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.:	**508-8592**
SRP Section:	**16 - Technical Specifications**
Application Section:	**16**
Date of RAI Issue:	**08/01/2016**

Question No. 16-193

Paragraph (a)(11) of 10 CFR 52.47 states that a design certification (DC) applicant is to propose Technical Specifications (TS) prepared in accordance with 10 CFR 50.36 and 50.36a. NUREG-1432, "Standard Technical Specifications (STS)-Combustion Engineering Plants," Rev. 4, provides NRC guidance on format and content of technical specifications as one acceptable means to meet 10 CFR 50.36 requirements. Staff needs to evaluate all technical differences from standard TS (STS) NUREG-1432, STS Combustion Engineering Plants, Rev. 4, which is referenced by the DC applicant in DCD Tier 2 Section 16.1, and the docketed rationale for each difference because conformance to STS provisions is used in the safety review as the initial point of guidance for evaluating the adequacy of the generic TS to ensure adequate protection of public health and safety, and the completeness and accuracy of the generic TS Bases.

The Writer's Guide for Plant-Specific Improved Technical Specifications (TSTF-GG-05-01) also provides guidance for the format and content of the TS. There are format and content differences between the DCD and the Writer's Guide. These following corrections are necessary to ensure the completeness and accuracy of the TS and Bases.

The applicant is requested to address the following issues within the Bases for Technical Specification (TS) 3.9.6 "Refueling Water Level."

- The title in the Bases for Technical Specification 3.9.6 is incorrect. The title for TS 3.9.6 is "Refueling Water Level", which is how the title of the section appears in both the STS and the APR1400 TS. However, the Bases incorrectly titles the section as "Refueling Pool Water Level." The title should be corrected to read "Refueling Water Level" for the following:
    - Table of Contents for the Bases (page iii)
    - Subsection heading on page B3.9.6-1

  - Heading (Upper right hand corner) for pages B3.9.6-1 through B3.9.6-3

- Applicable Safety Analysis Section (page B3.9.6-1)

  - The first sentence of the first paragraph in the section contains the phrase "…water level in the refueling pool and refueling canal…" The phrase should read "…water level in the refueling cavity and refueling canal…" This would align the text with the STS and DCD Section 9.1.4.

- Action Section (page B3.9.6-2)

  - In the Action A.1 and A.2 section, the final sentence states "The suspension of fuel CORE ALTERATIONS and movement shall not…" The sentence should read "The suspension of CORE ALTERATIONS and irradiated fuel movement shall not…"

- In the Action A.3 statement, a portion reads "…movement of irradiated fuel, actions…" The statement should read "…movement of irradiated fuel assemblies, actions…"

- Surveillance Requirement (SR) Section (page B3.9.6-2)

  - The second paragraph of the APR1400 Bases for SR 3.9.6.1 reads "The 24-hour Frequency ensures that the water is at the required level and is considered adequate due to the large volume of water and the normal procedural controls of valve positions, significant unplanned level changes are unlikely." The wording in this paragraph is not as clear as the text in the STS and the staff recommends replacing said paragraph with the wording used in the STS which reads "The Frequency of 24 hours is based on engineering judgment and is considered adequate in view of the large volume of water and the normal procedural controls of valve positions, which make significant unplanned level changes unlikely."

- References Section (page B3.9.6-3)

  - Reference 3 reads "NUREG-0800, Section 15.0.1, July 2007." The Reference should read "NUREG-0800, Section 15.0.3, March 2007."

These corrections are required to ensure the accuracy and completeness of the TS Bases.

Response

The area filled with water to transfer the fuel from the reactor is called the refueling pool, instead of the refueling cavity in APR1400 DCD. Therefore, DCD Tier 2 Subsection 9.1.4, TS LCO 3.9.1, B 3.9.1, B 3.9.6 will be revised for the consistency. DCD Tier 2 TS Table of contents, B 3.7.14, B 3.9.4, and B 3.9.6 will be revised to incorporate the other items as indicated in the Attachment. Please note that no changes have been made to B3.9.6-1 Applicable Safety Analysis Section since the use of "refueling pool" is correct.

