UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

September 13, 2016

Mr. Thomas A. Vehec
Site Vice President
NextEra Energy
Duane Arnold Energy Center
3277 DAEC Road
Palo, IA 52324-9785

SUBJECT: DUANE ARNOLD ENERGY CENTER - STAFF EVALUATION RELATING TO OVERALL INTEGRATED PLAN IN RESPONSE TO PHASE 2 OF ORDER EA-13-109 (SEVERE ACCIDENT CAPABLE HARDENED VENTS) (CAC NO. MF4391)

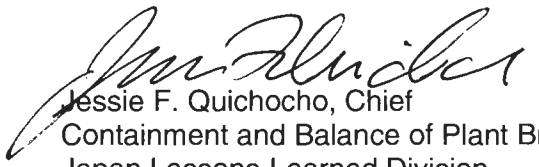
Dear Mr. Vehec:

By letter dated June 6, 2013, the U.S. Nuclear Regulatory Commission (NRC) issued Order EA-13-109, "Order to Modify Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions" (Agencywide Documents Access and Management System (ADAMS) Accession No. ML13143A334). By letter dated December 22, 2015 (ADAMS Accession No. ML15358A043), NextEra Energy Duane Arnold, LLC (NextEra, the licensee), submitted its third six-month status report of the implementation of the Commission order with Regard to Requirements for Reliable Hardened Vents (EA-13-109). The letter also included the Overall Integrated Plan (OIP) for Duane Arnold Energy Center (Duane Arnold) in response to Phase 2 of Order EA-13-109. The focus of the Phase 2 Interim Staff Evaluation (ISE) is to document the NRC staff's review of the information provided for implementation of Phase 2 requirements of Order EA-13-109. The new information provided related to Phase 1 of the order and open items identified in the staff's ISE on Phase 1 will be addressed separately. Any changes to the compliance method will be reviewed as part of the ongoing audit process.

The licensee's OIP for Duane Arnold appears consistent with the guidance found in Nuclear Energy Institute (NEI) 13-02, Revision 1, endorsed, in part, by the NRC's Japan Lessons-Learned Project Directorate (JLD) Interim Staff Guidance (ISG) JLD-ISG-2015-01, as an acceptable means for implementing the requirements of Phase 2 of Order EA-13-109. This conclusion is based on satisfactory resolution of the open items detailed in the enclosed interim staff evaluation. This evaluation only addressed consistency with the guidance. Any plant modifications will need to be conducted in accordance with plant engineering change processes, the licensing basis, and the Commission's regulations.

If you have any questions, please contact Brian E. Lee, Project Manager, at 301-415-2916 or at Brian.Lee@nrc.gov.

Sincerely,



Jessie F. Quichocho, Chief
Containment and Balance of Plant Branch
Japan Lessons-Learned Division
Office of Nuclear Reactor Regulation

Docket No. 50-331

Enclosure:
Interim Staff Evaluation

cc w/encl: Distribution via Listserv

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

INTERIM STAFF EVALUATION

BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO ORDER EA-13-109 PHASE 2, MODIFYING LICENSES

WITH REGARD TO RELIABLE HARDENED CONTAINMENT VENTS CAPABLE OF

OPERATION UNDER SEVERE ACCIDENT CONDITIONS

NEXTERA ENERGY DUANE ARNOLD, LLC DUANE ARNOLD ENERGY CENTER

DOCKET NO. 50-331

1.0 INTRODUCTION

By letter dated June 6, 2013, the U.S. Nuclear Regulatory Commission (NRC, the Commission) issued Order EA-13-109, "Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation under Severe Accident Conditions" [Reference 1]. The order requires licensees to implement its requirements in two phases. In Phase 1, licensees of boiling-water reactors (BWRs) with Mark I and Mark II containments shall design and install a venting system that provides venting capability from the wetwell during severe accident conditions. In Phase 2, licensees of BWRs with Mark I and Mark II containments shall design and install a venting system that provides venting capability from the drywell under severe accident conditions, or, alternatively, those licensees shall develop and implement a reliable containment venting strategy that makes it unlikely that a licensee would need to vent from the containment drywell during severe accident conditions. As required by Order EA-13-109, NextEra Energy Duane Arnold, LLC (NextEra, the licensee) submitted its Overall Integrated Plan (OIP) for Duane Arnold Energy Center (DAEC, Duane Arnold) for Phase 1 on June 25, 2014 [Reference 2]. The NRC staff's evaluation of the licensee's OIP for implementation of Phase 1 requirements was provided in the interim staff evaluation (ISE) for Phase 1 on February 11, 2015 [Reference 3].

This ISE focuses on the staff's review of the information provided for implementation of the Phase 2 requirements of Order EA-13-109. Phase 2 of Order EA-13-109 requires that BWRs with Mark I and Mark II containments have either a vent path from the containment drywell or a strategy that makes it unlikely that venting would be needed from the drywell before alternate, reliable containment heat removal and pressure control is reestablished. The second phase is not required to be installed concurrently with the first phase. The second phase shall be implemented no later than startup from the first refueling outage that begins after June 30, 2017, or June 30, 2019, whichever comes first.

By letter dated December 22, 2015 [Reference 4], NextEra provided its OIP for Duane Arnold in compliance with Section IV, Condition D.2 of Order EA-13-109. The OIP describes the licensee's currently proposed modifications to systems, structures, and components, new and revised guidance, and strategies that it intends to implement in order to comply with the requirements of Phase 2 of Order EA-13-109. The OIP also includes the third 6-month update for Phase 1 of the order in accordance with Section IV, Condition D.3 of Order EA-13-109. As stated above, this ISE will focus on the NRC staff's review of information provided in the OIP related to implementation of requirements for Phase 2 of the order. In specific areas where Phase 1 requirements are associated with the Phase 2 strategy, it is addressed in this ISE.

2.0 REGULATORY EVALUATION

Following the events at the Fukushima Dai-ichi nuclear power plant on March 11, 2011, the NRC established a senior-level agency task force referred to as the Near-Term Task Force (NTTF). The NTTF was tasked with conducting a systematic and methodical review of the NRC regulations and processes and determining if the agency should make improvements to these programs in light of the events at Fukushima Dai-ichi. As a result of this review, the NTTF developed a set of recommendations, documented in SECY-11-0093, "Near-Term Report and Recommendations for Agency Actions Following the Events in Japan," dated July 12, 2011 [Reference 5]. These recommendations were enhanced by the NRC staff following interactions with stakeholders. Documentation of the NRC staff's efforts is contained in the Commission's staff requirements memorandum (SRM) for SECY-11-0124, "Recommended Actions to be Taken without Delay from the Near-Term Task Force Report," dated September 9, 2011 [Reference 6], and SECY-11-0137, "Prioritization of Recommended Actions to be Taken in Response to Fukushima Lessons Learned," dated October 3, 2011 [Reference 7].

As directed by the Commission's SRM for SECY-11-0093 [Reference 8], the NRC staff reviewed the NTTF recommendations within the context of the NRC's existing regulatory framework and considered the various regulatory vehicles available to the NRC to implement the recommendations. SECY-11-0124 and SECY-11-0137 established the NRC staff's prioritization of the recommendations based upon the potential safety enhancements.

