

## REVISED RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

### APR1400 Design Certification

Korea Electric Power Corporation / Korea Hydro & Nuclear Power Co., LTD

Docket No. 52-046

**RAI No.:** 496-8630  
**SRP Section:** 06.03 – Emergency Core Cooling System  
**Application Section:** 6.3  
**Date of RAI Issue:** 06/17/2016

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### **Question No. 06.03-10**

As required by 10 CFR 50.36(c)(3), the design must have surveillance requirements to assure that the necessary quality of systems and components is maintained, that facility operation will be within safety limits, and that the limiting conditions for operation will be met.

As mentioned in RAI 158-7997, Question 06.03-7, the applicant stated “boron recycling operations are not used for the APR1400.” However, the staff noted that in DCD Tier 2, Section 9.3.4, the CVCS provides for the capability of recycling boron. The staff determined that it is unclear whether the APR1400 uses boron recycling for water contained in the SIS (IRWST and SITs). As documented in RAI 158-7997, Question 06.03-7, the staff determined the need for a technical specification and associated surveillance requirement if boron recycling is to be used in the APR1400. If boron recycling is not to be used in the APR1400, the DCD should clearly reflect that since there is currently no technical specification and surveillance requirement that verifies the boron-10 atom percent of the SIS water when that water is recycled.

The staff needs the applicant to update DCD Tier 2, Section 6.3 and Section 9.3.4 to clearly specify whether or not boron recycling will be used for SIS water (IRWST and SITs) in the APR1400. If boron recycling is to be used, the applicant shall provide a discussion in the DCD about how the current proposed technical specifications and surveillance requirements ensure a minimum boron-10 atom percent when that water is recycled, or provide an additional technical specification and surveillance requirement as laid out in RAI 158-7997, Question 06.03-7. If boron recycling is not to be used, the applicant shall provide a clear discussion in the DCD detailing that boron-10 atom percent surveillance verification of the SIS water is not necessary since boron recycling will not be used for the APR1400. The staff must ensure that for a COL applicant incorporating the APR1400 by design, who wishes to utilize the APR1400's capability of boron recycling, a technical specification and surveillance requirement must be added to the applicant's technical specifications to ensure boron-10 atom percent is greater than some minimum limit after recycling.

**Response – (Rev. 2)**

The boron recovery system, described in DCD Tier 2 Section 9.3.4, is used to recover excess boron from the RCS and to store for later use such as to correct boron concentration of the SITs or IRWST. Thus, the B-10 atom percent of the SITs and IRWST can be decreased gradually.

Surveillance Requirement 3.5.1.6 and B 3.5.1.6 will be added to verify the isotopic concentration of B-10 in each SIT every 24 months. Surveillance Requirement 3.5.4.4 and B 3.5.4.4 will be added to verify the isotopic concentration of B-10 in the IRWST every 24 months as indicated in attachment.

During reactor operation, the B-10 isotopic concentration of the reactor coolant in the RCS is gradually depleted, caused by the neutron flux in the core. The reactor coolant in the RCS is mixed with the refueling water in the IRWST during refueling outages. The B-10 isotopic concentration of the refueling water in the IRWST can be decreased over time whenever the mixture process is repeated. The B-10 isotopic concentration in the SITs also can decrease over a long time, because the IRWST water may be utilized in order to add water inventory to the SITs.

Since B-10 in the IRWST and SITs is not directly exposed to a significant neutron flux and the IRWST water used as inventory for the SITs is only mixed with the reactor coolant during refueling outages, 24 months is considered conservative. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk.

Since the B-10 isotopic concentration of the water in the SFP is gradually depleted caused by the neutron flux in the SFP, Surveillance Requirement 3.7.15.2 and B 3.7.15.2 will be added to verify the isotopic concentration of B-10 in the SFP every 24 months as indicated in attachment. The 24 months Frequency is appropriate because the boron in the spent fuel pool is not exposed to a significant neutron flux.

As stated in the response to RAI 158-7997, Question 06.03-7 (ref. KHNP submittal MKD/NW-16-0014L), the reduction of B-10 atom percent during 15 years is 0.2 a/o (to 19.6 a/o from 19.8 a/o of initial atom percent) according to the operating experience of OPR1000 Units. This reduction is equivalent to 0.02 a/o per fuel cycle of 18-month. Since the minimum boron concentration in IRWST is 4,000 ppm, the corresponding difference in boron concentration is about 4 ppm ( $= 4000 \times 0.02 / 19.8$ ) between cycles. The boron concentration in the IRWST to maintain APR1400 core subcritical ( $0.99 k_{\text{eff}}$ ) for post-LOCA is estimated to be less than 3,000 ppm, while the required minimum boron concentration for the IRWST is 4,000 ppm.

