NEXTera ENERGY
DUANE ARNOLD

June 26, 2018

NG-18-0066

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

Duane Arnold Energy Center
Docket No. 50-331
Renewed Facility Operating License No. DPR-49

NextEra Energy Duane Arnold, LLC's Six-Month Status Report in Response to June 6, 2013 Commission Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions (Order Number EA-13-109)

References:
1. Order EA-13-109, "Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions," dated June 6, 2013 (ML13130A067)
2. NextEra Energy Duane Arnold LLC's Phase 1 Overall Integrated Plan in Response to June 6, 2013 Commission Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions (Order Number EA-13-109, dated June 25, 2014 (ML14182A423)
3. NextEra Energy Duane Arnold, LLC's Six-Month Status Report and Phase 1 and 2 Overall Integrated Plan in Response to June 6, 2013 Commission Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions (Order Number EA-13-109) dated December 22, 2015 (ML15358A043)

On June 6, 2013, the Nuclear Regulatory Commission ("NRC" or "Commission") issued an Order (Reference 1) to NextEra Energy Duane Arnold, LLC. Reference 1 was immediately effective and directs NextEra Energy Duane Arnold, LLC (hereafter NextEra Energy Duane Arnold) to install a reliable hardened venting capability for pre-core damage and under severe accident conditions, including those involving a breach of the reactor vessel by molten core debris. Specific requirements are outlined in Attachment 2 of Reference 1.

Reference 1 required submission of a Phase 1 Overall Integrated Plan (OIP) pursuant to Section IV, Condition D, and status reports at six-month intervals thereafter. NextEra Energy Duane Arnold submitted the Phase 1 OIP by letter dated December 10, 2014 (Reference 2). Reference 3 included the required six-month status update, as well as the Phase 2 OIP submittal. The consolidated Phase 1 and 2 OIP document provided a list of the Phase 1 OIP open items, and addressed the NRC Interim Staff Evaluation open items for Phase 1. This letter is being submitted to satisfy the requirements for providing the six-month updates for Phases 1 and 2 of the Order in accordance with Section IV, Condition D.3, of Reference 1.

This letter contains no new regulatory commitments. If you have any questions regarding this submittal, please contact Michael Davis, Licensing Manager at 319-851-7032.

I declare under penalty of perjury that the foregoing is true and correct.
Executed on June 26, 2018.

Dean Curtland
Site Director, Duane Arnold Energy Center
NextEra Energy Duane Arnold, LLC

Enclosure

cc: Director, Office of Nuclear Reactor Regulation
USNRC Regional Administrator Region III
USNRC Project Manager, Duane Arnold Energy Center
USNRC Resident Inspector, Duane Arnold Energy Center

Enclosure to NG-18-0066

NextEra Energy Duane Arnold, LLC's Six-Month Status Report in Response to June 6, 2013 Commission Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions (Order Number EA-13-109)

15 pages follow

1 Introduction

NextEra Duane Arnold Energy Center, LLC developed an Overall Integrated Plan (Reference 1 in Section 8), documenting the planned installation of a Hardened Containment Vent System (HCVS) that provides reliable hardened venting capability for pre-core damage and under severe accident conditions, including those involving a breach of the reactor vessel by molten core debris, in response to Reference 2.

NextEra Duane Arnold Energy Center, LLC developed an updated and combined Phase 1 and 2 Overall Integrated Plan dated December 22, 2015 (Reference 7), documenting:

1. The planned installation of a HCVS as described above; and

2. An alternative venting strategy that makes it unlikely that a drywell vent is needed to protect the containment from overpressure related failure under severe accident conditions, including those that involve a breach of the reactor vessel by molten core debris, in response to Reference 2.

This enclosure provides an update of milestone accomplishments since submittal of the combined Phase 1 and 2 Overall Integrated Plan, including any changes to the compliance method, schedule, or need for relief/relaxation and the basis, if any.

