic event (such as a complete drainage of the SFP with rearrangement of spent fuel rack geometry and/or the addition of rubble to the SFP). This analysis includes an assumption of adiabatic conditions, which means no heat transfer from the spent fuel via conduction, convection, or radiation.

In the case of VY, the licensee determined that the fuel removed from the reactor would have sufficiently decayed by April 15, 2016, to significantly reduce the risk from SFP draining events. To support this determination, the licensee provided an adiabatic analysis indicating that the fuel cladding temperature would not reach levels associated with a significant radiological release within 10 hours after the loss of all means of cooling. The licensee

maintains strategies and equipment to cool the spent fuel in the unlikely event that coolant is lost, and the 10-hour adiabatic heating time would provide sufficient time for personnel to respond with onsite equipment to restore a means of spent fuel cooling.

In addition, the licensee cited NRC-staff developed reports concluding that the high density storage of fuel in the SFP is safe and the risk of a large radiological release is very low. The staff presented an independent evaluation of a SFP subject to a severe earthquake in NUREG-2161, "Consequence Study of a Beyond-Design-Basis Earthquake Affecting the Spent Fuel Pool for a U.S. Mark I Boiling Water Reactor," September 2014 (ADAMS Accession No. ML14255A365). This evaluation concluded that, for a representative boiling-water reactor (BWR), fuel in a dispersed high-density configuration would be adequately cooled by natural circulation airflow within several months after discharge from a reactor if the pool was drained of water.

By letter dated November 23, 2015 (ADAMS Accession No. ML15329A167), ENO confirmed that the plant design and fuel storage configuration considered in NUREG-2161 were consistent with the VY plant design and fuel storage configurations to be used in the decommissioning of VY. The staff independently confirmed that the fuel assembly decay power was also consistent. Thus, after 15.4 months decay, which will be reached by the requested effective date of April 15, 2016 for this exemption, the fuel stored in the VY SFP will be able to adequately be cooled by air in the unlikely event the SFP drained. For the very unlikely beyond-design-basis accident scenario, where the SFP coolant inventory is lost in such a manner that all methods of heat removal from the spent fuel are no longer available, there will be a minimum of 10 hours from the initiation of the accident until the cladding reaches a temperature where offsite radiological release might occur. The staff finds that 10 hours is

sufficient time to support deployment of mitigation equipment to prevent the zirconium cladding from reaching a point of rapid oxidation.

Based on the above discussion and SECY-96-256, the NRC staff determined \$50 million to be an adequate level of onsite property damage insurance for a decommissioning reactor, once the spent fuel in the SFP is no longer susceptible to a zirconium fire. The staff has postulated that there is still a potential for other radiological incidents at a decommissioning reactor that could result in significant onsite contamination besides a zirconium fire. In SECY-96-256, the NRC staff cited the rupture of a large contaminated liquid storage tank, causing soil contamination and potential groundwater contamination, as the most costly postulated event to decontaminate and remediate (other than a SFP zirconium fire). The postulated large liquid radiological waste storage tank rupture event was determined to have a bounding onsite cleanup cost of approximately \$50 million. Therefore, the staff determined that the licensee's proposal to reduce onsite insurance to a level of \$50 million would be consistent with the bounding cleanup and decontamination cost, as discussed in SECY-96-256, to account for the postulated rupture of a large liquid radiological waste tank at the VY site, should such an event occur.

A. Authorized by Law

The regulation in 10 CFR 50.54(w)(1) requires each licensee to have and maintain onsite property damage insurance of either \$1.06 billion or whatever amount of insurance is generally available from private sources, whichever is less. In accordance with 10 CFR 50.12, the Commission may grant exemptions from the regulations in 10 CFR part 50, as the Commission determines are authorized by law.

As explained above, the NRC staff has determined that the licensee's proposed reduction in onsite property damage insurance coverage to a level of \$50 million is consistent

with SECY-96-256. Moreover, the staff concluded that as of April 15, 2016, sufficient irradiated fuel decay time will have elapsed at VY to decrease the probability of an onsite and offsite radiological release from a postulated zirconium fire accident to negligible levels. In addition, the licensee's proposal to reduce onsite insurance to a level of \$50 million is consistent with the maximum estimated cleanup costs for the recovery from the rupture of a large liquid radiological waste storage tank.

The NRC staff has determined that granting of the licensee's proposed exemption will not result in a violation of the Atomic Energy Act of 1954, or other laws, as amended. Therefore, based on its review of ENO's exemption request, as discussed above, and consistent with SECY-96-256, the NRC staff concludes that the exemption is authorized by law.

B. No Undue Risk to Public Health and Safety

The onsite property damage insurance requirements of 10 CFR 50.54(w)(1) were established to provide financial assurance that following a significant nuclear incident, onsite conditions could be stabilized and the site decontaminated. The requirements of 10 CFR 50.54(w)(1) and the existing level of onsite insurance coverage for VY are predicated on the assumption that the reactor is operating. However, VY is a permanently shutdown and defueled facility. The permanently defueled status of the facility has resulted in a significant reduction in the number and severity of potential accidents, and correspondingly, a significant reduction in the potential for and severity of onsite property damage. The proposed reduction in the amount of onsite insurance coverage does not impact the probability or consequences of potential accidents. The proposed level of insurance coverage is commensurate with the reduced consequences of potential nuclear accidents at VY. Therefore, the NRC staff concludes that granting the requested exemption will not present an undue risk to the health and safety of the public.

