



EA-12-049
EA-12-051

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102-06985-DCM/TNW
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U.S. Nuclear Regulatory Commission
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- References:
1. NRC Order Number EA-12-049, *Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events*, dated March 12, 2012
 2. NRC Order Number EA-12-051, *Order Modifying Licenses with Regard to Requirements for Reliable Spent Fuel Pool Instrumentation*, dated March 12, 2012

Dear Sirs:

Subject: **Palo Verde Nuclear Generating Station (PVNGS) Unit 1**
Docket No. STN 50-528
Notification of Full Compliance with NRC Orders EA-12-049 and EA-12-051 for PVNGS Unit 1

On March 12, 2012, the Nuclear Regulatory Commission (NRC) issued orders regarding mitigation strategies for beyond design bases external events and reliable spent fuel pool instrumentation (References 1 and 2).

Reference 1 required full implementation of mitigating strategies for beyond design basis external events no later than two refueling cycles after submittal of the Overall Integrated Plan (OIP) or December 31, 2016, whichever comes first. Reference 2 required full implementation of reliable spent fuel pool instrumentation no later than two refueling cycles after submittal of the OIP or December 31, 2016, whichever comes first. The orders also directed that achievement of full compliance be reported to the Commission.

This letter with the enclosure fulfills the requirement of the orders to report to the Commission that full compliance with the referenced orders has been achieved in PVNGS Unit 1. The enclosure provides a brief summary of the key elements associated with compliance to the orders. The attachment to the enclosure provides a high level summary response for each of the open and pending items being tracked by the NRC staff with regard to the orders.

No commitments are being made to the NRC by this letter.

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Should you have any questions concerning the content of this letter, please contact
Thomas Weber, Department Leader, Regulatory Affairs, at (623) 393-5764.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on 1/9/15
(Date)

Sincerely,

A. C. Merino

DCM/TNW/PJH/

Enclosure: Summary of Compliance with NRC Orders Regarding Mitigation
Strategies for Beyond-Design-Basis External Events (EA-12-049) and
Reliable Spent Fuel Pool Instrumentation (EA-12-051)

cc:	M. L. Dapas	NRC Region IV Regional Administrator
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ENCLOSURE

PVNGS Unit 1

**Summary of Compliance with NRC Orders Regarding
Mitigation Strategies for Beyond-Design-Basis
External Events (EA-12-049) and
Reliable Spent Fuel Pool Instrumentation (EA-12-051)**

Enclosure

**PVNGS Unit 1 Summary of Compliance with NRC Orders Regarding
Mitigation Strategies for Beyond-Design-Basis External Events (EA-12-049)
and Reliable Spent Fuel Pool Instrumentation (EA-12-051)**

1. Introduction

Arizona Public Service Company (APS) developed an Overall Integrated Plan (OIP) (Reference 1) to provide diverse and flexible strategies (FLEX) in response to Order EA-12-049, *Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events* (Reference 2). The information provided herein, as well as the implementation of the OIP, documents compliance with Order EA-012-049 for Palo Verde Nuclear Generating Station (PVNGS) Unit 1.

APS also developed an OIP (Reference 3) to address reliable spent fuel pool (SFP) instrumentation in response to Order EA-12-051 *Order Modifying Licenses with Regard to Requirements for Reliable Spent Fuel Pool Instrumentation* (Reference 4). The information provided herein, as well as the implementation of the OIP, documents compliance with Order EA-012-051 for PVNGS Unit 1.

2. Open Item Resolution

Issues from the NRC Interim Staff Evaluation (ISE) (Reference 5) and Audit Report (Reference 6) have been addressed by APS. The issues that were identified as open and pending in the NRC tracking system are listed below:

ISE Open Item (ISE OI) – ISE OI 3.1.1.2.A

ISE Confirmatory Items (ISE CI) – ISE CI 3.2.2.A and 3.2.4.10.A

Licensee Identified Open Items – PVNGS has no open or pending licensee identified open items.