As described in B 3.5.1, the LCO established the minimum conditions required to ensure the SITs are available to accomplish their core cooling safety function following the LOCA. For a SIT to be considered OPERABLE, the motor operated isolation valve must be fully open with power removed (SR 3.5.1.1, SR 3.5.1.5) and the limits established in the SR for contained volume (SR 3.5.1.2), boron concentration (SR 3.5.1.4, SR 3.5.1.6) and nitrogen cover gas pressure (SR 3.5.1.3) must be met.

Therefore, by verifying the Surveillance Requirements from 3.5.1.1 to 3.5.1.6, we can ensure that the LCO 3.5.1 (four SITs shall be operable) is met.

The prior revisions of the RAI response were incorporated into Rev. 1 of the DCD; therefore this revision only contains mark-ups to Revision 1 of the DCD.

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### **Impact on DCD**

DCD Tier 2 Subsection 9.3.4.2.2 was revised in Rev.1 of the DCD.

Same as changes described in the Impact on Technical Specifications section.

### **Impact on PRA**

There is no impact on the PRA.

### **Impact on Technical Specifications**

Technical Specification condition A of LCO 3.5.1, condition A of LCO 3.5.4, LCO 3.7.15 and Surveillance Requirements 3.5.1.6, 3.5.4.4, 3.7.15.2 and B 3.5.1, B 3.5.4, and B 3.7.15 will be changed as indicated in attachment.

### **Impact on Technical/Topical/Environmental Reports**

There is no impact on any Technical, Topical or Environmental Report.

3.5 EMERGENCY CORE COOLING SYSTEM (ECCS)

3.5.1 Safety Injection Tanks (SITs)

LCO 3.5.1 Four SITs shall be OPERABLE.

APPLICABILITY: MODES 1 and 2,  
 MODES 3 and 4 with pressurizer pressure  $\geq 50.3 \text{ kg/cm}^2\text{A}$  (715 psia).

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One SIT inoperable due to boron concentration not within limits. <u>OR</u> One SIT inoperable due to the inability to verify water level or pressure.	A.1 Restore SIT to OPERABLE <u>OR</u> One SIT inoperable due to B-10 isotopic concentration not within limits.	72 hours
B. One SIT inoperable for reasons other than Condition A.	B.1 Restore SIT to OPERABLE status.	1 hour
C. Required Actions and associated Completion Times of Condition A or B not met.	C.1 Be in MODE 3. <u>AND</u> C.2 Reduce pressurizer pressure to $< 50.3 \text{ kg/cm}^2\text{A}$ (715 psia).	6 hours  12 hours
D. Two or more SITs inoperable.	D.1 Enter LCO 3.0.3.	Immediately

## SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.5.1.1	Verify each SIT isolation valve is fully open.	12 hours
SR 3.5.1.2	Verify borated water volume in each SIT is $\geq 29\%$ and $\leq 69\%$ (% narrow range).	12 hours
SR 3.5.1.3	Verify nitrogen cover-pressure in each SIT is $\geq 40.6 \text{ kg/cm}^2\text{G}$ (578 psig) and $\leq 43.9 \text{ kg/cm}^2\text{G}$ (624 psig).	12 hours
SR 3.5.1.4	Verify boron concentration in each SIT is $\geq 2,300 \text{ ppm}$ and $\leq 4,400 \text{ ppm}$ .	31 days  <u>AND</u>  ----- NOTE ----- Only required to be performed for affected SIT. -----  Once within 6 hours after each solution volume increase of $\geq 1\%$ of tank volume that is not the result of addition from the in-containment refueling water tank
SR 3.5.1.5	Verify power is removed from each SIT isolation valve operator when pressurizer pressure is $\geq 50.3 \text{ kg/cm}^2\text{A}$ (715 psia).	31 days
SR 3.5.1.6	Verify isotopic concentration of B-10 in each SIT is within the limit specified in the COLR.	24 months

## BASES

LCO (continued) For a SIT to be considered OPERABLE, the motor operated isolation valve must be fully open with power removed and the limits established in the SR for contained volume, boron concentration and nitrogen cover gas pressure must be met.