C. Consistent with the Common Defense and Security

The proposed exemption would not eliminate any requirements associated with physical protection of the site and would not adversely affect ENO's ability to physically secure the site or protect special nuclear material. Physical security measures at VY are not affected by the requested exemption. Therefore, the proposed exemption is consistent with the common defense and security.

D. Special Circumstances

Under 10 CFR 50.12(a)(2)(ii), special circumstances are present if the application of the regulation in the particular circumstances would not serve the underlying purpose of the rule or is not necessary to achieve the underlying purpose of the rule. The underlying purpose of 10 CFR 50.54(w)(1) is to provide reasonable assurance that adequate funds will be available to stabilize conditions and cover onsite cleanup costs associated with site decontamination, following an accident that results in the release of a significant amount of radiological material. Because VY is permanently shut down and defueled, it is no longer possible for the radiological consequences of design-basis accidents or other credible events at VY to exceed the limits of the EPA PAGs at the exclusion area boundary. The licensee has evaluated the consequences of highly unlikely, beyond-design-basis conditions involving a loss of coolant from the SFP. The analyses show that after April 15, 2016, the likelihood of such an event leading to a large radiological release is negligible. The NRC staff's evaluation of the licensee's analyses confirm this conclusion.

The NRC staff also finds that the licensee's proposed \$50 million level of onsite insurance is consistent with the bounding cleanup and decontamination cost, as discussed in SECY-96-256, to account for the hypothetical rupture of a large liquid radiological waste tank at the VY site, should such an event occur. Therefore, the staff concludes that the application of

the current requirements in 10 CFR 50.54(w)(1) to maintain \$1.06 billion in onsite insurance coverage is not necessary to achieve the underlying purpose of the rule for the permanently shutdown and defueled VY reactor.

Under 10 CFR 50.12(a)(2)(iii), special circumstances are present whenever compliance would result in undue hardship or other costs that are significantly in excess of those contemplated when the regulation was adopted, or that are significantly in excess of those incurred by others similarly situated.

The NRC staff concludes that if the licensee was required to continue to maintain an onsite insurance level of \$1.06 billion, the associated insurance premiums would be in excess of those necessary and commensurate with the radiological contamination risks posed by the site. In addition, such insurance levels would be significantly in excess of other decommissioning reactor facilities that have been granted similar exemptions by the NRC.

The NRC staff finds that compliance with the existing rule would result in an undue hardship or other costs that are significantly in excess of those contemplated when the regulation was adopted and are significantly in excess of those incurred by others similarly situated.

Therefore, the special circumstances required by 10 CFR 50.12(a)(2)(ii) and 10 CFR 50.12(a)(2)(iii) exist.

E. Environmental Considerations

The NRC approval of the exemption to insurance or indemnity requirements belongs to a category of actions that the Commission, by rule or regulation, has declared to be a categorical exclusion, after first finding that the category of actions does not individually or cumulatively have a significant effect on the human environment. Specifically, the exemption is categorically excluded from further analysis under § 51.22(c)(25).

Under 10 CFR 51.22(c)(25), granting of an exemption from the requirements of any regulation of Chapter I to 10 CFR is a categorical exclusion provided that (i) there is no significant hazards consideration; (ii) there is no significant change in the types or significant increase in the amounts of any effluents that may be released offsite; (iii) there is no significant increase in individual or cumulative public or occupational radiation exposure; (iv) there is no significant construction impact; (v) there is no significant increase in the potential for or consequences from radiological accidents; and (vi) the requirements from which an exemption is sought involve: surety, insurance, or indemnity requirements.

The Director, Division of Decommissioning, Uranium Recovery and Waste Programs, Office of Nuclear Material Safety and Safeguards, has determined that approval of the exemption request involves no significant hazards consideration because reducing the licensee's onsite property damage insurance for VY does not 1) involve a significant increase in the probability or consequences of an accident previously evaluated; or 2) create the possibility of a new or different kind of accident from any accident previously evaluated; or 3) involve a significant reduction in a margin of safety. The exempted financial protection regulation is unrelated to the operation of VY. Accordingly, there is no significant change in the types or significant increase in the amounts of any effluents that may be released offsite; and no significant increase in individual or cumulative public or occupational radiation exposure.

In addition, the exempted regulation is not associated with construction, so there is no significant construction impact. The exempted regulation does not concern the source term (i.e., potential amount of radiation in an accident), nor mitigation. Therefore, there is no significant increase in the potential for, or consequences of, a radiological accident. In addition, there would be no significant impacts to biota, water resources, historic properties, cultural resources, or socioeconomic conditions in the region. Moreover, the requirement for onsite

property damage insurance involves surety, insurance, and indemnity matters. Accordingly, the exemption request meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(25). Therefore, pursuant to 10 CFR 51.22(b) and 51.22(c)(25), no environmental impact statement or environmental assessment need be prepared in connection with the approval of this exemption request.

IV. Conclusions

Accordingly, the Commission has determined that, pursuant to 10 CFR 50.12(a), the exemption from 50.54(w)(1) is authorized by law, will not present an undue risk to the public health and safety, and is consistent with the common defense and security. In addition, special circumstances are present as set forth in 10 CFR 50.12. Therefore, the Commission hereby grants VY an exemption from the requirements of 10 CFR 50.54(w)(1). The exemption will permit VY to lower minimum required onsite insurance to \$50 million no earlier than April 15, 2016.

The exemption is effective upon issuance.

Dated at Rockville, Maryland, this 15th day of April, 2016.

For the Nuclear Regulatory Commission.

/RA/

John R. Tappert, Director,
Division of Decommissioning, Uranium Recovery
and Waste Programs,
Office of Nuclear Material Safety and Safeguards.