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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 96 TO FACILITY OPERATING LICENSE NO. NPF-51

ARIZONA PUBLIC SERVICE COMPANY, ET AL.

PALO VERDE NUCLEAR GENERATING STATION, UNIT NO. 2

DOCKET NO. STN 50-529

1.0 INTRODUCTION

By application dated April 1, 1996, as supplemented by letters dated April 3, 1996, the Arizona Public Service Company (APS or the licensee) requested changes to the Technical Specifications (Appendix A to Facility Operating License No. NPF-51) for the Palo Verde Nuclear Generating Station, Unit 2. The Arizona Public Service Company submitted this request on behalf of itself, the Salt River Project Agricultural Improvement and Power District, Southern California Edison Company, El Paso Electric Company, Public Service Company of New Mexico, Los Angeles Department of Water and Power, and Southern California Public Power Authority. The proposed amendment would revise TS 3/4.9.6, "Refueling Machine," to temporarily allow the use of a hoist instead of the refueling machine for moving the fuel assembly at core location A-07. This amendment will expire when the fuel assembly at core location A-07 has been fully withdrawn and moved into a storage location in the spent fuel pool.

This amendment was necessitated by the inability to move the fuel assembly at core location A-07 using the refueling machine and normal refueling methods. During the full core off-load for the sixth refueling, this fuel assembly was found to be damaged and stuck in its core location. All other fuel assemblies have been removed from the core.

This change would also replace the expired TS 3/4.9.6 footnote related to the temporary increase in the refueling machine overload limit. The new footnote reads:

> A hoist may be used for movement of the fuel assembly at core location A-07 during core offload of Unit 2, sixth refueling outage. The hoist shall have a minimum capacity of 2400 pounds. A load cut off limit of 1600 pounds will be applied administratively using a load cell. The hoist shall be demonstrated operable within 72 hours prior to the start of fuel movement by performing a load test of at least 2400 pounds.

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2.0 EVALUATION

The fuel assembly in core location A-07 in PVNGS Unit 2 is damaged. The licensee is adding reinforcement to the assembly to provide structural integrity. With the addition of the structural reinforcement, the assembly would not have sufficient clearance to be able to be withdrawn into the refueling machine mast. Therefore, movement of the assembly from core location A-07 needs to be performed by an alternate means. Prior to movement, the licensee will relieve the stress in the fuel assembly lower end fitting by cutting notches in two locations. Once the assembly is removed from location A-07 a lower end fitting will be attached to the assembly to prevent movement of the protruding fuel pins. The assembly will then be moved to the fuel upender and transferred to the spent fuel pool for storage.

The operability requirements for the refueling machine ensure that (1) the machine will be used for moving fuel assemblies, (2) the machine has sufficient load capacity to lift a fuel assembly, and (3) the core internals and pressure vessel, as well as the fuel assembly being moved and adjacent assemblies, are protected from excessive lifting force in the event they are inadvertently engaged during lifting operations.

The purpose of TS 3/4.9.6 is to prevent fuel assemblies from being dropped or damaged and from being withdrawn too far and not having the minimum shielding-water coverage (with resultant personnel overexposure).

The refueling machine contains mechanical and electrical interlocks to accomplish these protective functions. The temporary use of a manually controlled hoist to withdraw and move the fuel assembly from core location A-07 would result in the loss of the built-in electrical and mechanical protective functions provided by the refueling machine. The licensee will therefore implement the following mechanical and procedural controls to compensate for those lost functions. Refueling machine interlocks involved in movement of fuel assembly A-07 are described in CESSAR Section 9.1.4.2.1.1 as follows:

(1) Overload Cutoff Limit Interlock

The overload cutoff limit interlock interrupts hoisting of a fuel assembly if the load increases above the overload setpoint specified in TS 3/4.9.6. The hoisting load is visually displayed so that the operator can manually terminate the withdrawal operation if an overload occurs and the hoist continues to operate. The hoist motor stall torque is limited such that the cable load is less than the allowable fuel assembly tensile load.

Compensatory Action: The hoist will be carefully controlled to limit the load placed on the hoist. While the hoist is being operated, a calibrated load cell will be used to continuously monitor the load, ensuring that the load is no more than 1600 pounds (as required by TS 3/4.9.6).

(2) Vertical Elevation Interlock

The vertical elevation interlock interrupts hoisting of a fuel assembly when the correct (full-up) vertical elevation is reached. A mechanical up-stop physically restrains the hoisting of a fuel assembly above where it would have less than the minimum shielding-water coverage.

Compensatory Action: The minimum water coverage is specified in CESSAR Section 9.1.4.3.4d. as 9 feet over the active portion of the fuel assembly; this coverage limits the radiation level to 2.5 mr/hr or less at the surface of the water when the additional shielding of the handling tool is taken into account. The hoist will be physically restricted from raising the fuel assembly above a depth that will maintain a minimum of 8 feet of water above the active portion of the fuel. While the fuel assembly is being moved, radiation dose rates will be continuously monitored to ensure that dose limits are not exceeded.

(3) Load Decrease Interlock

The load decrease interlock interrupts insertion of a fuel assembly if the load decreases below the underload setpoint before the assembly is properly seated. This interlocks prevents the assembly from being rested or unloaded in an unseated position. The load is visually displayed so that the operator can manually terminate the insertion operation if an underload occurs and the hoist continues to operate.

Compensatory Action: Procedural controls and the use of an underwater camera will assist the operator in preventing an underload condition due to incorrect placement or interference. The fuel assembly will be visually monitored while being moved.

(4) No-Load Interlock

The no-load interlock interrupts lowering of the hoist under a no-load condition. The weighing system interlock is backed up by an independent slack cable switch, which also terminates lowering under a no-load condition.

Compensatory Action: The load cell will be continuously monitored while the hoist is being operated, and the operator will terminate lowering the hoist when a no-load condition is reached.

(5) Translation Interlock

The translation interlock denies translation of the bridge and trolley while the fuel hoist is operating. An additional circuit is provided which, after initiation of a hoisting operation, requires that a separate switch be actuated before normal operation of the translation drives is possible. The translation interlock also denies hoisting during translation of the bridge and/or trolley.