On February 17, 2012, the NRC staff provided SECY-12-0025, "Proposed Orders and Requests for Information in Response to Lessons Learned from Japan's March 11, 2011, Great Tohoku Earthquake and Tsunami" [Reference 9], to the Commission, including the proposed order to implement the installation of a reliable hardened containment venting system (HCVS) for Mark I and Mark II containments. As directed by SRM-SECY-12-0025 [Reference 10], the NRC staff issued Order EA-12-050, "Order Modifying Licenses with Regard to Reliable Hardened Containment Vents" [Reference 11], which required licensees to install a reliable HCVS for Mark I and Mark II containments.

While developing the requirements for Order EA-12-050, the NRC acknowledged that questions remained about maintaining containment integrity and limiting the release of radioactive materials if the venting systems were used during severe accident conditions. The NRC staff presented options to address these issues for Commission consideration in SECY-12-0157, "Consideration of Additional Requirements for Containment Venting Systems for Boiling Water Reactors with Mark I and Mark II Containments" [Reference 12]. In the SRM for SECY-12-0157 [Reference 13], the Commission directed the staff to issue a modification to Order EA-12-050,

requiring licensees with Mark I and Mark II containments to "upgrade or replace the reliable hardened vents required by Order EA-12-050 with a containment venting system designed and installed to remain functional during severe accident conditions." The NRC staff held a series of public meetings following issuance of SRM SECY-12-0157 to engage stakeholders on revising the order. Accordingly, by letter dated June 6, 2013, the NRC issued Order EA-13-109, "Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Performing under Severe Accident Conditions."

Order EA-13-109, Attachment 2, requires that BWRs with Mark I and Mark II containments have a reliable, severe-accident capable HCVS. This requirement shall be implemented in two phases. In Phase 1, licensees of BWRs with Mark I and Mark II containments shall design and install a venting system that provides venting capability from the wetwell during severe accident conditions. Severe accident conditions include the elevated temperatures, pressures, radiation levels, and combustible gas concentrations, such as hydrogen and carbon monoxide, associated with accidents involving extensive core damage, including accidents involving a breach of the reactor vessel by molten core debris. In Phase 2, licensees of BWRs with Mark I and Mark II containments shall design and install a venting system that provides venting capability from the drywell under severe accident conditions, or, alternatively, those licensees shall develop and implement a reliable containment venting strategy that makes it unlikely that a licensee would need to vent from the containment drywell during severe accident conditions.

On November 12, 2013, the Nuclear Energy Institute (NEI) issued NEI 13-02, "Industry Guidance for Compliance with Order EA-13-109," Revision 0 [Reference 14] to provide guidance to assist nuclear power reactor licensees with the identification of measures needed to comply with the requirements of Phase 1 of the HCVS order. On November 14, 2013, the NRC staff issued Japan Lessons-Learned Project Directorate (JLD) interim staff guidance (ISG) JLD- ISG-2013-02, "Compliance with Order EA-13-109, 'Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Performing under Severe Accident Conditions'" [Reference 15], endorsing, in part, NEI 13-02, Revision 0, as an acceptable means of meeting the requirements of Phase 1 of Order EA-13-109, and published a notice of its availability in the *Federal Register* (FR) (November 25, 2013, 78 FR 70356). As required by the order, the licensee submitted its OIP for Duane Arnold for Phase 1 on June 25, 2014. As stated above, the NRC staff issued its ISE for implementation of Phase 1 requirements on February 11, 2015 [Reference 3].

On April 23, 2015, the NEI issued NEI 13-02, "Industry Guidance for Compliance with Order EA-13-109," Revision 1 [Reference 16] to provide guidance to assist nuclear power reactor licensees with the identification of measures needed to comply with the requirements of Phase 2 of Order EA-13-109. On April 29, 2015, the NRC staff issued 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 Performing under Severe Accident Conditions'" [Reference 17], endorsing, in part, NEI 13-02, Revision 1, as an acceptable means of meeting the requirements of Phase 2 of Order EA-13-109, and published a notice of its availability in the FR [May 7, 2015, 80 FR 26303]. Licensees are free to propose alternate methods for complying with the requirements of Order EA-13-109.

By letter dated May, 27, 2014 [Reference 18], the NRC notified all BWR Mark I and Mark II licensees that the staff will be conducting audits of the implementation of Order EA-13-109.

This letter described the audit process to be used by the staff in its review of the information contained in licensee's submittals in response to Phase 1 of Order EA-13-109. The staff is using a similar process for its review of the information submitted for implementation of Phase 2 requirements of the order.

3.0 TECHNICAL EVALUATION

DAEC is a single unit General Electric BWR with a Mark I containment system with an existing containment venting system installed in accordance with NRC Generic Letter 89-16, "Installation of a Hardened Wetwell Vent" [Reference 29]. To implement the Phase 1 HCVS requirement of Order EA-13-109, the licensee plans to upgrade the existing containment venting capability from the containment wetwell to provide a reliable, severe accident capable hardened vent to assist in preventing core damage and, if necessary, to provide venting capability during severe accident conditions. New piping will be routed in the reactor building and will exit through the reactor building roof. To implement the Phase 2 (alternate strategy) requirements, the licensee plans to provide (i) a capability for severe accident water addition (SAWA), which will include a combination of permanently installed and portable equipment to provide a means to add water to the reactor pressure vessel (RPV) following a severe accident and monitor system and plant conditions and (ii) a severe accident water management (SAWM) strategy and guidance for controlling the water addition to the RPV for the sustained operating period. The OIP describes evaluations of temperature and radiological conditions to ensure that operating personnel can safely access and operate controls and support equipment. In addition, the OIP describes programmatic changes that include procedures, training, drills, and maintenance for SAWA and SAWM actions.

3.1 GENERAL INTEGRATED PLAN ELEMENTS AND ASSUMPTIONS

3.1.1 Evaluation of Extreme External Hazards

Extreme external hazards for Duane Arnold were evaluated in the Duane Arnold OIP in response to Order EA-12-049 (Mitigation Strategies) [Reference 21]. In the Duane Arnold ISE for Mitigation Strategies [Reference 20], the NRC staff documented an analysis of Duane Arnold extreme external hazards evaluation. The following extreme external hazards screened in: Seismic, Severe storms with high winds, Flooding, Snow, Ice and Extreme Cold, and High Temperatures. There were no extreme external hazards that were screened out. The NRC staff's review confirmed that the licensee's approach described in the Duane Arnold OIP in response to Order EA-12-049 (Mitigation Strategies) [Reference 19], is consistent with the guidance found in NEI 12-06 [Reference 27], as endorsed, by JLD-ISG-2012-01 [Reference 28], and that the requirements of Order EA-12-049 will be met for screening of the extreme external hazards if these requirements are implemented as described.

3.1.2 Assumptions

In its OIP, the licensee stated that it has adopted a set of generic assumptions associated with Order EA-13-109 Phase 1 and Phase 2 actions. The NRC staff reviewed the information in the OIP and determined that the set of generic assumptions appear to establish a baseline for HCVS evaluation consistent with the guidance found in NEI 13-02, Revision 1, as endorsed, in

part, by JLD-ISG-2013-02 and JLD-ISG-2015-01 as an acceptable method to implement the requirements of Order EA-13-109.