Audit Questions/Audit Report Open/Pending Items - Items RAI-2-B, RAI-14-B, RAI-27-B, SE-4, SE-6, SE-8, RAI-33-B and RAI-34-B

A summary of the response to each of the issues is provided in the attachment to this enclosure. The open and pending items do not affect the compliance of Unit 1 to Order EA-012-049 or Order EA-012-051.

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**PVNGS Unit 1 Summary of Compliance with NRC Orders Regarding
Mitigation Strategies for Beyond-Design-Basis External Events (EA-12-049)
and Reliable Spent Fuel Pool Instrumentation (EA-12-051)**

3. Milestone Schedule – Items Complete

Unit 1 FLEX and SFPI Milestone	Unit 1 FLEX Completion Date	Unit 1 SFPI Completion Date
Submit Overall Integrated Plan	February 2013	February 2013
Submit 6 Month Updates:		
Update 1	August 2013	August 2013
Update 2	February 2014	February 2014
Update 3	August 2014	August 2014
FLEX Strategy Evaluation	September 2013	N/A
Perform Staffing Analysis	June 2014	N/A
Modifications:¹		
Modifications Final Design Completion	November 2014	July 2014
Unit 1 Final Modification Implementation	November 2014	November 2014
Storage:¹		
Storage Design Engineering Completion	March 2014	N/A
Storage Implementation	November 2014	N/A
FLEX Equipment:¹		
Procure On-Site Equipment	October 2014	October 2014

¹ Milestone actions were completed prior to Unit 1 Cycle 19 startup (November 10, 2014).

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**PVNGS Unit 1 Summary of Compliance with NRC Orders Regarding
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4. Order EA-12-049 Compliance Elements Summary

The elements identified below for PVNGS Unit 1 as well as the FLEX OIP (Reference 1), the 6-Month Status Reports (References 7, 8, and 9) and additional docketed correspondence, demonstrate compliance with Order EA-12-049.

Strategies - Complete

PVNGS Unit 1 strategies are in compliance with Order EA-12-049. There are no strategy related Open Items, Confirmatory Items, or Audit Questions/Audit Report Open Items.

Modifications - Complete

The modifications required to support the FLEX strategies for PVNGS Unit 1 have been fully implemented in accordance with the station processes.²

Equipment – Procured and Maintenance & Testing - Complete

The equipment required to implement the FLEX strategies for PVNGS Unit 1 has been procured, received at PVNGS, initially tested and performance verified as recommended in accordance with NEI 12-06, *Diverse and Flexible Coping Strategies (FLEX) Implementation Guide* and is available for use.

Maintenance and testing requirements are included in the PVNGS Preventative Maintenance Program such that equipment reliability is monitored and maintained.

Protected Storage - Complete

The initial storage facility required to implement the FLEX strategies for PVNGS Unit 1 has been constructed and provides adequate protection from the applicable site hazards. The equipment required to implement the FLEX strategies for PVNGS Unit 1 is stored in its protected configuration.³

² Portions of the originally designed 4160V modification for the "recovery" phase were not installed in Unit 1 during U1R18. The 4160V modification is not required for the "coping" strategy of Phase 2 or Phase 3 of FLEX.

³ The construction of the final storage facility is currently in progress.

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Procedures - Complete

FLEX Support Guidelines (FSGs) for PVNGS Unit 1 have been developed and integrated with existing procedures. The FSGs and applicable procedures have been verified and are available for use in accordance with the site procedure control program.

Training - Complete

Training for PVNGS Unit 1 has been completed in accordance with an accepted training process, as recommended in NEI 12-06, *Diverse and Flexible Coping Strategies (FLEX) Implementation Guide*.

Staffing - Complete

The PVNGS Phase 2 staffing study for PVNGS (Reference 10) has been completed in accordance with 10 CFR 50.54(f) letter (Reference 11). The NRC has reviewed the Phase 2 staffing study and concluded that it adequately addresses the response strategies needed to respond to a beyond design basis external event using Palo Verde procedures and guidelines. This is documented in NRC letter dated September 29, 2014 (Reference 12).