Impact on DCD

DCD Tier 2 Subsection 9.1.4 will be revised as shown in the Attachment. And same as changes described in Impact on Technical Specifications section.

Impact on PRA

There is no impact on the PRA.

Impact on Technical Specifications

TS Subsection LCO 3.9.1, B.3.7.14 B 3.9.1, B 3.9.4, and B 3.9.6 will be revised as shown in the Attachment.

Impact on Technical/Topical/Environmental Reports

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

and the fuel handling area in the auxiliary building through the transfer tube. The building layouts related to refueling operations are also shown in Figure 9.1.4-8 and Figure 9.1.4-9.

All of the LLHS equipment is classified as non-nuclear safety with the single exception of the double-blind flange assembly.

The two cavity fuel carriers are designed to meet the same criticality considerations as the spent fuel storage racks. The ~~plant refueling cavity~~ refueling pool is equipped with devices that monitor the level of the refueling water in the refueling ~~cavity~~ pool. If the monitoring devices detect an inappropriate decrease in the level of refueling water during the refueling operation, the operator in the main control room (MCR) is alerted, and the operator takes immediate action to prevent water leakage. Makeup water is provided by plant procedures.

Tools and lift rigs are also used to disassemble reactor components.

The major tools and servicing equipment that are used for refueling are listed in Table 9.1.4-1.

In the design of fuel handling equipment, mechanical stops and positive locks are provided to prevent damage to or dropping of the fuel assemblies.

All machines in each refueling system are networked together to provide a simple method for communicating machine status and other pertinent information from one machine to another.

9.1.4.2.1 Components and Tools

9.1.4.2.1.1 Refueling Machine

The refueling machine is shown in Figure 9.1.4-1. The refueling machine is a traveling bridge and trolley that is located above the ~~pool~~ refueling pool and rides on rails set in the concrete on each side of the refueling ~~cavity~~ pool. Motors on the bridge and trolley position the machine over each fuel assembly location within the reactor core or fuel transfer carrier. During withdrawal or insertion of a fuel assembly, the load on the hoist cable is monitored at the console to provide reasonable assurance that movement is not being restricted.

Locking between the grapple and the fuel assembly is provided by the engagement of the grapple actuator arm in axial channels running the length of the fuel hoist assembly.

wheels are captured in two rails. New fuel is loaded into the elevator by means of the fuel handling hoist of the overhead crane and a new fuel handling tool.

The elevator is powered by a cable winch, and fuel is contained in a simple support structure whose wheels are captured at the two rails. Interlocks are installed to prevent a fuel assembly from being raised.

9.1.4.2.1.8 Underwater Television

A closed-circuit television system, as shown in Figure 9.1.4-13, monitors the fuel handling operations within the refueling ~~cavity~~ pool. The camera is mounted on the refueling machine fuel hoist box (Figure 9.1.4-1) so that the fuel assembly can be sighted prior to and during grappling and removal from the core.

A similar underwater television camera is provided on the SFHM so that the fuel assembly can be sighted prior to and during grappling. The positions of the fuel assemblies in the racks are verified by the camera.

9.1.4.2.1.9 Control Element Assembly Elevator

A CEA elevator, as shown in Figure 9.1.4-5, is used to assemble new CEAs and to disassemble irradiated CEAs. The elevator is powered by a cable winch, and the CEAs are contained in a simple support structure whose wheels are captured at the two rails. Tooling used to handle CEAs within the elevator is supported from the CEA change platform.

9.1.4.2.1.10 CEA/ICI Transport Container

The CEA/ICI transport container is used to store and move cut-up pieces of spent CEAs and ICIs from the containment building to the fuel handling area.

The CEA/ICI transport container has the same outside dimensions as a fuel assembly and has a top fitting that joins the fuel grapple, enabling the container to be moved by fuel-handling equipment.