2 Milestone Accomplishments

At the time of this update, all activities associated with implementation of Phase 1 have been completed. Refer to the Phase 1 Milestone Schedule and Phase 1 ISE Items status for details.

The following milestone(s) have been completed since the six-month update submitted on December 19, 2017 (Reference 9), and are current as of June 1, 2018.

- Submit 6 Month Status Report (Complete with this submittal)

3 Milestone Schedule Status

The following provides an update to Part 5 of the combined Phase 1 and 2 Overall Integrated Plan. It provides the activity status of each item, and whether the expected completion date has changed. The dates are planning dates subject to change as design and implementation details are developed.

Phase 1 Milestone Schedule:

Milestone	Target Completion Date	Activity Status	Comments {Includes date changes}
Issue preliminary/conceptual design report	June 2014	Complete	
Submit Overall Integrated Implementation Plan	June 2014	Complete	
Initial Outage for Phase 1 Planning	Nov. 2014	Complete	
Submit 6 Month Status Report	Dec. 2014	Complete	
Submit 6 Month Status Report	June 2015	Complete	
Submit 6 Month Status Report	Dec. 2015	Complete	
Design Complete Phase 1	Mar. 2016	Complete	
Submit 6 Month Status Report	June 2016	Complete	
Operations Procedure Changes Developed	Oct. 2016	Complete	
Site Specific Maintenance and Testing Procedures Developed	Oct. 2016	Complete	
Training Complete	Oct. 2016	Complete	
Implementation Outage	End of RFO25	Complete	
Procedure Changes Active	End of RFO25	Complete	
Walk Through Demonstration/Functional Test	End of RFO25	Complete	
Submit Completion Report	60 days after RFO25	Not Required	Not required for Phase 1

Phase 2 Milestone Schedule

Milestone	Target Completion Date	Activity Status	Comments {Include date changes in this column}
Submit Overall Integrated Implementation Plan	Dec. 2015	Complete	
Hold preliminary/conceptual design meeting	Feb 2017	Complete	
Submit 6 Month Status Report	June 2016	Complete	
Submit 6 Month Status Report	Dec. 2016	Complete	
Submit 6 Month Status Report	June 2017	Complete	
Submit 6 Month Status Report	Dec. 2017	Complete	
Design Engineering On-site/Complete	Jan. 2018	Complete	
Submit 6 Month Status Report	June 2018	Complete with this submittal	
Operations Procedure Changes Developed	Oct. 2018	Started	
Site Specific Maintenance Procedure Developed	Oct. 2018	Started	
Training Complete	Oct. 2018	Started	
Implementation Outage	RFO 26	Not Started	
Procedure Changes Active	RFO26	Not Started	
Walk Through Demonstration/Functional Test	RFO 26	Not Started	
Submit Completion Report	RFO 26	Not Started	

4 Changes to Compliance Method

There are no changes to the compliance method as documented in the combined Phase 1 and 2 Overall Integrated Plan (Reference 7). However, changes have been made to the design details which affect descriptions contained in Reference 7.

- The HCVS "Nitrogen Supply Isolation at 1A3 ROS" (V43-0642) will be normally closed and locked to prevent inadvertent vent operation. This valve will have to be manually opened at the Remote Operating Station (ROS) in the 1A3 Essential Switchgear Room to supply nitrogen for CV operation and purging.

- The HCVS nitrogen supply and purge pressure control valves (PCV4360 and PCV4361) will be normally closed to prevent inadvertent over pressurization. The PCVs are located at the ROS and will be manually adjusted to the prescribed setpoints after the main pneumatic supply valve is opened (V43-0642).

- The Uninterruptible Power Supply (UPS) originally had the normal power supply from 1B32. Analysis identified that 1B32 did not have adequate margin to add this load; therefore the normal power supply has been changed to 1B15. A receptacle will be installed at the UPS for direct connection to the portable 480 VAC generator. The power to 1B15 will be lost during an ELAP. The UPS will provide power for 24 hours; the FLEX 480 VAC generator will provide power beyond 24 hrs.

