Entergy

Entergy Nuclear Operations, Inc.
Pilgrim Nuclear Power Station
600 Rocky Hill Road
Plymouth, MA 02360

John A. Dent, Jr.
Site Vice President

June 24, 2016

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

SUBJECT: Request for Extension to Comply with NRC Order EA-13-109, Order Modifying Licenses With Regard To Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions

Pilgrim Nuclear Power Station
Docket No. 50-293
Renewed License No. DPR-35

References:

1. NRC Order EA-13-109, Issuance of Order to Modify Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions, dated June 6, 2013
2. Interim Staff Guidance, JLD-ISG-2013-02, Compliance with Order EA-13-109, Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions, dated November 25, 2013 (FRN Nol. 78, No. 227)
3. Letter from Pilgrim Nuclear Power Station, Permanent Cessation of Operations at Pilgrim Nuclear Power Station, dated November 10, 2015, ML15328A053
4. Pilgrim FLEX Final Integrated Plan, PNPS Letter 2.15.050 dated July 17, 2015, ML15202A415
5. Pilgrim HCVS Overall Integrated Plan, PNPS Letter 2.14.045 dated June 30, 2014, ML14188B731

LETTER NUMBER: 2.16.028

Dear Sir or Madam:

On June 6, 2013, the U. S. Nuclear Regulatory Commission (NRC) issued Order EA-13-109 (Reference 1) to all licensees that operate boiling-water reactors with Mark I and Mark II containment designs. The Order was effective immediately and is applicable to Pilgrim Nuclear Power Station (Pilgrim). On November 25, 2013, the NRC issued Interim Staff Guidance, JLD-ISG-2013-02 (Reference 2). In Reference 3, Pilgrim notified the NRC of plans to permanently shut down Pilgrim and cease operation no later than June 1, 2019.

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In accordance with Section IV of NRC Order EA-13-109, Entergy is hereby requesting that the Director, Office of Nuclear Reactor Regulation, grant an extension to comply with the requirements in Section IV of NRC Order EA-13-109 concerning implementation of the Phase 1 (wetwell vent) and Phase 2 (drywell vent) at Pilgrim until December 31, 2019. Pilgrim will submit a request for relief from NRC Order EA-13-109 no later than December 31, 2019 based upon the permanent shutdown condition of the plant at that time.

Entergy and Pilgrim have reviewed the in-depth severe accident studies and evaluations performed by the NRC as described in the SECY-12-0157 series of documents and its references. The previously submitted "PNPS FLEX Strategy" (Reference 4) for NRC Order EA-12-049 seeks to mitigate all Beyond-Design-Basis-External-Events successfully without core damage under the most extreme conditions, but we understand the obligation to consider the full spectrum of severe accident conditions as part of the NRC efforts to address all the Fukushima lessons-learned and to enhance and solidify defense-in-depth for all plants. A bounding envelope for such extreme events has been defined in the previously submitted PNPS EA-13-109 Phase 1 Overall Integrated Plan (Reference 5) and it is shown that the actions to be taken will preclude or substantially mitigate the release of core damage materials from containment for the accident timelines that are postulated for the purpose of encompassing the defined set of severe accident events.

The Hardened Containment Vent System (HCVS) Severe Accident Capable Wetwell Vent continues to be used for the purpose of preserving and maintaining containment integrity, providing heat removal, and controlling combustible gases under all conditions. The overall strategy remains based on the timely and continued deployment of equipment and capabilities that are simple, robust, and independent, to the extent practicable, from permanent plant systems that may be affected by Beyond-Design-Basis-External-Events. These capabilities are focused on the principal and highest priority goal of maintaining core cooling and submergence under all conditions using the most reliable methods available that can be implemented under potentially severe environmental conditions with only on-site assets, and subsequently maintaining that capability indefinitely with additional off-site resources. It is our belief that the proposed FLEX Severe Accident Strategy will preclude the occurrence of core damage, but also includes the capability for restoring and maintaining containment integrity and to cool core debris and thereby allow recovery without the serious complications that were encountered at Fukushima Dai-ichi.

As described in the Enclosure to this letter, at Pilgrim we designed a FLEX Strategy that utilizes Wetwell Venting and Severe Accident Water Addition and Management Strategies to mitigate all Beyond-Design-Basis conditions. It is our intention to have in-place a fully capable Severe Accident Strategy that meets all of the primary objectives of NRC Order EA-13-109. Given the remaining schedule for power operation at Pilgrim through mid-2019, some of the HCVS instrumentation installations that would not have been completed until 2017 have been replaced with enhancements to our existing FLEX capabilities that were already designed with Severe Accident capabilities. We are confident that this strategy can perform all the core cooling, mitigation, and recovery tasks for severe accident conditions that are soundly based on the lessons-learned from the Fukushima Dai-ichi experience.

The Enclosure to this letter provides the basis and justification supporting the request for extension to comply with the requirements of NRC Order EA-13-109 for Pilgrim.

If you have any questions regarding this information, please contact Everett P. Perkins, Jr. at (508) 830-8323.

There are two regulatory commitments contained in Attachment 4 to the Enclosure of this letter.

I declare under penalty of perjury that the foregoing is true and correct; executed on the June 24, 2016

Sincerely,

John A. Dent, Jr.
Site Vice President

JAD/rb

Enclosure:

Request for Extension to Comply with NRC Order EA-13-109, Section IV Requirements Regarding Implementation of Phase 1 and Phase 2 Severe Accident Capable Vents for Pilgrim Nuclear Power Station

cc:

Mr. Daniel H. Dorman
Regional Administrator, Region I
U.S. Nuclear Regulatory Commission
2100 Renaissance Boulevard, Suite 100
King of Prussia, PA 19406-1415

Mr. William M. Dean
Director, Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, DC 20555

NRC Senior Resident Inspector
Pilgrim Nuclear Power Station

Ms. Booma Venkataraman, Project Manager
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Mail Stop O-8C2A
Washington, DC 20555

Entergy

ENCLOSURE

PILGRIM NUCLEAR POWER STATION

Renewed Facility Operating License DPR-35

Request for Extension to Comply with NRC Order EA-13-109, Section IV Requirements Regarding Implementation of Phase 1 and Phase 2 Severe Accident Capable Vents for Pilgrim Nuclear Power Station

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SUMMARY OF PILGRIM'S PROPOSED PLAN VS. EACH ORDER CRITERION OVERVIEW

Entergy requests the extension of NRC Order EA-13-109, Hardened Containment Vent System (HCVS), for Pilgrim Nuclear Power Station (Pilgrim). The extension is based on the planned shutdown of Pilgrim scheduled mid-2019. This extension request is based on the extension request already approved by the NRC for Oyster Creek, which also has a scheduled shutdown date during 2019.

Pilgrim reviewed Oyster Creek's extension plan, actions, and requests for additional information (RAIs) from NRC. Pilgrim is taking a similar approach. This approach is reasonable given the similar design of the containment venting systems. In general, the differences are minor and easily resolved. The one noteworthy difference is between Oyster Creek's Generic Letter (GL) 89-16 piping and Pilgrim's GL 89-16 piping. Oyster Creek's piping is routed directly to the stack and does not interface with the standby gas treatment system (SGTS), whereas Pilgrim's GL 89-16 HCVS piping does interface with the SGTS discharge piping. Pilgrim's design includes isolation valves and SGTS backflow prevention, which mitigates this difference. A specific discussion of the bases of how this difference is addressed is contained under the Differences section.

As mentioned above, in addition to a thorough review of the Oyster Creek request, a thorough review was performed of all the RAIs related to the Oyster Creek extension. A Pilgrim response to each RAI was developed and is attached to this document as a proactive step for the NRC staff's convenience.

The following attachments are included within:

- Attachment 1 contains a summary of Pilgrim's proposed plan vs. each Order criterion.
- Attachment 2 contains a detailed explanation of how Pilgrim's proposed plan addresses each Order criterion.
- Attachment 3 contains Pilgrim responses to the Phase 1 and Phase 2 RAIs asked by NRC to Oyster Creek. Additionally, excerpts from the RAI responses are included in the Attachment for consistency and include RAI numbers noted in the Attachment body.
- Attachment 4 tabulates Pilgrim's commitments to the NRC.

<u>Differences</u>

<u>Notable Differences between Oyster Creek and Pilgrim</u>

The differences between the two approaches are listed in Table 1. Only one of these differences is significant enough to warrant a detailed discussion. This difference is that Oyster Creek's HCVS is routed directly to its stack, whereas Pilgrim's HCVS interfaces with the SGTS. In "TEPCO Fukushima Nuclear Accident Analysis Report" dated June 20, 2012, TEPCO concluded that the most likely reason for the explosion in the Fukushima Dai-ichi U4 reactor building was due to cross flow of venting gasses (i.e., hydrogen) from the U3 primary containment vent (PCV) piping via the common stack due to the absence of backdraft dampers on U4's SGTS filter trains. The report goes on to state, in part, on page 351: "*...at Fukushima Daiichi Unit 4, as mentioned earlier, since the valves on*

SUMMARY OF PILGRIM'S PROPOSED PLAN VS. EACH ORDER CRITERION OVERVIEW

the standby side are kept closed in that one system is in operation and the other system is on standby, a backflow prevention damper was considered as unnecessary and has never been installed..". Pilgrim is equipped with backflow preventers. Pilgrim has also implemented actions in site procedure 5.3.36 to ensure a second set of valves (SGTS isolation valves AO-N-108 and AO-N-112) in the same lines are closed prior to any venting action taken for EA-12-049 conditions. There are other minor differences between the sites' plans (e.g., Oyster Creek's external HCVS piping above grade required a wind/missile evaluation, whereas Pilgrim's external piping is underground); these differences are addressed in this extension request. Since Pilgrim's final refueling outage is scheduled prior to June 30, 2017 and the site is scheduled to be permanently shutdown prior to the June 30, 2019 due date, Pilgrim is not required to implement Phase 2 of the Order.

Differences between Order Requirements and Pilgrim Plan

Pilgrim's current venting system was installed to meet GL 89-16. The system was modified in 2014 to provide the following:

1) A long term nitrogen supply to maintain the HCVS Primary Containment Isolation Valves (PCIVs) open,
2) A means to manually open the HCVS PCIVs in the unlikely event of a loss of power from the safety related station batteries that provide DC power to the valves and,
3) Removal of Rupture Diaphragm in HCVS to ensure reliability.

This design meets the requirements of NRC Order EA-13-109 with the following exceptions.

Radiation Monitoring

In lieu of permanently installing a radiation monitor in accordance with (IAW) Order criterion 1.2.9, Pilgrim plans to use the existing SGTS and HCVS radiation monitors. The SGTS radiation monitor is a low range (10 Rad/Hr) monitor powered from the 250 VDC vital motor generator set (robust IAW with current design basis) and is available for at least the initial eight hours (reference: Pilgrim FLEX Final Integrated Plan (FIP)) of the Extended Loss of AC Power (ELAP) event. The HCVS radiation monitor is a high range (10,000 Rad/Hr) monitor repowered before eight hours after the ELAP event by the FLEX diesel generators connected to the Post Accident Monitoring (PAM) system.

