



Entergy Nuclear Operations, Inc.
1340 Echelon Parkway
Jackson, MS 39213
Tel 601-368-5573

Mandy K. Halter
Director, Nuclear Licensing

10 CFR 50.12
10 CFR 50.54(w)(1)

2.19.020

March 25, 2019

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Subject: Request for Exemption From 10 CFR 50.54(w)(1)
Pilgrim Nuclear Power Station (PNPS)

NRC Docket No. 50-293
Renewed Facility Operating License No. DPR-35

Reference: Entergy letter to NRC, "Request for Exemptions from Portions of 10 CFR
50.47 and 10 CFR Part 50, Appendix E," dated July 3, 2018 (ADAMS
Accession No. ML18186A635)

In accordance with Title 10 Code of Federal Regulations (CFR) 50.12, "Specific Exemptions," Entergy Nuclear Operations, Inc. (Entergy) hereby requests a permanent exemption from 10 CFR 50.54(w)(1) for Pilgrim Nuclear Power Station (PNPS). 10 CFR 50.54(w)(1) requires individual power reactor licensees to obtain insurance coverage from private sources to provide protection covering the licensee's obligation, in the unlikely event of an accident, to stabilize and decontaminate the reactor and the reactor site. Specifically, licensees must obtain insurance having a minimum coverage limit for each reactor station site of either \$1.06 billion or whatever amount of insurance is generally available from private sources, whichever is less. This insurance coverage is referred to as "onsite coverage" or "onsite insurance coverage."

Entergy is requesting an exemption to 10 CFR 50.54(w)(1) to reduce the PNPS minimum onsite insurance coverage to \$50 million.

The underlying purpose of 10 CFR 50.54(w)(1) is to require sufficient property damage insurance to ensure adequate funding of onsite post-accident recovery, stabilization and decontamination costs following an accident at an operating nuclear power plant. However, the regulation does not take into consideration the reduced potential for, and consequences of, such nuclear incidents at permanently shutdown facilities. Upon docketing of the 10 CFR 50.82(a)(1) certifications for permanent cessation of operations and permanent removal of fuel from the reactor vessel, the 10 CFR Part 50 license will no longer authorize operation of the reactor or emplacement or retention of fuel into the reactor vessel. Since PNPS is permanently shutting down and defueling, no additional fission products will be generated from the plant after shutdown and the decay heat load on the spent fuel will continue to decline. The proposed

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exemption would allow a reduction in the level of onsite insurance coverage to a level that is commensurate with the future of the facility and the underlying purpose of the rule.


Entergy evaluated the effects of an accident where the spent fuel assemblies in the Spent Fuel Pool (SFP) are uncovered following a drain down event. A fire would be necessary to create a significant airborne release. The analysis associated with the Reference demonstrates that a significant release of radioactive material from the spent fuel is not possible after approximately 10 months following permanent cessation of power operations. Based on the length of time it would take for the adiabatic heat up to occur, there is ample time to respond to any partial drain down event that might cause such an occurrence by restoring SFP cooling or makeup, or providing SFP spray. As a result, the likelihood that such a scenario would progress to a zirconium fire is deemed not credible.

Based on PNPS's projected cessation of operations by June 1, 2019, the decay period of 10 months would be reached by April 1, 2020. Therefore, Entergy requests approval of the proposed exemption by April 1, 2020. The exemption request is provided in the enclosure to this letter.

There are no regulatory commitments contained in this letter.

Should you have any questions regarding this submittal, please contact Mr. Peter J. Miner at 508-830-7127.

Sincerely,

A handwritten signature in black ink that reads "Mandy K. Halter". The signature is written in a cursive, flowing style.

Mandy K. Halter

MKH/rm

Enclosure: Request for Exemption From 10 CFR 50.54(w)(1)

cc: NRC Region I Regional Administrator
NRC Senior Resident Inspector – Pilgrim
NRR Project Manager – Pilgrim

Enclosure

2.19.020

Request for Exemption From 10 CFR 50.54(w)(1)

DESCRIPTION AND EVALUATION OF THE PROPOSED CHANGES

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I. BACKGROUND

Pilgrim Nuclear Power Station (PNPS) is located in the town of Plymouth, Plymouth County, in the Commonwealth of Massachusetts. It is situated on the western coast of Cape Cod Bay, on approximately 1600 acres of land, owned by Entergy Nuclear Generation Company. A detailed description of the plant is given in the PNPS Updated Final Safety Analysis Report (UFSAR).

Chapter 14 of the PNPS UFSAR describes the design-basis-accident (DBA) scenarios that are applicable to PNPS during power operations. The most severe postulated accidents for nuclear power plants involve damage to the nuclear reactor core and the release of large quantities of fission products. The UFSAR accident scenarios include a Control Rod Drop Accident (CRDA), a Loading Error Accident, a Loss-of-Coolant Accident (LOCA), a Fuel Handling Accident (FHA), a Radwaste System Accident, and a Main Steam Line Break Accident.

Many of the accident scenarios postulated in the UFSAR for operating power reactors involve failures or malfunctions of systems, which could affect the fuel in the reactor vessel, and in the most severe postulated accidents, would involve the release of large quantities of fission products. With the termination of reactor operations and the permanent removal of fuel from the reactor vessel, such accidents are no longer possible. Therefore, the postulated accidents involving failure or malfunction of the reactor, reactor cooling system, steam system, or turbine generator are no longer applicable.