Compensatory Action: Procedural controls will be used to prohibit the movement of the bridge and trolley while the fuel assembly is being manually raised or lowered. The hoist will be hung on a beam fixed to the refueling machine so that the hoist cannot move laterally independent of the refueling machine. Procedural controls will also be used to prohibit raising or lowering the fuel assembly while the bridge or trolley is in motion.

(6) Grapple/Translation Interlock

The grapple/translation interlock denies translation of the bridge and/or trolley with the spreader or grapple extended or when the grappled fuel assembly is still in the core. The underwater TV system can be used by the operator to determine whether the spreader or grapple has been raised, and lights on the control console indicate whether they are withdrawn or extended.

Compensatory Action: Administrative controls will be in place to prohibit movement of the bridge or trolley unless the hoist grapple is clear of the fuel assembly or the grappled and lifted assembly has been raised to the proper vertical position for lateral movement. The position of the assembly and/or grapple will be monitored visually from the refueling bridge and with an underwater camera.

(7) Anticollision Interlock

The anticollision interlock stops translation of the bridge and/or trolley when the collision ring on the mast is contacted and deflected. Redundant switches are provided to minimize the possibility of this interlock becoming inoperative. Slow bridge speeds are provided for movement of the refueling machine in areas other than its normal travel route which might contain obstructions. Travel limits are also provided to prevent machine contact with obstructions within the pool area.

Compensatory Action: Bridge/trolley speeds will be restricted by procedure to the minimum speeds available. Additionally, spotters will be used to monitor the fuel assembly as it is moved through the refueling pool. Normal refueling machine travel limit stops will continue to prevent machine contact with obstructions within the pool area.

(8) Hoist Speed Interlock

The hoist speed interlock restricts maximum hoisting speed when the fuel is within the core. During insertion and withdrawal, the change in hoist speed can be monitored by observation of the hoist vertical position indicator. A change in the sound of the hoist accompanies the change in hoist speed.

Compensatory Action: Hoisting speed of the hoist will be closely controlled by the operator to ensure careful raising and lowering of the assembly. There are no other fuel assemblies in the core that could potentially interfere.

Since the fuel assembly will not be drawn into the protective shroud of the refueling machine mast before lateral movement, the lateral movement of the assembly will be well controlled to ensure that the moving assembly is not damaged.

The hoist design will not allow the assembly to free-fall while it is being suspended.

Before the fuel assembly is actually handled, the hoist will be cycled through its operation using a dummy fuel assembly (CESSAR 9.1.4.3.4). Also, within 72 hours prior to being used for fuel movement, the hoist and load cell will be load tested with a load of 2400 pounds.

3.0 NRC REQUEST FOR ADDITIONAL INFORMATION AND APS RESPONSES

On April 3, 1996, the NRC staff requested additional information related to the proposed amendment. The licensee responded by letter dated April 3, 1996. The staff's questions and the licensee's responses were as follows:

(1) How will the structural integrity of the fuel assembly at location A-07 be assured during movement?

Structural integrity of the fuel assembly will be assured by installing external reinforcement using one of the following two methods:

The first method of reinforcement is the use of two separate 1-inch wide stainless steel straps installed on opposite sides of the assembly. The straps will be attached by clips to a steel jacking plate, installed on the upper plate at the top of the assembly, and to the web of the assembly's lower end fitting (LEF) (see Figure 1). The jacking plate will have adjusting bolts that will press against another steel plate underneath (the bearing plate) and thus pull up on, and tension, the straps. The straps will be tensioned enough to take up the slack, but not enough to compress the fuel assembly.

The second method of reinforcement is the use of stainless steel cables. This reinforcement will consist of separate stainless steel cables (see Figure 2). The ends of the cables will be attached to a steel plate installed at the top of the assembly. This steel plate (the jacking plate) will have adjusting screws that will push against another steel plate underneath (the bearing plate) and thus pull up on, and tension, the cables. The cables will be tensioned enough to take up the slack, but not enough to compress the fuel assembly.

Both the straps and cables are designed for the full weight of the assembly, including all attachments. After the installation of one of the reinforcement mechanisms described above, the Electro-Discharge Machining (EDM) cuts on the LEF will be made and, if necessary, the fuel assembly hydraulic jacks will be installed. The hydraulic jacks will provide the lifting force to free the assembly while maintaining a constant load through the fuel handling tool. This method will ensure a smooth lift eliminating sudden movement normally associated with members under tension that are suddenly released.

The EDM tooling is a process which vaporizes the metal using an electrical arc and will be used to stress relieve the LEF legs. The EDM process will be performed by Combustion Engineering (ABB-CE) with APS support prior to lifting the fuel assembly. To ensure the process is properly controlled, several process control steps have been built into the procedure. The process setup and cutting operation will be monitored by video cameras. During set-up of the EDM cutting head, an end plate will be behind the LEF web and in front of any protruding fuel rods. This will provide EDM protection for the exposed fuel pins for the lower 50 percent of the cut. No misalignment of the cutting head setup will be allowed, and power to the cutting head will only be initiated once the EDM head is verified to be in the correct position to initiate cutting.

ABB-CE has performed calculations showing that the allowable jacking load on the v-notch with a single web cut per side is 3500 pounds. The cuts are planned to be made on the south face of the southwest foot and the north face of the northwest foot. ABB-CE has analyzed the existing crack in the LEF and determined that there is no possibility of "flap" motion as a result of jacking up to 3500 pounds and/or EDM cutting. The basis for this assessment is as follows:

The majority of the observed deformation is due to plastic rather than elastic deformation. Therefore, spring-back is not expected to be large when the legs and webs are jacked or altered slightly.

Following EDM cutting, the LEF legs are still engaged, but with stress relieved. Therefore, the LEF is not expected to move more than a few mils (as a result of the cutting) before the legs will tend to stop any lateral motion.

The load bearing path from the shroud to front legs/pins occurs primarily through peripheral intact regions of the flow plate. Thus, any load change will not cause a significant change in the stress state at the center region nor any significant change in nozzle/flap rotation.

The core reloading procedure has been modified to ensure the jacking force and hoist load limits are not exceeded.

To improve lateral stability, guide tube stabilizers (304 stainless steel rods) will be installed into two of the guide tubes prior to attempting to lift the assembly. The addition of these stabilizers has no deleterious effect on the assembly and can be reversed at any time later in the handling or storage process.