5 Need for Relief/Relaxation and Basis for the Relief/Relaxation

NextEra Duane Arnold Energy Center, LLC expects to comply with the order implementation date and no relief/relaxation is required at this time.

6 Open Items from Combined Phase 1 and 2 Overall Integrated Plan and Interim Staff Evaluations

The following tables provide a summary of the open items documented in the combined Phase 1 and 2 Overall Integrated Plan or the Interim Staff Evaluation (ISE) and the status of each item.

Combined Phase 1 and 2 OIP Open Item	Status
Phase 1 Open Items	
1. Confirm secondary containment bypass leakage is acceptable without an installed rupture disk or retain an appropriate disk.	Completed. Appropriate rupture disk is included in design of modification.
2. Perform severe accident evaluation for FLEX DG and replacement gas to confirm accessibility for use for post 24 hour actions.	Completed. Actions to connect the FLEX DG and replace nitrogen bottles are performed in the Control Building battery room corridor and 1A3 essential switchgear room. DAEC has completed evaluations of temperature and radiological conditions to ensure that operators can safely access and operate controls and support equipment in these areas.
3. Evaluate tornado/missile effects on HCVS components above the protected area of the Reactor Building.	Complete.
4. Evaluate the system design for H2/CO measures to be taken.	Complete.

Phase 1 Interim Staff Evaluation Open Items	Status
1. Make available for NRC staff audit documentation of licensee confirmation that secondary containment leakage is acceptable without an installed rupture disk or that an appropriate rupture disk, including procedures for rupture during HCVS operation, is included in the HCVS design. (Section 3.1.2, Section 3.2.2.8)	Complete. The DAEC final design of the HCVS utilizes an installed rupture disk. Procedures for rupturing the disk have been developed for use during beyond design bases conditions.
2. Make available for NRC staff audit analyses demonstrating that HCVS has the capacity to vent the steam/energy equivalent of one (1) percent of licensed/rated thermal power (unless a lower value is justified), and that the suppression pool and the HCVS together are able to absorb and reject decay heat, such that following a reactor shutdown from full power containment pressure is restored and then maintained below the primary containment design pressure and the primary containment pressure limit. (Section 3.2.2.1, Section 3.2.2.2)	Complete. DAEC has completed analysis demonstrating the HCVS has the capacity to vent the steam/energy equivalent to one percent of licensed thermal power and that the suppression pool and HCVS together are able to absorb and reject decay heat such that following a reactor shutdown from full power containment pressure will be maintained below the primary containment design pressure limit of 53 PSIG.
3. Make available for NRC staff audit evaluations of tornado missile effects on HCVS components above the protected area of the reactor building. (Section 3.2.2.3)	Complete. DAEC has evaluated the potential effects of tornado missiles on HCVS components above the protected area of the reactor building and confirmed that HCVS function will not be impaired. HCVS components located above the protected area of the reactor building are limited to piping components and supports.

4. Make available for NRC staff audit additional detail on the design features that minimize unintended cross flow of vented fluids within a unit, including a one line diagram containing sufficient detail to confirm the description in the OIP. (Section 3.2.2.7)	Eliminated. The DAEC design has been modified since issuance of the ISE. The HCVS system utilizes a dedicated penetration from the torus to HCVS piping with no connecting systems eliminating the possibility of unintended cross flow.
5. Provide a description of the final design of the HCVS to address hydrogen detonation and deflagration. (Section 3.2.2.6)	Complete. The final DAEC design of the HCVS addresses the potential for hydrogen detonation and deflagration with the use of a nitrogen purge of the HCVS piping that ensures hydrogen and oxygen concentrations within the HCVS system are not susceptible to detonation or deflagration (Option 3 of Appendix H of NEI 13-02). The HCVS system isolation is performed by two primary containment isolation valves (PCIVs) to minimize any potential leakage. Prior to use of the system a partial purge of the system is performed to ensure no hydrogen is directly downstream of the PCIVs at the time of actuation. A full nitrogen purge is performed immediately following each period of venting the torus. Each purge is performed with nitrogen flow at sufficient velocity to limit stratification and ensure turbulent flow to preclude retaining hydrogen in the pipe. The piping is sloped upwards from the outboard PCIV to the atmospheric vent discharge to ensure hydrogen will exit the vent through buoyancy. No trapped high points are provided in the piping.
6. Provide a description of the strategies for hydrogen control that minimizes the potential for hydrogen gas migration and ingress into the reactor building or	Complete. DAEC strategies for hydrogen control are as noted above in response to Open Items 4 and 5. The HCVS system utilizes a dedicated penetration from the torus to HCVS piping with no