When the reactor is permanently defueled, the Spent Fuel Pool (SFP) and its supporting systems will be modified and dedicated only to spent fuel storage. A SFP cooling and clean-up system is provided to remove decay heat from spent fuel stored in the SFP and to maintain a specified water temperature, purity, clarity, and level.

II. DETAILED DESCRIPTION

In accordance with 10 CFR 50.12, "Specific exemptions," Entergy Nuclear Operations, Inc. (Entergy) requests a permanent exemption from 10 CFR 50.54(w)(1) for PNPS. 10 CFR 50.54(w)(1) requires individual power reactor licensees to obtain insurance coverage from private sources to provide protection covering the licensees obligation, in the unlikely event of an accident, to stabilize and decontaminate the reactor and the reactor site. Specifically, licensees must obtain insurance having a minimum coverage limit for each reactor station site of either \$1.06 billion or whatever amount of insurance is generally available from private sources, whichever is less. This insurance coverage is referred to as "onsite coverage" or "onsite insurance coverage."

Entergy is requesting an exemption to 10 CFR 50.54(w)(1) to reduce the minimum coverage limit of 10 CFR 50.54(w)(1) to \$50 million for PNPS.

10 CFR 50.54(w)(1) reads as follows:

"(w) Each power reactor licensee under this part for a production or utilization facility of the type described in §§ 50.21(b) or 50.22 shall take reasonable steps to obtain insurance available at reasonable costs and on reasonable terms from private sources or to demonstrate to the satisfaction of the NRC that it possesses an equivalent amount of protection covering the licensee's obligation, the event of an accident at the licensee's

reactor, to stabilize and decontaminate the reactor and the reactor station site at which the reactor experiencing the accident is located, provided that:

- (1) *The insurance required by paragraph (w) of this section must have a minimum coverage limit for each reactor station site of either \$1.06 billion or whatever amount of insurance is generally available from private sources, whichever is less. The required insurance must clearly state that, as and to the extent provided in paragraph (w)(4) of this section, any proceeds must be payable first for stabilization of the reactor and next for decontamination of the reactor and the reactor station site. If a licensee's coverage falls below the required minimum, the licensee shall within 60 days take all reasonable steps to restore its coverage to the required minimum. The required insurance may, at the option of the licensee, be included within policies that also provide coverage for other risks, including, but not limited to, the risk of direct physical damage."*

III. DISCUSSION

The underlying purpose of 10 CFR 50.54(w)(1) is to require sufficient property damage insurance to ensure adequate funding of onsite post-accident recovery, stabilization and decontamination costs following an accident at an operating nuclear power plant. The requirements of 10 CFR 50.54(w)(1) were developed taking into consideration the risks associated an operating nuclear power including the potential consequences of a release of radioactive material from the reactor.

This regulation does not take into consideration the reduced potential for, and consequences of, such nuclear incidents at permanently shutdown facilities. The PNPS facility is a single reactor site and the reactor will be permanently shut down and defueled. The proposed exemption would allow a reduction in the level of onsite insurance coverage to a level that is commensurate with the planned permanently defueled status of PNPS and the underlying purpose of the rule.

Although the likelihood of an accident at an operating reactor is small, the consequences can be large, in part due to the high temperatures and pressures of the reactor coolant system as well as the inventory of radionuclides. For a permanently shutdown and defueled reactor, nuclear accidents involving the reactor and its associated systems, structures and components are no longer possible. Furthermore, reductions in the probability and consequences of non-operating reactor nuclear incidents are substantially reduced because: 1) the decay heat from the spent fuel decreases over time, which reduces the amount of cooling required to prevent the spent fuel from heating up to a temperature that could compromise the ability of the fuel cladding to retain fission products; and 2) the relatively short-lived radionuclides contained in the spent fuel, particularly volatile components like iodine and noble gasses, decay away, thus reducing the inventory of radioactive materials available for release.

Although the potential for, and consequences of, nuclear accidents decline substantially after a plant permanently defuels its reactor, they are not completely eliminated. There are potential onsite and offsite radiological consequences that could be associated with the onsite storage of the spent fuel in the SFP. In addition, a site with a permanently shutdown and defueled reactor may contain an inventory of radioactive liquids, activated reactor components, and contaminated materials. For purposes of modifying the amount of onsite insurance coverage maintained by a permanently shutdown and defueled reactor licensee, the potential radiological

consequences of these non-operating reactor nuclear incidents are appropriate to consider, despite their very low probability of occurrence.

NRC Proposed Rulemaking

The NRC has generically evaluated the legal, technical, and policy issues regarding the financial protection requirements for large nuclear power plants that have been permanently shut down. The results of these evaluations were summarized in SECY-96-256 (Reference 1) and the NRC staff recommended course of action was approved by the Commission in a Staff Requirements Memo (SRM). These documents established the basis for the NRC exercising its discretionary authority to specify an appropriate level of onsite insurance coverage for permanently shutdown nuclear power reactors.

In SECY-97-186 (Reference 2), the NRC staff proposed rulemaking for Commission approval that was consistent with SECY-96-256, Option 2. In SECY-97-186, the NRC staff proposed changes to 10 CFR 50.54(w)(1) that would establish appropriate levels of onsite insurance coverage for plants that are permanently shutdown and defueled and that meet specified facility configurations during permanent shutdown.