HCVS Dedicated Power

In lieu of permanently installing a dedicated HCVS power supply IAW Order criterion 1.2.6, Pilgrim will utilize the safety related station batteries to power the HCVS and SGTS valves' solenoids and position indications. Additionally, as part of the EA-12-049 FLEX strategies, the station batteries will have their chargers repowered within eight hours (references: FSG No. 5.9.4.2 REPOWER BATTERY CHARGERS D11, D12, D13, D14 AND D15, FIP Table 2, FIP page 96/115).

Operation, Testing, and Inspection

While Pilgrim will comply with the current established testing and inspection, the abbreviated operating timeframe (i.e., one operating cycle) will not require development of detailed plans for HCVS testing and inspection required by the Order.

SUMMARY OF PILGRIM'S PROPOSED PLAN VS. EACH ORDER CRITERION OVERVIEW

Overview

Pilgrim's plan for justification for extension of EA-13-109 provides a criterion-by-criterion explanation of how Pilgrim satisfies the Order requirements or provides an acceptable approach that is reasonable, considering the planned short term facility operation through 2019. This extension request includes Pilgrim responses to the Phase 1 and Phase 2 RAIs previously submitted from NRC to Oyster Creek. The RAI numbers used in this extension request refer to the Oyster Creek Phase 1 and Phase 2 RAIs.

The plan proposed in this extension request is similar to the plan proposed in Oyster Creek's extension request. Noteworthy differences between Pilgrim and Oyster Creek are discussed in detail in this extension request. Other differences include the following (these are tabulated on the next page):

1. Due to physical differences between the stacks, Oyster Creek's plan includes opening up a hatch at the bottom of its stack and installing a deflector plate on the HCVS piping inside their stack, to allow dilution air flow into its stack. Pilgrim has evaluated combustible gas concentrations in its stack and has concluded that its present plan (which does not include dilution air) avoids the presence of a combustible mixture in its stack. The differences between the stacks are discussed in detail in the Pilgrim response to RAI-11.

2. Oyster Creek's GL 89-16 piping is routed directly to the stack and does not interface with the SGTS. Pilgrim's GL 89-16 HCVS piping ties into the SGTS discharge piping. This extension request evaluates the acceptability of Pilgrim's configuration.

3. Oyster Creek's plans do not require any use of ladders or temporary scaffolding. While use of ladders or temporary scaffolding is not required for Pilgrim's HCVS main strategy, one compensatory measure requires use of a ladder for manual closure of a SGTS isolation valve. If operators are required to perform the compensatory action to manually close this SGTS isolation valve in the event it fails open due to loss of its safety related (FLEX-backed) DC power supply or loss of its safety related 30-day air supply, a ladder would be required to perform this action.

4. Oyster Creek's extension request discussed their redundant safety related isolation condensers. Pilgrim is equipped with a Reactor Core Isolation Cooling (RCIC) system for the similar function of providing makeup water to an isolated reactor pressure vessel. This difference is not discussed in detail herein because this difference between plant designs does not significantly impact either site's HCVS plans.

5. Oyster Creek's extension request does not document that any jumpers or keylock switches are required for their HCVS strategies. Pilgrim's HCVS strategies either require installation of a jumper across relay contacts, installation of two fuses, and use of a keylock switch (all in the main control room) or manually opening the HCVS primary containment isolation valves from the valve station in the reactor building.

SUMMARY OF PILGRIM'S PROPOSED PLAN VS. EACH ORDER CRITERION OVERVIEW

6. Oyster Creek's backup nitrogen connection point is located outside the reactor building. Pilgrim's similar backup nitrogen station and valve station are located inside the reactor building. The acceptability of this configuration is discussed in the description of how Pilgrim satisfies Order criteria A.1.1.4 and A.1.2.4, in Attachment 2.

7. Oyster Creek's HCVS piping that is routed externally to the reactor building is above grade elevation, so Oyster Creek's extension request documents that the piping has been evaluated to be protected from wind/missiles. Pilgrim's external HCVS piping is routed underground then terminates in the main stack, so no discussion of protection from wind/missiles is needed.

8. The condensed water in the horizontal portion of Oyster Creek's vent pipe outside the reactor building will flow down towards the stack where it will be drained to the bottom of the stack through the 2" drain provided at the low point of the vent pipe inside the stack. Pilgrim's plan to address accumulation of condensate in the stack is similar, allowing the condensate to accumulate in the stack basement compartment for approximately the initial 92 hours after initiation of the HCVS (reference: Calculation M1408 R0) after which it will drain back into the HCVS piping low point where the condensate will drain into the Torus Compartment.

9. Oyster Creek's final refueling outage (fall 2018) is scheduled after June 30, 2017, whereas Pilgrim's final refueling outage (spring 2017) is scheduled prior to June 30, 2017. Therefore, the "no later than startup from the first refueling outage that begins after June 30, 2017" is applicable to Oyster Creek, but not to Pilgrim. Oyster Creek is therefore required to implement Phase 2 of the Order prior to startup from its fall 2018 refueling outage. However, since Pilgrim's final refueling outage is scheduled prior to June 30, 2017 and the site is scheduled to be permanently shutdown prior to the June 30, 2019 hard due date, Pilgrim is not required to implement Phase 2 of the Order.

Table 1 Differences Between Oyster Creek and Pilgrim HCVS Strategies

Item	Subject	Oyster Creek	Pilgrim	Impact
1	Combustible gas control in main stack	Oyster Creek will open up a hatch at the bottom of the stack and install a deflector plate on the HCVS piping inside the stack.	Pilgrim's stack design does not require any modifications. Also, Pilgrim's stack is significantly smaller than Oyster Creek's stack (30" diameter versus 8'-6" diameter).	This extension request documents that an evaluation will be performed. The evaluation is expected to conclude that steam inerting and the velocity of the HCVS flow through the stack maintains the combustible gas concentration less than that which would result in deflagration or detonation in the stack under all conditions.
2	HCVS interfacing systems	Oyster Creek's HCVS piping routed directly to main stack; no interfacing system evaluation required.	Pilgrim's HCVS piping has several interfaces that required cross flow evaluation.	A summary of Pilgrim's interfacing systems cross flow evaluation is provided in this extension request.
3	Use of ladders/scaffolding	OC revised their HCVS strategies such that use of ladders/scaffolding not required.	One Pilgrim compensatory measure requires use of a ladder.	Pilgrim's HCVS strategy does not require use of ladders/scaffolding. One compensatory measure (loss of DC power to one of the SGTS isolation valves) would require use of a ladder to manually (pneumatically) close the valve.
4	Isolation Condensers	Oyster Creek is equipped with redundant isolation condensers.	Pilgrim is equipped with a RCIC system.	No impact; both systems provide reactor pressure vessel makeup.
5	Use of jumpers, removing/installing fuses, or use of keylock switches	Oyster Creek's HCVS strategies do not require installation of any electrical jumpers, removal/installation of fuses, or use of key lock switches.	Pilgrim's strategy requires installation of one relay jumper, two fuses, and use of one keylock switch in the main control room or manual opening of the valves at the valve station in the reactor building.	No significant difference.
6	Location of backup nitrogen connection point	Oyster Creek's backup nitrogen connection point is located outside the reactor building, is accessible, and is protected from all hazards.	Pilgrim's backup nitrogen station and valve station are located inside the reactor building, are accessible, and are protected from all hazards.	This extension request documents ability of Pilgrim's operators to access the backup nitrogen station and valve station if required.
7	HCVS piping route to main stack	Oyster Creek's HCVS piping is routed outside of the reactor building, above grade elevation, to the main stack.	Pilgrim's HCVS piping is routed underground from the reactor building to the stack.	No significant difference HCVS piping external to reactor building is protected from wind/missiles at both units.
8	Draining condensate from main stack	Oyster Creek's stack configuration includes the ability to drain the stack basin using an existing 2" drain and the stack floor drain.	Pilgrim will allow the condensate to accumulate in the stack and drain back into the HCVS low point approximately 92 hours after initiation of the HCVS, at which point the condensate will drain into the torus room area.	This difference is noted here because it is recognized that the condensate will be highly radioactive if a severe accident has occurred.
9	Implement Phase 2 of the Order (i.e., incorporate BWROG EPC Issue 1314 (SAWA/SAWM) into EPGs/SAGs)	Oyster Creek is required to implement Phase 2 of the Order, so Oyster Creek plans to incorporate BWROG EPC Issue 1314 (SAWA/SAWM) into its site-specific EPGs/SAGs.	Pilgrim is not required to implement Phase 2 of the Order, so Pilgrim does not plan to Incorporate BWROG EPC Issue 1314 (SAWA/SAWM) into its site-specific EPGs/SAGs.	The outage timing is different for the sites, resulting in Phase 2 implementation being required at Oyster Creek, but not at Pilgrim.

DETAILED EXPLANATION OF HOW PILGRIM'S PROPOSED PLAN ADDRESSES EACH ORDER CRITERION

Phase 1 Requirements (reference: NEI 13-02 R1 Table B-1 of Appendix B) HCVS Performance Objectives

A.1.1.1 Minimize reliance on operator actions

- Pilgrim's venting plan minimizes reliance on operator actions. The only additional operator actions required for the HCVS compared to the originally installed GL 89-16 vents are presented below. Two of these actions are only performed if required.
- Deploy pre-staged flexible drain hose from Auxiliary Bay connection downstream of manual valve 44-HO-114 to the torus room water seal, then open valve 44-HO-114—action drains condensate from drain trap added to HCVS piping low point prior to HCVS piping route out of reactor building and underground. Condensate that accumulates at the base of the stack will drain back into the HCVS low point (approximately 92 hours after initiation of the HCVS, ref: Calculation M1408 R0), at which point the condensate will drain into the torus room area.
- Route hose from the additional connection point near the backup nitrogen (N2) station to a continuously accessible area, where the FLEX compressor or remote N2 bottles can be placed in service.
- Replace N2 bottles or supply pneumatics (air or nitrogen) from FLEX compressor or nitrogen from remote N2 bottles, via the hose connected to the additional connection point.
- Manually (pneumatically) open both HCVS PCIVs from valve station in reactor building (*only required if safety related DC power not available to HCVS valves' solenoids*).
- Reference: Initial Phase 1 Overall Integrated Plan (OIP), pages 7/58 and 8/58, Table 2-1

A.1.1.2 Minimize operators' exposure to occupational hazards

- HCVS connections required for portable equipment are protected from all applicable screened-in hazards and located such that operator exposure to radiation and occupational hazards will be minimized. The HCVS connections are located inside the reactor building, a safety related structure. This configuration meets the requirements identified in NEI-12-06 section 11 for screened in hazards.
- The HCVS is designed to allow initiation, control, and monitoring of venting from the main control room (MCR), with monitoring of containment parameters either from the MCR or by local measurements, if necessary. This control location (MCR) minimizes plant operators' exposure to adverse temperature and radiological conditions and is protected from hazards assumed in OIP section "Part 1 (General Integrated Plan Elements and Assumptions section)".
- Reference: Initial Phase 1 OIP, page 15/58
- Reference: Initial Phase 1 OIP, page 29/58

A.1.1.3 Account for radiological conditions that would impede event response

- Based on the timing of core damage (one hour after the onset of the loss of all injection sources) and the actions to be performed, it was determined that the timing of core damage and the operation of the HCVS will not require access following core damage. Therefore, specific detailed analysis of radiological conditions is not required for Pilgrim.