A center post handling tool will be used to install a center post into the upper end fitting of the fuel assembly. The center post will provide a continuous load path for lifting the fuel assembly, instead of relying on the load path through the guide tubes.

The external reinforcement has been designed and will be tested to support 1600 pounds. The stainless steel reinforcement straps will be load tested to 150 percent of design load (i.e., 2400 pounds). The stainless steel cables have been load tested to show that two strands of the cable (one cable loop) can achieve a 2800 pound force without distortion or breaking.

(2) Describe how the temporary hoist will be attached to the refueling machine.

The temporary lift rig will consist of the following:

An 8-foot, 4-inch long, 4-inch square steel tube will run across the top of the refueling bridge hoist frame rails. The tube will be attached to the hoist frame rails by two 1/2-inch U-bolts and a 3/4-inch steel plate at each rail. The beam will extend 41 inches past one side of the refueling machine frame rail. A lug will be welded to the underside of the beam such that the load cell/hoist assembly will hang at a position 36 inches past the frame rail. The beam has a design capacity of at least 3000 pounds, which is approximately 1.5 times the maximum expected load.

A load cell (with a capacity of 5000 pounds) will be hung from the lug, welded to the underside of the beam at the end, extending past the refueling machine.

A hoist will be hung from the load cell.

The new-fuel grapple will be hung from the hoist.

A drawing is attached that shows the temporary lift rig attachment (see Figure 3).

(3) Describe the accuracy of the load cell.

The load cell is 5000 pound capacity with an accuracy of ± 0.3% full scale or ± 15 pounds. [The licensee has also stated that the load cell readout is digital, at 1 pound increments.]

(4) Describe how this temporary lift rig assembly will be load tested.

The licensee fabricated components (beam, lug, and attachment of beam to load frame) will be load tested after the temporary lift rig is installed on the refueling machine and prior to lifting the fuel assembly. The test will be performed by applying a lift strain, using an attachment point in containment, until the 3000 pound load test force is reached. The load test will verify the strength of the licensee fabricated components. The load test will not include the hoist, load cell, and new-fuel grapple. The other rigging components (excluding the licensee fabricated components) have been certified by the manufacturer, or load tested and certified in accordance with the PVNGS rigging control program to have capacities in excess of any expected loads during the evolution. All of the components will be assembled in accordance with the drawings by personnel certified in accordance with the PVNGS rigging control program.

(5) Describe how the temporary hoist will be attached to the fuel assembly.

The new-fuel grapple will be used to connect the temporary hoist to the fuel assembly. The new-fuel grapple engages the assembly in the same manner as the refueling machine grapple. This grapple is similar to the grapple on the refueling machine, except that the new-fuel grapple also has a locking collar that provides a positive hold on the hooks latched to the fuel assembly. The new-fuel grapple is normally used to move new fuel from the shipping container to the new-fuel storage racks and from the new-fuel storage racks to the spent fuel pool.

(6) Discuss single failure protection (current refueling machine vs. alternate lift rig).

The current refueling machine was not designed or licensed to be single failure proof. Similarly, the temporary lift rig is not designed to be single failure proof.

(7) Discuss the load path of the fuel assembly including any intermediate steps to storage.

The fuel assembly will initially be lifted a sufficient distance to clear the fuel alignment pins. Once the assembly has cleared the alignment pins, it will be moved to position it over the fuel cap fixture, which will have been placed as close as possible to the A-07 location. The fuel cap fixture restricts further movement of the fuel rods. The fuel assembly will be slowly lowered on to the fuel cap fixture until it engages the LEF. When the integrity of the fixture has been verified to be secure, the assembly will again be lifted and bridged west to the reactor center-line. From this location, the load path will be the same as that followed during normal refueling operations. The load path is due south to the trolley index zone, and then west to the upender. The upender takes the fuel assembly through the transfer canal to the spent fuel pool area. The spent fuel bridge will then transfer the assembly to location A-38.

The April 1, 1996, submittal requesting the TS amendment stated that the bridge and trolley speeds would be restricted to the minimum speeds available. It is intended that the speeds will be selected to minimize fuel assembly swing and to ensure positive control of the fuel assembly is maintained at all times.

(8) Describe the refueling water clarity and the contingency should clarity be diminished.

The water clarity in the refueling cavity and reactor vessel is maintained in a near transparent state, free from pollution and cloudiness, by the fuel pool cooling and cleanup system (PC) and submersible filtering units.

The PC system utilizes a disposable resin mixed bed ion exchanger that is capable of 150 gallon per minute flow through three micron filters. The system will maintain radiological exposure in the vicinity of the pool to <2.5 mRem/hr and also maintains water clarity through the removal of particulates and dissolved solids.

The PC system has been augmented by two submersible filtering units which are installed in the refueling pool. These filtering units are capable of 650 and 250 gallon per minute flow rates through 1 micron filter. The 250 gpm unit has a skimmer attachment; and both units are in continuous operation. Plant experience has demonstrated that 500 gpm flow is sufficient to maintain water clarity and that filter plugging is unlikely because of the small particulate size.

Water clarity will be maintained such that refueling personnel will be able to clearly view the fuel and refueling tools both from underwater cameras and from above. Underwater lights have been installed to enhance viewing capability. If the water clarity should diminish such that viewing is impaired, fuel movement will be suspended until clarity is restored.

(9) Discuss how the assembly will be kept stable during the jacking and lifting and also during lateral transit. Include a discussion about the jacking method and any analysis of the possibility of a sudden jump while jacking.

The structural integrity of the fuel assembly will be reestablished using either of the techniques discussed in response to Question 1. These techniques will provide the mechanism to augment/replace the guide tubes as the main structural lifting members. Guide tube stabilizers will be installed into two of the guide tubes to provide additional lateral stability.

Upon installation of the external reinforcement, the fuel assembly will be grappled using hoisting equipment as described in response to Question 2. A manual hoist will be attached to a fuel handling tool which utilizes a fuel assembly grapple, locking device, and rigging attachment. Once the assembly has been grappled, lifting force will be applied with the hoist. This lifting force will provide stability of the fuel assembly during the jacking evolution.

