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U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555

Gentlemen:

Subject: **WNP-2, OPERATING LICENSE NPF-21, ADDITIONAL INFORMATION RELATED TO BULLETIN 96-02, "MOVEMENT OF HEAVY LOADS OVER SPENT FUEL, OVER FUEL IN THE REACTOR CORE, OR OVER SAFETY-RELATED EQUIPMENT"**

References:
1) Letter, GO2-97-064, dated April 3, 1997, DA Swank (SS) to NRC, "Response to NRC Request for Additional Information Related to Bulletin 96-02, Movement of Heavy Loads Over Spent Fuel, Over Fuel in the Reactor, or Over Safety-Related Equipment"

2) Letter, GI2-96-289, dated December 5, 1996, NRC to JV Parrish (SS), "Request for Additional Information Related to Bulletin 96-02, Movement of Heavy Loads Over Spent Fuel, Over Fuel in the Reactor Core, or Over Safety-Related Equipment"

3) NUREG-0892, Supplement 4, "Safety Evaluation Report Related to the Operation of WPPSS Nuclear Project No. 2"

In accordance with Reference 1, the Supply System hereby provides the staff with the results of a detailed review of our reactor building crane design. The Supply System performed the review in order to provide additional assurance and documentation of our compliance with the appropriate requirements of NUREG-0612, "Control of Heavy Loads of Nuclear Power Plants," regarding single-failure-proof cranes. As discussed in Reference 1, and as requested by the staff in Reference 2, the Supply System has already provided the staff with preliminary information regarding the chronology of applicable design codes and standards in effect during and after the crane was purchased, a discussion of crane upgrades or modifications, and a discussion of Supply System compliance with present crane design standards. As was also discussed in Reference 1, the Supply System has addressed acceptable safe load paths for heavy loads, as well as the spent fuel cask loading and unloading process.

## ADDITIONAL INFORMATION RELATED TO BULLETIN 96-02

Based on a detailed review of our crane design, the Supply System has concluded, as stated in FSAR Section 15.7.5, that "The reactor building crane is provided with sufficient redundancy such that no credible postulated failure of any crane component required to lift, hold, and move loads, will result in the dropping of the fuel cask." FSAR Section 9.1.4.2.2.2 discusses the safety features of the crane that include:

1) A single hoist motor drives two separate shafts. The motor has two centrifugally tripped limit switches, one outboard of each hoist input pinion at each end of the motor shaft assembly. These provide an automatic safety shutdown and protection from any control or motor malfunction which might result in a runaway condition of the load.

2) Each motor driven shaft passes through a 150% capacity solenoid actuated brake. A failure of either the motor shaft, the connecting shafts, or the shaft couplings would not result in a load drop since the redundant dual solenoid actuated brakes would be effective in holding the load.

3) After the brake, each motor shaft enters its own gear reducer. If a component of one gear case (gear teeth, shafts, bearings, or structural component) should fail, the other gear reducer will hold the load with its brake.

4) Each gear case is fitted on its output end with a pinion meshing with the drum gear. A failure of a pinion, drum gear, pinion shaft, or pinion bearing will result in the load being carried by the other similar set of parts on the other end of the drum. In each of the main hoist gear cases there is a mechanical load brake with cooling of the gear case oil to offer additional safety in load handling.

5) In the event of failure of the drum shaft, drum bearing, or drum bearing bracket, the drum flange will drop a fraction of an inch onto structural seats located such that the drum is supported. The remaining pinion and gear will stay in mesh to restrain the load.

6) Two separate wire ropes are led from the main hoist drum, each being reeved through a set of sheaves, upper and lower (block sheaves), and back to an equalizer bar arranged for equal division of the load between the two ropes. If one rope fails, the remaining rope will support the load. The equalizer bar is fitted with double acting springs to minimize the shock when the entire load is transferred to one rope. Therefore, load drop is precluded. To protect against overloading of the cables and to provide indication of load balancing, a load sensing system consisting of tension type load cells is installed in each of the hoist cables at its connection to the equalizer bar assembly under the trolley.

7) All sheaves, both upper and block sheaves, are contained in heavy structural casings which usually carry a negligible load. In the event of a sheave pin failure, the sheaves would rise to the top of the block or drop to the base of the upper sheave housing and stop at those points. Thus a load drop is precluded.

8) The block assembly contains two 100% capacity load carrying devices consisting of a sister hook and an eye hook. This redundancy, in attachment to lifting assembly and in load carrying capability, is such that a single failure will not cause a load drop.

In addition, based on a detailed review of our crane design, the Supply System has concluded that the crane meets the requirements for a single failure proof crane as per NUREG-0612, Appendix C. Appendix C to NUREG-0612 provides guidelines to operating plants, or plants under construction, for implementation of NUREG-0554, "Single-Failure-Proof Cranes for Nuclear Power Plants." NUREG-0554 provides guidance for the design, fabrication, installation, and testing of new cranes. As noted in Reference 1, the staff also concluded in Reference 3, Section 9.1.5, "Overhead Heavy Load Handling Systems," that the guidelines of NUREG-0612 had been satisfied, and the objectives of Section 5.1 of NUREG-0612 had been met. Section 5.1 of NUREG-0612 contains subsection 5.1.6, which addresses adherence to NUREG-0554 or to Appendix C of NUREG-0612 to meet single-failure-proof design criteria.