DETAILED EXPLANATION OF HOW PILGRIM'S PROPOSED PLAN ADDRESSES EACH ORDER CRITERION

- A hose will be connected to the additional nitrogen connection point in the reactor building early in the severe accident sequence and routed outside the reactor building to allow connection of nitrogen cylinders to the HCVS valves' pneumatic supply tubing system. This configuration assures that an adequate long term N2 supply is available for the HCVS valves to be maintained continuously open. Required portable equipment (e.g., FLEX air compressor and/or additional N2 cylinders) will be reasonably protected from screened in hazards listed in Part 2.1.1 of Pilgrim's FLEX FIP.
- The required Operator actions taken for the FLEX strategy are all evaluated and take place before 10 hours into the event, which is the earliest time that HCVS venting is required to be initiated based on containment pressure approaching the Primary Containment Pressure Limit (PCPL) due to 250°F saturation pressure plus 40 psig hydrogen gas pressure due to core overheating.
- After HCVS venting has been placed into use, there are areas where radiation dose rates will be elevated, especially in the vicinity of the HCVS Vent Piping, which is only exposed in one localized area of the reactor building outside of the Traversing In-core Probe (TIP) Room. To accommodate this concern and provide an unlimited source of compressed air to the HVCS pneumatic controls, a pneumatic hose connection will be deployed early to connect to the existing HCVS Backup Nitrogen System and the hose laid out to allow a FLEX Air Compressor or N2 bottles to provide an unlimited source of compressed air or N2 from a remote and continuously accessible location.
- The HCVS is designed to allow initiation, control, and monitoring of venting from the MCR, with monitoring of containment parameters either from the MCR or by local measurements if necessary. This control location (MCR) minimizes plant operators' exposure to adverse temperature and radiological conditions and is protected from hazards assumed in OIP section "Part 1 (General Integrated Plan Elements and Assumptions section)".
- References:
  - Calculation M1380 Rev 0 PNPS FLEX Strategy Thermal-Hydraulic Analysis
  - Initial Phase 1 OIP, page 15/58
  - Initial Phase 1 OIP, pages 4/58 thru 6/58

A.1.1.4 Accessible controls and indications

- The HCVS is designed to allow initiation, control, and monitoring of venting from the MCR, with monitoring of containment parameters either from the MCR or by local measurements if necessary. This control location (MCR) minimizes plant operators' exposure to adverse temperature and radiological conditions and is protected from hazards assumed in OIP section "Part 1 (General Integrated Plan Elements and Assumptions section)".
- Reference: Initial Phase 1 OIP, page 19/58.

HCVS Design Features

A.1.2.1 Capacity to vent 1 percent of thermal power

- The HCVS Wetwell path is designed for venting steam/energy at a nominal capacity of 1% or greater of 2,028 MW thermal power at pressure of 56 psig (OIP reference 4D). This pressure is the lower of the containment design pressure and the PCPL value (OIP reference 9A). The size of

DETAILED EXPLANATION OF HOW PILGRIM'S PROPOSED PLAN ADDRESSES EACH ORDER CRITERION

the Wetwell portion of the HCVS is a minimum of 8" in diameter which provides adequate capacity to meet or exceed the Order criteria.

- Reference: Initial Phase 1 OIP, page 14/58.

A.1.2.2 Discharge the effluent to a release point above plant structures

- The existing GL 89-16 (HCVS) Wetwell Vent at Pilgrim includes an 8" Air-Operated Butterfly Valve, AO-5025, which is capable of venting the Wetwell airspace through an 8" branch line between PCIVs AO-5042A and B from 20" Torus Penetration X-227. The HCVS Torus Vent flow path via AO-5042B and AO-5025 connects to the 20" discharge line downstream of the SGTS filter trains, which then discharges to the plant's Main Stack (30") via a buried piping run. The HCVS will continue to use the existing HCVS discharge path to the Main Stack. The SGTS filter trains will be isolated prior to initiating the venting operation per Pilgrim procedure 5.3.36.
- The vent discharge terminates in the stack horizontally at elevation 60'-6" inside the main stack. The main stack's elevated release point is at elevation 400'-0", above grade and approximately 700' west of the station centerline.
- References:
  - Drawing M-110
  - Drawing C332A
  - UFSAR section 1.6.1.2
  - Initial Phase 1 OIP, page 14/58
  - Initial Phase 1 OIP references 8A, 8B, 8C.

A.1.2.3 Design features to minimize cross flow

- The HCVS vent valves are PCIVs for containment isolation. These containment isolation valves are Air Operated Valves (AOVs) that are air-to-open and spring-to-shut. A solenoid operated valve (SOV) must be energized to allow the motive air to open the valve. AO-5042B receives a containment isolation signal automatically de-energizing the SOV causing the AOV to shut. AO-5025 is only used for emergency venting and not during normal plant operation; therefore, it does not receive a containment isolation signal. In a beyond design basis event, steps to manually override the containment isolation function have been incorporated into operating procedures to allow for operation of the HCVS.
- The cross-flow potential experienced upstream of AO-5025 is with normally closed, fail closed PCIVs that are subjected to Appendix J testing; therefore, these are considered acceptable for minimizing cross flow between the HCVS and buildings/other systems.
- Cross-flow potential exists downstream of AO-5025 at the outlet of the SGTS. The cross flow potential at this location is minimized by isolating the discharge of the SGTS. Local manual closure of SGTS isolation valves AO-N-108 and AO-N-112 is accomplished using manual actuator overrides local to the valves in the Reactor Building, Elevation 51'.
- There is no cross flow potential for the other systems that also discharge to the Main Stack. The potential for unintended cross flow and hydrogen migration is precluded for systems that have open-ended vertical exhaust piping in the vertical base section of the Main Stack.
- References:
  - Initial Phase 1 OIP, page 16/58
  - Initial Phase 1 OIP references 1E, 1R
  - Initial Phase 1 OIP references 4C, 6A

DETAILED EXPLANATION OF HOW PILGRIM'S PROPOSED PLAN ADDRESSES EACH ORDER CRITERION

- A strong argument for minimizing cross flow of combustible gases into the SGTS by closure of the SGTS isolation valves in series with backdraft dampers is presented in the TEPCO report "TEPCO Fukushima Nuclear Accident Analysis Report" dated June 20, 2012 (http://www.tepco.co.jp/en/nu/fukushima-np/interim/index-e.html). TEPCO concluded in this report that the most likely reason for the explosion in the Fukushima Daiichi U4 reactor building was due to cross flow of venting gasses (i.e., hydrogen) from the U3 PCV piping via the common stack due to the absence of backdraft dampers on U4's SGTS filter trains. The TEPCO report states in part on page 346: "*Normally the SGTS is on standby and not in operation; and the air operated valves installed in the system are closed. Therefore, even if PCVS venting gasses flowed from the Unit 3 side they should not have flowed into Unit 4. However, the circumstances of the Fukushima Daiichi NPS accident, in particular the extended complete SBO at multiple adjacent units, exceeded accident management assumptions and the Unit 3 PCV was vented amidst an SBO. Similarly, Unit 4 also became SBO, and the valves of the SGTS, which are designed to operate in the event of an emergency, opened automatically with the loss of power thereby creating a line by which PCV venting gasses from Unit 3 could flow into Unit 4 via SGTS piping. There is a high possibility that it is in this way that hydrogen generated by the Unit 3 reactor flowed into Unit 4, accumulated, and exploded.*" The TEPCO report also states in part on page 351: "*...at Fukushima Daiichi Unit 4, as mentioned earlier, since the valves on the standby side are kept closed in that one system is in operation and the other system is on standby, a backflow prevention damper was considered as unnecessary and has never been installed..*". The TEPCO report also states in part on page 352: "*...As a result of the post-accident examination on the possibility of vent gasses flowing into the SGTS in conducting PCV venting, it is considered that backflow of gasses (including hydrogen) into the reactor building via the SGTS at Units 1 to 3 was limited due to the installation of backflow prevention dampers. On the other hand, as mentioned earlier, in the case of Unit 4, vented gasses from Unit 3 flowed into the Unit 4 reactor building.*" These conclusions are also referenced in NAS publication "Lessons Learned from the Fukushima Nuclear Accident for Improving Safety of U.S. Nuclear Plants" (ISBN 98-0-309-27253-7); the footnote on page 4-24 states: "*TEPCO (2012b, p. 351-352) notes that the standby gas treatment system may not have been isolated from the stack at the time of venting*".

A.1.2.4 Operation from control panel for sustained operations

- The Pilgrim Wetwell HCVS is capable of being manually operated during sustained operations from a control panel located in the MCR and will meet the requirements of Order Element 1.2.4. The MCR is a readily accessible location with no further evaluation required. MCR dose associated with HCVS operation conforms to General Design Criteria (GDC) 19. The HCVS is designed to allow initiation, control, and monitoring of venting from the MCR.
- Reference: Initial Phase 1 OIP reference 1E
- Reference: Initial Phase 1 OIP , pages 18/58 & 19/58

A.1.2.5 Alternate manual operation capability

- Pilgrim has the ability to perform alternate manual operation to place the HCVS in service. This action can be implemented provided radiological conditions are acceptable considering emergency dose limits.
- Reference: Initial Phase 1 OIP, page 15/58

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A.1.2.6 Operation with permanently installed equipment for 24 hours

- Pilgrim installed a pneumatic source that provides much greater than 24 hours of motive force to open the HCVS valves to assure the HCVS is capable of providing the FLEX anticipatory vent function. This pneumatic source also includes an additional connection point to which N2 cylinders can be connected from outside the reactor building. A hose will be connected to the additional N2 connection point early in the severe accident sequence and routed outside the reactor building to allow connection of N2 cylinders to the HCVS valves' pneumatic supply tubing system (guidance to be developed). This configuration assures that an adequate long term N2 supply is available for the HCVS valves to be maintained continuously open. Since Entergy has decided to shutdown Pilgrim in 2019, Entergy will credit the safety related station batteries (FLEX backed) in lieu of installing an HCVS-specific power system. The RAI 6 response contains the detailed evaluation of the safety related station batteries' coping times and documents that these batteries' chargers are re-powered by the FLEX portable diesel generators.
- Reference: Extension request response to RAI 6.

A.1.2.7 Prevention of inadvertent actuation

- The primary feature that prevents inadvertent actuation from the MCR is two PCIVs in series powered from different divisions.
    - The downstream vent valve AO-5025 requires installation of two fuses in the MCR to allow opening of the valve.
    - The upstream vent valve AO-5042B requires installation of a jumper to defeat the containment isolation signal, after which its keylock switch will be used to open the valve.
    - Procedures also provide clear guidance to not circumvent containment integrity by simultaneously opening Torus and Drywell Vent Valves during any design basis transient or accident.
- The primary feature that prevents inadvertent actuation at the HCVS Local Panel (reactor building elevation 23') is locked open solenoid vent valves which prevent pressurization of the valve actuators should the nitrogen supply valves be inadvertently opened.
- References:
    - Initial Phase 1 OIP reference 5A
    - Initial Phase 1 OIP reference 5B
    - Initial Phase 1 OIP references 7B, 7C
    - Initial Phase 1 OIP, page 17/58.