Two fuel assembly hydraulic jacks will be utilized. One will be positioned on the north face and the other on the south face at the web area of the foot of the assembly. The EDM cuts on the LEF legs are expected to relieve much of the frictional force between the legs and the alignment pins. The two west side alignment pins are taller than the east side alignment pins. The total height of the west side tapered pins is 3.375 inches with a straight shank of 1.75 inches and the balance of the alignment pin length (1.625 inches) tapering down at a 30 degree slope. Some of the load in the LEF is due to elastic deformation while the majority is plastic deformation. The hydraulic jacks will be in contact with the straps. While maintaining a constant lifting load, an initial pressure will be applied to both hydraulic jacks. Pressure will be increased to a maximum of 3500 psig in 100 psig increments. The intent of this evolution is to provide lift control of the fuel assembly utilizing the hydraulic lifting assemblies.

ABB-CE has performed testing and analyses to evaluate the dynamic movement of the fuel assembly as it is being removed by the hydraulic jacks. Sudden movement of the fuel assembly as it comes off the alignment pins is expected to be minimal (on the order of mils) and lateral motion of the assembly would be limited by the two taller west alignment pins.

Since the majority of the observed deformation is due to plastic rather than elastic deformation, spring-back is not expected to be large when the "supports," in the form of legs and webs, are jacked or altered slightly. As the assembly is raised above the straight shank, the LEF will attempt to release some of its potential energy. It is at this point when any "jump" would be expected to occur. The EDM cuts on the LEF legs are expected to relieve much of the frictional force between the legs and the alignment pins, minimizing any "jump" which may occur. The legs of the LEF will not lose contact with the two west alignment pins and the potential energy will be dissipated by friction between the leg and the alignment pins as well as between the LEF and the shroud wall. No significant "jumping" of the LEF as it was removed from the alignment pins has been observed during testing.

There is no stored potential energy in the incompressible hydraulic system. The hydraulic jack lifting force will quickly dissipate as the assembly tends to move up just a short distance, since the incompressible hydraulic fluid pressure will decrease almost instantaneously.

During lateral transit, a tag line will be utilized to restrain movement of the fuel assembly and slow speeds will be used as the bridge and trolley are moved.

(10) Describe contingency plans if any fuel pins move in the assembly while the assembly is being moved.

It is not anticipated that fuel pin movement will occur during the evolution of fuel movement. Fuel pin movement has not been observed during past attempts to remove the fuel assembly. The potential for fuel rod movement exists while the fuel assembly is being jacked from its stuck position. During this time a stainless steel plate will be located underneath the stuck assembly in location A-07 to prevent fuel rods falling to the bottom of the reactor vessel. Additionally, a video camera will be monitoring the evolution to ensure that fuel rod movement is detected should it occur.

If fuel rod movement should occur at any time prior to installation of the fuel cap fixture, fuel movement will be immediately stopped.

(11) Discuss the operator license qualification and applicability to movement of the fuel assembly using the temporary hoist.

The Licensed Senior Reactor Operators (LSRO) for refueling training program has been developed in accordance with the INPO accredited training program (ACAD 91-012), "Guidelines for Training and Qualification of Licensed Operators." The LSRO training is a subset of the SRO/RO training program utilizing a systematic approach to training which is implemented through PVNGS training department procedures. The objective of the program is to provide the LSRO candidate or incumbent with the knowledge and skills necessary to perform the duties of a Senior Reactor Operator supervising core alterations. The LSRO tasks are identified in the Job Task Analysis Task-to Training Matrix. The task analysis augments the specific job/topic analysis and knowledge and abilities identified in NUREG-1122, "Knowledge and Abilities Catalog for Nuclear Power Plant Operator: Pressurized Water Reactor."

The LSRO program consists of initial and continuing training with initial and requalification license examinations administered in accordance with NUREG-1021, "Operator Licensing Examiner Standard (ES 701)." The initial training consists of eight weeks of classroom and four weeks on-the-job training. Continuing training consists of 40 hours prior to each refueling or every six months, whichever is more limiting. Participation in concurrent refueling outages is credited as one refueling and additional training on lessons learned from the previous core offload is provided prior to the second core offload. LSROs are also required to stand a minimum of eight hours in the control room discussing refueling operations, TS associated with refueling, and refueling procedure requirements. Continuing evaluation of the LSRO incumbent's knowledge and abilities is performed through annual operating and biennial written examinations.

PVNGS currently has thirteen LSROs. All thirteen LSROs are current in their qualification status and have an active LSRO license. The LSROs participating in the removal of fuel assembly A-07 will be required to demonstrate satisfactory performance during a "dry run" test using a dummy fuel assembly. This validation test will require the LSRO to perform the revised procedure requirements identified in the core reloading procedure 72IC-9RX03. The procedure has been revised to include precautions and limitations for using the manual hoist. In addition to the procedure requirements, a pre-job briefing will be held with the LSROs, refueling, and control room personnel, to ensure appropriate communications are established.

(12) Describe the "procedural controls" that will be used.

Procedural controls will be implemented to direct the fuel assembly movement evolution. The controlling core reloading procedure will include specific instructions for performing the fuel movement. Prior to implementation, the procedural controls and manual hoist operation will be reviewed with the operators and the procedure will be validated utilizing a dummy fuel assembly. The validation will demonstrate the lifting of the dummy fuel assembly from the core, traversing to the upender, and ungrappling the dummy fuel assembly.

Specific instructions, explanatory notes, and cautionary statements will be provided in the procedure to ensure that fuel movement is halted in the event of any unusual conditions such as unexpected radiological changes, inadequate water clarity, movement of protruding fuel pins, and/or unanticipated changes in load conditions. These requirements will not preclude placing the assembly in a safe condition.

Instructions will also be provided to compensate for the absence of interlock features of the refueling machine as described in the TS amendment request. These compensatory actions include (but are not limited to) ensuring that (1) the hoist does not exceed load limits or lifting height, (2) the bridge or trolley will not be moved during the hoisting operation, (3) the hoist shall not be lowered to a no-load (cable slack) condition, and (4) the fuel assembly does not contact any unintended components during hoisting or movement.

(13) With respect to the discussion about minimum water coverage over the fuel assembly, clarify the "additional shielding of the handling tool."