The NRC staff's review also noted that there was one new plant-specific assumption added for implementation of Phase 1 requirements of the order in the OIP. The new plant-specific assumption is:

PLT-2 The existing torus hard pipe vent system (discharging to the off gas stack) will be decommissioned. A new HCVS will be installed off of existing (capped) 12" torus nozzle N23 0A. The new vent will be routed from the Torus Room to the Southwest Corner Room, up through Reactor Building (RB) South Stairwell #6 to the RB Refuel Floor, and vent to atmosphere through the roof of the RB. The piping from the 12" torus nozzle will be reduced to 10" and remain at 10" for the entire vent length. The HCVS will include two Containment Isolation Valves (CV-4360 and CV-4361) and a rupture disc (PSE-43-62).

The NRC staff reviewed the information in the OIP and determined that the additional plant specific assumption for Duane Arnold does not appear to create deviations from the guidance found in NEI 13-02, as endorsed, in part, by JLD-ISG-2013-02 as an acceptable method to implement the requirements of Order EA-13-109.

The NRC staff's review noted that there were no plant-specific assumptions added for implementation of Phase 2 requirements of the order in the OIP.

3.1.3 Compliance Timeline and Deviations

In Part 1 of its OIP, the licensee stated that compliance will be attained with no known deviations to the guidelines included in JLD-ISG-2013-02, JLD-ISG-2015-01, and NEI 13-02 for each phase. Specifically, the OIP noted that the HCVS will be comprised of installed and portable equipment and operating guidance. For compliance with Phase 1 requirements of the order, the severe accident wetwell vent will be a permanently installed vent from the suppression pool to a discharge point above the Reactor Building roof. For compliance with Phase 2 requirements of the order, strategies for the use of SAWA and SAWM will include a combination of permanently installed and portable equipment to provide a means to add water to the RPV following a severe accident and guidance for controlling the water addition to the RPV for the sustained operating period. The OIP states that the current compliance schedule for Phase 2 is in the fourth Quarter of 2018. The OIP also noted that if deviations are identified at a later date, then the deviations will be communicated in a future 6-month update following identification.

Duane Arnold's implementation schedule complies with the requirements of the order, neither Duane Arnold nor the NRC staff has identified any deviations. Therefore, the staff concludes that if the schedule is implemented as described, it appears Duane Arnold will attain compliance with Phase 2 of Order EA-13-109 with no known deviations to the guidance found in NEI 13-02, endorsed, in part, by JLD-ISG-2013-02 and JLD-ISG-2015-01 as an acceptable method to implement the requirements of Order EA-13-109.

3.2 BOUNDARY CONDITIONS FOR WETWELL VENT

As documented in the ISE for implementation of Phase 1, dated February 11, 2015 [Reference 3], the NRC staff determined that the licensee's approach to Boundary Conditions for Wetwell Vent, if implemented as described in Section 3.2 and pending acceptable resolution of open items, appears to be consistent with the guidance found in NEI 13-02, endorsed, in part, by JLD-ISG-2013-02 as an acceptable means for implementing the requirements of Order EA-13-109. For the staff's complete analysis of the Boundary Conditions for Wetwell Vent, see the referenced ISE. Any new information included in the 6-month updates related to implementation of Phase 1 requirements of the order will be addressed separately.

3.3 BOUNDARY CONDITIONS FOR EA-13-109, OPTION B.

Order EA-13-109, Section B states that licensees with BWRs with Mark I and Mark II containments shall either:

(1) design and install a HCVS, using a vent path from the containment drywell, that meets the requirements of Section B.1, or

(2) develop and implement a reliable containment venting strategy that makes it unlikely that a licensee would need to vent from the containment drywell before alternate reliable containment heat removal and pressure control is established that meets the requirements in Section B.2.

In its OIP, the licensee confirmed that it will be using Option B.2 of EA-13-109 (SAWA and SAWM; or 545 degrees Fahrenheit (°F) severe accident drywell vent with SAWA). Therefore, the licensee used the OIP template found in NEI letter dated September 28, 2015 [Reference 23], and endorsed in NRC letter dated October 8, 2015 [Reference 26], as guidance to structure its OIP submittal. Both SAWM and severe accident drywell vent require the use of SAWA and may not be done independently. As a result, the HCVS actions under Part 2 of the licensee's OIP apply to Part 3 of the OIP, which includes the SAWA section and two subsections (SAWM and severe accident drywell vent, respectively). In Attachment 2.1.C of the licensee's OIP, additional plant-specific information is provided to support SAWA and SAWM actions.

3.3.1 Sequence of Events (SOE)

Order EA-13-109, Sections B.2.1, B.2.2, and B.2.3 state that:

2.1 The strategy making it unlikely that a licensee would need to vent from the containment drywell during severe accident conditions shall be part of the overall accident management plan for Mark I and Mark II containments.

2.2 The licensee shall provide supporting documentation demonstrating that containment failure as a result of overpressure can be prevented without a drywell vent during severe accident conditions.

2.3 Implementation of the strategy shall include licensees preparing the

necessary procedures, defining and fulfilling functional requirements for installed or portable equipment (e.g., pumps and valves), and installing the needed instrumentation.

In accordance with the requirements of Order EA-13-109, the operation of the HCVS using SAWA will be designed to minimize the reliance on operator actions in response to hazards listed in Part 1 of the OIP and in Section 3.1.1 above. These include: seismic, external flooding, extreme cold, high winds, and extreme high temperature. The licensee noted in its OIP, that initial operator actions will be completed by plant personnel and will include the capability for remote-manual initiation from the MCR using control switches, at Motor Control Center/Busses in the control building and locally in the turbine building and the pumphouse. In addition, HCVS initiation may occur at the remote operating station (ROS) at the 757' elevation in the control building (1A3 essential switchgear room).

The licensee developed timelines (see attachments 2A, SOE Timeline – HCVS, and 2.1.A, SOE Timeline – SAWA/SAWM, of the OIP for SAWA and SAWM) to identify required operator response times and actions. The timelines are an expansion of Attachment 2A of the OIP and begin either as core damage occurs (SAWA) or after initial SAWA injection is established and as the SAWA flowrate is adjusted for Option B.2 (SAWM) of Order EA-13-109. The licensee also indicated in its OIP that the timelines are appropriate for both in-vessel and ex-vessel core damage conditions. A list of manual actions needed to be performed by the plant personnel are noted in Table 3.1 of the OIP. The licensee stated that all operator actions, either from the primary operating station (POS) in the MCR or the remote operating system (ROS) will be evaluated for expected radiological and temperature conditions using the guidance provided in NEI 13-02 and HCVS-FAQ [Frequently Asked Questions]-12 [Reference 23].

The NRC staff reviewed the three cases contained in the SOE timeline for use of the HCVS [Attachment 2A of the OIP] and compared them with the information contained in the guidance document NEI 13-02, Revision 1, and determined that the three cases appropriately bound the conditions for which the HCVS is required. The three cases are: (1) successful FLEX implementation with no failure of reactor core isolation cooling (RCIC); (2) late failure of RCIC leading to core damage; and (3) failure of RCIC to inject at the start of the event. The timelines accurately reflect the progression of events as described in the Duane Arnold Mitigation Strategies OIP [Reference 21], SECY-12-0157 [Reference 12] and the State-of-the-Art Reactor Consequence Analyses [Reference 22]. The NRC staff also reviewed the SOE timeline - SAWA/SAWM [Attachment 2.1.A of the OIP] and determined that the appropriate actions are identified for which the SAWA/SAWM is required and are consistent with the generic guidance provided in NEI 13-02, Revision 1.