9.1.4.2.1.11 Refueling Pool Seal

The refueling pool seal is designed to connect the RV seal ledge to the embedment ring in the refueling ~~cavity~~ pool floor to permit filling of the refueling ~~cavity~~ pool for fuel handling activities. During normal refueling operations, the pool seal is designed to withstand the pressure resulting from a water head that is the full depth of the refueling ~~cavity~~ pool from the elevation of the operating floor. Pool seal welds required for structural integrity or sealing integrity are inspectable. The openings for ex-core detector servicing and inspection and for ~~cavity~~ reactor cavity ventilation are designed to permit pressure testing to verify their integrity before filling with the refueling water. The pool seal is designed for the impact of a fuel assembly drop from the maximum height. Transfer of heavy loads over the RV is prohibited during fuel handling operations. Therefore, the drop of such loads is not considered credible in the design of the pool seal. The COL applicant is to provide plant procedures for preventing and mitigating inadvertent reactor cavity drain down events, maintenance procedures for the maintenance and inspection of refueling pool seal, and emergency response procedures for the proper measures during pool drain down events (COL 9.1 (4)).

9.1.4.2.1.12 In-Core Instrumentation and Control Element Assembly Cutters

A portable underwater hydraulic cutter, similar to that shown in Figure 9.1.4-14, is provided to cut the irradiated CEAs into lengths that are suitable for conveyance to the fuel handling area of auxiliary building using CEA/ICI transport container. A second cutter is used for disposal of the ICI leads.

9.1.4.2.1.13 Gripper Operating Tool

The gripper operating tool is approximately 5.18 m (17 ft) long and consists of two concentric tubes with a funnel at the end to facilitate engagement with the CEA extension shafts. When installed, pins attached to the outer tube are engaged with the extension shaft. The inner tube of the tool is then lifted and rotated relative to the outer tube, which compresses a spring, allowing the gripper to release, thus separating the extension shaft from the CEA.

9.1.4.2.2.3 Refueling Procedure

9.1.4.2.2.3.1 Reactor Disassembly

The control element drive mechanisms (CEDMs) are disengaged from their driveshaft extensions by deenergizing the motor coils. The head area cables, which include the CEDM cables, the heated junction thermocouple cables, and the acoustic leak monitoring system/loose parts monitoring system cables, are disconnected from the refueling disconnect panels. The CEDM cooling fan cables are disconnected from the fan disconnect panels.

The RV head vent pipe is removed from the integrated head assembly (IHA) vent pipe flange. The seismic restraints are lifted vertically by winch assembly and wire prior to lifting the IHA.

The studs are detensioned using the single stud tensioner (Figure 9.1.5-5). Stud hole plugs are installed to minimize contamination of the empty stud holes. Two RV alignment pins are reinstalled into the RV flange to assist in subsequent operations. The ICI assemblies are then disconnected and withdrawn from the core region to allow the fuel assembly to be removed. Next, the blind flange of the transfer tube is removed. The IHA is lifted with RV closure head and placed on the RV closure head storage stands by the polar crane while the refueling ~~cavity~~ pool is filled with borated water.

The UGS lift rig is installed on and locked to the UGS. The extension shafts and CEAs are withdrawn into the lift rig and the extension shafts latched to the work platform. The UGS is removed from the RV and placed on its storage stand. During transfer of the core support barrel or UGS and their lift rigs over the refueling pool seal, the SFP is isolated from the refueling ~~cavity~~ pool. After the RV internals are moved to their storage areas, water levels are equalized in the refueling ~~cavity~~ pool and SFP, and the transfer tube is opened. Components are not lifted over the refueling ~~cavity~~ pool when the refueling machine handles a fuel assembly.

9.1.4.2.2.3.2 Fuel Handling

Following reactor disassembly, the refueling machine hoist mechanism is positioned at the desired location over the core. Alignment of the hoist to the top of the fuel assembly is accomplished through the use of a digital readout system and is monitored by closed-circuit television. After the fuel hoist is lowered, minor adjustments can be made to properly position the hoist if misalignment is indicated on the monitor. The operator then energizes the actuator assembly, which rotates the grapple at the bottom of the hoist and locks the fuel assembly to the hoist. The hoist motor is started, and the fuel assembly is withdrawn into the fuel hoist box assembly, which protects the fuel during transportation to the upender. After removal from the core, the spent fuel assembly is moved underwater to the transfer area of the refueling ~~cavity~~ pool. The spent fuel assembly is lowered into the empty cavity of the fuel carrier in the refueling ~~cavity~~ pool. The upender lowers the spent fuel assembly to a horizontal position, and a cable drive then transports the transfer carriage on tracks through the transfer tube.