National Safer Response Centers - Complete

APS has established a contract with Pooled Equipment Inventory Company (PEICo) and has joined the Strategic Alliance for FLEX Emergency Response (SAFER) Team Equipment Committee for off-site facility coordination. It has been confirmed that PEICo is ready to support PVNGS with Phase 3 FLEX equipment stored in the National SAFER Response Centers in accordance with the site specific SAFER Response Plan.

Validation - Complete

APS has completed validation in accordance with industry developed guidance to assure required tasks, manual actions and decisions for FLEX strategies are feasible and may be executed within the constraints identified in the FLEX OIP for Order EA-12-049 (References 1 and 2).

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FLEX Program Document - Established

The APS PVNGS FLEX Program Document has been developed in accordance with the requirements of NEI 12-06, *Diverse and Flexible Coping Strategies (FLEX) Implementation Guide*.

5. Order EA-12-051 Compliance Elements Summary

APS has completed implementation of the new SFP level monitoring system which includes: diverse level sensors in the SFP, backup uninterruptible power supplies (UPS), and level indicators in the control room area and the Auxiliary Building. Modifications and training are complete and applicable procedures have been verified and are available for use in accordance with the site procedure control program.

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**PVNGS Unit 1 Summary of Compliance with NRC Orders Regarding
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and Reliable Spent Fuel Pool Instrumentation (EA-12-051)**

References

1. APS Letter 102-06670, *APS 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, [Agencywide Documents Access And Management System (ADAMS) Accession No. ML13070A342]
2. NRC Order Number EA-12-049, *Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events*, dated March 12, 2012, [ADAMS Accession Nos. ML13326A713 and ML13336A775]
3. APS Letter 102-06669, *APS Overall Integrated Plan in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation (Order Number EA-12-051)*, dated February 28, 2013, [ADAMS Accession No. ML13070A077]
4. NRC Order Number EA-12-051, *Order Modifying Licenses with Regard to Requirements for Reliable Spent Fuel Pool Instrumentation*, dated March 12, 2012 [ADAMS Accession No. ML12054A682]
5. NRC Letter Palo Verde Nuclear Generating Station, Units 1,2, and 3- *Interim Staff Evaluation Relating to Overall Integrated Plan in Response to Order EA-12-049- Mitigation Strategies*, dated November 25, 2013 [ADAMS Accession Nos. ML13326A713 and ML13308C153]
6. NRC Letter Palo Verde Nuclear Generating Station, Units 1 ,2, and 3- *Report for the Audit Regarding Implementation of Mitigating Strategies and Reliable Spent Fuel Pool Instrumentation Related to Orders EA-12-049 and EA-12-051*, dated September 8, 2014 [ADAMS Accession No. ML14239A181]
7. APS Letter 102-06758, *APS First 6-Month Status Report on the PVNGS Overall Integrated Plan for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049)*, dated August 28, 2013 [ADAMS Accession No. ML13246A007]
8. APS Letter 102-06840, *APS Second 6-Month Status Report on the PVNGS Overall Integrated Plan for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049)*, dated February 28, 2014 [ADAMS Accession No. ML14066A036]
9. APS Letter 102-06932, *APS Third 6-Month Status Report on the PVNGS Overall Integrated Plan for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049)*, dated August 28, 2014 [ADAMS Accession No. ML14246A211]
10. APS Letter 102-06885, *APS Submittal of Phase 2 Staffing Assessment Report*, dated June 11, 2014 [ADAMS Accession No. ML14167A397]
11. NRC Letter, *Request for Information Pursuant to Title 10 of the Code of Federal Regulations 50.54(f) Regarding Recommendations 2.1, 2.3, and 9.3 of the Near-Term Task Force Review of Insights from the Fukushima Dai-Ichi Accident*, dated March 12, 2012
12. NRC Letter, *Response Regarding Licensee Phase 2 Staffing Submittals Associated With Near-Term Task Force Recommendation 9.3 Related To The Fukushima Dai-Ichi Nuclear Power Plant Accident*, dated September 29, 2014, [ADAMS Accession No. ML 14262A296]