CESSAR Section 9.1.4.3.4.d describes, as a design basis, that nine feet of water above the active portion of a fuel assembly is expected to limit the dose rates at the water surface to 2.5 mRem/hr or less when the additional shielding of the handling tool is taken into account. As stated in the April 3, 1996, supplemental amendment request, the manual hoist would be physically limited from raising the fuel assembly above a depth needed to maintain a minimum of eight feet of water above the active portion of the fuel. Although the raised fuel assembly would be outside of the refueling mast, and the normal shielding provided by the refueling machine would be reduced, that shielding is negligible compared with the shielding provided by the eight feet of water.

On March 31, 1996, actual dose rates were obtained for fuel assembly A-07 and documented under Radiation Protection Survey 2-96-01672. Based on the results of this survey, dose rate calculations were performed for seven, eight and nine feet of water. The results of the calculations are as follows:

7 feet = 4.7 mR/hr
8 feet = 0.36 mR/hr
9 feet = 0.0277 mR/hr

Based on these calculations the dose to personnel at the refueling bridge would not exceed the established limits of 2.5 mR/hr even without the additional shielding provided by the refueling mast.

The radiation dose rates will be monitored by portable instruments and personnel doses will be maintained within administrative limits and 10 CFR 20 limits, and will be kept as low as reasonably achievable (ALARA), as required by 10 CFR 20.1101(b) and plant procedures.

(14) Clarify the purpose and functions of the "spotter".

The purpose of the spotter is to compensate for the absence of the anti-collision interlock feature of the refueling machine. Each of the refueling team members will act as spotters during fuel movement, although one of the refueling operators will be specifically tasked as a spotter. Movement of fuel assembly A-07 will be discontinued should the spotter observe movement which could potentially damage the fuel assembly and/or surrounding areas. Movement may continue when NRC staff certifies that continued movement is safe.

The spotters function will be to visually monitor the fuel assmebly during movement to verify that all of the rigging, the external reinforcement devices, and grapple perform as intended and ensure the assembly does not come in contact with obstructions as it is being moved. Fuel assembly movement will be observed through a remote camera and direct visual observation.

Communications among the crew during fuel assembly movement will be verbal, face-to-face communications, with repeat backs, in accordance with existing conduct of shift operations procedures. In addition, the LSRO will be in constant communication, using headsets, with the control room. Management will also be present on the refueling bridge in an oversight function during the manipulation.

(15) <u>Describe what is meant by free-fall and how the hoist prevents it.</u>

The April 1, 1996, amendment request states that the hoist design will not allow the assembly to free-fall while it is being suspended. This means that when the fuel assembly is being suspended by the hoist and is not being raised or lowered, design features of the hoist will prevent the assembly from lowering inadvertently. The hand operated chain hoist has a Weston (mechanical load or friction) brake which prevents the load from moving downward unless the load is manually lowered using the hand chain. The hoist meets the requirements of ASME B30.16-1993, "Overhead Hoist (Underhung)."

The staff has reviewed the licensee's temporary change to allow the use of a hoist to remove the fuel assembly at core location A-07. The temporary use of a hoist to withdraw and move this fuel assembly will not significantly increase the probability of dropping or damaging the fuel assembly because controls will be in place to compensate for the protective functions of the refueling machine. The intent of the requirement of TS 3/4.9.6 is to ensure that the refueling machine has a minimum capacity of 3590 pounds and that the lifting device can sustain the intended load without failing. This intent will be met since the hoist will be load-tested to 2400 pounds, which is 150 percent of the actual load limit of 1600 pounds. The temporary structure on the refueling machine to support the hoist was designed to support 1600 pounds plus the weight of the hoist, load cell, and attachments. To ensure that the hoist tension is stopped before it exceeds 1600 pounds, the load cell will be continuously monitored while the hoist is being operated, and communication will be continuously maintained with the hoist operator. This limit is based on an engineering analysis of the structural strength of fuel assembly A-07 and its the external structural reinforcement.

To ensure the minimum necessary shielding water coverage, controls will be in place to prevent the fuel assembly from being withdrawn above 8 feet below the water. The previous analysis assumed the failure of all 236 fuel rods in an assembly (enriched to 4.30 w/o U-235) 100 hours after shutdown. The assembly was simulated to experience an irradiation history of 3 full-power years with an assumed plant capacity factor of 80 percent. These modeling assumptions were consistent with NRC Regulatory Guide 1.25, "Assumptions Used for Evaluating the Potential Radiological Consequences of a Fuel Handling Accident in the Fuel Handling and Storage Facility for Boiling and Pressurized Water Reactors." The results of the fuel handling accident analysis were within the requirements of Standard Review Plan, Section 15.7.4. The characteristics of the fuel assembly at location A-07 are within the assumptions of the fuel handling accident analysis. The staff has also reviewed the licensee's procedures and tooling and observed portions of the dry run, and finds them to be acceptable. The staff find this temporary one-time change to be acceptable.

4.0 EXPLANATION OF THE EMERGENCY CIRCUMSTANCES

Palo Verde Nuclear Generating Station (PVNGS) Unit 2 is currently in its sixth refueling outage, performing the Cycle 6 core offload. The fuel assemblies in core locations A-06 and A-07 were discovered to be stuck on March 22, 1996, at approximately 2:30 p.m. MST, and March 24, 1996, at approximately 3:00 p.m. MST, respectively. The NRC issued TS Amendment 95 on March 26, 1996, to allow the refueling machine overload cutoff limit to be increased from 1600 pounds to as much as 2000 pounds to withdraw the assembly in location A-06. The assembly in location A-06 was withdrawn without exceeding 1600 pounds and moved to the spent fuel pool. The fuel assembly in core location A-07 continues to be stuck, and its structural integrity is questionable because the assembly was compressed after the last (fifth) reload. Fission product activity in the reactor coolant indicates that no fuel pins in the assembly are breached. The fuel assembly in location A-07 is the only one in the reactor vessel, and its lower end fitting feet appear to be splayed, binding against the core locating pins.