A.1.2.8 Monitoring of vent status from control panel

- The HCVS and SGTS valves' indications will be verified using the indicating lights in the MCR.
- Since the instrumentation dedicated for containment pressure monitoring is AC powered, the containment pressure will have alternate monitoring by using the RCIC or High Pressure Coolant Injection (HPCI) suction pressure instrumentation which are powered by the 125/250 VDC System. The containment pressure monitoring instrumentation will be available upon the installation of the FLEX diesels generators supplying power to the 120 VAC distribution panels (Y3/Y31 and/or Y4/Y41).

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- Reference: Initial Phase 1 OIP, pages 18/58 & 19/58
- Reference: Initial Phase 1 OIP reference 3A

A.1.2.9 Means to monitor the effluent discharge

- Pilgrim plans to use the existing SGTS and HCVS radiation monitors. The SGTS radiation monitor is a low range (10 Rad/Hr) monitor powered from the 250 VDC vital motor generator set (robust IAW with current design basis) and is available for at least the initial eight hours of the ELAP event. The HCVS radiation monitor is a high range (10,000 Rad/Hr) monitor repowered before eight hours after the ELAP event by the FLEX diesel generators connected to the Post Accident Monitoring (PAM) system.
- Reference: Extension request RAI-9 response

A.1.2.10 Design for severe accident and dynamic conditions

- The Operator actions taken for the FLEX strategy are all evaluated and take place before 10 hours into the event, which is the earliest time that HCVS venting is required to be initiated based on containment pressure approaching PCPL due to 250°F saturation pressure plus 40 psig hydrogen gas pressure due to core overheating. This includes the bulleted items below:
  - Installation of a condensate drain hose from Auxiliary Bay, Elevation 3' to the Torus Room.
  - Isolating the outlet of the SGTS using valves AO-N-108 and AO-N-112 (Reactor Building, Elevation 51'). Note: This is a compensatory measure that would only be required if the safety related (FLEX-backed) DC power were lost to the SGTS' isolation valves' solenoids.
- System control:
  - Active: Same as for OIP section "BDBEE Venting Part 2"
  - Passive: Same as for OIP section "BDBEE Venting Part 2"
- References:
  - Calculation M1380 Rev 0 PNPS FLEX Strategy Thermal-Hydraulic Analysis
  - Initial Phase 1 OIP, pages 21/58
  - Initial Phase 1 OIP, page 22/58
  - Initial Phase 1 OIP, page 26/58

A.1.2.11 Flammability control

- Pilgrim has determined that the most viable and sensible approach to accommodate Hydrogen (H2) gas generation due to core overheating events is to ensure that the H2 is vented from Primary Containment as a steam-diluted mixture via the HCVS vent path. Once initiated, containment venting provides a continuous vent flow path until an alternate method of Containment Heat Removal has been established and is functioning at a sufficient rate to provide all further Heat Removal. The HCVS Wetwell Vent pipeline from the Torus to the Main Stack will remain steam

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inerted; thus preventing accumulation of detonable gases or the infiltration of oxygen into the HCVS vent pipeline at all times that it is in use.

- Considering the overall objective of maintaining continuous core cooling and precluding or preventing additional core damage and the resulting release of radioactive products, there are no instances where an established Containment Venting Strategy is intermittently stopped until alternative Heat Removal is established, with due consideration that full cycling (Open-Closed-Open) of an operating Containment Vent may result in Condensation Water Hammer and/or Deflagration of Combustible Gases in the Vent System, resulting in a more deteriorated overall condition and negative consequences for the principal objectives of protecting Containment, maintaining Core Cooling, and minimizing the release of radioactive material. If needed, the vent flow rate may be reduced by controlled throttling of the HCVS System valves, using Containment Temperature and Pressure indications for guidance. This would not be needed until at least several days into a successful FLEX injection and venting strategy.
- Reference: Initial Phase 1 OIP, pages 15/58 & 16/58

A.1.2.12 Designed to minimize hydrogen gas migration

- See response to A.1.2.3 above

A.1.2.13 Operation, testing, inspection and maintenance

- While Pilgrim will comply with the current established testing and inspection, the abbreviated operating timeframe (i.e., one operating cycle after spring 2017 refueling outage) will not require development of detailed plans for HCVS testing and inspection required by the Order.

HCVS Quality Standards

A.2.1 Design basis of containment isolation function

- The design basis of the containment isolation function is not impacted by Pilgrim's HCVS strategies.
- See response to A.1.2.7

A.2.2 Reliable and rugged performance

- The HCVS downstream of the second containment isolation valve, including piping and supports, valves and the valve actuators' pneumatic supplies, have been designed/analyzed to conform to the requirements consistent with the applicable design codes (e.g., Non-safety, Cat 1, ASME or B31.1, NEMA 4, etc.) for the plant and to ensure functionality following a design basis earthquake.
- Reference: Initial Phase 1 OIP, page 20/58

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HCVS Programmatic Requirements

A.3.1 Develop, implement, and maintain procedures

- Venting for primary containment pressure control without core damage (and therefore no combustible gases) is directed by steps in the Emergency Operating Procedures (EOPs). Venting with core damage (i.e., including combustible gas control) and primary containment pressure control is directed by steps in the Severe Accident Management Guidelines (SAMGs) and implemented through support procedures.
- Reference: Initial Phase 1 OIP, page 34/58

A.3.2 Train appropriate personnel

- Personnel expected to perform direct execution of the HVCS receive necessary training in the use of plant procedures for system operations when normal and backup power is available and during ELAP conditions. The training is refreshed on a periodic basis. Training content and frequency will be established using the Systematic Approach to Training (SAT) process. In addition, personnel on-site during an event would be available to supplement trained personnel.
- Reference: Initial Phase 1 OIP, page 34/58
- Reference: Initial Phase 1 OIP reference 1J

Phase 2 Requirements (reference NEI 13-2 R1 Table B-1 of Appendix B)

B.1.1 Meet performance objectives, design features, quality requirements, and programmatic requirements

- Pilgrim is permanently ceasing operation no later than June 1, 2019. This cessation date is prior to the June 30, 2019 Phase 2 Order date.

B.1.2 Justify confidence drywell vent is not necessary

- Pilgrim is permanently ceasing operation no later than June 1, 2019. This cessation date is prior to the June 30, 2019 Phase 2 Order date.

Phase 2 SAWA/SAWM Requirements (reference NEI 13-2 R1 Appendix I)

I.1.2 Water Addition Point

- Pilgrim is permanently ceasing operation no later than June 1, 2019. This cessation date is prior to the June 30, 2019 Phase 2 Order date.

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I.1.3 RPV Pressure Control

- Pilgrim is permanently ceasing operation no later than June 1, 2019. This cessation date is prior to the June 30, 2019 Phase 2 Order date.

I.1.4 Water Addition Source

- Pilgrim is permanently ceasing operation no later than June 1, 2019. This cessation date is prior to the June 30, 2019 Phase 2 Order date.

I.1.5 Motive Force

- Pilgrim is permanently ceasing operation no later than June 1, 2019. This cessation date is prior to the June 30, 2019 Phase 2 Order date.

I.1.6 Instrumentation

- Pilgrim is permanently ceasing operation no later than June 1, 2019. This cessation date is prior to the June 30, 2019 Phase 2 Order date.

I.1.7 Severe Accident Considerations

- Pilgrim is permanently ceasing operation no later than June 1, 2019. This cessation date is prior to the June 30, 2019 Phase 2 Order date.

Comparison to NEI 13-02, Revision 1, Appendix C, Severe Accident Water Management:

- Pilgrim is permanently ceasing operation no later than June 1, 2019. This cessation date is prior to the June 30, 2019 Phase 2 Order date.

Significant attributes of the water management strategy that will be implemented include:

- Pilgrim is permanently ceasing operation no later than June 1, 2019. This cessation date is prior to the June 30, 2019 Phase 2 Order date.

Significant existing plant design features that support the water management strategy include:

- Pilgrim is permanently ceasing operation no later than June 1, 2019. This cessation date is prior to the June 30, 2019 Phase 2 Order date.

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RAI responses are applicable to Pilgrim's HCVS strategies. However, when possible, identical wording from the Oyster Creek responses is utilized for ease of review. In some cases, the differences between plant designs limit the applicability of the RAIs to Pilgrim's HCVS strategies. Pilgrim is permanently ceasing operation no later than June 1, 2019.

RAI-1

Discuss the environmental conditions to which the operators would be subjected in order to accomplish these actions. Discuss the availability of operator aids (such as ice vests or self-contained breathing apparatus) needed to perform these tasks, if applicable.

Pilgrim Response

The GL 89-16 HCVS currently installed at Pilgrim is capable of performing during a Station Blackout (SBO) event. The safety related (FLEX-backed) DC power to the pilot solenoids controlling the motive force (pneumatics) to the HCVS AOVs is maintained available via load shedding and re-powering of the batteries' chargers with a FLEX portable diesel generator. The time this DC power will remain available is discussed in the response to RAI-6 below. The AOVs' motive force will be available from the backup N2 supply in the reactor building, which was added to the plant design to support FLEX anticipatory venting. The duration that the backup N2 supply can supply this motive force is discussed in the response to RAI-5 below.

As noted above, a plant modification has been installed to provide the HCVS AOVs with a N2 backup system designed to provide the pneumatic motive force if the instrument air system is no longer capable of providing adequate pressure to open the HCVS valves. The backup N2 supply is equipped with two regulators, one regulator set to provide N2 from two N2 bottles if instrument air pressure drops below 88 psig nominal pressure and another regulator set to provide N2 from two additional N2 bottles if instrument air pressure drops below 83 psig nominal pressure. Therefore, the venting operation will normally be performed IAW the existing EOPs from the MCR. The design criterion for this pneumatic supply is that two bottles are capable of cycling the HCVS valves a total of five times over a 72 hour time period. This is a very conservative measure due to the fact that the HCVS strategy is to maintain the HCVS AOVs continuously open once they are opened in response to a Beyond Design Basis External Event (BDBEE). In addition, a hose will be connected to an additional N2 connection point included in the HCVS valves' modified pneumatic supply system (located near the backup N2 station) early in the severe accident sequence and routed outside the reactor building to allow connection of N2 cylinders to the HCVS valves' pneumatic supply tubing system. This configuration assures that an adequate long term N2 supply is available for the HCVS valves to be maintained continuously open. This backup N2 station, along with the capability to connect N2 cylinders outside the reactor building, increases HCVS operational capabilities during an ELAP and limits operator environmental and radiological exposure when implementing compensatory actions.

Compensatory Measures

The outboard HCVS valve, AO-5025, can be manually opened by dispatching an operator to unlock/close the pneumatic system vent piping isolation valves 31-HO-409 and 31-HO-413 and to unlock/open the pneumatic system pressure supply isolation valves 31-HO-407 and 31-HO-411, all of which are located at the valve station in the reactor building. The inboard HCVS valve, AO-5042B, can be manually opened by dispatching an operator to unlock/close the pneumatic system vent piping isolation valves 31-HO-410 and 31-HO-414 and to unlock/open the pneumatic system pressure

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supply isolation valves 31-HO-408 and 31-HO-412, all of which are located at the valve station in the reactor building. If manual operation of the HCVS valves is required, it will be performed early. This action can be implemented provided radiological conditions are acceptable considering emergency dose limits. Therefore, the use of devices such as ice vests or self-contained breathing apparatus would not be required in order to operate the HCVS.