The NRC staff reviewed the licensee discussion on the SOEs identified in the OIP against the guidance in NEI 13-02 and confirmed that the identified items appear to be appropriately derived from the timelines developed in Attachment 2.1.A of the OIP, consistent with the guidance found in NEI 13-02, Revision 1, endorsed, in part, by JLD-ISG-2015-01. The timeline establishes when electrical power and Order EA-12-049 actions are needed to support the strategies for Order EA-13-109, Phase 1 and Phase 2; and when to initiate SAWA flow to the RPV.

3.3.2 Boundary Conditions for SAWA

Order EA-13-109, Sections B.2.2, and B.2.3 state that:

> 2.2 The licensee shall provide supporting documentation demonstrating that containment failure as a result of overpressure can be prevented without a drywell vent during severe accident conditions.
>
> 2.3 Implementation of the strategy shall include licensees preparing the necessary procedures, defining and fulfilling functional requirements for installed or portable equipment (e.g., pumps and valves), and installing the needed instrumentation.

3.3.2.1 SAWA Manual and Time Sensitive Actions

Table 3.1 of the OIP provides a list of SAWA manual actions, which are time sensitive. These manual actions include establishing HCVS capability, making several electrical and mechanical connections in order to initiate water injection to the RPV, and monitoring SAWA indications. These time sensitive manual actions are expected to be performed within 6 hours from the loss of injection systems due to a severe accident and to support the strategies and actions needed for Phase 1 and Phase 2 requirements of Order EA-13-109. These actions will also support the SAWA flow to the RPV in less than 8 hours. The time sensitive actions to be completed within the reactor building will be evaluated per guidance in NEI 13-02 and HCVS-FAQ-12 [Reference 23]. Time constraints for operator actions and their bases, including their validation will be completed per guidance in NEI 13-02 and HCVS-FAQ-13 [Reference 23].

In non-flood conditions, the flow path will be from the Cedar River by way of the FLEX pump obtaining suction from the circulation water pit at the pumphouse, and discharging by hose to the connection point in the turbine building heater bay. The FLEX pump has a discharge flow indication. The pump has a minimum flow capability, which also provides freeze protection. This connection has a manual isolation valve. This piping routes through the turbine building/reactor building wall, into the reactor building, and ties into the "A" residual heat removal (RHR) loop via manual isolation valves (FLEX RPV injection point). Once the SAWA components are deployed and connected, the SAWA flow path is completed by opening the A RHR low pressure core injection (LPCI) injection valve. The A RHR LPCI injection valve is normally closed and will be manually or electrically opened in SAWA conditions. Backflow prevention is provided by the A RHR LPCI injection loop check valve.

Cross flow into other portions of the RHR system will be isolated by ensuring closure of the other motor operated valves (MOVs). Select RHR MOVs will be powered from the FLEX diesel generator. Drywell pressure and suppression pool level will be monitored and flowrate will be adjusted by use of the flow control valve at the FLEX (SAWA) pump. Communication will be established between the MCR and the FLEX (SAWA) pump location.

MOVs and containment instrumentation required for SAWA will be powered by the FLEX diesel generators, connected at the control building essential switchgear room as described in the EA-12-049 compliance documents. The FLEX diesel generators will be located on the north side of the turbine building, which is a significant distance from the HCVS (greater than 200 feet) and are on the opposite side of the buildings (vent is located on the south side of the reactor

building). Refueling of the FLEX diesel generator and FLEX (SAWA) pump will be accomplished using the established FLEX procedures, and will account for dose rates and area accessibility. The pumphouse is a significant distance away from the HCVS, and substantial structural shielding is provided at this location.

In a flood condition, the FLEX (SAWA) pump is staged in the turbine building rail bay. The flow path takes suction from the main condenser hotwell. The pump suction is connected to the hotwell condenser bypass line via a hard pipe branch, manual isolation valve, and connection point in the turbine building 1st floor heater bay. A hose will be ran from this connection point to the south turbine building rail bay area and connected to the pump inlet. The pump discharge hose will be connected and routed to the FLEX RPV injection point, at the turbine building first floor heater bay. From this point on the injection flow path is the same as the non-flood condition (through the A RHR LPCI injection line), as described above.

The NRC staff reviewed the SAWA Manual Actions (Table 3.1 of the OIP) and time sensitive SAWA actions and found that the components required for manual operation appear to be in areas that are readily accessible to plant operators, and do not require extensive operator actions to operate the SAWA system. Additionally, the manual actions minimize the time operators need to spend at the SAWA monitoring locations during system operation under severe accident conditions. The NRC staff reviewed the SAWA manual and time sensitive actions against the guidance in Section 6.1 and Attachment I of NEI 13-02, Revision 1 [Reference 16], and confirmed that these actions appear to consider minimizing the reliance on operator actions and be timely taken. This appears to be in accordance with the guidance found in NEI 13-02, Revision 1, endorsed, in part, by JLD-ISG-2015-01 as an acceptable means for implementing applicable requirements of Order EA-13-109.

3.3.2.2 SAWA Severe Accident Operation

The SAWA operating requirements during a severe accident were developed using guidance provided in NEI 13-02, Section 4 and Appendix I. The guidance indicates that a maximum water addition flow of 500 gallons per minute (gpm) is sufficient for SAWA. The guidance also indicates that time to establish water addition capability is expected to be less than 8 hours. Plant connection points and portable equipment satisfying the requirements of Order EA-12-049 may be credited by providing actions necessary to deploy and maintain equipment that can be performed under the thermal and radiological conditions that exist during a severe accident. The SAWA flow path should contain backflow prevention to minimize the possibility of combustible gases, and the backflow of hot and radioactive fluids from exiting containment through the SAWA system.

In its OIP, the licensee stated that its strategy for SAWA assumes loss of reactor injection at the onset of the event. The SAWA capability will be available within 8 hours and will use existing and portable equipment. The OIP also noted that the SAWA flow path includes methods to minimize exposure of personnel to radioactive liquids, gases and potentially flammable conditions by inclusion of backflow prevention. The RHR LPCI system injection mode has an installed emergency core cooling system check valve qualified for severe accident conditions to prevent reverse flow from the RPV.

The NEI guidance states that a maximum SAWA flow of 500 gpm is acceptable. The guidance also indicates sites may use a SAWA capacity equivalent to the site specific reactor core isolation cooling (RCIC) design flow rate if less than 500 gpm. SAWA capacity less than 500 gpm or site specific RCIC design flow should be supported by site specific design. The guidance provides that SAWA flow rate may be determined by scaling, a ratio of the plant thermal power rating over the reference plant power level multiplied by 500 gpm. Duane Arnold determined their SAWA flow rate by scaling their licensed thermal power of 1912 MWt (megawatts thermal) to the reference plant's licensed thermal power of 3514 MWt and multiplying by 500 gpm to yield a Duane Arnold site specific SAWA flow rate of 272 gpm.

As part of SAWA operation, the OIP described the SAWA actions that will be required for the first 24 hours and coping details for greater than 24 hours of operation. The OIP indicated that SAWA operation is the same for the full period of sustained operation. The SAWA system shall be capable of providing a RPV injection rate of 272 gpm within 8 hours of a loss of all RPV injection following an extended loss of alternating current (ac) power (ELAP)/Severe Accident. The SAWA system shall meet the design characteristics of the HCVS with the exception of the dedicated 24 hours power source. Hydrogen mitigation is provided by the presence of a backflow prevention device in the SAWA flow path as described above, which is consistent with the guidance found in Section I.1.4.4 of NEI 13-02, Revision 1.