On October 30, 1997, the NRC published a proposed rulemaking to amend regulations governing liability coverage for permanently shutdown nuclear plants. The proposed rulemaking established four different configurations for permanently shutdown plants that encompassed anticipated spent fuel characteristics and storage modes during the period between permanent shutdown and termination of the license. The rulemaking proposed financial protection requirements for each of the four specified plant configurations, including a configuration where the plant is permanently shutdown, the reactor defueled, and the spent fuel stored in the spent fuel pool is not susceptible to a zircaloy cladding failure or gap release caused by an incipient fuel cladding failure if the pool is accidentally drained.

However, the NRC staff rulemaking efforts were suspended prior to issuing the final rule when it was realized that an NRC staff-approved technical basis did not exist for generic decay times after which the zirconium cladding failure concern could be eliminated. The proposed changes to regulations governing onsite insurance coverage were subsequently included in a risk-informed, integrated rulemaking initiative for decommissioning nuclear power plants, which has yet to be acted on. This rulemaking initiative, documented in SECY-00-145 (Reference 3), included onsite insurance coverage requirements based on the proposed decommissioning insurance rulemaking issued on October 30, 1997, as modified to address the public comments received in response to that proposed rulemaking. The modified rulemaking, as incorporated into SECY-00-145, would have allowed the minimum onsite insurance coverage to be reduced to \$25 million once the spent fuel in the SFP is no longer thermal-hydraulically capable of sustaining a zirconium fire, based on a plant-specific analysis.

As discussed in the staff response to a question in SECY-00-145 (see "NRC Staff Responses to NEI White Paper Comments on Improving Decommissioning Regulations," page 6, response to Question 3):

"The staff believes that full insurance coverage must be maintained for 5 years or until a licensee can show by analysis that its spent fuel pool is no longer vulnerable to such [a zirconium] fire."

In addition, as discussed in the staff response to a question in SECY-00-145 (see "NRC Staff Responses to NEI White Paper Comments on Improving Decommissioning Regulations, page 5, response to Question 2):

"Since the zirconium fire scenario would be possible for up to several years following shutdown, and since the consequences of such fire are severe in terms of property damage and land contamination, the staff position is that full onsite liability coverage must be retained for five years or until analysis has indicated that a zirconium fire is no longer possible."

In a memorandum dated August 16, 2002, the NRC Executive Director for Operations provided the NRC Commissioners a status of the regulatory exemptions for plants in decommissioning. This memorandum stated that,

"In the absence of any anticipated nuclear power plant decommissionings in the near term, the staff believes that there is no immediate need for moving forward with a majority of the decommissioning regulatory improvement work that is currently planned. Specifically, broad scope regulatory improvements for decommissioning nuclear power plants do not appear to be of sufficient priority given a lack of future licensees that would benefit at this time. Due to higher priorities, resources are being deferred for decommissioning rulemakings that are not currently in progress or not related to security.... If any plants do unexpectedly shutdown permanently, decommissioning regulatory issues would continue to be addressed through the exemption process in a manner similar to current practice."

Thus, the proposed rulemaking process changes for decommissioning plants discussed above were stopped in deference to the exemption process that had been used for previous licensees.

In January 2018, NRC issued its "Regulatory Analysis for Regulatory Basis: Regulatory Improvements for Power Reactors Transitioning to Decommissioning" NRC-2015-0070, RIN 3150-AJ59 (Reference 4). In Section 5.8 of this Regulatory Basis document the NRC staff assessed offsite and onsite financial protection requirements and indemnity agreements and proposed alternatives that include an alternative "FP-2." This alternative would involve rulemaking to reduce the on-site property damage requirement in 10 CFR 50.54(w) to \$50 million for a reactor that "is defueled and permanently shut down, and spent fuel in the SFP has decayed and cooled sufficiently that it cannot heat up to clad ignition temperature within 10 hours under adiabatic conditions." In Section 8.2.9 of the Regulatory basis document, the NRC staff has recommended alternative FP-2.

IV. TECHNICAL EVALUATION

Chapter 14 of the PNPS UFSAR describes the DBA scenarios that are applicable to PNPS during power operations. The most severe postulated accidents for nuclear power plants involve damage to the nuclear reactor core and the release of large quantities of fission products. The UFSAR accident scenarios include a CRDA, a Loading Error Accident, a LOCA, a FHA, a Radwaste System Accident, and a Main Steam Line Break Accident.

However, upon docketing of the 10 CFR 50.82(a)(1) certifications for permanent cessation of operations and permanent removal of fuel from the reactor vessel, the 10 CFR Part 50 license

will no longer authorize operation of the reactor or emplacement or retention of fuel into the reactor vessel. Since PNPS is permanently shutting down and defueling, no additional fission products will be generated from the plant after shutdown and the decay heat load on the spent fuel will continue to decline. Most of the DBA scenarios postulated in the UFSAR will no longer be possible. The irradiated fuel will be stored in the SFP and the Independent Spent Fuel Storage Installation (ISFSI) until it is shipped off site, consistent with the spent fuel management planning schedules provided in the Post Shutdown Decommissioning Activities Report (Reference 5) and the updated Irradiated Fuel Management Plan (Reference 6).

When the reactor is permanently defueled, the SFP and its supporting systems will be dedicated only to spent fuel storage. With the reactor defueled, the reactor vessel assembly and supporting structures and systems are no longer in operation and have no function related to the safe storage and management of irradiated in the SFP. Fuel pool cooling and makeup capabilities function to remove decay from pool and to maintain a specified water temperature and level.