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ATTACHMENT

PVNGS Unit 1

Responses to Unit 1 Open and Pending Items

Enclosure

**PVNGS Unit 1 Summary of Compliance with NRC Orders Regarding
Mitigation Strategies for Beyond-Design-Basis External Events (EA-12-049)
and Reliable Spent Fuel Pool Instrumentation (EA-12-051)**

ATTACHMENT – Responses to Unit 1 Open and Pending Items

APS provides the following responses for the Open and Pending Items identified in the NRC tracking system.

Item	Description	Summary Response
ISE OI 3.1.1.2.A (Open)	Separation of vehicles to avoid seismic interactions	<p>APS evaluated the seismic stability of parked utility vehicles under the FLEX canopy structure. The analysis was performed for the four categories of vehicles, namely, commercial trucks, debris removal vehicles, all-terrain vehicles (ATVs), and yard trucks.</p> <p>The analysis concluded that the vehicles may slide by as much as 1 inch. Using a safety factor of 2, the design sliding displacement is 2 inches. The corresponding maximum horizontal displacement at the extreme top of the vehicles, as a result of rocking of these vehicles is calculated to be 4 inches. The calculated seismic movement is significantly less than the minimum prescribed separation distance of six feet.</p> <p>Reference: NM1000-A00057, Rev. 1, <i>PVNGS FLEX Mods – Yard Vehicles Seismic Stability Analyses: Separation Requirements For Various Vehicles Under The Canopy Structure To Avoid Seismic Interaction</i></p>
ISE CI 3.2.2.A (Open)	Analysis for ability of SFP makeup pump to deliver 200 gpm	<p>APS calculated the available net positive suction head (NPSH) for the new FLEX pump. The FLEX pump will take suction from either the Condensate Storage Tank (CST) or the Refueling Water Tank (RWT). The pump discharge piping will be installed to provide make-up water to the Spent Fuel Pool (SFP) during beyond design basis external events. There will be fire hoses staged to connect either the CST or the RWT to the suction of the FLEX pump, depending upon availability and plant conditions.</p> <p>The NPSH requirements were provided by the FLEX pump supplier and input into the computer model. The NPSH available for the</p>

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Item	Description	Summary Response
ISE CI 3.2.2.A (Open) (Continued)		<p>required pump flow rate of 200 gallons per minute (gpm) is considerably higher than required and provides a substantial margin above the NPSH requirements.</p> <p>Reference: NM1000-A00032, Rev. 1, <i>Spent Fuel Pool Cooling FLEX Pump NPSH Availability</i></p>
ISE OI 3.2.4.10.A (Open)	Station battery extended discharge rates	<p>Performance testing was completed on NCN-17 model batteries. The NCN-17 model battery was selected to represent all cell sizes due to the fact that it contains the least amount of electrolyte per unit volume for the NCN product line and it contains the largest number of plates per unit volume. This was considered to be conservative and representative.</p> <p>Two NCN-17 batteries were cycled in a controlled manner. Discharges were performed as follows:</p> <ul style="list-style-type: none"> • 8-hour discharge @ 150A • 24-hour discharge @ 56A • 72-hour discharge @ 21.2A <p>This test data justifies that the discharge rates used for the PVNGS load shed battery analysis are reasonable.</p> <p>References: 1. NEI Position Paper, <i>Mitigating Strategies Resolution of Extended Battery Duty Cycles Generic Concern</i>, ADAMS Accession No. ML13241A186 2. EN050B-A00024, Rev. 4, <i>Installation, Operation And Maintenance Manual For Class 1E Batteries And Racks</i> 3. NM1000-A00048, <i>FLEX Project Study Report For The Battery Discharge Capacity During Extended Loss Of AC Power (ELAP)</i></p>