The location of the backup N2 station took into consideration the environmental and radiological conditions to which the operator would be exposed during an event. Since the backup N2 station is located in the reactor building, it is protected from severe external events. The valves used to manually open HCVS valves AO-5025 and AO-5042B are located at the valve station, approximately 10' from the backup N2 station. Use of the valves is a simple operation and does not require disassembly or reassembly of components. Additionally, the modifications described have increased system operational capabilities during an ELAP and limit operator environmental and radiological exposure when implementing compensatory actions.

If either the safety related (FLEX-backed) DC power or the safety related 30-day instrument air supply is lost to SGTS isolation valve's AO-N-108 air actuator, the valve will fail open. In this unlikely scenario, station operators would be required to perform steps in Attachment 9 of Pilgrim site procedure 5.3.36 to manually close this valve by removing and replacing this valve's solenoid and its tubing with a tubing "kit" (staged in the SGTS room) prior to venting using the HCVS. If this compensatory action is required, station operators would be required to access the valve using a ladder.

<u>RAI-2</u>

Discuss the operator's ability to complete the tasks in the assumed dose fields. Has a site specific analysis in accordance with the guidance of NEI 13-02, Appendices F and G been performed to determine the predicted radiological conditions which would be applicable at OCNGS following a severe accident? If not, discuss the differences between the NEI 13-02, Appendices F and G analysis and the dose assumptions used at OCNGS.

<u>Pilgrim Response</u>

NEI 13-02, Appendix F requires evaluation of operator dose under the severe accident conditions that may be present under an EA-13-109 order scenario. NEI 13-02, Appendix G requires evaluation of source terms for the HCVS under the severe accident conditions that may be present under an EA-13-109 order scenario. After HCVS venting has been placed into use, there are areas where radiation dose rates will be elevated, especially in the vicinity of the HCVS vent piping, which is only exposed in one localized area of the reactor building outside of the TIP Room. To accommodate this concern and provide an unlimited source of compressed air to the HVCS pneumatic controls, a pneumatic hose connection will be deployed early to connect to the existing HCVS Backup N2 System and the hose laid out to allow a FLEX air compressor or N2 bottles to provide an unlimited source of compressed air or N2 from a remote and continuously accessible location.

The HCVS is designed to allow initiation, control, and monitoring of venting from the MCR, with monitoring of containment parameters either from the MCR or by local measurements if necessary. This location (MCR) minimizes plant operators' exposure to adverse temperature and radiological conditions and is protected from hazards assumed in OIP section "Part 1 (General Integrated Plan Elements and Assumptions section)".

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Pilgrim's NRC GL 89-16 HCVS was specifically designed to vent the equivalent of 1% thermal energy in response to the original BWR accident sequence as described in NUREG-75/014, Appendix V, page V-58 as a failure of long term decay heat removal from the containment following a plant transient and trip from hot operating conditions. For this sequence, the reactor is sub-critical, steam is released to the suppression pool via the main steam safety valve(s) and makeup to the reactor is available. As part of the development of the FLEX and HCVS Strategies in response to NRC Orders EA-12-049 and EA-13-109, the HCVS 1% thermal energy venting capacity was validated and the range of operation expanded to also cover operation at reduced temperatures and pressures.

Reference: Calculation M1380 Rev 0 PNPS FLEX Strategy Thermal-Hydraulic Analysis
Reference: Calculation M1387 Rev 0 Hardened Containment Vent Capacity

Compensatory Measures

Pilgrim has modified the pneumatic supply to the HCVS isolation valves, AO-5025 and AO-5042B, to enhance the capability of the HCVS during ELAP conditions. A backup N2 station has been installed in the reactor building to provide a long term pneumatic motive force to the HCVS isolation valves, extending the availability of this motive force. A valve station modification has also been installed in the reactor building which provides a means of operating the HCVS isolation valves manually (pneumatically) in the event the station were to experience a total loss of station AC power, DC power, and the normal instrument air supply. A pneumatic hose connection will be deployed early to connect to the existing HCVS Backup N2 System and the hose laid out to allow a FLEX Air Compressor or N2 Bottles to provide an unlimited source of compressed air or N2 to the HCVS Pneumatic Controls from a remote and continuously accessible location.

After HCVS venting has been placed into use, there are areas where radiation dose rates will be elevated, especially in the vicinity of the HCVS vent piping, which is only exposed in one localized area of the reactor building outside of the TIP Room. To accommodate this concern and provide an unlimited source of compressed air to the HVCS pneumatic controls, a pneumatic hose connection will be deployed early to connect to the existing HCVS Backup N2 System and the hose laid out to allow a FLEX air compressor or N2 bottles to provide an unlimited source of compressed air or N2 from a remote and continuously accessible location

The HCVS is designed to allow initiation, control, and monitoring of venting from the MCR, with monitoring of containment parameters either from the MCR or by local measurements if necessary. This location (MCR) minimizes plant operators' exposure to adverse temperature and radiological conditions and is protected from hazards assumed in OIP section "Part 1 (General Integrated Plan Elements and Assumptions section)".

If the safety related (FLEX-backed) DC power is available, station operators must install a jumper in the MCR IAW station procedure 5.3.21 to bypass isolation signals to allow opening of AO-5042B. Also, station operators must install two fuses IAW procedure 5.4.6 to allow opening of AO-5025, which is opened using a keylocked switch. Once these actions have been taken, both HCVS valves can be opened from the MCR. Operators are periodically trained on EOPs. This operator training includes items such as job performance measures.

SGTS isolation valve AO-N-112 fails closed due to loss of electrical power or loss of motive air. SGTS isolation valve AO-N-108 fails open due to loss of electrical power or loss of motive air. Both SGTS isolation valves are powered by safety related 125 VDC busses evaluated per the FLEX strategies to maintain adequate voltage during a BDBEE. These batteries' chargers are re-powered before the batteries before battery voltage has decreased to an unacceptable level per the existing FLEX strategies. Also, both SGTS isolation valves are supplied motive air from existing safety related

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accumulators that provide a 30-day supply of motive air. Therefore, these SGTS isolation valves will normally be closed, with their positions verifiable from the MCR. If either the safety related (FLEX-backed) DC power or the safety related 30-day air supply is not available to these SGTS isolation valves, AO-N-112 will fail closed and a station operator will be required to manually close AO-N-108 by removing and replacing the valve's solenoid and tubing with a tubing "kit" (staged in the SGTS room) that provides motive air directly to the valve's actuator. If manual closure of AO-N-108 is required, this compensatory action will require use of a ladder. The steps required for this action are provided in Attachment 9 of site procedure 5.3.36. These steps (if required) are performed prior to opening the HCVS PCIVs AO-5025 and AO-5042B from the MCR IAW procedure 5.9.8.1 or manually opening the PCIVs in the reactor building IAW procedure 5.9.8.3.

RAI-3

Provide a description of the differences, if any, between the guidance stated in NEI 13-02, Section 4.1.5.2.3, and the actual, physical configuration and/or capabilities of the containment venting system which will be in operation during the requested period of extension. Include a description of compensatory measures, if any, which will be utilized to achieve equivalent or similar capabilities as required by the order and described in the guidance.

Pilgrim Response

Pilgrim's NRC GL 89-16 external hardened vent path is protected against wind (hurricane or tornado) generated missiles because the HCVS piping is routed inside the reactor building, is then routed underground from the reactor building to the main stack, then terminates inside the main stack below grade. The vent discharge terminates in the stack horizontally at elevation 60'-6". The main stack's elevated release point is at elevation 400'-0", above grade and approximately 700' west of the station centerline.

As described above, the portions of the existing vent path installed in response to NRC GL 89-16 that exist outside safety-related structures are either underground or inside the main stack. The backup N2 supply and valve station panel described in the response to RAI-1 above are installed in the safety related reactor building (elevation 23') such that the backup N2 supply is protected from wind generated missiles.

Pilgrim's main stack is not designed to withstand tornado wind loading. Since the stack is located approximately 700' away from safety related plant structures, even if the stack were to collapse due to wind related loadings, its failure would not impact other safety related structures. To assure the FLEX anticipatory vent function would be available if this failure were to occur, Pilgrim modified the stack dilution system ductwork to provide a parallel discharge path that can be manually placed in service if needed.

References:

- Drawing M210
- Drawing C332A
- UFSAR section 1.6.1.2
- EC-0000052380 FLEX Stack Alternate Vent Duct Exhaust Port & Steam Condensate Drain Installation

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RAI-4

For the actions listed in the OCNGS UFSAR Section 6.2.7.2.2 quoted above, clarify whether any of the proposed operator actions require temporary ladders or operations atop scaffolding to accomplish the objectives.

Pilgrim Response

Pilgrim's HCVS will be operated as described in the response to RAI-1 above. The air operated HCVS isolation valves would be opened in the MCR. Closure of the SGTS isolation valves would also be verified in the MCR.

Compensatory Measures

As described in the response to RAI-1, a backup nitrogen supply and a valve station panel have been installed in the reactor building to enhance the capability of the HCVS during ELAP conditions. If the safety related (FLEX-backed) DC power is lost to the HCVS valves' solenoids, the HCVS valves can be manually opened and closed from the valve station panel. The backup nitrogen supply includes four nitrogen bottles. Two of the nitrogen bottles provide nitrogen gas to the HCVS valves when instrument air pressure drops below 88 psig nominal pressure and two nitrogen bottles will provide nitrogen gas to the HCVS valves when instrument air pressure drops below 83 psig nominal pressure, thereby extending the availability of this motive force. As described in the response to RAI-1, two nitrogen bottles are capable of cycling the HCVS valves five times over a 72 hour duration. This capability of cycling the HCVS valves five times is a very conservative measure because Pilgrim's strategy is to maintain the HCVS valves continuously open for the duration of a BDBEE. Also, the backup nitrogen station is equipped with two additional nitrogen bottles that provide nitrogen gas to the HCVS valves when instrument air pressure drops to 83 psig nominal pressure; these bottles provide 100% backup volume to the nitrogen bottles initially used in the event. The backup nitrogen supply is also equipped with another connection point to which additional nitrogen bottles can be connected if required. A pneumatic hose connection will be deployed early to connect to the existing HCVS Backup N2 System and the hose laid out to allow a FLEX air compressor or N2 Cylinders to provide an unlimited source of compressed air or N2 from a remote and continuously accessible location. The backup N2 supply modification and procedure changes have provided a means of operating the HCVS isolation valves from the backup nitrogen supply and valve station panel in the reactor building with a total loss of station AC, DC, and instrument air supply. The control switches used to open and close the HCVS isolation valves are located in the MCR. The HCVS isolation valves' and SGTS isolation valves' indicating lights are located in the MCR. The backup nitrogen supply and valve station panel are located in the reactor building.

Since the backup N2 supply and valve station panel are located in the reactor building, the backup N2 supply is protected from severe external events. The connections (i.e., N2 bottle replacements) are simple and do not require the disassembly or reassembly of components. The only scenario in which a ladder will be required is if either the safety related (FLEX-backed) DC power supply or the safety related 30-day air supply were lost to the SGTS isolation valves. In the unlikely event this were to occur, station operators would be required to manually close SGTS isolation valve AO-N-108, which fails open, by removing and replacing its solenoid valve and its tubing with a tubing "kit" (staged in the SGTS room) that would directly apply gas pressure to the actuator.