APPLICABILITY In MODES 1 and 2, and MODES 3 and 4 with RCS pressure  $\geq 50.3 \text{ kg/cm}^2\text{A}$  (715 psia), the SIT OPERABILITY requirements are based on an assumption of full power operation. Although cooling requirements decrease as power decreases, the SITs are still required to provide core cooling as long as elevated RCS pressures and temperatures exist.

This LCO is only applicable at pressures  $\geq 50.3 \text{ kg/cm}^2\text{A}$  (715 psia). Below  $50.3 \text{ kg/cm}^2\text{A}$  (715 psia), the rate of RCS blowdown is such that the SI pumps can provide adequate injection to ensure that peak clad temperature remains below the 10 CFR 50.46 (Ref. 3) limit of  $1,204.4^\circ\text{C}$  ( $2,200^\circ\text{F}$ ).

In MODES 3 and 4 with pressure  $< 50.3 \text{ kg/cm}^2\text{A}$  (715 psia) and in MODES 5 and 6, the SIT motor-operated isolation valves are closed to isolate the SITs from RCS. This allows RCS cooldown and depressurization without discharging the SITs into the RCS or requiring

If the Boron-10 isotopic concentration is not within limits, it must be returned to within the limits within 72 hours. The reactor coolant in the RCS is mixed with the refueling water in the IRWST during the refueling outages. The Boron-10 isotopic concentration of the refueling water in the IRWST can decrease over time whenever the mixture process is repeated. The Boron-10 isotopic concentration in the SITs also can decrease over a long time, because the IRWST water may be utilized in order to add water inventory to the SITs. The 72 hour Completion Time to restore Boron-10 isotopic concentration in the affected SITs is reasonable considering that discovery of a low Boron-10 isotopic concentration most likely would occur when the unit is outside the LCO's Applicability and would have to be corrected before entering the Applicability as required by LCO 3.0.4, and the low probability that a low SIT Boron-10 isotopic concentration condition will occur between performances of SR 3.5.1.6; the 72 hours Completion Time also provides sufficient time to correct the condition and avoid an unnecessary unit shutdown.

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## BASES

## SURVEILLANCE REQUIREMENTS (continued)

SR 3.5.1.5

Verification every 31 days that power is removed from each SIT isolation valve operator when the pressurizer pressure is  $\geq 50.3 \text{ kg/cm}^2\text{A}$  (715 psia) ensures that an active failure could not result in the undetected closure of an SIT motor operated isolation valve. If this were to occur, only three SITs would be available for injection during a LOCA. Since installation and removal of power to the SIT isolation valve operators is conducted under administrative control, the 31 day Frequency was chosen to provide additional assurance that power is removed.

This SR allows power to be supplied to the motor operated isolation valves when pressurizer pressure is  $< 50.3 \text{ kg/cm}^2\text{A}$  (715 psia), thus allowing operational flexibility by avoiding unnecessary delays to manipulate the breakers during unit startups or shutdowns. Even with power supplied to the valves, inadvertent closure is prevented by the RCS pressure interlock associated with the valves. Should closure of a valve occur in spite of the interlock, the SI signal provided to the valves would open a closed valve in the event of a LOCA.

## REFERENCES

1. IEEE Standard 603-1991.
2. FSAR, Subsection 6.3.
3. 10 CFR 50.46.
4. FSAR, Chapter 15.
5. NUREG-1366, February 1990.

SR 3.5.1.6

Periodic verification that the isotopic concentration of Boron-10 in each SIT is within the limit specified in the COLR ensures that the Boron-10 isotopic concentration assumed in the safety analysis is available. Since Boron-10 in the SITs is not directly exposed to a significant neutron flux and the IRWST water used as inventory for the SITs is only mixed with the reactor coolant during refueling outages, the Frequency of 24 months is considered conservative. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk.

3.5 EMERGENCY CORE COOLING SYSTEM (ECCS)

3.5.4 In-Containment Refueling Water Storage Tank (IRWST)

LCO 3.5.4 The IRWST shall be OPERABLE.