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Item	Description	Summary Response
RAI-2-B (Open)	Operator Actions and consistency with CENTS analysis assumptions for RCP seal leakage	<p>The FLEX Support Guideline (FSG) was based on the strategy developed from the CENTS computer program, which used a 25 gpm leak per Reactor Coolant Pump (RCP) to model the event. Operator training was developed based on the FSG and the analysis for responding to the Extended Loss of AC Power (ELAP) event. The <i>Operations simulator ELAP scenario</i> was programmed with the 25 gpm RCP seal leak/pump from an initiating seismic event and the time sensitive actions associated with Phase 1 and Phase 2 per the OIP were time validated to be feasible within the constraint times.</p> <p>Item SE-8 below further describes the procedures.</p> <p>References: 1. NM1000-A00002, Rev. 0, <i>Palo Verde Units 1, 2 & 3 Beyond Design Bases Event-Extended Loss of AC Power</i> 2. NLR14S050501 (Simulator Scenario) <i>Fukushima FLEX</i> (CENTS Computer Model) 3. NLR14C050200 (Operator Training) <i>Fukushima FLEX Mods</i> 4. 79IS-9ZZ07, Rev. 0, <i>PVNGS Extended Loss of All Site AC Guideline Modes 1 - 4</i></p>
RAI-14-B (Open)	FLEX equipment should be rated for the environmental conditions in which it may be required to operate.	<p>APS procurement specifications were issued to purchase commercial FLEX portable equipment, with the requirement of continuous operation at an ambient temperature of 130 degrees Fahrenheit (F). The limiting ambient temperature was selected based on the historical peak temperature recorded for Maricopa County, Arizona plus a design margin. All the FLEX equipment vendors have met this requirement.</p> <p>References: 1. NM1000-A00015, Rev. 0, <i>Electric Powered Positive Displacement Pumps For Palo Verde Diverse and Flexible Coping</i></p>

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Item	Description	Summary Response
RAI-14-B (Open) (Continued)		<p><i>Strategies (FLEX)</i></p> <p>2. NM1000-A00016, Rev. 0, <i>Diesel Powered Centrifugal Pumps For Palo Verdes Diverse and Flexible Coping Strategies (FLEX)</i></p> <p>3. NM1000-A00022, Rev. 1, <i>480 Volt Generator (APS FLEX)</i></p>
RAI-27-B (Open)	Analysis for FLEX pump sizing	<p>Makeup flow requirements for the Steam Generator (SG) and Reactor Coolant (RC) Systems were developed per the ELAP analysis and used as an input for the FLEX pump sizing analysis. APS developed hydraulic models of the primary and alternate makeup flowpaths for both the SG and RC makeup strategies that will be used to implement FLEX for PVNGS.</p> <p>The hydraulic models used a specified flow rate at a delivered system pressure and iterated the tank level until the NPSH requirements were met. The corresponding tank level, available NPSH, pump inlet pressure, and pump head were reported. The pump speed was determined by examining the vendor data plots. FLEX pumps were selected based on the analysis and vendor data.</p> <p>Reference: NM1000-A00020, Rev. 2, <i>APS Palo Verde Nuclear Generating Station Detailed FLEX AFT FATHOM Models</i></p>
SE-4 (Open)	FLEX generator sizing	<p>Palo Verde plans to use two 800kW 480V FLEX generators for each unit to support Phase 2 operation during an ELAP event. These generators are rated for 725kW at 104 degrees Fahrenheit ambient temperature. At a maximum ambient temperature of 130 degrees Fahrenheit the generators are conservatively derated to 500kW. APS has calculated the power factor (pf) of the total load demand and confirmed that the FLEX generators derated capacity exceeds the total load demand.</p>

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ATTACHMENT – Responses to Unit 1 Open and Pending Items