Accident Analysis Overview

10 CFR 50.82(a)(2) specifies that the 10 CFR Part 50 license no longer authorizes operation of the reactor or emplacement or retention of fuel in the reactor vessel after docketing the certifications for permanent cessation of operations and permanent removal of fuel from the reactor vessel in accordance with 10 CFR 50.82(a)(1). Following the termination of power operations at PNPS, and the permanent removal of the fuel from the reactor vessel, the postulated accidents involving failure or malfunction of the reactor and supporting structures, systems, and components are no longer applicable.

A summary of the postulated radiological accidents analyzed for the permanently shut down and defueled condition is presented below. Current guidance provided in the EPA's, "Protective Action Guides and Planning Guidance for Radiological Incidents, EPA-400/R-17/001," dated January 2017, Section 2.2.4, "PAGs and Nuclear Facilities Emergency Planning Zones (EPZ)," states that the EPZ is based on the maximum distance at which a PAG might be exceeded.

Section 5.0 of Interim Staff Guidance (ISG) – 02 (Reference 7) indicates that site-specific analyses should demonstrate that: (1) the radiological consequences of the remaining applicable postulated accidents would not exceed the limits of the EPA PAGs at the Exclusion Area Boundary (EAB); (2) in the event of a beyond design basis event resulting in the partial drain down of the SFP to the point that cooling is not effective, there is a period of at least 10 hours (assuming an adiabatic heat up) from the time that the fuel is no longer being cooled until the hottest fuel assembly reaches 900 degrees Celsius (°C); (3) adequate physical security is in place to assure implementation of security strategies that protect against spent fuel sabotage; and (4) in the unlikely event of a beyond design basis event resulting from a loss of all SFP cooling, there is sufficient time to implement pre-planned mitigation measures to provide makeup or spray to the SFP before the onset of zirconium cladding ignition.

Entergy also described the applicable PNPS analyses in the "Request for Exemptions from Portions of 10 CFR 50.47 and 10 CFR Part 50, Appendix E," dated July 3, 2018 (ADAMS Accession No. ML18186A635). Specific analyses are summarized in the following sections.

1. Consequences of Design Basis Events

The current design basis FHA is a drop of a fuel assembly over the reactor cavity, the most limiting location for an FHA to occur at PNPS. After permanent shutdown and removal of fuel from the reactor, an FHA in the reactor cavity is no longer a credible accident. While spent fuel remains in the SFP, the postulated DBA that will remain applicable to PNPS that could contribute to dose upon implementation of the requested exemptions is the FHA in the reactor building, where the SFP is located. PNPS performed an analysis documenting that the current design basis FHA results are bounding. The DBA FHA analysis uses the accident source term guidelines outlined in NUREG-1465 (Reference 8), Regulatory Guide 1.183 (Reference 9), and Regulatory Guide 1.194 (Reference 10). The results of the analysis, detailed in UFSAR Table 14-5.5, indicate that the EAB, Low Population Zone (LPZ), and Control Room doses are within their respective regulatory allowable limits for an FHA occurring in the reactor building. Additionally, the analysis concludes that the dose at the EAB 72 hours after shutdown is 0.91 rem Total Effective Dose Equivalent (TEDE), which is below the EPA PAG limit of 1 rem.

PNPS UFSAR Section 14.5 incorporated the GE Hitachi Nuclear Energy Report, "Fuel Handling Accident in the Spent Fuel Pool Generic Dose Assessment" (Reference 11) for the fuel handling accident involving an unchanneled fuel assembly in the SFP. The assessment concluded that for the consequences of the design basis FHA to remain bounding, an unchanneled fuel assembly must be allowed to decay for a minimum of 45 days from the time of reactor shutdown in which the assembly in question was part of the critical reactor core. The 45-day decay period ensures the radiological source term is sufficiently reduced so that the consequences of the design basis FHA remain bounding. The PNPS design basis FHA assumes the source term in an irradiated fuel assembly has been reduced by 24 hours (1 day) of decay since the time of reactor shutdown. To ensure the consequences of postulated drop of an unchanneled fuel assembly in the SFP are bounded by the PNPS design basis FHA, an additional 45 days of decay is required. Therefore, PNPS maintains a procedurally enforced administrative restriction prohibiting the handling of unchanneled assemblies unless they have decayed for a minimum of 46 days following reactor shutdown to ensure the consequences of the design basis FHA remains bounding for the drop of an unchanneled irradiated fuel assembly in the SFP.

Due to the amount of decay calculated (72 hours after reactor shutdown) and the procedurally enforced administrative restriction prohibiting the handling of unchanneled assemblies unless they have decayed for a minimum of 46 days following reactor shutdown, the results of this analysis may be applied after August 15, 2019, assuming a PNPS shutdown by June 1, 2019.

2. Consequences of Beyond Design Basis Events

With respect to beyond design basis events, Entergy analyzed a partial drain down of the SFP water that would effectively impede any decay heat removal (adiabatic heatup). The analysis compares the conditions for the hottest fuel assembly stored in the PNPS SFP to a criterion proposed in SECY-99-168 (Reference 12) applicable to offsite emergency response for a unit in the decommissioning process. This criterion considers the time for the hottest assembly to heat up from 30°C to 900°C adiabatically.

Based on the limiting fuel assembly for decay heat and adiabatic heat up analysis, 10 months after permanent cessation of power operations is the time for the hottest fuel assembly to reach 900°C 10 hours after the assemblies have been uncovered. As stated in NUREG-1738, "Technical Study of Spent Fuel Pool Accident Risk at Decommissioning Nuclear Power Plants," (February 2001) (Reference 13), 900°C is an acceptable temperature to use for assessing the onset of fission product release under transient conditions (to establish the critical decay time for determining availability of 10 hours to evacuate) if fuel and cladding oxidation occurs in air.