APPLICABILITY: MODES 1, 2, 3, 4, and 5,  
MODE 6 with RCS level < 39.7 m (130 ft 0 in)

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>A. IRWST boron concentration not within limits.</p> <p><u>OR</u></p> <p>IRWST water temperature not within limits.</p>	<p>A.1 Restore IRWST to OPERABLE status.</p> <p><u>OR</u></p> <p>IRWST B-10 isotopic concentration not within limits.</p>	8 hours
<p>B. IRWST water volume not within limits.</p>	<p>B.1 Restore IRWST to OPERABLE status.</p>	1 hour
<p>C. Required Action and associated Completion Time of Condition A or B not met in MODE 1, 2, 3, or 4.</p>	<p>C.1 Be in MODE 3.</p> <p><u>AND</u></p> <p>C.2 Be in MODE 5.</p>	<p>6 hours</p> <p>36 hours</p>
<p>D. Required Action and associated Completion Time of Condition A or B not met in MODE 5 or MODE 6 with RCS level &lt; 39.7 m (130 ft 0 in).</p>	<p>D.1 Initiate action to restore RCS level to <math>\geq 39.7</math> m (130 ft 0 in).</p> <p><u>AND</u></p> <p>D.2 Reduce RCS cold leg temperature to <math>&lt; 57.2^{\circ}\text{C}</math> (<math>135^{\circ}\text{F}</math>).</p>	<p>Immediately</p> <p>24 hours</p>

## SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.5.4.1	Verify IRWST water temperature is $\geq 10^{\circ}\text{C}$ ( $50^{\circ}\text{F}$ ) and $\leq 49^{\circ}\text{C}$ ( $120^{\circ}\text{F}$ ).	24 hours
SR 3.5.4.2	Verify IRWST water volume is $\geq [2,373.5 \text{ m}^3$ (627,000 gal)] and $\leq [2,540.6 \text{ m}^3$ (671,162 gal)] (i.e., $\geq 74.43\%$ and $\leq 79.67\%$ ).	7 days
SR 3.5.4.3	Verify IRWST boron concentration is $\geq 4,000$ ppm and $\leq 4,400$ ppm.	7 days
SR 3.5.4.4	Verify isotopic concentration of B-10 in the IRWST is within the limit specified in the COLR.	24 months

## BASES

## APPLICABLE SAFETY ANALYSES (continued)

The LOCA dose analyses assumes a volume of at least (2,370 m<sup>3</sup> (627,000 gal)) for dilution of radionuclide in water. The 4,000 ppm limit for minimum boron concentration was established to ensure that, following a LOCA with a minimum IRWST level, the reactor will remain subcritical in the cold condition following mixing of the IRWST and RCS water volumes. Small break LOCAs assume that all control rods are inserted, except for the control element assembly (CEA) of highest worth, which is withdrawn from the core. Large break LOCAs assume that all CEAs remain withdrawn from the core. The most limiting case occurs at

The safety analysis assumes that the boron has the minimum Boron-10 isotopic concentration limit specified in the COLR.

boron limit of 4,400 ppm in the IRWST is based on boron in the core following a LOCA. With the reactor vessel at saturated conditions, the core dissipates heat by pool nucleate boiling. Because of this boiling phenomenon in the core, the boric acid concentration will increase in this region. If allowed to proceed in this manner, boron precipitation will occur in the core. Post-LOCA emergency procedure directs the operator to establish simultaneous hot leg/DVI nozzle injection to prevent this condition by a forced flow through the core regardless of break location.

This procedure is based upon the minimum time in which precipitation could occur, assuming the maximum LCO limit of the IRWST boron concentration. Boron concentrations in the IRWST in excess of the limit could result in precipitation earlier than assumed in the analysis.

The safety analyses assumes the minimum allowed IRWST water temperature is 10°C (50°F) and the maximum temperature of the IRWST is 49°C (120°F).

The IRWST satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii).

## BASES

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### LCO

The IRWST ensures that an adequate supply of borated water is available to cool and depressurize the containment in the event of a design basis accident (DBA) and to cool and cover the core in the event of a LOCA. The IRWST ensures the reactor remains subcritical following a DBA.

To be considered OPERABLE, the IRWST must meet the limits established in the SR for water volume, boron concentration and temperature.

The flow path for each train must maintain its designed independence to ensure that no single failure can prevent delivery of the minimum required flow rate.

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### APPLICABILITY

In MODES 1, 2, 3 and 4, the IRWST OPERABILITY requirements are dictated by the SIS and CSS OPERABILITY requirements. Since both the SIS and CSS must be OPERABLE in MODES 1, 2, 3 and 4, the IRWST must be OPERABLE to support these systems.