The NRC staff reviewed the SAWA severe accident operation against the guidance in Section 4 and Appendix I to NEI 13-02, Revision 1 and determined that if operated as described in the Duane Arnold OIP, this strategy appears to be able to maintain the temperature in the drywell less than 545 °F in an ELAP scenario. This appears to be in accordance with the guidance found in NEI 13-02, Revision 1, endorsed, in part, by JLD-ISG-2015-01 as an acceptable means for implementing applicable requirements of Order EA-13-109.

3.3.2.3 Equipment Locations/Controls/Instrumentation

The licensee used the guidance provided in NEI 13-02, Section I.1.6 in selecting the equipment locations, controls, and instrumentation. The locations of the SAWA equipment and controls, as well as ingress and egress paths need to be evaluated for the expected severe accident conditions for the sustained operating period. Severe accident conditions include temperature, humidity, and radiation. The equipment needs to be evaluated to remain operational throughout the period of sustained operation. Personnel exposure and environmental conditions for operation of SAWA equipment also needs to be evaluated per plant safety guidelines. In its OIP, the licensee stated that electrical equipment and instrumentation will be powered from the existing station batteries, and from ac distribution systems that are powered from the generators used in support of EA-12-049 requirements. The SAWA system will use a FLEX pump to pump water from the circulating water pit at the pumphouse under non-flood conditions or from the condenser hotwell during flood conditions to the RHR/LPCI system piping which has connections to the RPV.

Open Item: 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.

In its OIP, the licensee provided information regarding how electrical equipment and instrumentation will be powered to monitor the required parameters during the sustained period of operation. The parameters to be monitored as noted in the OIP table include:

- Drywell Pressure
- Suppression Pool Level
- SAWA Flow
- Valve controls

The NRC staff reviewed the information provided regarding power sources for the electrical equipment and instrumentation to support the HCVS operation during the sustained operating period and finds it consistent with the guidance provided Appendix I of NEI 13-02. The OIP also stated that equipment and instrumentation has been evaluated to perform its function for the sustained operating period under the expected radiological and temperature conditions.

The OIP also stated that SAWA components and connections external to protected buildings have been protected against the screened-in hazards of Order EA-12-049 for the station. Regarding component qualifications, the OIP stated that the SAWA permanently installed equipment shall meet the same qualifications as for the wetwell operation during severe accident conditions. Temporary and portable equipment shall be qualified and stored to the same requirements as FLEX equipment as specified in NEI 12-06.

Open Item: Licensee to demonstrate that SAWA components and connections external to protected buildings have been protected against the screened-in hazards of Order EA-12-049 for the station.

The NRC staff reviewed the equipment locations, controls, and instrumentation that are described for SAWA monitoring and control against the guidance in Appendix I to NEI 13-02, Revision 1 and, confirmed that it is consistent. This appears to be in accordance with NEI 13-02, Revision 1, endorsed, in part, by JLD-ISG-2015-01, pending satisfactory resolution of open items, as an acceptable means for implementing applicable requirements of Order EA-13-109.

3.3.2.4 SAWA Procedures/Guidelines

In its OIP, the licensee stated that the procedures and guidelines for SAWA implementation will be developed per guidance provided in NEI 13-02, Sections 1.3 and 6.1.2. The NRC staff reviewed the Duane Arnold OIP section which describes elements and action items in support of SAWA implementation. The staff agrees that the information provided will support completing the SAWA procedures and guidelines in support of SAWA implementation. This appears to be in accordance with NEI 13-02, Revision 1, endorsed, in part, by JLD-ISG-2015-01 as an acceptable means for implementing applicable requirements of Order EA-13-109.

3.3.3 Boundary Conditions for SAWA/SAWM

Order EA-13-109, Attachment 2, requirement A.1.2.1 requires the HCVS to have the capacity to vent the steam/energy equivalent of one percent of the licensed/rated thermal power and be able to restore and maintain containment pressure below the primary containment design pressure and the primary containment pressure limit. This was identified in the OIP for Phase 1.

Order EA-13-109, Attachment 2, requirement B.2.2 requires that the licensee shall provide supporting documentation demonstrating that containment failure as a result of overpressure can be prevented without a drywell vent during severe accident conditions. Requirement A.1.2.1 provides assurance the HCVS has sufficient capacity to prevent containment failure as a result of over pressurization. Maintaining the availability of the wetwell vent makes it unlikely that a licensee would need to vent from the containment drywell during severe accident conditions.

Guidance document NEI 13-02, Revision 1, as endorsed, in part, by NRC guidance JLD-ISG-2015-01, states that the preservation of the wetwell vent path, which is accomplished by managing the water addition flow rate to the extent that the wetwell vent line remains available until other means of severe accident coping are available, is termed Severe Accident Water Management (SAWM).

In NEI 13-02, Revision 1, it also states that there are three approaches for demonstrating a successful SAWM strategy that constitute a reliable containment venting strategy that makes it unlikely that a licensee would need to vent from the containment drywell before alternate reliable containment heat removal and pressure control is reestablished.

Open Item: Licensee to demonstrate that containment failure as a result of overpressure can be prevented without a drywell vent during severe accident conditions.

In its OIP, the licensee indicated that SAWM can be maintained greater than 7 days without the need for a drywell vent to maintain pressure below the Primary Containment Pressure Limit, which meets the criteria for the first approach identified in the aforementioned guidance document. The NRC staff reviewed the boundary conditions for SAWA/SAWM against the guidance in Appendix C.7 to NEI 13-02, Revision 1, and confirmed that under this approach, no detail concerning plant modifications or procedures is necessary in the licensee's OIP with respect to how alternate containment heat removal will be provided. This appears to be in accordance with the guidance found in NEI 13-02, Revision 1, endorsed, in part, by JLD-ISG-2015-01, pending satisfactory resolution of open items, as an acceptable means for implementing applicable requirements of Order EA-13-109.

3.3.3.1 Basis for SAWM Time Frame

In NEI 13-02, Revision 1, endorsed, in part, by JLD-ISG-2015-01, it states that SAWM will lead to an HCVS Stable State for the drywell and wetwell for at least 7 days from the start of the ELAP as shown in Figures C-2 through C-6 of the guidance document. Figures C-2 through C-6 of NEI 13-02, Revision 1, which are based on a representative BWR-4 with Mark I containment using Modular Accident Analysis Program [MAAP] 5.02, demonstrate that SAWA and SAWM in conjunction with the wetwell vent, can stabilize containment parameters and prevent containment failure even with a delay in water injection that results in core debris

breaching the reactor vessel for the representative plant. In addition, the wetwell vent is effective in removing non-condensable gases from containment, including any hydrogen generated by the core oxidation and the core-concrete interaction. The licensee states in its OIP that Duane Arnold is bounded by the evaluations performed in Boiling Water Reactor Owners Group TP-15-008 and representative of the reference plant in guidance document NEI 13-02 figures C-2 through C-6.

Open Item: Licensee to demonstrate how the plant is bounded by the reference plant analysis that shows the SAWM strategy is successful in making it unlikely that a drywell vent is needed.