The compensatory measures will provide a means to reposition the HCVS isolation valves using the backup nitrogen supply and valve station, both of which are located in the reactor building, during a

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loss of all station AC and DC power. The backup nitrogen supply and valve station provide a parallel source of motive force to open the HCVS valves that automatically goes into service due to loss of instrument air and can be used to manually (using pneumatics) open the HCVS isolation valves. As noted above, the only scenario for which compensatory measures would require operators to use a ladder is if the station operators are required to manually close SGTS isolation valve AO-N-108 in the unlikely event the valve were to lose its safety related (FLEX-backed) DC power supply or its safety related 30-day air supply.

RAI-5

Provide a site-specific justification which describes how the six cycles of motive force available in the accumulators is sufficient to support the OCNGS procedural actions to cope with the first 24 hours of a postulated severe accident. Include a description of compensatory measures, if any, which will be utilized to achieve equivalent or similar capabilities as required by the order and described in the guidance during the requested period of extension.

Pilgrim Response

The backup nitrogen supply and valve station installed in the reactor building provide a backup motive pneumatic force for HCVS isolation valves AO-5025 and AO-5042B. The backup N2 supply and valve station were sized to allow cycling of both HCVS valves five times over a 72 hour timeframe using two nitrogen bottles. Since Pilgrim's strategy is to maintain the HCVS continuously open once it is placed in service during a BDBEE, the five cycles in 72 hours design is an extremely conservative design criterion. In addition, two N2 bottles have been evaluated to contain 246.5 standard cubic feet (SCF), 191.1 SCF more than the 55.4 SCF required to cycle both HCVS valves five times. The backup nitrogen supply includes four nitrogen bottles. Two bottles provide motive force when the instrument air system pressure drops below 88 psig (nominal) and the other two bottles provide motive force when the instrument air system pressure drops below 83 psig (nominal). A pneumatic hose connection will be deployed early to connect to the existing HCVS Backup N2 System and the hose laid out to allow a FLEX Air Compressor or N2 Cylinders to provide an unlimited source of compressed air or N2 from a remote and continuously accessible location.

Reference: Calculation M1386 R.0 HCVS Vent Valves AO-5025 and AO-5042B Backup N2 System

Compensatory Measures

If the HCVS isolation valves' safety related (FLEX-backed) DC power is available, the valves are opened/closed using the valves' control switches in the MCR. In the unlikely event the valves' safety related (FLEX-backed) DC power is unavailable, the backup nitrogen supply and valve station provide the capability to manually open the HCVS valves pneumatically. The location of the backup nitrogen supply allows for replacement of nitrogen bottles, indefinitely extending the availability of the HCVS isolation valve motive force. A pneumatic hose connection will be deployed early to connect to the existing HCVS Backup N2 System and the hose laid out to allow a FLEX Air Compressor or N2 Cylinders to provide an unlimited source of compressed air or N2 from a remote and continuously accessible location. The modification and procedure changes have provided a means of opening the HCVS isolation valves with a total loss of station AC, DC and instrument air supply using the backup nitrogen supply and valve station panel.

Since the backup N2 station and valve station are located in the reactor building, they are protected from severe external events. The connections (e.g., connecting additional nitrogen bottles) are simple and do not require disassembly or reassembly of components. The only scenario in which a ladder is

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required is if SGTS isolation valve AO-N-108 must be manually closed in the unlikely event it loses either its safety related (FLEX-backed) DC power or its safety related 30 day air supply.

RAI-6

The extension request states that, "Power for the solenoid valves is available as long as "B" battery can supply power and indefinitely once the FLEX generator restores the "B" battery charger. What is the length of time the "B" battery can supply power to the solenoid valves before the FLEX generator is required?

Pilgrim Response

Pilgrim Station 125V and 250V DC Load Flow Studies concluded the following in regards to DC power supplies needed to support the FLEX strategies:

- The 125V ‘A’ DC system provides adequate voltage for eight hours assuming load shedding occurs at two hours, five hours, and eight hours.
- The 125V ‘B’ DC system provides adequate voltage for 10.5 hours assuming load shedding occurs at two hours, five hours, and after ten hours.
- The 250V DC system provides adequate voltage for 10 hours assuming load shedding occurs at 2 hours, five hours, eight and-a-half hours, and after ten hours.
- With the load stripping performed IAW the FLEX Support Guidelines (FSGs), the usable station Class 1E battery life is extended beyond eight hours for the station batteries, with the intention that the FLEX diesel generators will have repowered the DC Battery Chargers within that timeframe, well before battery voltage has decreased to an unacceptable level.
- Reference: Calculation PS258 R1 125V and 250V DC Load Flow Studies – Fukushima Response Project
- Reference: FLEX FIP Page 12/115

Compensatory Measures

The backup N2 supply and valve station panel, both of which are located in the reactor building, provide a backup compressed gas supply to the HCVS isolation valves, extending the availability of this motive force. The location of the N2 supply station and valve station panel allow for replacement of the compressed gas source, indefinitely extending the availability of the HCVS isolation valve motive force. The modification and procedure changes provided a means of operating the HCVS isolation valves in the unlikely event of a total loss of station AC, DC and instrument air supply, from the backup N2 supply and valve station panel. If the HCVS isolation valves' safety related (FLEX-backed) DC power is available, the valves are opened/closed using the valves' control switches in the MCR and the HCVS and SGTS isolation valves' position indications will be monitored in the MCR.

Since the backup N2 supply and valve station panel are located in the reactor building, the backup N2 supply is protected from severe external events. The connections (e.g., nitrogen bottle replacement) are simple and do not require disassembly or reassembly of components. The only scenario in which a ladder is required is if SGTS isolation valve AO-N-108 must be manually closed in the unlikely event it loses either its safety related (FLEX-backed) DC power or its safety related 30-day air supply. Also, station operators have the capability to manually (using pneumatics) open/close the HCVS isolation valves using the backup N2 supply and valve station panel, in the unlikely event the instrument air or safety related (FLEX-backed) DC power is lost.

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RAI-7

The extension request states, "If there is a loss of station air, AC and DC power, then the current site B.5.b procedures direct manual opening of the HCVS isolation valves." Provide a description of how the manual opening and keeping open of the containment isolation valves is accomplished.

Pilgrim Response

FSG 5.9.8.3 provides direction to station operators in regards to opening the HCVS isolation valves using the backup N2 supply and valve station panel. The HCVS valves are verified to have stroked open from MCR panel C7. Once the HCVS isolation valves are opened, they are maintained continuously open.

Compensatory Measures

Pilgrim installed modifications that enhanced the capability of the HCVS during ELAP conditions. The modifications installed a backup N2 supply and a valve station panel in the reactor building, extending the availability of this motive force. A pneumatic hose connection will be deployed early to connect to the existing HCVS Backup N2 System and the hose laid out to allow a FLEX Air Compressor or N2 Cylinders to provide an unlimited source of compressed air or N2 from a remote and continuously accessible location. The modification and procedure changes have provided a means of operating the HCVS isolation valves using the backup nitrogen supply and valve station panel in the event of a total loss of station AC, DC and instrument air supply.

In the unlikely event the safety related 30-day air supply or the safety related (FLEX-backed) DC power is lost to SGTS isolation valve AO-N-108, procedure 5.3.36 provides direction to manually close SGTS isolation valve AO-N-108 (this valve fails open due to loss of air supply or loss of DC power) by removing and replacing the valve's SOV and its tubing with a tubing "kit" staged in the SGTS room. The procedure and system configuration as currently designed require working from a ladder to connect the tubing "kit" to AO-N-108's air operator.

Since the backup N2 station is located in the safety related reactor building, it is protected from severe external events. With exception of the compensatory steps to manually close SGTS isolation AO-N-108 valve described above, connections (e.g., replacement of a N2 bottle) are simple and do not require disassembly or reassembly of components. As noted above, if SGTS isolation valve AO-N-108 must be manually closed by installing the staged tubing "kit", a ladder would be required to access the tubing. Otherwise, the use of ladders or scaffolding will not be required to implement venting operations.

RAI-8

Provide a description of the differences, if any, between the guidance in NEI 13-02, Section 4.2.2, and the actual, physical configuration and/or capabilities of the containment venting system which will be in operation during the requested period of extension. Include a description of compensatory measures, if any, which will be utilized to achieve equivalent or similar capabilities as required by the order and described in the guidance during the requested period of extension.

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Pilgrim Response

NEI 13-02, Section 4.2.2 specifies that a control panel for sustained operation of the HCVS be designed with the ability for manual operation with means of monitoring the status of the vent system (e.g., radiation, temperature, pressure, and valve position indication) and that the monitoring system shall be designed for sustained operation during an extended loss of AC power. The HCVS should include indications for the containment pressure and wetwell level for determination of vent operation. Other aspects of NEI 13-02, Section 4.2.2 are addressed in the responses to RAI-2 and RAI-7 above.

There is no effluent temperature monitoring of the HCVS piping. The HCVS utilizes the existing stack radiation monitor and its instrumentation, which is currently instrumented to the MCR. During an ELAP, the stack effluent process radiation monitoring system is non-functional (as described in the response to RAI-9 below). There is no pressure indication of the HCVS piping locally or in the MCR. Operators will rely on containment pressure and Torus water level indication in making the decision to vent. Torus level and containment pressure indications are available in the MCR during an ELAP.

The HCVS valves' control switches and position indicating lights and the SGTS valves' position indicating lights are located in the MCR. As described in the response to RAI-2, AO-5042B's isolation signal is bypassed by installing a jumper in the MCR to allow this valve to be opened with an isolation signal present. Position indications for HCVS CIVs AO-5025 and AO-5042B remain available in the MCR during an ELAP because both are powered by the 125 VDC batteries that have been evaluated to provide adequate voltage for at least eight hours (also, the FLEX portable diesel generator re-powers the battery chargers between four hours and eight hours, ref: FLEX FIP).

Compensatory Measures

Pilgrim installed modifications that enhanced the capability of the HCVS during ELAP conditions. The modifications installed a backup N2 supply and valve station panel in the reactor building, extending the availability of this motive force. The location of the backup N2 supply will allow for replacement of an exhausted N2 bottle, indefinitely extending the availability of the HCVS isolation valve motive force. A pneumatic hose connection will be deployed early to connect to the existing HCVS Backup N2 System and the hose laid out to allow a FLEX Air Compressor or N2 Cylinders to provide an unlimited source of compressed air or N2 from a remote and continuously accessible location. The modification and procedure changes have provided a means of operating the HCVS isolation valves using the backup N2 supply and valve station panel in the event of a total loss of station AC, DC and instrument air supply.

If the safety related 30-day air supply or safety related (FLEX-backed) DC power is lost to SGTS isolation valve AO-N-108, EDMG 5.3.36 provides direction to manually close SGTS isolation valve AO-N-108 (this valve fails open due to loss of air supply or loss of DC power) by replacing the valve's SOV and tubing with a tubing "kit" staged in the SGTS room. The procedure and system configuration as currently designed require working from a ladder to connect the tubing "kit" to AO-N-108's air operator.