In MODES 5 and MODE 6 with RCS level < 39.7 m (130 ft), the IRWST OPERABILITY requirements are dictated by the SIS. The requirements of SIS are specified in LCO 3.5.3. Two trains of SIS, one in each division, are required in these MODES, therefore the IRWST must be OPERABLE to support the SIS.

MODE 6 considers a loss of decay heat removal (DHR) resulting from a break in the bottom of the hot leg or a lower head instrument line (2.8 cm<sup>2</sup> (0.003 ft<sup>2</sup>)). If the reactor coolant water level is above the reactor vessel flange (> 39.7 m (130 ft)), the low power shutdown risk is negligible because sufficient water inventory in refueling pool is available.

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### ACTIONS

#### A.1

, Boron-10 isotopic concentration,

With IRWST boron concentration or water temperature not within limits, they must be returned to within limits within 8 hours. In this condition neither the SIS nor the CSS can perform its design functions, therefore, prompt action must be taken to restore the tank to OPERABLE condition.

The allowed Completion Time of 8 hours to restore the IRWST boron concentration or temperature to within limits was developed considering the time required to change boron concentration or temperature and that the contents of the tank are still available for injection.

## BASES

## ACTIONS (continued)

Therefore, the reactor flange water level above the reactor vessel flange with head off in MODE 6 does not require one safety injection pump after loss of coolant accident at low power shutdown risk. In addition, if RCS water level is below the flange of the reactor vessel, there is a potential of evaporation of the coolant. The reduction of RCS cold leg temperature to  $< 57.2^{\circ}\text{C}$  ( $135^{\circ}\text{F}$ ) will provide a reduction in clad temperature. If RCS cold leg temperature reaches above  $57.2^{\circ}\text{C}$  ( $135^{\circ}\text{F}$ ), there is a potential to evaporate. The 24 hour Completion Time limits the time the plant is subject to conditions where the LCO is applicable.

SURVEILLANCE  
REQUIREMENTSSR 3.5.4.1

IRWST water temperature shall be verified every 24 hours to be within the limits assumed in the accident analysis. This Frequency has been

SR 3.5.4.4

Periodic verification that the isotopic concentration of Boron-10 in the IRWST is within the limit specified in the COLR ensures that the Boron-10 isotopic concentration assumed in the safety analysis is available. Since Boron-10 in the IRWST is not directly exposed to a significant neutron flux and the IRWST water is only mixed with the reactor coolant during refueling outages, the Frequency of 24 months is considered conservative. The Surveillance Frequency is based on operating experience, equipment reliability, and plant risk.

through operating experience.

SR 3.5.4.3

The boron concentration of the IRWST shall be verified every 7 days to be within the required range. This Frequency ensures that the reactor will remain subcritical following a LOCA. Further, it ensures that the resulting IRWST pH is maintained in an acceptable range such that boron precipitation in the core will not occur earlier than predicted and the effect of chloride and caustic stress corrosion on mechanical systems and components will be minimized. Since the IRWST volume is normally stable, a 7 day sampling Frequency is appropriate and has been shown through operating experience to be acceptable.

## REFERENCES

- 10 CFR Part 50, Appendix A, GDC 35.

3.7 PLANT SYSTEMS

3.7.15 Spent Fuel Pool Boron Concentration

LCO 3.7.15 The spent fuel pool boron concentration shall be  $\geq 2,150$  ppm.  
, and the SFP B-10 isotopic concentration shall be  $\geq 19.9\%$  (atomic percent).

APPLICABILITY: When fuel assemblies are stored in the spent fuel pool and spent fuel pool verification has not been performed since the last movement of fuel assemblies in the spent fuel pool.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Spent fuel pool boron concentration not within limit.  OR  Spent fuel pool B-10 isotopic concentration not within limits.	NOTE LCO 3.0.3 is not applicable.	
	A.1 Suspend movement of fuel assemblies in spent fuel pool.	Immediately
	AND  A.2.1 Initiate action to restore spent fuel pool boron concentration to within limit.	Immediately
	OR  A.2.2 Initiate action to perform a fuel storage pool verification.	Immediately

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.7.15.1	Verify spent fuel pool boron concentration is within limit.	7 days
SR 3.7.15.2	Verify isotopic concentration of B-10 in the SFP is $\geq 19.9\%$ (atomic percent).	24 months