After the fuel has passed through the transfer tube, another upender returns the fuel carrier to the vertical position. The spent fuel handling machine can install a new fuel assembly into the fuel carrier, then remove the spent fuel assembly from the fuel carrier and transport it to the spent fuel storage rack. The operations vary slightly under complete core offload conditions.

For a complete core offload, the fuel assemblies are removed one at a time from the core using the refueling machine. The refueling machine transfers the fuel assembly to the transfer carriage in the upender. The upender lowers the fuel assembly to a horizontal position and the transfer carriage moves to the fuel handling area upender while the refueling machine retrieves the next fuel assembly from the core. The SFHM removes the fuel assembly from the upended fuel carrier and places the fuel assembly in its designated position in the spent fuel storage racks. This process continues until all fuel assemblies have been transferred to the spent fuel storage racks.

During and after spent fuel discharge from the reactor core to the SFP, the spent fuel assemblies may be examined by visual inspection and ultrasonic testing. After completion of the fuel examination, the new fuel assemblies and acceptable irradiated fuel assemblies are reloaded into the transfer carriage and carried through the transfer tube to the refueling ~~cavity~~ pool where they are upended to allow the refueling machine to pick them up and place them in their proper position in the core.

In parallel with the refueling operation, the ICI changeout operation can be carried out. This operation may not be performed for each refueling. Also in parallel, and at a location separate from the fuel handling operations, the CEAs are relocated as required, within the

b. Miscellaneous special design features that facilitate handling operations include the following:

   1) Manual operation of the refueling machine hoist and drives and CEA change platform traverse drives in the event of power failure

   2) Transfer system motor with a two-stage gearbox to permit applying an increased pull on the transfer carriage in the event it becomes stuck

   3) Viewing port in the refueling machine trolley deck to provide visual access to the reactor for the operator

   4) Protective shroud into which the fuel assembly is drawn by the refueling machine

   5) Removal of the transfer system components from the refueling ~~cavity~~ pool for servicing without draining the water from the refueling ~~cavity~~ pool

c. The fuel transfer tube is sufficiently large to provide natural circulation cooling of a fuel assembly in the unlikely event that the transfer carriage should be stopped in the tube. The manual operator for the fuel transfer tube valve extends from the valve to the operating deck. Also, the valve operator has enough flexibility to allow for operation of the valve even with thermal expansion of the fuel transfer tube.

d. Mechanical stops in both the refueling machine and the spent fuel handling machine restrict withdrawal of the spent fuel assemblies. The resulting radiation level at a minimum water depth from the spent fuel is designed to meet the radiation dose limits in the work area when the shielding of the fuel handling equipment is taken into account.

The LLHS meets positions C.1 and C.2 of NRC RG 1.29 (Reference 12) and positions C.1, C.5, C.6, and C.8 of NRC RG 1.13 (Reference 11), as they relate to the ability of the equipment to withstand the effects of earthquakes. With respect to radioactive release as a result of fuel damage, the machines conform to the guidelines of positions C.1 and C.5 of

3.9 REFUELING OPERATIONS

3.9.1 Boron Concentration

LCO 3.9.1 Boron concentrations of the Reactor Coolant System, the refueling canal, and the refueling ~~cavity~~ pool shall be maintained within the limit specified in the COLR.

APPLICABILITY: MODE 6.