Based on the length of time it would take for the adiabatic heat up to occur, there is ample time to respond to any partial drain down event that might cause such an occurrence by restoring SFP cooling or makeup, or providing SFP spray. As a result, the likelihood that such a scenario would progress to a zirconium fire is deemed not credible.

3. Consequences of Other Analyzed Events

3.1 Spent Fuel Pool Drain Down Event

Entergy analyzed a drain down event of the SFP to determine a dose rate curve at the EAB and Control Room. NUREG-0586, "Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities," (Reference 14) Supplement 1, Section 4.3.9, identifies that a SFP drain down event is beyond design basis. Although the analysis demonstrated that a significant release of radioactive material from the spent fuel is not possible within 10 hours from the time the spent fuel is uncovered after approximately 10 months following permanent cessation of power operations, the potential exists for radiation exposure to an offsite individual if shielding of the fuel is lost. The SFP water and the concrete pool structure serve as radiation shielding. A loss of water shielding above the fuel could increase the offsite radiation levels because of the gamma rays streaming up out of the pool and being scattered back to a receptor at the site boundary.

The offsite and Control Room radiological impact of a postulated complete loss of SFP water was assessed in a calculation provided to the NRC in the "Request for Exemptions from Portions of 10 CFR 50.47 and 10 CFR 50, Appendix E," Letter No. CNRO-2018-00031, dated July 3, 2018. The calculation documents that the gamma radiation dose rate at the EAB would be limited to small fractions of the EPA PAGs. The EPA PAGs were developed to respond to a mobile airborne plume that could transport and deposit radioactive material over a large area. In contrast, the radiation field formed by scatter from a drained SFP would be stationary rather than moving and would not cause transport or deposition of radioactive materials. The extended period required to exceed the integrated EPA PAG limit of 1 Rem TEDE would allow sufficient time to develop and implement onsite mitigative actions and provide confidence that additional offsite measures could be taken without preplanning if efforts to reestablish shielding over the fuel are delayed.

Based on the data presented, it is reasonably estimated that 10 months following permanent cessation of power operations, the dose rate in the Control Room will be less than 0.02 mrem/hr. There are no acceptance criteria for dose rates in the Control Room in NSIR/DPR-ISG-02, "Emergency Planning Exemption Requests for Decommissioning Nuclear Power Plants," (Reference 7). However, Appendix A to 10

CFR Part 50, "General Design Criteria (GDC)," Criterion 19 – Control Room states, in part:

"A control room shall be provided from which actions can be taken to operate the nuclear power unit safely under normal conditions and to maintain it in a safe condition under accident conditions, including loss-of-coolant accidents. Adequate radiation protection shall be provided to permit access and occupancy of the control room under accident conditions without personnel receiving radiation exposures in excess of 5 rem whole body, or its equivalent to any part of the body, for the duration of the accident."

The dose rate in the Control Room conservatively does not include shielding provided by walls and floors between the SFP and Control Room. This includes the 30-inch concrete slab ceiling of the Control Room, which would provide a considerable reduction in the dose rate.

3.2 Radioactive Waste Handling Accident

Entergy evaluated the drop of a high integrity container (HIC) containing radioactive waste. The event considered a waste handling accident where a fully loaded HIC is dropped onto another fully loaded HIC and a fraction of the contents from both HICs are released. The spilled contents from the two HICs are then assumed to be engulfed in a fire resulting in a fraction of the contents being aerosolized. The accident evaluated the drop of a HIC containing a bounding activity of 945 curies of 22 various radionuclides representing a bounding isotopic mix. The calculation postulates that the accident occurs 100 meters (328 feet) from the EAB with subsequent container failure. The analysis assumes that 1% of the contents are released and 0.78% of the release becomes aerosolized and carried in the direction of the EAB. The resulting two-hour dose at the EAB is projected to be 27 millirem TEDE, which is below the EAB limit of 1 rem TEDE.

3.3 Consequences of a Beyond Design Basis Earthquake

NUREG-1738 (Reference 13) identifies beyond design basis seismic events as the dominant contributor to events that could result in a loss of SFP coolant that uncovers fuel for plants in the Central and Eastern United States. Additionally, NUREG-1738 identifies a zirconium fire, resulting from substantial loss-of-water inventory from the SFP, as the only postulated scenario at a decommissioning plant that could result in significant offsite radiological release. The scenarios that lead to this condition have very low frequencies of occurrence (i.e., on the order of one to tens of times in a million years) and are considered beyond design basis events because the SFP and attached systems are designed to prevent a substantial loss of coolant inventory under accident conditions. However, the consequences of such accidents could potentially lead to an offsite radiological dose in excess of the EPA PAGs at the EAB.

The risk associated with zirconium cladding fire events decreases as the spent fuel ages. When the spent fuel ages, the decay time increases, the decay heat decreases, and the short-lived radionuclides decay away. As the decay time increases, the overall risk of zirconium cladding fire continues to decrease due to two factors: (1) the amount of time available for preventative actions increases, which reduces the

probability that the actions would not be successful; and (2) the increased likelihood that the fuel is able to be cooled by air, which decreases the reliance on actions to prevent a zirconium fire. The results of the research conducted for NUREG-1738 and 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) (Reference 15) suggests that, while other radiological consequences can be extensive, a postulated accident scenario leading to a SFP zirconium fire, where the fuel has had significant decay time, will have little potential to cause offsite early fatalities due to dose, regardless of the type of offsite response.