B 3.7 PLANT SYSTEMS

B 3.7.15 Spent Fuel Pool Boron Concentration

<u>BASES</u>	and the SFP Boron-10 isotopic concentration is $\geq 19.9\%$ (atomic percent)	Safe operation with unborated water and no movement of assemblies may be achieved by controlling the location of each assembly in accordance with LCO 3.7.16, "Spent Fuel Assembly Storage". Prior to movement of an assembly, it is necessary to perform SR 3.7.16.1.
BACKGROUND	As described in Limiting Condition 3.7.16.1, "Spent Fuel Assembly Storage", fuel assemblies are stored in spent fuel racks in accordance with discharge burnup. Although the water in the spent fuel pool is normally borated to $\geq 2,150$ ppm, the criteria which limits the storage of a fuel assembly to specific rack locations is conservatively developed without taking credit for boron.	

APPLICABLE SAFETY ANALYSES

A fuel assembly could be inadvertently loaded into a spent fuel rack location not allowed by LCO 3.7.16 (e.g., an unirradiated fuel assembly or an insufficiently depleted fuel assembly). This accident is analyzed assuming the case of misloading the fuel pool racks with an unirradiated assembly of maximum enrichment. Another type of postulated accident is associated with a fuel assembly which is dropped onto the fully loaded fuel pool storage rack. Either incident could have a positive reactivity effect, decreasing the margin to criticality. However, the negative reactivity effect of the soluble boron compensates for the increased reactivity caused by either one of the two postulated accident scenarios.

The concentration of dissolved boron in the fuel pool satisfies Criterion 2 of 10 CFR 50.36(c)(2)(ii).

LCO

The specified concentration of dissolved boron in the fuel pool preserves the assumptions used in the analyses of the potential accident scenarios described above. This concentration of dissolved boron is the minimum required concentration for fuel assembly storage and movement within the fuel pool.

The SFP effective multiplication factor ( $k_{eff}$ ) storage limit of 0.95 is maintained during the events by a minimum boron concentration of greater than or equal to 1,240 ppm. Compliance with the LCO minimum boron concentration limit of 2,150 ppm ensures that the credited concentration is always available.

BASES

**APPLICABILITY** This LCO applies whenever fuel assemblies are stored in the spent fuel pool until a complete spent fuel pool verification has been performed following the last movement of fuel assemblies in the spent fuel pool. This LCO does not apply following the verification since the verification would confirm that there are no misloaded fuel assemblies. With no further fuel assembly movements in progress, there is no potential for a misloaded fuel assembly or a dropped fuel assembly.

**ACTIONS** A.1, A.2.1, and A.2.2

It will be moved.

The Required Actions are modified by a Note indicating that LCO 3.0.3 does not apply.

or Boron-10 isotopic concentration

When the concentration of boron in the spent fuel pool is less than required, immediate action must be taken to preclude an accident from happening or to mitigate the consequences of an accident in progress. This is most efficiently achieved by immediately suspending the movement of fuel assemblies. This does not preclude the movement of fuel assemblies to a safe position. In addition, action must be immediately initiated to restore boron concentration to within limit. Alternately, an immediate verification, by administrative means, of the fuel storage pool fuel locations, to ensure proper locations of the fuel since the last movement of fuel assemblies in the fuel storage pool, can be performed.

and Boron-10 isotopic concentration

However, prior to resuming movement of fuel assemblies, the concentration of boron and Boron-10 isotopic concentration must be restored.

If moving irradiated fuel assemblies while in MODE 5 or 6, LCO 3.0.3 would not specify any action. If moving irradiated fuel assemblies while in MODE 1, 2, 3, or 4, the fuel movement is independent of reactor operation. Therefore, inability to suspend movement of fuel assemblies is not sufficient reason to require a reactor shutdown.

**SURVEILLANCE REQUIREMENTS** SR 3.7.15.1

This SR verifies that the concentration of boron in the spent fuel pool is within the required limit. As long as this SR is met, the analyzed incidents are fully addressed. The 7 day Frequency is appropriate because no major replenishment of pool water is expected to take place over a short period of time.

**REFERENCES**

None.

SR 3.7.15.2

Periodic verification that the isotopic concentration of Boron-10 in the SFP is  $\geq 19.9\%$  (atomic percent) ensures that the Boron-10 isotopic concentration assumed in the safety analysis is available. The 24 month Frequency is appropriate because the boron in the SFP is not exposed to a significant neutron flux.