Possible damage to the fuel assembly includes separation of the control element assembly (CEA) guide tube(s) from the lower end fitting. Consequently, to ensure the structural integrity of the assembly during movement, retaining reinforcement will be put on the outside of the assembly. With the external reinforcement, there would not be sufficient clearance to withdraw the reinforced assembly into the refueling machine mast. Therefore, the licensee proposes to revise TS 3/4.9.6 to allow the use of a manually controlled hoist to withdraw the fuel assembly at location A-07.

The emergency circumstances exist because, once the temporary external reinforcement is put in place, the fuel assembly cannot be withdrawn with the refueling machine (as required by TS 3/4.9.6), fuel movement cannot be completed, and power operations cannot be resumed. The suspension of fuel movement has left the core partially unloaded.

The emergency circumstances could not be avoided because the stuck fuel assembly condition in Unit 2 and the need to use a temporary external reinforcement were unexpected.

The limiting condition for operation (LCO) of TS 3/4.9.6 currently specifies that the refueling machine shall be used for moving fuel assemblies and shall be operable with a minimum capacity of 3590 pounds and an overload cutoff limit of less than or equal to 1600 pounds. This amendment request, under emergency circumstances, justifies allowing PVNGS Unit 2 to continue fuel movement with a hoist. The hoist has a minimum rated capacity of 3000 pounds. The TS 3/4.9.6 limit of 1600 pounds lifting force from the hoist will be imposed by the use of a calibrated load cell which will be continuously monitored while the hoist load is being operated. This monitoring will prevent the manually controlled hoist and the fuel assembly from being overloaded during the fuel movement.

5.0 NO SIGNIFICANT HAZARDS CONSIDERATION DETERMINATION

The Commission has provided standards for determining whether a significant hazards consideration exists as stated in 10 CFR 50.92. A proposed amendment to an operating license for a facility does not involve a significant hazards consideration if operation of the facility in accordance with a proposed amendment would not (1) involve a significant increase in the probability or consequences of an accident previously evaluated; or (2) create the possibility of a new or different kind of accident from any accident previously evaluated; or (3) involve a significant reduction in a margin of safety. A discussion of these standards as they relate to this amendment request follows:

Standard 1--Does the proposed change involve a significant increase in the probability or consequences of an accident previously evaluated?

The proposed amendment would revise TS 3/4.9.6 to temporarily allow the use of a hoist instead of the refueling machine for moving the fuel assembly at core location A-07. The only possible accident that could be associated with this change would be the fuel handling accident. The temporary use of a hoist to withdraw and move the fuel assembly from core location A-07 would not involve a significant increase in the probability of dropping or damaging a fuel assembly because controls will be in place to compensate for the protective functions of the refueling machine. The intent of the requirement of TS 3/4.9.6 that the refueling machine have a minimum capacity of 3590 pounds is to ensure that the lifting device is capable of sustaining the intended load without failure. That intent would be met since the hoist will be load tested to 2400 pounds, which is 150 percent of the actual load limit of 1600 pounds. The temporary structure on the refueling machine to support the hoist was designed to support the load limit of 1600 pounds plus the weight of the hoist, load cell, and attachments. The intent of the requirement of TS 3/4.9.6 that the refueling machine have an overload cutoff limit of 1600 pounds is to ensure the fuel assembly, core internals, and pressure vessel are not damaged by the lifting device. This intent will be met by continuously monitoring a load cell and maintaining constant communication with the hoist operator while the hoist is being operated; the hoist tension will be stopped if the load exceeds 1600 pounds. This limit is based on engineering analysis of the structural strength of fuel assembly A-07 with the external structural reinforcement installed.

This change would not involve a significant increase in the consequences of a fuel assembly drop accident previously analyzed since any fuel assembly drop would be bounded by the previous analysis. The previous analysis assumed the failure of all 236 fuel rods in an assembly (enriched to 4.30 w/o U-235) 100 hours after shutdown. The analyzed assembly was simulated to experience an irradiation history of 3 full-power years with an assumed plant capacity factor of 80 percent. These modeling assumptions were consistent with NRC Regulatory Guide 1.25. The results of the fuel handling accident analysis were within the requirements of Standard Review Plan, Section 15.7.4. The characteristics of the fuel assembly at location A-07 are within the assumptions of the fuel handling accident analysis.

This change would not affect the probability or consequences of any other previously evaluated accident since the only possible accident involving the use of a hoist to move the fuel assembly at core location A-07 is a fuel handling accident. Cooling and reactivity of the fuel would not be affected by the change.

The hoist will be physically restricted from raising the fuel assembly above a depth that will maintain a minimum of 8 feet of water above the active portion of the fuel. While the fuel assembly is being moved, radiation dose rates will be continuously monitored to ensure that dose limits are not exceeded.

Therefore, the proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated.

Standard 2--Does the proposed change create the possibility of a new or different kind of accident from any accident previously evaluated?

The proposed change to temporarily allow the use of a hoist for movement of the fuel assembly at core location A-07 does not create the possibility of a new or different kind of accident from any accident previously evaluated. The only possible accident involving the use of a hoist to move the fuel assembly at core location A-07 would be a fuel handling accident. Cooling and reactivity of the fuel would not be affected by the change. The consequences of a fuel handling accident as previously analyzed bound any possible malfunction during fuel movement. To ensure the minimum necessary shielding water coverage, controls will be in place to prevent the fuel assembly from being withdrawn above 8 feet below the water.

Therefore, the proposed change does not create the possibility of a new or different kind of accident from any accident previously evaluated.

Standard 3--Does the proposed change involve a significant reduction in a margin of safety.

The proposed change to temporarily allow the use of a hoist for movement of the fuel assembly at core location A-07 does not significantly reduce any margin of safety. Controls will be in place to compensate for the protective functions of the refueling machine. The intent of the requirement of TS 3/4.9.6 that the refueling machine have a minimum capacity of 3590 pounds is to ensure the lifting device is capable of sustaining the intended load without failure. This would be met since the hoist will be load tested to 2400 pounds, which is 150 percent of the actual load limit of 1600 pounds. The hoist has a rated capacity of 3000 pounds. The temporary structure on the refueling machine had been designed to support the load limit of 1600 pounds plus the weight of the hoist, load cell, and attachments. The intent of the requirement of TS 3/4.9.6 that the refueling machine have an overload cutoff limit of 1600 pounds is to ensure the fuel assembly is not damaged by the lifting device. This will be met by continuous monitoring of a load cell and maintaining constant communication with the hoist operator while the hoist is being operated; the hoist tension will be stopped before the load exceeds 1600 pounds. This limit is based on engineering analysis of the structural strength of fuel assembly A-07 with the external structural reinforcement installed. The hoist will be physically restricted from raising the fuel assembly above a depth that will maintain a minimum of 8 feet of water above the active portion of the fuel. While the fuel assembly is being moved, radiation dose rates will be continuously monitored to ensure that dose limits are not exceeded.