Since the backup N2 supply is located in the safety related reactor building, it is protected from severe external events. With exception of the compensatory steps to manually close SGTS isolation AO-N-108 valve described above, connections (e.g., replacement of a N2 bottle) are simple and do not require disassembly or reassembly of components. As noted above, in the unlikely event of loss of its safety related (FLEX-backed) DC power supply or loss of its safety-related 30-day instrument air supply, SGTS isolation valve AO-N-108 must be manually closed. This is performed by removing and replacing the valve's SOV and tubing with a tubing "kit" (staged in the SGTS room); a ladder is

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required to access the SOV and tubing. Otherwise, the use of ladders or scaffolding is not required to place the HCVS in service.

The compensatory measure modification has the following features which have the capabilities or similar capabilities of those described in NEI 13-02, Section 4.2.2.

- The ability to open/close the HCVS isolation valves during the event (five times per 72 hours) by providing an adequate supply of motive gas at the backup N2 supply.
- Providing station operators the ability to open the HCVS isolation valves manually (using pneumatics).
- The ability to replace exhausted N2 bottles outside the reactor building during an event, providing sustained operations greater than seven days.
- Simple connect/disconnect of N2 bottles.
- Backup N2 supply, valve station panel, and MCR protected from severe external events.
- Staged portable equipment is consistent with the guidance for NRC Order EA-12-049 which states: "*The equipment would be staged and reasonably protected from applicable site-specific severe external events to provide reasonable assurance that the equipment will remain deployable following such an event.*"
- With exception of the compensatory action to remove and replace SGTS isolation valve AO-N-108's SOV and tubing with a tubing "kit" to manually (using pneumatics) close AO-N-108 in the unlikely event its safety related (FLEX-backed) DC power or safety related 30 day instrument air supply is unavailable, the HCVS can be placed in service without being required to access scaffolding or use ladders.
- After HCVS Venting has been placed into use, there are areas where radiation dose rates will be elevated, especially in the vicinity of the HCVS Vent Piping, which is only exposed in one localized area of the Reactor Building outside of the TIP Room. To accommodate this concern and provide an unlimited source of compressed air to the HVCS Pneumatic Controls, a pneumatic hose connection will be deployed early to connect to the existing HCVS Backup N2 System and the hose laid out to allow a FLEX Air Compressor or N2 Cylinders to provide an unlimited source of compressed air or N2 from a remote and continuously accessible location.

RAI-9

Provide a description of the differences, if any, between the guidance in NEI 13-02, Section 4.2.4.1.2, and the actual, physical configuration and/or capabilities of the containment venting system which will be in operation during the requested period of extension. Include description of compensatory measures, if any, which will be utilized to achieve equivalent or similar capabilities as required by the order and described in the guidance during the requested period of extension.

Pilgrim Response

Pilgrim plans to use the existing SGTS and HCVS radiation monitors. The SGTS radiation monitor is a low range (10 Rad/Hr) monitor powered from the 250 VDC vital motor generator (MG) set (robust IAW with current design basis) and is available for at least the initial eight hours of the ELAP event. Pilgrim plans to use the existing HCVS high range radiation monitor (10,000 Rad/Hr), which is repowered before eight hours after the ELAP event by the FLEX diesel generators connected to the PAM system.

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Compensatory Measures

No compensatory measures are required for this RAI response.

RAI-10

Provide a description of the differences, if any, between the guidance in NEI 13-02, Section 2.4.4.1, and the actual, physical configuration and/or capabilities of the containment venting system which will be in operation during the requested period of extension. Include a description of compensatory measures, if any, which will be utilized to achieve equivalent or similar capabilities, as required by the order and described in the guidance during the requested period of extension.

Pilgrim Response

The existing design was not evaluated for 545°F for drywell venting. However, criteria and options have significantly evolved since the issuance of NEI 13-02, Revision 0 and have now been finalized.

Pilgrim's NRC GL 89-16 hardened vent path is designed for <56 psig with a maximum average working pressure (MAWP) of 62 psig) at 281°F. The existing design pressure meets the NRC Order EA-13-109 requirements since it is equal to the Torus design pressure (56 psig) and exceeds the Primary Containment Pressure Limit (55 psig). The design temperature of 281°F was based on the saturation temperature at 35 psig. AO-5042B's design temperature is 350°F. AO-5025's design temperature is 305°F. Since venting using the HCVS PCIVs assumes saturated conditions in the Torus, the valves' design temperatures meet the intent of the Order for Torus venting. In addition, NEI 13-02, Section 2.4.4.1.1 addresses the possibility of operation at more extreme temperatures and states that: "*Inherent margins above design of the components, such as higher plastic failure temperatures provide assurance of this capability* ..." The rated capacity is 1% of rated thermal power assuming a containment pressure of 55 psig.

Moisture that collects at the low point of the HCVS piping inside the Reactor Building will be removed from the piping via a steam trap. No other portions of HCVS piping are postulated to accumulate any significant amounts of moisture since Pilgrim's strategy is to maintain the HCVS continuously open once the HCVS has been placed in service. Condensate that accumulates at the base of the stack will drain back into the HCVS low point (approximately 92 hours after initiation of the HCVS, (reference: Calculation M1408 R0), at which point the condensate will drain into the torus room area.

The HCVS piping is routed from the TIP room, then down through the reactor building below grade and is routed underground to the main stack. This routing minimizes the radiation dose rate to the operators and plant personnel. If manual operation of the HCVS valves is required, it will be performed early in the severe accident sequence, prior to the point at which significant source term would be present in the HCVS piping when the HCVS is placed in service. Also, a hose will be connected to the additional N2 connection point early in the severe accident sequence and routed outside the reactor building to allow connection of N2 cylinders to the HCVS valves' pneumatic supply tubing system.

Reference: Calculation M1380 Rev 0 PNPS FLEX Strategy Thermal-Hydraulic Analysis

Compensatory Measures

No compensatory measures are required for this RAI response.

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RAI-11

Provide a description of the differences, if any, between the guidance in NEI 13-02, Section 4.1.7, and the actual, physical configuration and/or capabilities of the containment venting system which will be in operation during the requested period of extension. Include a description of compensatory measures, if any, which will be utilized to achieve equivalent or similar capabilities as required by the order and described in the guidance during the requested period of extension

Pilgrim Response

Pilgrim's NRC GL 89-16 hardened vent path was not originally designed to ensure that the flammability limits of gases passing through the system are not reached or designed to withstand dynamic loading resulting from hydrogen deflagration and detonation. The following paragraphs address the concern of a hydrogen detonation.

Pilgrim's GL 89-16 hardened vent path is discussed in the response to RAIs 1 and 3 above. The HCVS strategy is to maintain the HCVS continuously open once the system is placed in service. This strategy precludes the risk of outside air being drawn into the piping that would occur due to cycling the HCVS valves open and closed, which could result in a deflagrable/detonable air-hydrogen and/or air-CO mixture in the HCVS piping.

The main stack is a seismic category 1 structure. The stack inside diameter at the lower plenum area is 6'-4", and the outer diameter of the top portion of the stack, which is piping, is 2'-6" (5/8" piping thickness). The 20" nominal diameter hardened vent line discharges horizontally into the lower plenum area of the stack at the 60'-6" elevation. The floor of the stack is at elevation 53'-0". The top of the stack is at elevation 400'-0", yielding an inside height of 347'-0" from the floor of the stack. The length from the point at which the stack piping exits the stack and filter building (95'-0" elevation) to the top of the stack (400'-0" elevation) is 305'-0". The containment pressure during severe accident venting will be close to the PCPL of 55 psig, the torus will be at saturated conditions, and the vented fluid temperature will be approximately 300°F. Consequently, the initial high flow velocity exiting the vent pipe elbow and the buoyancy forces for the hydrogen and steam both add to the upward flow of the vented fluid.

There are no internal obstructions in the stack to hinder vertical flow out of the stack. As noted previously, once venting is started, there will be a continuous outflow through the stack.

Venting will only be from the torus. The vented fluids initially consist of N2 and steam. Following core damage progression and depletion of the heavier nitrogen, the vented fluid consists of steam and hydrogen. The assumed limiting hydrogen concentration is 40% by volume (Reference 5 NEI 13-02 R1) with the balance being steam. This condition (60% steam, 40% hydrogen, a 1.5 ratio of steam to hydrogen) represents the limiting case for venting into the stack.

A steam concentration above approximately 40% in an air, hydrogen, and steam environment results in "steam-inerting" that eliminates the potential for hydrogen detonation. Steam concentrations below 40% remain beneficial since the steam significantly reduces the sensitivity of the mixture to detonate and it reduces the range of hydrogen concentrations that would detonate. The steam and hydrogen discharged into the stack are considered well mixed due to the flow through a considerable length of 20" HCVS piping. In order for the vented fluids to reach a detonable condition, the steam to hydrogen ratio has to be reduced from the initial value of 1.5 to less than 0.40. This would require a steam reduction of 73% in the vented fluid. Consequently, at the pipe exhaust into the stack there is a considerable initial excess of steam to prevent detonation.

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The presence of steam also significantly reduces the likelihood of detonation even with a detonable mixture present. Reference 2 (NUREG/CR-5525) states:

> "*Stoichiometric mixtures with steam concentrations of 10, 20, and 30 percent increase the experimental cell width by factors of approximately 4, 23.6, and 92.8, respectively, compared to stoichiometric mixtures without steam. This corresponds to decreasing the likelihood of a detonation for these mixtures by factors of 64, 13,100, and 800,000.*"

There are no electrical or electronic components in the stack that could provide a spark. Also, given that there would be significant steam flow into the stack, the stack inside surface is expected to be moist, further reducing the possibility of an ignition source on the stack surface.

In summary, when the hardened vent fluid is discharged into the stack, the vented fluid will contain a significant amount of saturated steam. Due to the upward discharge velocity and the buoyancy of the steam, the residence time within the stack for the vented fluids is very short which would minimize the loss of steam inerting due to condensation.

Reference: Drawing C332A
Reference: Calculation M1380 Rev 0 PNPS FLEX Strategy Thermal-Hydraulic Analysis

<u>Compensatory Measures</u>

No compensatory measures are required for this RAI response.

<u>RAI-12</u>

Given the severe accident conditions associated with the order, address the potential failure of the hardened vent pipes in the response to RAI-12 below.

Provide a description of the differences, if any, between the guidance in NEI 13-02, Section 5.2 and 5.3, and the actual, physical configuration and/or capabilities of the containment venting system which will be in operation during the requested period of extension. Include a description of compensatory measures, if any, which will be utilized to achieve equivalent or similar capabilities as required by the order and described in the guidance during the requested period of extension.

<u>Pilgrim Response</u>

<u>NEI 13-02 Sections 5.2.1 and 5.3.1.1</u>

The in-plant HCVS components, including all interface and component connections, including instrumentation, are designed, as a minimum, to meet the original seismic design requirements of the plant. This includes all portions of the PNPS NRC GL 89-16 hardened vent path downstream of the primary containment penetrations consisting of 8" and 20" nominal diameter piping. New HCVS interface and component connections added as part of the Pilgrim FLEX modifications are designed to higher-level FLEX BDBEE seismic criteria. This complies with NEI 13-02, 5.2.1 and 5.3.1.1. This response is based on design basis seismic criteria for pre-existing plant equipment, along with consideration of the inherent seismic robustness of engineered piping and electrical systems for beyond design basis seismic events.