-- NOTE --
Only applicable to the refueling canal and refueling ~~cavity~~ pool when connected to the RCS.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Boron concentration not within limit.	A.1 Suspend positive reactivity additions.	Immediately
	AND	
	A.2 Initiate actions to restore boron concentration to within limit.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.9.1.1	Verify boron concentration is within the limit specified in the COLR.	72 hours

TABLE OF CONTENTS

Page

B 3.7 PLANT SYSTEMS (continued)
B 3.7.10 Essential Chilled Water System (ECWS) ..... B 3.7.10-1
B 3.7.11 Control Room HVAC System (CRHS) ..... B 3.7.11-1
B 3.7.12 Auxiliary Building Controlled Area Emergency Exhaust System (ABCAEES) ..... B 3.7.12-1
B 3.7.13 Fuel Handling Area Emergency Exhaust System (FHAEES) ..... B 3.7.13-1
B 3.7.14 Spent Fuel Pool Water Level (SFPWL) ..... B 3.7.14-1
B 3.7.15 Spent Fuel Pool Boron Concentration ..... B 3.7.15-1
B 3.7.16 Spent Fuel Assembly Storage ..... B 3.7.16-1
B 3.7.17 Secondary Specific Activity ..... B 3.7.17-1

B 3.8 ELECTRICAL POWER SYSTEMS
B 3.8.1 AC Sources – Operating ..... B 3.8.1-1
B 3.8.2 AC Sources – Shutdown ..... B 3.8.2-1
B 3.8.3 Diesel Fuel Oil, Lube Oil, and Starting Air ..... B 3.8.3-1
B 3.8.4 DC Sources – Operating ..... B 3.8.4-1
B 3.8.5 DC Sources – Shutdown ..... B 3.8.5-1
B 3.8.6 Battery Cell Parameters ..... B 3.8.6-1
B 3.8.7 Inverters – Operating ..... B 3.8.7-1
B 3.8.8 Inverters – Shutdown ..... B 3.8.8-1
B 3.8.9 Distribution Systems – Operating ..... B 3.8.9-1
B 3.8.10 Distribution Systems – Shutdown ..... B 3.8.10-1

B 3.9 REFUELING OPERATIONS
B 3.9.1 Boron Concentration ..... B 3.9.1-1
B 3.9.2 Nuclear Instrumentation ..... B 3.9.2-1
B 3.9.3 Containment Penetrations ..... B 3.9.3-1
B 3.9.4 Shutdown Cooling System (SCS) and Coolant Circulation – High Water Level ..... B 3.9.4-1
B 3.9.5 Shutdown Cooling System (SCS) and Coolant Circulation – Low Water Level ..... B 3.9.5-1
B 3.9.6 Refueling ~~Pool~~ Water Level ..... B 3.9.6-1

BASES

APPLICABILITY

This LCO applies during movement of irradiated fuel assemblies in the spent fuel pool since the potential for a release of fission products exists.

ACTIONS

A.1

Required Action A.1 is modified by a Note indicating that LCO 3.0.3 does not apply.

When the initial conditions for an accident cannot be met, steps should be taken to preclude the accident from occurring. When the spent fuel pool water level is lower than the required level, the movement of irradiated fuel assemblies in the spent fuel pool is immediately suspended. This effectively precludes a spent fuel handling accident from occurring. This does not preclude moving a fuel assembly to a safe position.

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 MODES 1, 2, 3, and 4, the fuel movement is independent of reactor operations. Therefore, in either case, inability to suspend movement of irradiated fuel assemblies is not sufficient reason to require a reactor shutdown.

SURVEILLANCE REQUIREMENTS

SR 3.7.14.1

This SR verifies sufficient spent fuel pool water is available in the event of a fuel handling accident. The water level in the spent fuel pool must be checked periodically. The 7-day Frequency is appropriate because the volume in the pool is normally stable. Water level changes are controlled by plant procedures and are acceptable, based on operating experience.

During refueling operations, the level in the spent fuel pool is in equilibrium with the refueling canal, and the level in the refueling canal is checked daily in accordance with LCO 3.9.6, “Refueling ~~Pool~~ Water Level.”

BASES

APPLICABILITY

This LCO is applicable in MODE 6 to ensure that the fuel in the reactor vessel will remain subcritical. The required boron concentration ensures a k_{eff} of less than or equal to 0.95. Above MODE 6, LCO 3.1.1, "SHUTDOWN MARGIN (SDM) – T_{cold} > 99 °C (210 °F)," and LCO 3.1.2, "SHUTDOWN MARGIN (SDM) – T_{cold} ≤ 99 °C (210 °F)," ensures that an adequate amount of negative reactivity is available to shut down the reactor and to maintain the reactor subcritical.