Instrumentation that will be utilized to implement the SAWM strategy includes drywell pressure, suppression pool level, and SAWA flow. The first two required instruments are initially powered by station batteries and then by the FLEX (EA-12-049) diesel generator, which is placed in-service prior to core breach. The diesel generator will provide power throughout the sustained operation period (7 days). FLEX (SAWA) pump flow is monitored using a mechanical flow element/indicator. Drywell temperature monitoring is not a requirement for compliance with Phase 2 of the order, but some knowledge of temperature characteristics provides information for the operation staff to evaluate plant conditions under a severe accident and provide confirmation to adjust SAWA flow rates.

The OIP states that suppression pool level indication will be maintained throughout the sustained operation period, while the HCVS remains in-service. The time to reach the level at which the wetwell vent must be secured is greater than 7 days using SAWM flowrates. Procedures will be developed that control the suppression pool level in the indicating range. The instruments to monitor pressure in the drywell will also be maintained to assist in determining how effectively the core is being cooled, whether in-vessel or ex-vessel. Procedures will dictate conditions during which the SAWM flowrate should be adjusted (up or down) using suppression pool level and drywell pressure as controlling parameters to remove the decay heat from the containment.

The NRC staff reviewed the basis for the SAWM time frame against the guidance in Appendix C to NEI 13-02, Revision 1 and, confirmed that they are consistent. This appears to be in accordance with NEI 13-02, Revision 1, endorsed, in part, by JLD-ISG-2015-01, pending satisfactory resolution of open items, as an acceptable means for implementing applicable requirements of Order EA-13-109.

3.3.3.2 SAWM Manual and Time Sensitive Actions

Table 3.1.B of the OIP provides a list of SAWM manual actions. The time sensitive SAWM actions include: (1) initiate actions to maintain the wetwell vent capability by lowering injection rate, while maintaining the cooling of the core debris; and (2) monitor SAWM critical parameters while ensuring the severe accident wetwell vent remains available.

The NRC staff reviewed the SAWM Manual Actions (Table 3.1.B of the OIP) and time sensitive SAWM actions, and found that the components required for manual operation appear to be in areas that are readily accessible to plant operators, and do not require extensive actions to facilitate the SAWM strategy. Additionally, the manual actions appear to minimize the time

operators need to spend at the SAWM monitoring locations during system operation under severe accident conditions. The NRC staff reviewed the SAWA manual and time sensitive actions against the guidance in Section 6.1 and Attachment C of NEI 13-02, Revision 1 [Reference 16], and confirmed that these actions appear to consider minimizing the reliance on operator actions. This appears to be in accordance with the guidance found in NEI 13-02, Revision 1, endorsed, in part, by JLD-ISG-2015-01 as an acceptable means for implementing applicable requirements of Order EA-13-109.

3.3.3.3 SAWM Severe Accident Operation

Order EA-13-109 Attachment 2, Sections B.2.2 and B.2.3 state that:

> 2.2 The licensee shall provide supporting documentation demonstrating that containment failure as a result of overpressure can be prevented without a drywell vent during severe accident conditions.
>
> 2.3 Implementation of the strategy shall include licensees preparing the necessary procedures, defining and fulfilling functional requirements for installed or portable equipment (e.g., pumps and valves), and installing the needed instrumentation.

The licensee anticipates that SAWM will only be used in severe accident events based on presumed failure of plant injection systems, as directed by the plant Severe Accident Management Guidelines (SAMGs). Attachment 2.1.D of the OIP provides language for SAWM that will be incorporated into the site SAMGs.

The SAWA capability will be established, as described above in Section 3.2.2. The SAWM strategy will use the installed instrumentation to monitor and adjust the flow from the SAWA equipment to control the pump discharge to deliver flowrates applicable to the SAWM strategy. Once the SAWA initial flow rate has been established for 4 hours, the flow will be controlled while monitoring drywell pressure and suppression pool level. The SAWA flowrate under SAWM will be controlled to maintain containment parameters and preserve the wetwell vent path. The SAWA equipment is expected to be capable of injection for the period of sustained operation.

The SAWA/SAWM flow strategy will be employed until alternate reliable containment heat removal and pressure control is reestablished (which is not expected to exceed 7 days). The SAWM flow strategy uses the SAWA flow path and no additional modifications are being made for SAWM.

The instrumentation necessary to employ the SAWM strategy shall be capable of monitoring the containment parameters of drywell pressure and suppression pool level to provide information to operators to assist them in determining how SAWA injection rates should be controlled, until alternate containment decay heat/pressure control is established. The SAWA equipment is expected to be capable of injection for the period of sustained operation (7 days).

The NRC staff reviewed the SAWM severe accident operation, specifically the expected SAWA flow rates from initiation of SAWA, the expected suppression pool water level response, the

suppression pool freeboard, and the minimum permitted flow rate for containment protection. It was determined that under this water management strategy, sufficient water will be supplied to reduce thermal challenges to the containment so that the containment capability remains intact, and in addition, water flow rate can be optimized, when appropriate, in order to avoid compromising the wetwell vent path. The NRC staff reviewed the SAWM severe accident operation against the guidance in Appendix C to NEI 13-02, Revision 1 and determined that if operated as described, this strategy may be used in an ELAP scenario to mitigate core damage. This appears to be in accordance with the guidance found in NEI 13-02, Revision 1, endorsed, in part, by JLD-ISG-2015-01 as an acceptable means for implementing applicable requirements of Order EA-13-109.

3.3.3.4 Equipment Locations/Controls/Instrumentation

The SAWM control location is the same as the SAWA control location. The OIP indicates the SAWA flowrate is provided by an inline flow meter in the hose to the turbine building heater bay connection point and will not require external power source. The SAWA injection flowrate is controlled at the FLEX pump using flow indication and local valves. Suppression pool level and drywell pressure are read in the control room using indicators powered by the FLEX diesel generator installed under EA-12-049. These indications are used to control SAWM flowrate to the RPV.

Open Item: Licensee to demonstrate that there is adequate communication between the MCR and the operator at the FLEX pump during severe accident conditions.

The OIP also noted that key parameters used for SAWM implementation are:

- Drywell Pressure
- Suppression Pool Level
- SAWA Flowrate

The OIP indicates that instrumentation and equipment being used for SAWA and SAWM along with supporting equipment have been evaluated to perform for the sustained operating period under the expected radiological and temperature conditions. The drywell pressure and suppression pool level instruments are qualified to NRC Regulatory Guide 1.97. The SAWA flow instrumentation needs to be qualified for the expected environmental conditions.

Open Item: Licensee to demonstrate the SAWM flow instrumentation qualification for the expected environmental conditions.

The NRC staff reviewed the equipment locations, controls, and instrumentation that are described for SAWM monitoring and control of the SAWA system and concluded that they appear to be reasonable. This appears to be in accordance with the guidance found in NEI 13-02, Revision 1, endorsed, in part, by JLD- ISG- 2015-01, pending satisfactory resolution of open items, as an acceptable means for implementing applicable requirements of Order EA- 13-109.

3.4 PROGRAMMATIC CONTROLS, TRAINING, DRILLS AND MAINTENANCE

3.4.1 Programmatic Controls

Order EA-13-109, Sections 3.1 and 3.2 state that:

> 3.1 The licensee shall develop, implement, and maintain procedures necessary for the safe operation of the HCVS. Procedures shall be established for system operations when normal and backup power is available, and during an extended loss of AC power.
>
> 3.2 The licensee shall train appropriate personnel in the use of the HCVS. The training curricula shall include system operations when normal and backup power is available, and during an extended loss of AC power.