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NEI 13-02 Sections 5.2.2 and 5.3.1.2

There are no HCVS components, including instrumentation, that are not required to be seismically designed by the design basis of the plant but that would be required to be capable of ensuring HCVS functionality following a seismic event.

NEI 13-02 Section 5.2.3

The Pilgrim pre-existing in-plant HCVS components meet all the original design basis requirements and the new HCVS interface and component connections added as part of the PNPS FLEX modifications are designed to higher level FLEX BDBEE seismic and environmental criteria, including the applicable external events, such that all HCVS components and their protective enclosures satisfy the requirements of NEI 12-06 as described below:

- Seismic: addressed in RAI-12 above.
- External Flooding: HCVS components (e.g., valves, actuators, nitrogen bottle rack) are physically located inside the reactor building such that all are protected from external flooding.
- Snow, Ice, and Extreme Cold: HCVS components (e.g., valves, actuators, backup nitrogen supply and valve station panel) are physically located inside the reactor building such that all are protected from snow, ice, and extreme cold hazards.
- Extreme High Temperature: The maximum expected outside air temperature in the UFSAR for the site area is documented as 102°F. Since all active components are located inside the reactor building and the HCVS piping is routed underground from the reactor building to the main stack, there are no HCVS components exposed to high ambient temperatures.
- High Wind Hazards: addressed in RAI-3 above.
- Reference: UFSAR Table 2.3-15

NEI 13-02 Section 5.2.4

Pilgrim is permanently ceasing operation no later than June 1, 2019. This cessation date is prior to the June 30, 2019 Phase 2 Order date.

NEI 13-02 Section 5.3

The HCVS modifications described in RAI-1 and RAI-10 comply with NEI 13-02, Section 5.2, Seismic and External Conditions and NEI 13-02, Section 5.3, Quality Requirements.

HCVS components including instrumentation, as minimum, meet the quality design requirements of the plant, ensuring HCVS functionality.

Compensatory Measures

No compensatory measures are required for this RAI response.

References:

1. ENN-MS-S-009-PNP Rev 2 Engineering Standard PILGRIM SAFETY CLASSIFICATION SITE SPECIFIC GUIDANCE AND SYSTEM SAFETY FUNCTION SHEETS
2. Specification E536 Rev 12 ENVIRONMENTAL PARAMETERS FOR USE IN THE ENVIRONMENTAL QUALIFICATION OF ELECTRICAL EQUIPMENT PER 10CFR50.49

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3. Specification M300 Rev 109 SPECIFICATION REPORT FOR PIPING
4. PNPS UFSAR Rev 30 Appendix A PRESSURE INTEGRITY OF PIPING AND EQUIPMENT PRESSURE PARTS
5. EC-0000042259 FLEX Strategy Master EC

NEI 13-02 Section 5.3.1.3

The HCVS modifications described in RAI-1 and RAI-10 comply with NEI 13-02, Section 5.2, Seismic and External Conditions and NEI 13-02, Section 5.3, Quality Requirements. All piping/components necessary for the hardened containment vent function are class I components able to withstand the design basis safe shutdown earthquake (SSE) seismic event and tornado event.

Compensatory Measures

No compensatory measures are required for this RAI response.

RAI-13

Provide a description of procedure changes and/or changes to the training curricula, if any, to support the use of the containment venting system during the requested period of extension.

Pilgrim Response

Pilgrim has requested an extension for implementation of NRC Order EA-13-109. The extension, if granted, would not change the design of the HCVS system. Procedures and training curriculum for the normal and off normal operation of the HCVS have been developed and implemented at the site. The approved procedure set includes operation of the HCVS during a FLEX event. Operator training for operation of the HCVS system currently consists of classroom lectures and infield walk downs.

Venting for primary containment pressure control without core damage (and therefore no combustible gases) is directed by steps in the EOPs. Venting with core damage (i.e., including combustible gas control) and primary containment pressure control is directed by steps in the SAMGs and implemented through support procedures.

Combustible Gas Migration into Interfacing Systems

Pilgrim Response

Sixteen interfaces with the HCVS piping were evaluated (reference: Calculation M1388 R0). Of these sixteen interfaces, eleven were considered not a concern with no further evaluation required and five were evaluated further. Of these five, the SGTS interface is considered the most significant and is addressed in detail below.

Since Pilgrim's GL 89-16 HCVS interfaces with the SGTS trains, it is possible that combustible gases could flow from the HCVS piping into the SGTS trains. SGTS isolation valves AO-N-108 and AO-N-112 isolate cross flow from the HCVS piping to the SGTS. AO-N-112 is normally closed and fails closed. AO-N-108 is normally closed and fails open. During an ELAP, both of these valves would close, assuming their safety related (FLEX-backed) DC power supplies and safety related 30 day air supplies are available. The valves' position indications are both powered by safety related DC (FLEX-backed) power supplies and would normally be verified in the MCR. AO-N-108 and AO-N-112 are

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nitrile lined butterfly valves that may permit minor leakage into the SGTS trains. Both SGTS trains' discharges are also equipped with backdraft dampers and normally closed motor operated dampers installed in ductwork between the isolation valves and the SGTS trains, both of which will also minimize leakage of combustible gases into the SGTS trains. Pressure relief of the SGTS duct work (rated for 0.25 psig) is provided by normally open drain paths via check valves on the filter compartments; therefore, there is no concern for unintended cross flow that may induce pressurization or steam intrusion at this interface. To minimize any potential build-up of combustible gas concentrations in the SGTS room, a ventilation flow path will be established by opening a hatch leading to the reactor building exhaust plenum, which is open to the atmosphere above the building and provides a natural vent path for the lighter hydrogen gas.

A strong argument for minimizing cross flow of combustible gases into the SGTS by closure of the SGTS isolation valves in series with backdraft dampers is presented in the TEPCO report "TEPCO Fukushima Nuclear Accident Analysis Report" dated June 20, 2012 (http://www.tepco.co.jp/en/nu/fukushima-np/interim/index-e.html). TEPCO concluded in this report that the most likely reason for the explosion in the Fukushima Daiichi U4 reactor building was due to cross flow of venting gasses (i.e., hydrogen) from the U3 primary containment vent (PCV) piping via the common stack due to the absence of backdraft dampers on U4's SGTS filter trains. The TEPCO report states in part on page 346: "*Normally the SGTS is on standby and not in operation; and the air operated valves installed in the system are closed. Therefore, even if PCVS venting gasses flowed from the Unit 3 side they should not have flowed into Unit 4. However, the circumstances of the Fukushima Daiichi NPS accident, in particular the extended complete SBO at multiple adjacent units, exceeded accident management assumptions and the Unit 3 PCV was vented amidst an SBO. Similarly, Unit 4 also became SBO, and the valves of the SGTS, which are designed to operate in the event of an emergency, opened automatically with the loss of power thereby creating a line by which PCV venting gasses from Unit 3 could flow into Unit 4 via SGTS piping. There is a high possibility that it is in this way that hydrogen generated by the Unit 3 reactor flowed into Unit 4, accumulated, and exploded.*" The TEPCO report also states in part on page 351: "*...at Fukushima Daiichi Unit 4, as mentioned earlier, since the valves on the standby side are kept closed in that one system is in operation and the other system is on standby, a backflow prevention damper was considered as unnecessary and has never been installed..*". The TEPCO report also states in part on page 352: "*...As a result of the post-accident examination on the possibility of vent gasses flowing into the SGTS in conducting PCV venting, it is considered that backflow of gasses (including hydrogen) into the reactor building via the SGTS at Units 1 to 3 was limited due to the installation of backflow prevention dampers. On the other hand, as mentioned earlier, in the case of Unit 4, vented gasses from Unit 3 flowed into the Unit 4 reactor building.*" These conclusions are also referenced in NAS publication "Lessons Learned from the Fukushima Nuclear Accident for Improving Safety of U.S. Nuclear Plants" (ISBN 98-0-309-27253-7); the footnote on page 4-24 states: "*TEPCO (2012b, p. 351-352) notes that the standby gas treatment system may not have been isolated from the stack at the time of venting*".

Compensatory Measures

Leakage past SGTS isolation valve AO-N-112 into the 'B' SGTS filter train is not a concern during an ELAP due to the fact that the valve would fail closed. In the unlikely scenario that AO-N-108 were to lose its safety related (FLEX-backed) DC power supply or its safety related 30 day air supply, the valve would fail open, which would leave an open path from the HCVS piping into the 'A' SGTS filter train discharge ductwork. If this valve failed open, station operators would be required to perform steps in Attachment 9 of procedure 5.3.36 to manually close the valve by removing and replacing its solenoid valve and tubing with a tubing "kit" (staged in the SGTS room). If this compensatory action must be performed, station operators would be required to access the valve using a ladder.

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Reference: Calculation M1388 Rev. 0 HCVS Unintended Cross Flow Evaluation

Phase 2 RAIs

NRC requested OCNGS (via email) to answer two Phase 2 HCVS RAIs. Pilgrim's responses to these RAIs are provided below.

RAI-1

Similar to Phase 1 RAIs, the staff will be evaluating OCNGS' request against the technical guidance of NEI 13-02, Rev. 1, as endorsed by ISG-2015-01. As such, the licensee should provide a discussion of the differences between Oyster Creek's Phase 2 hardware and procedural strategies during the period of extension and the requirements of Sections B.1 and B.2 of Order EA-13-109. Utilize information from NEI 13-02, Rev.1, Section 1.2, *HCVS Guiding Principles*, as appropriate. This discussion may include any proposed compensatory measures.

Pilgrim Response

Pilgrim is permanently ceasing operation no later than June 1, 2019. This cessation date is prior to the June 30, 2019 Phase 2 Order date.

Compensatory Measures

No compensatory measures are required for this RAI response.

RAI-2

If hardware and procedural strategies described as Option 1 (SAWA) or Option 2 (SAWA with SAWM) of NEI 13-02, Rev.1, Section 1.2, *HCVS Guiding Principles,* are to be employed during the period of extension, the licensee should provide a discussion of the capabilities of Oyster Creek's hardware and procedural strategies as compared to the guidance of NEI 13-02, Rev. 1, Appendix C, *Severe Accident Water Management,* and Appendix I – *Severe Accident Water Addition.* This discussion may also include any proposed compensatory measures.

Pilgrim Response

Pilgrim is permanently ceasing operation no later than June 1, 2019. This cessation date is prior to the June 30, 2019 Phase 2 Order date.

Compensatory Measures

No compensatory measures are required for this RAI response.

List of Regulatory Commitments

The following table identifies those actions committed to by Pilgrim in this document. Any other statements in this submittal are provided for information purposes and are not considered to be regulatory commitments.

PILGRIM COMMITMENTS	COMMITMENT TYPE (Check One)		SCHEDULED COMPLETION DATE
	ONE-TIME ACTION (YES/NO)	PROGRAMMATIC (YES/NO)	
Pilgrim will perform a site-specific evaluation to assure steam inerting precludes a combustible mixture in the main stack.	X		Prior to startup from RF021 refueling outage (spring 2017)
Pilgrim will revise appropriate procedures/guides (e.g., EOPs, FSGs) for implementation of Pilgrim's HCVS.	X		Prior to startup from RF021 refueling outage (spring 2017)