Item	Description	Summary Response
SE-4 (Open) (Continued)		<p>The station is not using a 4160V power strategy as part of the FLEX "coping" strategy (Phase 2). The 800kW 480V FLEX generators are adequate to supply the required power for the "coping" strategy per NEI 12-06 requirements.</p> <p>Reference: NM1000-A00065, Rev. 1, <i>Palo Verde FLEX - Load Flow & Motor Starting Calculation - 480V Train 'A'</i></p>
SE-6 (Open)	Fuel Management Strategy for FLEX Equipment and Procedures	<p>The initial fuel management strategy is to fill the Phase 2 diesel driven generators and pumps from a selected emergency diesel generator day tank at each unit. Each day tank in the diesel building has a capacity of 1,100 gallons and a Technical Specification minimum volume of 550 gallons. The smaller diesel driven generators and pumps will be filled using portable fuel containers and fuel tote trailers. The fuel containers hold five gallons of fuel and are deployed with the specific equipment to the applicable locations. Three fuel tote trailers that hold 500 gallons (25 gpm transfer rate) each will be used to fill the portable FLEX equipment at each unit.</p> <p>The fuel management strategy is governed by an approved PVNGS procedure.</p> <p>Reference: Procedure 14DP-0BD01, Rev. 0, <i>PVNGS Portable FLEX Equipment Administrative Deployment Strategy</i></p>
SE-8 (Open)	Verification and Validation	<p>The FSGs have been developed and aligned with industry guidelines. Site specific analysis and the FSG background documents prepared by the PWR Owners Group were used by APS during the development and verification of the FSGs. The FSGs were reviewed and verified by the involved industry groups to ensure that the strategies are feasible and satisfy the</p>

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Item	Description	Summary Response
SE-8 (Open) (Continued)		<p>guidance of NEI 12-06.</p> <p>The FLEX equipment was tested under the procurement process (Factory Acceptance Testing) and the Design Change Process (Site Acceptance Testing) to verify equipment capability and performance</p> <p>PVNGS used the NEI FLEX Validation process to assure that required individual tasks, manual actions, and decisions for the FLEX strategies directed in the FSGs are feasible, may be executed as planned, and that there is reasonable margin to account for the unknown. Control Room FSG actions were validated in the simulator. Validations of field directed FSGs were performed to ensure that the FLEX equipment could be deployed and that portable equipment, including hoses, cables, fittings, etc., could be assembled as designed. These validations included transporting and staging pumps and generators, routing hoses and cables, simulating the alignment of makeup water sources and electrical distribution systems, and other actions in accordance with the FSGs.</p> <p>An integrated validation was also completed to ensure adequate resources are available to accomplish the FLEX strategy as a whole. PVNGS developed an integrated FLEX FSG schedule which included the required FSG actions and accounted for the associated resource (including staffing and equipment). The integrated validation confirmed that PVNGS can successfully implement the FLEX strategies per the timeline using the minimum staffing documented in the Phase 2 Staffing Study.</p> <p>Reference: Condition Report Action Item (CRAI) 4580242 <i>FLEX Validation</i></p>

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ATTACHMENT – Responses to Unit 1 Open and Pending Items

Item	Description	Summary Response
RAI-33-B (Pending)	Discuss the analysis (including methods, assumptions, and results) to show that core cooling with SG not available can be maintained through once through heat removal from the RCS via coolant boil-off.	RAI 33-B was identified as a generic concern or question during the NRC public meeting on April 18, 2013, regarding the NRC order on mitigating strategies (Order EA-12-049). The nuclear industry will resolve this concern generically through the applicable industry groups (e.g., PWROG, EPRI, etc.). Once this concern is resolved, APS will provide an update to this RAI response in a periodic six-month update.
RAI-34-B (Pending)	Provide the following items regarding the discussion of core cooling with steam generators not available in Phases 2 and 3: b. The source of borated coolant once the inventory of the refueling water tank is depleted (e.g., reactor grade water, raw water mixed with boric acid).	RAI 34-B was identified as a generic concern and the nuclear industry will resolve this concern generically through the applicable industry groups (e.g., PWROG, EPRI, etc.). Once this concern is resolved, APS will provide an update to this RAI response in a periodic six-month update.