other buildings. (Section 3.2.2.6)	connecting systems and the HCVS piping does not pass through other buildings thus eliminating the potential for migration of hydrogen gas from the HCVS into the reactor building or other buildings. Nitrogen purge of the system prior to use and immediately following isolation of the system prevents detonation or deflagration of hydrogen inside the HCVS (Option 3 of NEI 13-02 Appendix H).
7. Make available for NRC staff audit documentation that demonstrates adequate communication between the remote HCVS operation locations and HCVS decision makers during ELAP and severe accident conditions. (Section 3.2.2.5)	Complete. DAEC docketed an assessment of communications capabilities under ELAP conditions in NG-12-0430 "Response to NRC 10 CFR 50.54(f) Request for Information Regarding Near-Term Task Force Recommendation 9.3, Emergency Preparedness" (ADAMS Accession No. ML 12307A120). NRC staff review of this assessment is documented in an NRC Letter dated June 6, 2013 "Duane Arnold Energy Center-Staff Assessment in Response to Recommendation 9.3 of the Near-Term Task Force Related to the Fukushima Dai-Ichi Nuclear Power Plant Accident" (ADAMS Accession No. ML 13142A320). The NRC staff concluded the communications assessment was reasonable to ensure communications were maintained during an ELAP. The HCVS operating locations are the main control room located in the control building and the Remote Operating Station in the 1A3 switchgear room also located in the control building. Severe accident conditions do not have an impact on communications in the control building beyond those defined in the communications assessment for ELAP conditions. HCVS decision makers are located in the control room so communication with the operating location in the control room can be

	made directly with no equipment requirements. Operators at the Remote Operating Station can communicate with HCVS decision makers via a variety of methods including sound powered phones, hand held radios, plant page, or telephone.
8. Make available for NRC staff audit an evaluation of temperature and radiological conditions to ensure that operating personnel can safely access and operate controls and support equipment. (Section 3.2.1, Section 3.2.2.3, Section 3.2.2.4, Section 3.2.2.5, Section 3.2.2.10, Section 3.2.4.1, Section 3.2.4.2, Section 3.2.5.2 and Section 3.2.6)	Complete. DAEC has completed evaluations of temperature and radiological conditions to ensure that operators can safely access and operate controls and support equipment for the HCVS system. HCVS controls and support equipment requiring access by operators are located within the control building to minimize radiological and temperature challenges.
9. Make available for NRC staff audit the final sizing evaluation for HCVS batteries/battery charger including incorporation into FLEX DG loading calculation. (Section 3.2.2.4, Section 3.2.3.1, Section 3.2.3.2, Section 3.2.4.1, Section 3.2.4.2, Section 3.2.5.1 and Section 3.2.5.2)	Complete. DAEC has completed final sizing evaluations for HCVS batteries to ensure the batteries can power HCVS equipment for a minimum of 24 hours. DAEC has completed an evaluation for the battery chargers to confirm they are capable of recharging the HCVS batteries while loaded. A review of the use of FLEX diesel generators to power the HCVS battery chargers has confirmed the load is within the capacity of the FLEX diesel generators. The 480 VAC FLEX diesel generators are equipped with two 50A output breakers and four 125A output breakers. One of the 50A breakers will be connected to the HCVS UPS via a 200 foot length cable. The voltage drop across the cable for the assumed 8A UPS load is 1.03 volt which is well within the +10/-12% allowable input voltage range specified by the UPS vendor, and is acceptable. The UPS batteries are adequate for the first 24