The Applicability is modified by a Note. The Note states that the limits on boron concentration are only applicable to the refueling canal and the refueling ~~cavity~~ pool when those volumes are connected to the RCS. When the refueling canal and the refueling ~~cavity~~ pool are isolated from the RCS, no potential path for boron dilution exists.

ACTIONS

A.1

Continuation of positive reactivity additions (including actions to reduce boron concentration) is contingent upon maintaining the plant in compliance with the LCO. If the boron concentration of any of the filled portions of the RCS, the refueling canal, or the refueling ~~cavity~~ pool is less than its limit, all operations involving or positive reactivity additions must be suspended immediately. Operations that individually add limited positive reactivity (e.g., temperature fluctuations from inventory addition or temperature control fluctuations), but when combined with all other operations affecting core reactivity (e.g., intentional boration)result in overall net negative reactivity addition, are not precluded by this action.

Suspension of positive reactivity additions shall not preclude completion of actions to establish a safe condition.

A.2

In addition to immediately suspending positive reactivity additions, boration to restore the concentration must be initiated immediately. In the determination of the required combination of boration flow rate and boron concentration, there is not a unique design basis event which must be satisfied. The only requirement is to restore the boron concentration to its required value as soon as possible. In order to raise the boron concentration of the RCS as soon as possible, the operator should begin boration with the best source available for unit conditions.

Once boration is initiated, it must be continued until the boron concentration is restored. The Completion Time depends on the amount of boron which must be injected to reach the required concentration.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.9.1.1

This SR ensures the reactor coolant boron concentration in the RCS, refueling canal and refueling pool is within the COLR limits. The boron concentration in the coolant is determined periodically by chemical analysis. Prior to reconnecting portions of the refueling canal or the refueling ~~cavity~~ pool to the RCS, this SR must be met per SR 3.0.4. If any dilution activity has occurred while the ~~cavity~~ pool or canal were disconnected from the RCS, this SR ensures the correct boron concentration prior to communication with the RCS. A minimum Frequency of once every 72 hours is a reasonable interval to verify boron concentration. The Surveillance Frequency is based on extensive operating experience and ensures that the boron concentration is checked at adequate intervals.

REFERENCES

1. 10 CFR Part 50, Appendix A, GDC 26.

2 DCD Tier 2, Subsection 15.4.6.

BASES

APPLICABILITY

One SCS train must be OPERABLE and in operation in MODE 6 with the water level greater than or equal to 7.0 m (23 ft) above the top of the reactor vessel flange to provide decay heat removal. The 7.0 m (23 ft) value was selected because it corresponds to the requirement for fuel movement established by LCO 3.9.6, "Refueling ~~Pool~~ Water Level." Requirements for the SCS in other MODES are covered by LCOs in Section 3.4, "Reactor Coolant System."

SCS train requirements in MODE 6 when water level is less than 7.0 m (23 ft) are located in LCO 3.9.5, "SCS and Coolant Circulation – Low Water Level."

SCS train requirements are met by having one SCS train OPERABLE and in operation except as permitted in the Note to the LCO.

ACTIONS

A.1

If one required SCS train is inoperable or not in operation, there will be no forced circulation to provide mixing to establish uniform boron concentrations. Reduced boron concentrations can occur by the addition of water with lower boron concentration than that contained in the RCS. Therefore, actions which reduce boron concentration shall be suspended immediately.

A.2

If one required SCS train is inoperable or not in operation, actions shall be taken immediately to suspend loading irradiated fuel assemblies in the core. With no forced circulation cooling, decay heat removal from the core occurs by natural convection to the heat sink provided by the water above the core. A minimum refueling water level of 7.0 m (23 ft) above the reactor vessel flange provides an adequate available heat sink. Suspending any operation which would increase decay heat load, such as loading a fuel assembly, is a prudent action under this condition.

A.3

If one required SCS train is inoperable or not in operation, immediate actions shall be taken and continued to satisfy the SCS train requirements. With the unit in MODE 6 and the refueling ~~pool~~ water level greater than or equal to 7.0 m (23 ft) above the top of the reactor vessel flange, the Completion Time of immediate ensures that prompt action is taken to meet the necessary SCS train cooling requirements.