The purpose of NUREG-2161 (Reference 15) was to determine if accelerated transfer of older, colder spent fuel from the SFP at a reference plant to dry cask storage significantly reduces the risks to public health and safety. The study states that "this study's results are consistent with earlier research studies' conclusions that spent fuel pools are robust structures that are likely to withstand severe earthquakes without leaking."

NUREG-2161 also states:

"The study shows the likelihood of a radiological release from the spent fuel pool after the analyzed severe earthquake at the reference plant to be about one time in 10 million years or lower. If a leak and radiological release were to occur, this study shows that individuals cancer fatality risk for a member of the public is several orders of magnitude lower than the Commission's Quantitative Health Objective of two in one million (2×10^{-6} /year). For such a radiological release, this study shows public and environmental effects are generally the same or smaller than earlier studies."

The reference plant for the study (a General Electric Type 4 BWR with a Mark I containment) generated approximately 3500 MWt and the SFP contained 2844 fuel assemblies. PNPS is a General Electric Type 3 BWR with a Mark I containment licensed to generate 2028 MWt. Following permanent cessation of power operations and transfer of all fuel from the reactor vessel to the SFP, the SFP will contain 2958 fuel assemblies.

Entergy conducted a structural integrity seismic risk assessment of the PNPS SFP to assess seismically-induced structural failure and rapid loss of inventory. This assessment was performed using EPRI 3002009564, "Seismic Evaluation Guidance: Spent Fuel Pool Integrity Evaluation," (Reference 16) and is comprised of several complementary seismic evaluations of the PNPS SFP, which satisfy the expectations and intent of SDA-6 of NUREG-1738 (Reference 13).

Consistent with NUREG-1738, the seismic risk assessment considers catastrophic structural failure as governing the seismic risk. In addition to the primary seismic evaluation, a structural drawing review of the PNPS SFP was conducted. The review was based on the Enhanced Seismic Checklist in NUREG-1738 using the as-built drawings of the PNPS Reactor Building and the SFP. The structural drawing review did not identify any specific design or detail any vulnerability of the PNPS SFP that would challenge its seismic capacity. Additionally, a review of non-structural considerations related to the seismic capacity of the PNPS SFP was conducted. This

review was based on the EPRI SFP Evaluation Guidance Report (Reference 16). Reference 16 provides screening-type evaluation criteria for demonstrating that a SFP will retain adequate water inventory for 72 hours following a seismic event, including non-structural considerations. The non-structural consideration review confirms that non-structural failure modes do not govern the overall seismic capacity of the SFP. This conclusion supports the use of structural integrity as the governing contributor for SFP seismic risk assessment. A seismic walkdown was also performed and confirmed the conclusions of the structural drawing review and of the non-structural considerations review, which also supports the SFP seismic risk assessment being governed by structural integrity of the SFP walls and slab (Reference 17).

The seismic evaluation demonstrates that the risk of a SFP seismically induced structural failure and rapid loss of inventory is 6.6×10^{-6} per year, which is less than the generic bounding estimates provided in NUREG-1738 ($<1 \times 10^{-5}$ per year including non-seismic events).

V. PRECEDENTS

The exemption request for 10 CFR 50.54(w)(1) is consistent with exemption requests that recently have been issued by the NRC for other nuclear power reactor facilities beginning decommissioning. Specifically, the NRC granted similar exemptions to Entergy Nuclear Operations, Inc., for Vermont Yankee (Reference 18); to Duke Energy Florida, Inc. for Crystal River Unit 3 (Reference 19); to Southern California Edison Company for SONGS, Units 1, 2, and 3 (Reference 20); and to Dominion Energy Kewaunee, Inc. for KPS (Reference 21). Similar to the current request, these precedents each resulted in exemptions from the requirements in 10 CFR 50.54(w)(1) to reduce the minimum coverage limit of 10 CFR 50.54(w)(1) to \$50 million.

VI. JUSTIFICATION FOR EXEMPTION AND SPECIAL CIRCUMSTANCES

10 CFR 50.12 states that the Commission may, upon application by any interested person or upon its own initiative, grant exemptions from the requirements of the regulations of Part 50 which are authorized by law, will not present an undue risk to the public health and safety, and are consistent with the common defense and security. 10 CFR 50.12 also states that the Commission will not consider granting an exemption unless special circumstances are present

As discussed below, this exemption request satisfies the provisions of 10 CFR 50.12.

A. The exemption is authorized by law

10 CFR 50.12 allows the NRC to grant exemptions from the requirements of 10 CFR Part 50. The proposed exemptions would not result in a violation of the Atomic Energy Act of 1954, as amended, or the Commission's regulations. Exemptions granted to other licensees for insurance reductions of the same regulation being requested here by Entergy have been previously determined to be authorized by law and granted (see Section V of this attachment).

In addition, the requested exemption is consistent with the guidelines presented by the NRC staff in SECY- 96-256. The proposed exemption is not contrary to the Atomic Energy Act of 1954, as amended, or the Commission's regulations. Therefore, the exemption is authorized by law.

B. The exemption will not present an undue risk to public health and safety

The requirements of 10 CFR 50.54(w)(1) and the existing level of onsite insurance coverage for PNPS are predicated on the assumption that the reactor is operating. However, PNPS will be a permanently shutdown and defueled facility. The planned permanently defueled status of the facility will result 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 risk and reduced consequences of potential nuclear accidents at PNPS once it is permanently defueled. Therefore, granting the requested exemption will not present an undue risk to the health and safety of the public.