In Part 4 of its OIP, the licensee states that site-specific program and procedures are being developed following the guidance provided in NEI 13-02, Sections 5, 6.1.2, and 6.1.3. These will address the use and storage of portable equipment relative to the severe accident defined in NRC Order EA-13-109 and the hazards applicable to the site per Section 3.1.1 above. In addition, procedures will be established for system operations when normal and backup power is available, and during ELAP conditions. The OIP also states that provisions will be established for out-of-service requirements of the HCVS and the compensatory measures. The OIP provided specific time frames for out-of-service requirements for the HCVS/SAWA functionality.

In its OIP, the licensee provides an overview of how programmatic controls and procedures are being developed for implementation of SAWA and SAWM strategy. The OIP also provides a list of key areas where either new procedures will be developed or existing procedures will be revised. The NRC staff reviewed the overall procedures and programs development process including the list of key components to be included and noted that, it appears to be consistent with the guidance found in NEI 13-02, Revision 1, endorsed, in part, by JLD-ISG-2013-02 and JLD-ISG-2015-01 as an acceptable means for implementing applicable requirements of Order EA-13-109. The NRC staff determined that procedure development appears to be in accordance with existing industry protocols. The provisions for out-of-service requirements appear to reflect consideration of the probability of an ELAP requiring severe accident venting and the consequences of a failure to vent under such conditions.

3.4.2 Training

Order EA-13-109, Section 3.2 states that:

> 3.2 The licensee shall train appropriate personnel in the use of the HCVS. The training curricula shall include system operations when normal and backup power is available, and during an extended loss of AC power.

In Part 4 of its OIP, the licensee stated that all personnel expected to perform direct execution of the HCVS/SAWA/SAWM actions will receive necessary training. The training plan will be developed per the guidance provided in NEI 13-02, Section 6.1.3 and will be refreshed on a periodic basis as changes occur to the HCVS/SAWA/SAWM actions, systems or strategies. In addition, training content and frequency will follow the systematic approach to training process.

The Duane Arnold OIP describes HCVS training requirements which the NRC staff reviewed and confirmed are consistent with the guidance found in Section 6.1.3 of NEI 13-02, Revision 1 [Reference 16]. The systematic approach to training process has been accepted by the NRC as appropriate for developing training for nuclear plant personnel. The training plan appears to be in accordance with the guidance found in NEI 13-02, Revision 1, endorsed, in part, by JLD-ISG-2015-01 as an acceptable means for implementing applicable requirements of Order EA-13-109.

3.4.3 Drills

Order EA-13-109, Section 3.1, states that:

> 3.1 The licensee shall develop, implement, and maintain procedures necessary for the safe operation of the HCVS. Procedures shall be established for system operations when normal and backup power is available, and during an extended loss of AC power.

In Part 4 of its OIP, the licensee states that drills and exercise parameters will be developed and aligned with the guidance provided in NEI 13-06, "Enhancements to Emergency to Response Capabilities for Beyond Design Basis Accidents and Events" [Reference 24] and NEI 14-01, "Emergency Response Procedures and Guidelines for Extreme Events and Severe Accidents" [Reference 25]. In addition, drills, tabletops, or exercises will be developed to use of HCVS/SAWA/SAWM system.

The Duane Arnold OIP describes an approach to drills, which the NRC staff reviewed and confirmed is consistent with the guidance found in Section 6.1.3 of NEI 13-02, Revision 1 [Reference 16]. This approach appears to be in accordance with the guidance found in NEI 13-02, Revision 1, endorsed, in part, by JLD-ISG-2015-01 as an acceptable means for implementing applicable requirements of Order EA-13-109.

3.4.4 Maintenance

Order EA-13-109, Section 1.2.13 states that:

> 1.2.13 The HCVS shall include features and provisions for the operation, testing, inspection and maintenance adequate to ensure that reliable function and capability are maintained.

For Phase 2 compliance requirements, Table 4-1 was revised to include testing and inspection requirements for SAWA components. The NRC staff reviewed Table 4-1 and found that it is consistent with Section 6.2.4 of NEI 13-02, Revision 1. Implementation of these testing and inspection requirements for HCVS and SAWA will ensure reliable operation of the systems.

In Part 4 of its OIP, the licensee states that the maintenance program will be developed following the guidance provided in NEI 13-02, Sections 5.4, and 6.2 and will utilize the standard Electric Power Research Institute industry preventive maintenance process for the maintenance calibration and testing for the HCVS/SAWA/SAWM components.

The Duane Arnold OIP describes an approach to maintenance, which the NRC staff reviewed and confirmed is consistent with the guidance found in Sections 5.4 and 6.2 of NEI 13-02, Revision 1 [Reference 16]. The maintenance plan as described appears to be in accordance with the guidance found in NEI 13-02, Revision 1, endorsed, in part, by JLD-ISG-2015-01 as an acceptable means for implementing applicable requirements of Order EA-13-109.

4.0 OPEN ITEMS

This section contains a summary of the open items identified to date as part of the staff's evaluation. Open items are topics for which there is insufficient information to fully resolve the issue, for which the NRC staff requires clarification to ensure the issue is on a path to resolution, or for which the actions to resolve the issue are not yet complete. The intent behind designating an issue as an open item is to highlight items that the staff intends to review further. The NRC staff has reviewed the licensee's OIP for consistency with NRC policy and technical accuracy. The NRC and licensee identified open items have been identified in Section 3.0 and are listed in the table below. Furthermore, these open items have been communicated to the licensee during the September , 2016, teleconference between NRC staff and the licensee.

List of Open items

Open Item	Action	ISE Section
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.	Section 3.3.2.3
2.	Licensee to demonstrate that SAWA components and connections external to protected buildings have been protected against the screened-in hazards of Order EA-12-049 for the station.	Section 3.3.2.3
3.	Licensee to demonstrate that containment failure as a result of overpressure can be prevented without a drywell vent during severe accident conditions.	Section 3.3.3
4.	Licensee to demonstrate how the plant is bounded by the reference plant analysis that shows the SAWM strategy is successful in making it unlikely that a drywell vent is needed.	Section 3.3.3.1
5.	Licensee to demonstrate that there is adequate communication between the MCR and the operator at the FLEX pump during severe accident conditions.	Section 3.3.3.4
6.	Licensee to demonstrate the SAWM flow instrumentation qualification for the expected environmental conditions.	Section 3.3.3.4

5.0 SUMMARY

As required by Order EA-13-109, the licensee has provided an OIP for implementation of Phase 2 requirements of the order. The OIP describes how containment venting strategies will be developed and used to remove decay heat from the containment, and maintain control of containment pressure within acceptable limits during a severe accident and loss of active heat removal capability. These strategies include use of SAWA equipment to inject water into the RPV and use of a SAWM strategy to control water injection and suppression pool level to ensure the HCVS wetwell vent will remain functional for removal of decay heat from containment during the prescribed period of Sustained Operation.

The NRC staff finds that the licensee's OIP for Phase 2 of Order EA-13-109 describes: plan elements and assumptions; boundary conditions; provisions for programmatic controls, training, drills and maintenance; and an implementation schedule that, subject to acceptable closure of the above open items, appear consistent with the guidance found in NEI 13-02, Revision 1, endorsed, in part, by JLD-ISG-2015-01 as an acceptable means for implementing Phase 2 requirements of Order EA-13-109..