B 3.9 REFUELING OPERATIONS

B 3.9.6 Refueling ~~Pool~~ Water Level

BASES

BACKGROUND	The movement of irradiated fuel assemblies or performance of CORE ALTERATIONS, except during latching and unlatching of control rod drive shafts, within containment requires a minimum water level of 7 m (23 ft) above the top of the reactor vessel flange. During refueling this maintains sufficient water level in the containment, the refueling canal, the fuel transfer canal, the refueling ~~cavity~~ pool, and the spent fuel pool. Sufficient water is necessary to retain iodine fission product activity in the water in the event of a fuel handling accident (References 1 and 2). Sufficient iodine activity would be retained to limit offsite doses from the accident to under 25 % of 10 CFR 50.34 limits, as provided by the guidance of Reference 3.
APPLICABLE SAFETY ANALYSES	During CORE ALTERATIONS and during movement of irradiated fuel assemblies, the water level in the refueling pool and refueling canal is an initial condition design parameter in the analysis of the fuel handling accident in containment postulated by NRC RG 1.183 (Reference 1). A minimum water level of 7 m (23 ft) allows a decontamination factor of 200 to be used in the accident analysis for iodine. This relates to the assumption that 99.5 % of the total iodine released from the pellet to cladding gap of all the dropped fuel assembly rods is retained by the refueling pool water. The fuel handling accident analysis inside containment is described in Reference 2. With a minimum water level of 7 m (23 ft) and a minimum decay time of 72 hours prior to fuel handling, the analysis and test programs demonstrate that the iodine release due to a postulated fuel handling accident is adequately captured by the water and offsite doses are maintained within allowable limits (Reference 4).
LCO	Refueling water level satisfies LCO SELECTION CRITERION 4. A minimum refueling water level of 7 m (23 ft) above the reactor vessel flange is required to ensure that the radiological consequences of a postulated fuel handling accident inside containment are within acceptable limits (Reference 3).

BASES

APPLICABILITY

LCO 3.9.6 is applicable during CORE ALTERATIONS, except during latching and unlatching of control rod drive shafts, and when moving irradiated fuel assemblies within containment. The LCO minimizes the possibility of a fuel handling accident in containment that is beyond the assumptions of the safety analysis. If irradiated fuel is not present in containment, there can be no significant radioactivity release as a result of a postulated fuel handling accident. Requirements for fuel handling accidents in the spent fuel pool are covered by LCO 3.7.14, "Spent Fuel Pool Water Level."

ACTIONS

A.1 and A.2

With a water level of less than 7 m (23 ft) above the top of the reactor vessel flange, all CORE ALTERATIONS and operations involving movement of irradiated fuel assemblies shall be suspended immediately to ensure a fuel handling accident cannot occur. The suspension of ~~fuel~~ CORE ALTERATIONS and irradiated fuel movement shall not preclude completion of movement to a safe position.

A.3

In addition to immediately suspending CORE ALTERATIONS or movement of irradiated fuel assemblies, actions to restore refueling ~~pool~~ water level must be initiated immediately.

SURVEILLANCE REQUIREMENTS

SR 3.9.6.1

Verification of a minimum refueling ~~pool~~ water level of 7 m (23 ft) above the top of the reactor vessel flange ensures that the design basis for the postulated fuel handling accident analysis during refueling operations is met. Water at the required level above the top of the reactor vessel flange, mitigates the consequences of a postulated fuel handling accident inside containment which results in damaged fuel rods (Reference 2).

~~The 24-hour Frequency ensures that the water is at the required level and is considered adequate due to the large volume of water and the normal procedural controls of valve positions, significant unplanned level changes are unlikely.~~

The Frequency of 24 hours is based on engineering judgment and is considered adequate in view of the large volume of water and the normal procedural controls of valve positions, which make significant unplanned level changes unlikely.

BASES

REFERENCES

1. NRC RG 1.183, July 2000.
2. DCD Tier 2, Subsection 15.7.4.
3. NUREG-0800, Section 15.0.~~1, July~~ 3, March 2007.
4. 10 CFR 50.34.