C. The exemption is 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 PNPS's ability to physically secure the site or protect special material. Physical measures at PNPS are not affected by the requested exemption. Therefore, the proposed exemption is consistent with the common defense and security.

D. Special Circumstances

Pursuant to 10 CFR 50.12(a)(2), the NRC will not consider granting an exemption to its regulations unless special circumstances are present. Special circumstances are present because the plant will be permanently shutdown and defueled and the radiological source term at the site will be reduced from that associated with reactor power operation. With the reactor power plant permanently shutdown and defueled, the DBAs and transients postulated to occur during reactor operation will no longer be possible. In particular, the potential for a release of a large radiological source term to the environment from the high pressures and temperatures associated with reactor operation will no longer exist.

1. 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 require sufficient property damage insurance to ensure funding of onsite post-accident recovery stabilization, and decontamination costs following an accident at an operating nuclear power plant. The requirements of 10 CFR 50.54(w)(1) were developed taking into consideration the risks associated with the operation of an operating nuclear power reactor, including the potential consequences of a release of radioactive material from the reactor. However, the regulation does not take into consideration the reduced potential for, and consequences of, nuclear incidents at permanently shutdown facilities.

The radiological consequences of accidents that will remain possible at PNPS in the permanently defueled condition are substantially lower than at an operating plant.

The proposed reduction in the level of onsite insurance coverage from \$1.06 billion to \$50 million would continue to serve the underlying purpose of the rule by requiring a level of financial protection commensurate with the significant reduction in the probability and consequences of nuclear incidents at PNPS. Consistent with the NRC's conclusions documented in SECY-00-145 (Reference 3), the proposed reduction in the level of onsite insurance coverage would continue to require sufficient property damage insurance to ensure funding for onsite post-accident recovery, stabilization, and decontamination costs in the unlikely event of an accident at PNPS.

Therefore, application of the requirement 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 this rule and special circumstances are present as defined in 10 CFR 50.12(a)(2)(ii).

2. 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.

Continued application of the requirement to maintain \$1.06 billion in onsite insurance coverage for PNPS would result in undue hardship and costs being incurred by the PNPS decommissioning trust fund for the purchase of unnecessary levels of onsite insurance coverage.

As tabulated in Section V of this attachment, other licensees of permanently shutdown power reactors have been granted exemptions by the NRC to the subject regulation in the same or lower insurance amounts being requested by Entergy for PNPS.

Therefore, compliance with the rule would result in an 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 and the special circumstances required by 10 CFR 50.12(a)(2)(iii) exist.

VII. ENVIRONMENTAL ASSESSMENT

The proposed exemption meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(25), because the proposed exemption involves: (i) no significant hazards consideration; (ii) no significant change in the types or significant increase in the amounts of any effluents that may be released offsite; (iii) no significant increase in individual or cumulative public or occupational radiation exposure; (iv) no significant construction impact; (v) no significant increase in the potential for or consequences from radiological accidents; and (vi) the requirements from which the exemption is sought involve surety, insurance or indemnity requirements. Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed exemption.

(i) No Significant Hazards Consideration Determination

Entergy has evaluated the proposed exemption to determine whether or not a significant hazards consideration is involved by focusing on the three standards set forth in 10 CFR 50.92 as discussed below:

1. Does the proposed exemption involve a significant increase in the probability or consequences of an accident previously evaluated?

The proposed exemption has no effect on structures, systems, and components (SSCs) and no effect on the capability of any plant SSC to perform its design function. The proposed exemption would not increase the likelihood of the malfunction of any plant SSC.

When the exemption becomes effective, there will be no credible events that would result in doses to the public beyond the exclusion area boundary that would exceed the Environmental Protection Agency Protective Action Guidelines. The probability of occurrence previously evaluated accidents is not increased, since most previously analyzed accidents will no longer be able to occur and the probability and consequences of the remaining FHA are unaffected by the proposed amendment.

Therefore, the proposed exemption does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. Does the proposed exemption create the possibility of a new or different kind of accident from any accident previously evaluated?

The proposed exemption does not involve a physical alteration of the plant. No new or different type of equipment will be installed and there are no physical modifications to existing equipment associated with the proposed exemption. Similarly, the proposed exemption will not physically change any SSCs involved in the mitigation of any accidents. Thus, no new initiators or precursors of a new or different kind of accident are created. Furthermore, the proposed exemption does not create the possibility of a new accident as a result of new failure modes associated with any equipment or personnel failures. No changes are being made to parameters within which the plant is normally operated, or in the setpoints which initiate protective or mitigative actions, and no new failure modes are being introduced.

Therefore, the proposed exemption does not create the possibility of a new or different kind of accident from any accident previously evaluated.

3. Does the proposed exemption involve a significant reduction in a margin of safety?

The proposed exemption does not alter the design basis or any safety limits for the plant. The proposed exemption does not impact station operation or any plant SSC that is relied upon for accident mitigation.

Therefore, the proposed exemption does not involve a significant reduction in a margin of safety.

Based on the above, Entergy concludes that the proposed exemption presents no significant hazards consideration, and, accordingly, a finding of "no significant hazards consideration" is justified.