	hours of HCVS service. The addition of the small load of the HCVS UPS to the FLEX 480 VAC generator after 24 hours is acceptable.
10. Make available for NRC staff audit the final sizing evaluation for pneumatic N2 supply. (Section 3.2.2.4, Section 3.2.3.1, Section 3.2.3.2, Section 3.2.4.1, Section 3.2.4.2, Section 3.2.5.1 and Section 3.2.5.2)	Complete. DAEC has completed the final sizing evaluation of pneumatic nitrogen supply that demonstrates adequate capacity is installed for the first 24 hours of an ELAP event. After 24 hours replacement nitrogen bottles can be applied in an accessible location in the control building.
11. Make available for NRC staff audit documentation of an evaluation verifying the existing containment isolation valves, relied upon for the HCVS, will open under the maximum expected differential pressure during BDBEE and severe accident wetwell venting. (Section 3.2.2.9)	Eliminated. As stated in NG-15-0169, Six Month Status Update, due to design changes in vent location and routing, existing containment isolation valves will no longer be used for venting. New vent design will utilize a spare torus penetration with two new primary containment isolation valves and a rupture disk. An evaluation has been done to ensure the two new containment isolation valves will open under the maximum expected differential pressure during BDBEE and severe accident wet well venting.
12. Make available for NRC staff audit descriptions of all instrumentation and controls (existing and planned) necessary to implement this order including qualification methods. (Section 3.2.2.10)	Complete. DAEC has completed evaluations of key instruments and controls necessary to implement NRC Order EA-13-109 including the qualification methods as part of the engineering change package for the HCVS system to ensure the instrumentation and controls are suitable for the application.
13. Make available for NRC staff audit the descriptions of local conditions (temperature, radiation and humidity) anticipated during ELAP and severe accident for the	Complete. DAEC has completed evaluations of key components necessary for HCVS venting to ensure they are capable of performing their intended function

components (valves, instrumentation, sensors, transmitters, indicators, electronics, control devices, and etc.) required for HCVS venting including confirmation that the components are capable of performing their functions during ELAP and severe accident conditions. (Section 3.2.2.3, Section 3.2.2.5, Section 3.2.2.9, Section 3.2.2.10)	under ELAP and severe accident conditions including local temperature, radiation and humidity as part of the engineering change package for the HCVS system.
14. Provide a justification for deviating from the instrumentation seismic qualification guidance specified in NEI 13-02, endorsed, in part, by JLD-ISG-2013-02 as an acceptable means for implementing applicable requirements of Order EA-13-109. (Section 3.2.2.9)	Eliminated. As stated in NG-15-0169, Six Month Status Update, the qualification method used for each HCVS instrument will be to the IEEE 344-2004 standard or a substantially similar industrial standard and therefore will not be deviating from NEI 13-02 or JLD-ISG-2013-02.

Phase 2 Interim Staff Evaluation Open Items	**Status**
1. Licensee to evaluate the SAWA equipment and controls, as well as ingress and egress paths for the expected severe accident conditions (temperature, humidity, radiation) for the sustained operating period.	Started. The SAWA pump and manual controls will either be placed behind the pump house or in the Turbine Building south rail bay. The temperature conditions in these locations will be at or near ambient conditions. Portable heaters are available for extreme cold conditions (SAMP-726). Proposed equipment locations are shielded by concrete walls.