Therefore, the proposed change does not involve a significant reduction in a margin of safety.

Thus, the NRC staff finds that the proposed change does not involve a significant hazards consideration.

6.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Arizona State official was notified of the proposed issuance of the amendment. The State official had no comments.

7.0 ENVIRONMENTAL CONSIDERATION

The amendment changes a requirement with respect to the installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20 and changes a surveillance requirement. The NRC staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission made a final no significant hazards consideration determination finding with respect to this amendment. Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b) no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendment.

8.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

Attachments:
1. Figure 1
2. Figure 2
3. Figure 3

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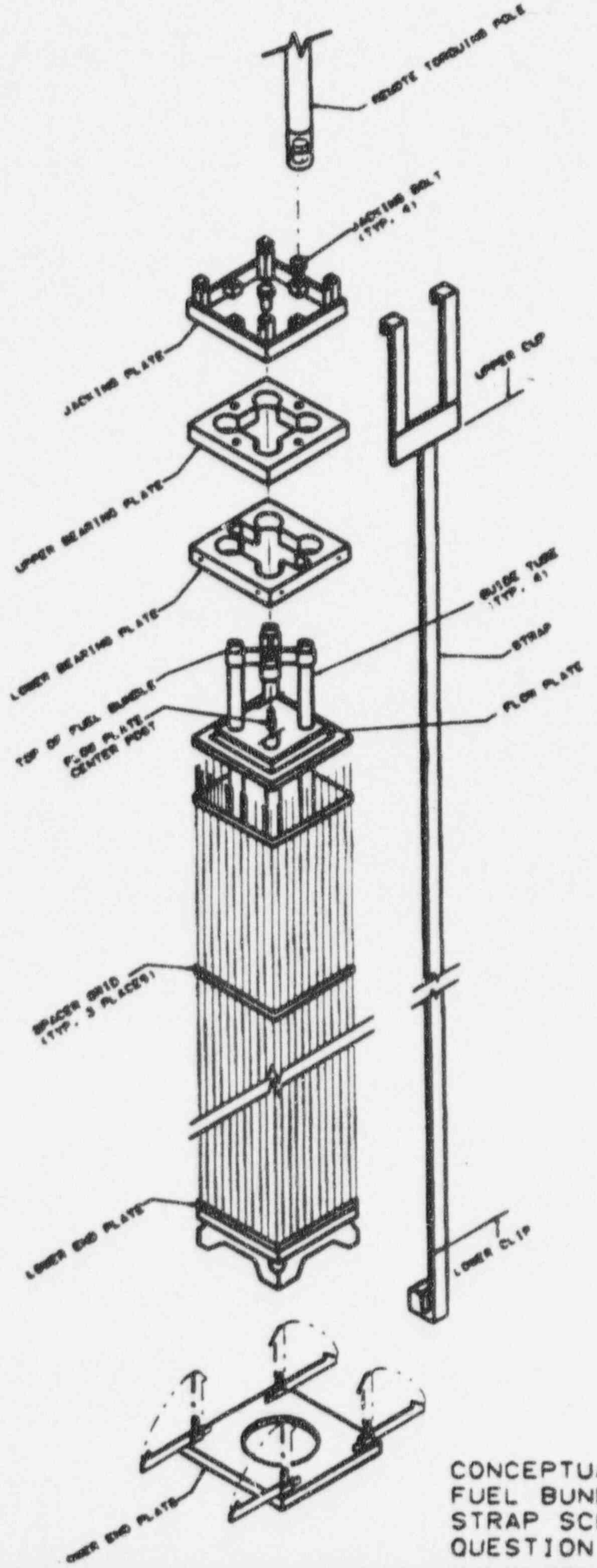
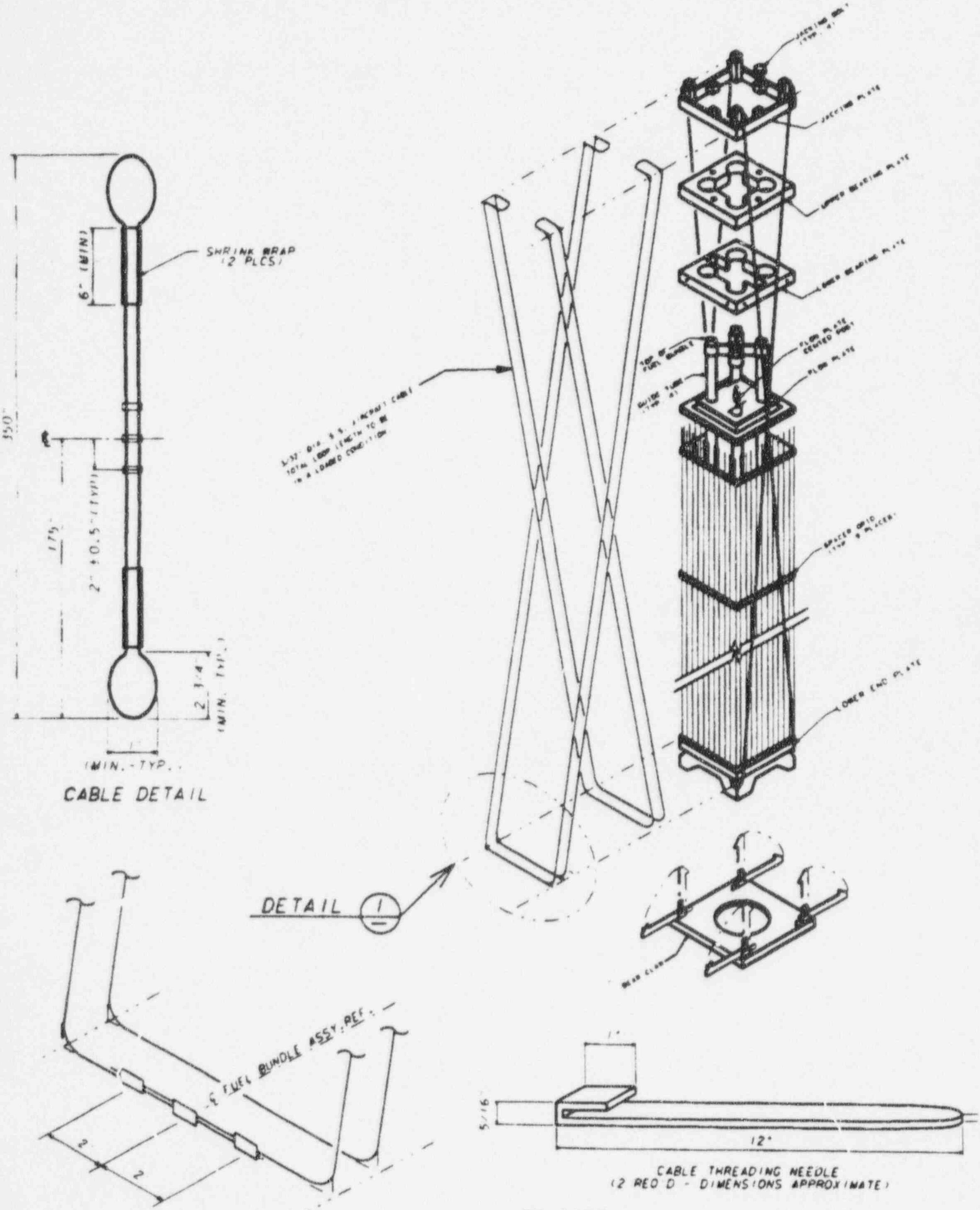
Date: April 3, 1996