- (ii) **There is no significant change in the types or significant increase in the amounts of any effluents that may be released offsite.**

There are no changes in the types, characteristics, or quantities of effluents discharged to the environment associated with the proposed exemption. There are no materials or chemicals introduced into the plant that could affect the characteristics or types of effluents offsite. In addition, the method of operation of waste processing systems will not be affected by the exemption. The proposed exemption will not result in changes to the design basis requirements of SSCs that function to limit or monitor the release of effluents. All the SSCs associated with limiting the release of effluents will continue to be able to perform their functions. Therefore, the proposed exemption will result in no significant change to 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.**

The proposed exemption does not involve any physical alterations to the plant configuration or any changes to the operation of the facility that could lead to a significant increase in individual or cumulative occupational radiation exposure.

- (iv) **There is no significant construction impact.**

No construction activities are associated with the proposed exemption.

- (v) **There is no significant increase in the potential for or consequences from radiological accidents.**

See the no significant hazards considerations discussion in Item (i)(1) above.

- (vi) **The requirements from which exemption is sought involve surety, insurance or indemnity requirements.**

The requirements from which the exemption is sought involve financial protection and for the indemnification and limitation of liability of licensees pursuant to Section 170 of the Atomic Energy Act of 1954, as amended and 10 CFR 50.54(w)(1).

VIII. CONCLUSION

In accordance with 10 CFR 50.12, Entergy is requesting a permanent exemption from 10 CFR 50.54(w)(1) for PNPS. Based on the considerations discussed above, the requested exemption 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 in 10 CFR 50.12.

REFERENCES

1. SECY-96-256, "Changes to the Financial Protection Requirements for Permanently Shutdown Nuclear Power Reactors, 10 CFR 50.54(w) and 10 CFR 140.11, dated December 17, 1996.
2. SECY-97-186, "Changes to the Financial Protection Requirements for Permanently Shutdown Nuclear Power Reactors, 10 CFR 50.54(w) and 10 CFR 140.11," dated August 13, 1997
3. SECY-00-145, "Integrated Rulemaking Plan for Nuclear Power Plant Decommissioning, dated June 28, 2000
4. NRC-2015-0070, RIN 3150-AJ59, "Regulatory Analysis for Regulatory Basis: Regulatory Improvements for Power Reactors Transitioning to Decommissioning," dated January 2018 (ML17332A075)
5. Letter, Entergy Nuclear Operations, Inc. to USNRC, "Pilgrim Nuclear Power Station Post-Shutdown Decommissioning Activities Report," 2.18.070, dated November 16, 2018 (ML18320A034)
6. Letter, Entergy Nuclear Operations, Inc. to USNRC, "Update to Spent Fuel Management Plan Pursuant to 10 CFR 50.54(bb)," 2.18.071, dated November 16, 2018 (ML18320A036)
7. NSIR/DPR-ISG-02, Interim Staff Guidance, Emergency Planning Exemption Requests for Decommissioning Nuclear Power Plants, dated May 11, 2015
8. NUREG-1465, "Accident Source Terms for Light-Water Nuclear Power Plants," dated February 1995 (ML041040063)
9. USNRC Regulatory Guide 1.183, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors," July 2000
10. RG 1.194, "Atmospheric Relative Concentrations for Control Room Radiological Habitability Assessments at Nuclear Power Plants," June 2003 (ML031530505)
11. GE Hitachi Nuclear Energy, Fuel Handling Accident in the Spent Fuel Pool Generic Dose Assessment, dated June 2009 (GEH Proprietary Information)
12. SECY-99-168, Improving Decommissioning Regulations for Nuclear Power Plants, dated June 30, 1999
13. NUREG-1738, "Technical Study of Spent Fuel Pool Accident Risk at Decommissioning Nuclear Power Plants," dated February 2001
14. NUREG-0586, "Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities," dated October 2002
15. 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 (ML14255A365)

16. Electric Power Research Institute, "Seismic Evaluation Guidance: Spent Fuel Pool Integrity Evaluation," EPRI 3002009564, 2017
17. Electric Power Research Institute, EPRI Report No. 1025286, "Seismic Walkdown Guidance: For Resolution of Fukushima Near-Term Task Force Recommendation 2.3: Seismic," 2012
18. Vermont Yankee Nuclear Power Station—Exemption from the Requirements of Title 10 of the Code of Federal Regulations, Part 50, Section 50.54(w)(1) Concerning Insurance for Post-Accident Site Decontamination (CAC No. MF3981), dated April 15, 2016 (ADAMS Accession No. 16012A193)
19. Crystal River Unit 3 Nuclear Generating Plant—Exemption from the Requirements of Title 10 of the Code of Federal Regulations, Section 50.54(w)(1) Concerning Insurance for Post-Accident Site Decontamination (TAC No. L53108), dated March 16, 2016 (ADAMS Accession No. ML16020A463)
20. Request for Exemption from 10 CFR 50.54(w)(1), San Onofre Nuclear Generating Station Units 1, 2, and 3, dated October 22, 2015 (ADAMS Accession No. ML15299A220)
21. Kewaunee Power Station—Exemption from the Requirements of Title 10 of the Code of Federal Regulations, Part 50, Section 50.54(w)(1) Concerning Insurance for Post-Accident Site Decontamination (TAC No. MF3915), dated April 3, 2015 (ADAMS Accession No. ML15033A245)
22. Regulatory Guide 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis" dated July 1998
23. PNPS Letter to NRC, Subject: "License Amendment Request to Revise the Pilgrim Nuclear Power Station Emergency Plan to Address the Permanently Defueled Condition," dated January 12, 2018 (Letter Number 2.18.004) (ML 10823A687)
24. SECY-96-256, Changes to Financial Protection Requirements for Permanently Shutdown Nuclear Power Reactors, dated January 28, 1997 (Accession Number 9702070060)