5. Licensee to demonstrate that there is adequate communication between the MCR and the operator at the FLEX pump during severe accident conditions.	Complete. Communications between the MCR and the operator at the FLEX pump during severe accident conditions are described in Section 3.13 of the FLEX Final Integrated Plan (ML16347A010). 24 two-way radios are kept in the control room with chargers. These radios are capable of transmitting and receiving with or without a repeater to provide communications for plant operations.
6. Licensee to demonstrate the SAWM flow instrumentation qualification for the expected environmental conditions.	Complete. The evaluation of the operating design conditions and selection of the flowmeter has been completed. Considerations of seismic, temperature rating as well as process conditions are evaluated. All other instruments were evaluated as part of the FLEX project.

7 Interim Staff Evaluation Impacts

The June 2015 six-month update (Reference 6) noted the following two potential impacts to the Interim Staff Evaluation.

1) One ISE Open Item will be eliminated because the Hardened Pipe Vent will no longer use existing containment isolation valves. The revised vent pipe routing will instead use an existing spare torus penetration and install two new containment isolation valves and a rupture disk. An evaluation will be done to ensure the two new containment isolation valves will open under the maximum expected differential pressure during BDBEE and severe accident wetwell venting.

2) The Interim Staff Evaluation (ISE) inadvertently listed a vent pipe process pressure indicator which will not be part of the Duane Arnold design.

In addition, as discussed previously in Section 4:

The HCVS "Nitrogen Supply Isolation at 1A3 ROS" (V43-0642) will be normally closed and locked to prevent inadvertent vent operation. This valve will have to be manually opened at the Remote Operating Station (ROS) in the 1A3 Essential Switchgear Room to supply nitrogen for CV operation and purging.

The HCVS nitrogen supply and purge pressure control valves (PCV4360 and PCV4361) will be normally closed to prevent inadvertent over pressurization. The PCVs are located at the ROS and will be manually adjusted to the prescribed setpoints after the main pneumatic supply valve is opened (V43-0642).

The Uninterruptible Power Supply (UPS) originally had the normal power supply from 1B32. Analysis identified that 1B32 did not have adequate margin to add this load; therefore the normal power supply has been changed to 1B15. A receptacle will be installed at the UPS for direct connection to the portable 480 VAC generator. The power to 1B15 will be lost during an ELAP. The UPS will provide power for 24 hours; the FLEX 480 VAC generator will provide power beyond 24 hrs.

8 References

The following references support the updates to the combined Phase 1 and 2 Overall Integrated Plan described in this Enclosure.

1. NextEra Duane Arnold Energy Center, LLC Phase 1 Overall Integrated Plan in Response to June 6, 2013 Commission Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions (Order Number EA-13-109)," dated June 25, 2014.
2. NRC Order Number EA-13-109, "Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions" dated June 6, 2013.
3. NEI 13-02, "Industry Guidance for Compliance with NRC Order EA-13-109, 'To Modify Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions," Revision 1, dated April 2015.
4. NRC 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," Revision 0, dated November 2013 (Accession No. ML13304B836).
5. NRC Endorsement of Industry "Hardened Containment Venting System (HCVS) Phase 1 Overall Integrated Plan Template (EA-13-109) Rev 0" (Accession No. ML14128A219).
6. NextEra Energy Duane Arnold, LLC's Six-Month Status Report in Response to June 6, 2013 Commission Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions (Order Number EA-13-109), dated June 18, 2015 (ML15170A333)
7. NextEra Duane Arnold Energy Center, LLC Combined Phase 1 and 2 Overall Integrated Plan in Response to June 6, 2013 Commission Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions (Order Number EA-13-109), dated December 22, 2015.
8. NRC Interim Staff Guidance JLD-ISG-2015-01, "Compliance with Phase 2 of Order EA-13-109, Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions," Revision 0, dated April 2015 (Accession No. ML15104A118).
9. NextEra Energy Duane Arnold, LLC's Six-Month Status Report in Response to June 6, 2013 Commission Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions (Order Number EA-13-109), dated December 19, 2017 (ML17353A668).