Attachment 1

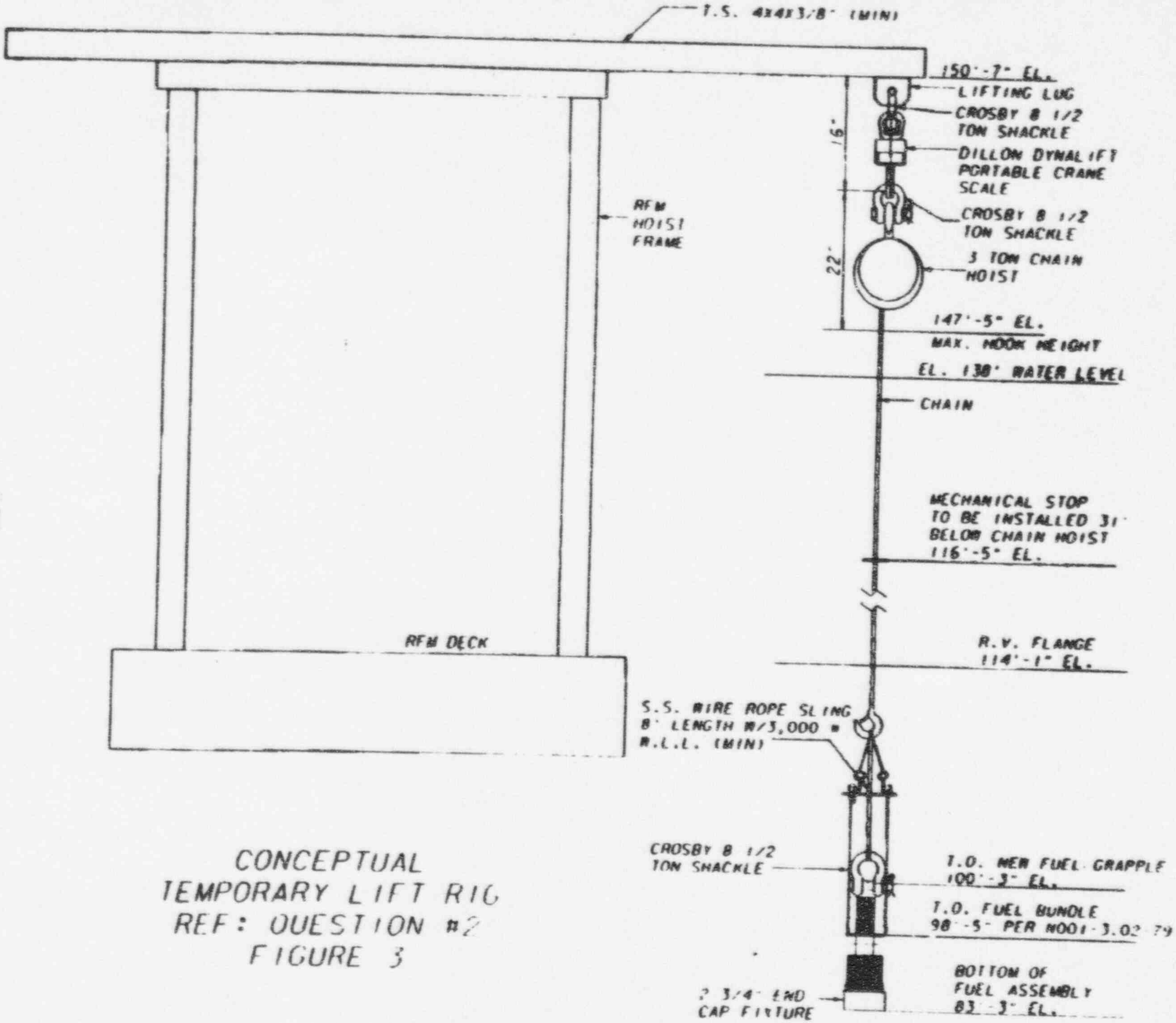


CONCEPTUAL
FUEL BUNDLE STRAP ASSEMBL
STRAP SCHEME
QUESTION 1 FIGURE 1

Attachment 2



CONCEPTUAL
QUESTION 1
FUEL BUNDLE STRAP ASSEMBLY
CABLE ROUTING



CONCEPTUAL
TEMPORARY LIFT RIG
REF: QUESTION #2
FIGURE 3

Attachment 3