6.0 REFERENCES

1. Order EA-13-109, "Order Modifying Licenses with Regard to Reliable Hardened Containment Vents Capable of Operation Under Severe Accident Conditions," June 6, 2013 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML13143A321).

2. Letter from NextEra to NRC, NextEra Energy Deane Arnold, LLC's 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 Phase 1 (Order EA-13-109)," dated June 25, 2014 (ADAMS Accession No. ML14182A423).

3. Letter from NRC to NextEra, "Duane Arnold Energy Center -Interim Staff Evaluation Relating To Overall Integrated Plan In Response To Phase 1 Of Order EA-13-109 (Severe Accident Capable Hardened Vents) (TAC No. MF4391)," dated February 11, 2015 (ADAMS Accession No. ML15006A319).

4. Letter from NextEra to NRC, "Duane Arnold, 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-1 3-109)" dated December 22, 2015 (ADAMS Accession No. ML15358A043).

5. SECY-11-0093, "Near-Term Report and Recommendations for Agency Actions Following the Events in Japan", (ADAMS Accession No. ML111861807).

6. SRM-SECY-11-0124, "Recommended Actions to be taken Without Delay from the Near-Term Task Force Report", (ADAMS Accession No. ML112911571).

7. SRM-SECY-11-0137, "Prioritization of Recommended Actions to be Taken in Response to Fukushima Lessons Learned", (ADAMS Accession No. ML113490055).

8. SRM-SECY-11-0093, "Staff Requirements – SECY-11-0093 – Near-Term Report and Recommendations for Agency Actions following the Events in Japan," August 19, 2011 (ADAMS Accession No. ML112310021).

9. SECY-12-0025, "Proposed Orders and Requests for Information in Response to Lessons Learned from Japan's March 11, 2011, Great Tohoku Earthquake and Tsunami," February 17, 2012 (ADAMS Accession No. ML12039A103).

10. SRM-SECY-12-0025, "Staff Requirements – SECY-12-0025 - Proposed Orders and Requests for Information in Response to Lessons Learned from Japan's March 11, 2011, Great Tohoku Earthquake and Tsunami," March 9, 2012 (ADAMS Accession No. ML120690347).

11. Order EA-12-050, "Order Modifying Licenses with Regard to Reliable Hardened Containment Vents," March 9, 2012 (ADAMS Accession No. ML12054A694).

12. SECY-12-0157, "Consideration of Additional Requirements for Containment Venting Systems for Boiling Water Reactors with Mark I and Mark II Containments", November 26, 2012 (ADAMS Accession No. ML12325A704).

13. SRM-SECY-12-0157, "Staff Requirements - SECY-12-0157, "Consideration Of Additional Requirements For Containment Venting Systems For Boiling Water Reactors With Mark I And Mark II Containments", March 19, 2013 (ADAMS Accession No. ML13078A017).

14. NEI 13-02, "Industry Guidance for Compliance with Order EA-13-109," Revision 0, November 12, 2013 (ADAMS Accession No. ML13316A853).

15. Interim Staff Guidance JLD-ISG-2013-02, "Compliance with Order EA-13-109, Severe Accident Reliable Hardened Containment Vents," November 14, 2013 (ADAMS Accession No. ML13304B836).

16. NEI 13-02, "Industry Guidance for Compliance with Order EA-13-109," Revision 1, April 23, 2015 (ADAMS Accession No. ML15113B318).

17. Interim Staff Guidance JLD-ISG-2015-01, "Compliance with Phase 2 of Order EA-13-109, Severe Accident Reliable Hardened Containment Vents," April 29, 2015 (ADAMS Accession No. ML15104A118).

18. Nuclear Regulatory Commission Audits Of Licensee Responses To Phase 1 of Order EA-13-109 to Modify Licenses With Regard To Reliable Hardened Containment Vents Capable Of Operation Under Severe Accident Conditions (ADAMS Accession No. ML14126A545).

19. Order EA-12-049, "Order to Modify Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events", March 12, 2012 (ADAMS Accession No. ML12054A735).

20. Duane Arnold Energy Center - Interim Staff Evaluation Relating To Overall Integrated Plan In Response To Order EA-12-049 (Mitigation Strategies) (TAC NO. MF1000) (ADAMS Accession No. ML14007A676).

21. Letter from NextEra to NRC, "NextEra Energy Duane Arnold, LLC's Overall Integrated Plan in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049)", dated February 28, 2013 (ADAMS Accession No. ML13063A148).

22. NUREG-1935, State-of-the-Art Reactor Consequence Analyses (SOARCA) Report (ADAMS Accession No. ML12332A058).

23. Letter from NRC to NEI, "Hardened Containment Venting System (HCVS) Phase 1 and 2 Overall Integrated Plan Template," Revision 1, dated September 22, 2015, and FAQs 10, 11, 12, and 13 (ADAMS Accession No. ML15273A141).

24. NEI 13-06, Enhancements to Emergency Response Capabilities for Beyond Design Basis Accidents and Events, Revision 0, dated March 2014.

25. NEI 14-01, Emergency Response Procedures and Guidelines for Extreme Events and Severe Accidents, Revision 0, dated March 2014.

26. Letter from NRC to NEI endorsing, "Hardened Containment Venting System (HCVS) Phase 1 and 2 Overall Integrated Plan Template," Revision 1, dated October 8, 2015, and FAQs 10, 11, 12, 13 (ADAMS Accession No. ML15271A148).

27. NEI 12-06, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide," Revision 0, dated August 2012.

28. Interim Staff Guidance JLD-ISG-2012-01, "Compliance with Order EA-12-049, Mitigation Strategies for Beyond-Design-Basis External Events," dated August 29, 2012.

29. Generic Letter 89-16, "Installation of a Hardened Wetwell Vent" (ADAMS Accession No. ML060760371)

Principal Contributors: Bruce Heida
Brian Lee
Brett Titus
Rajender Auluck

Date: September 13, 2016

If you have any questions, please contact Brian E. Lee, Project Manager, at 301-415-2916 or at Brian.Lee@nrc.gov.

Sincerely,

/RA/

Jessie F. Quichocho, Chief
Containment and Balance of Plant Branch
Japan Lessons-Learned Division
Office of Nuclear Reactor Regulation

Docket No. 50-331

Enclosure:
Interim Staff Evaluation

cc w/encl: Distribution via Listserv

DISTRIBUTION

PUBLIC
JOMB R/F
RidsNrrDorlLpl3-1Resource
RidsNrrPMDuaneArnoldResource
RidsNrrLASLentResource
RidsAcrsAcnw_MailCTR Resource
RidsOGCMailCenter
RidsRgn3MailCenter Resource
MValentin, NRR
RAuluck, NRR
BLee, NRR
JPaige, NRR

ADAMS Accession No.: ML16248A001 ***via email**

OFFICE	NRR/JLD/JCBB/PM	NRR/JLD/JLD/LA	NRR/JLD/JOMB/PM	NRR/JLD/JCBB/BC
NAME	BLee	SLent	MValentin	JQuichocho
DATE	09/ 01 /2016	09/ 08/2016	09/ 02 /2016	09/ 13 /2016

OFFICIAL RECORD COPY