As noted in Reference 1, the Supply System purchased and constructed the reactor building crane prior to the issuance of NUREG-0554, and relied primarily on the guidance of two major codes, the Crane Manufacturers of America (CMAA) Specification #70, "Specifications for Electric Overhead Traveling Cranes," and ANSI B30.2, "Safety Code for Cranes, Derricks and Hoists." In addition, the Supply System used the guidance provided by the NRC in Branch Technical Position (BTP) APCSB 9-1, "Overhead Handling Systems for Nuclear Power Plants," and Regulatory Guide (RG) 1.104, "Overhead Crane Handling Systems for Nuclear Power Plants," during plant construction.

In order to assess Supply System compliance with NUREG-0612, Appendix C, a detailed review of the crane design was performed against the design recommendations of NUREG-0554, even though strict adherence to specific criteria of NUREG-0554 is not required. Appendix C to NUREG-0612 allows for alternative means of assuring safe crane operation, permits crane components to not have redundant counterparts, and recognizes that the application of certain design recommendations of NUREG-0554 may not be practical. Attachment A summarizes those aspects of the Supply System's present crane design that do not strictly conform to NUREG-0554 design recommendations, and provides justification for the acceptability of the current reactor building crane design.

Should you have any questions or desire additional information regarding this matter, please call me or Mr. P. J. Inserra at (509)-377-4147.

Respectfully,

P. R. Bemis
Vice President, Nuclear Operations
Mail Drop PE23

Attachment

cc: EW Merschoff - NRC RIV
KE Perkins, Jr. - NRC RIV, WCFO
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ATTACHMENT A
ADDITIONAL INFORMATION RELATED TO BULLETIN 96-02

A detailed review of reactor building crane design was performed against the design recommendations of NUREG-0554. Listed below are those aspects of the Supply System's present crane design that do not strictly conform to NUREG-0554 design recommendations. It should be noted that none of these issues compromise safe load handling capability, nor do they impact the redundancy in reactor building crane design that ensures that a load drop accident is not a credible event.

1) RECOMMENDATION:

Cyclic loading induced by jogging or plugging an uncompensated hoist control system should be included in the design specification.

SUPPLY SYSTEM RESPONSE:

The main hoist controls do not prevent jogging. Control devices which prevent jogging can result in a loss of response to an operator initiated "off" signal, which also impairs the operator's control of the hoist operation and may not be a practical addition to the control system. The main hoist is provided with a precision drive so that the position of the load can be controlled without resorting to jogging. The five point controls do limit the motor torque if jogging is used. The secondary resistors prevent the sudden application of full line power to the motor and control the acceleration loads on the hoist components. Although the components were not explicitly analyzed, the original documents indicate that the hoist acceleration loads would be those encountered in ordinary practice with this type of hoist control.

2) RECOMMENDATION:

Provide an approximate 15% margin for components subject to wear.

SUPPLY SYSTEM RESPONSE:

The design rated load for the crane is 125 tons which meets the original contract specification. A 15% margin was not explicitly added to the loadings of wear susceptible parts in the original design calculations and no analysis has been performed to determine if any of the existing wear susceptible parts would meet design standards with a 15% margin. The main hoist was provided with a load limiting device consisting of load cells in the head block. NUREG-0612 Appendix C cites a case where the application was accepted in which the wear susceptible components were designed to the maximum critical load rating and not to a greater load rating to allow for wear. Although the recommendation to design components to a greater load rating was not met, it was accepted that an equivalent margin of safety was achieved because the hoisting mechanism contained a limiting device that with the proper settings effectively limited the load which the wear susceptible components will experience. The load limiting device on this crane would also limit the load which wear susceptible components experience. In addition, annual inspections are performed to detect wear on susceptible components.

3) RECOMMENDATION:

The maximum load including static and inertia forces should not exceed 10% of the manufactures published breaking strength.

SUPPLY SYSTEM RESPONSE:

ANSI B30.2.0 and CMAA #70 require that the rated load plus the weight of the load block divided by the total number of parts of rope not exceed 20% of the nominal breaking strength of the rope. This is a design factor of 5. Using this standard method for evaluating the strength of the rope, the original design calculations showed the rope at 10.4% of its minimum breaking strength or a design factor of 9.7. Dynamic effects are not included in calculating rope loading as a standard practice but are accounted for in the selection of the design factor for the application. The rope calculations showed a design factor of 8.3 when based on lead line pull or forces at about 12% of its minimum breaking strength. The maximum load including static and inertia forces slightly exceed 10% of the manufacturer's published breaking strength as specified by NUREG-0554. However, an acceptable margin of safety is achieved because of the redundant reeving system, the use of load limiting devices, the use of limit switches to prevent two-blocking, and reliance on annual inspections of the rope to detect wear.

4) RECOMMENDATION:

Maximum hoisting speed should be limited to the "slow" column of figure 70-6 of CMAA #70.

SUPPLY SYSTEM RESPONSE:

The drawings and the original design calculations show a hoist speed of 5.5 ft./min. This speed is 10% faster than the suggested slow speed in Figure 70-6 of CMAA #70, and does not impact the safe load handling capability of the crane. A precision drive provides a hoist speed of 5.5 in./min. for more accurate positioning and control when required.

5) RECOMMENDATION:

If the crane is used for lifting spent fuel elements, the crane control system should include interlocks that will prevent trolley and bridge movements while the load is being hoisted free of a reactor vessel or a storage rack.

SUPPLY SYSTEM RESPONSE:

The reactor building crane is not used to lift spent fuel assemblies. When used in the future to move dry casks, safe load paths and administrative controls will be in place to minimize the risks of impacts with adjacent structures and components due to inadvertent lateral movements of the crane.

6) RECOMMENDATION:

Controls should be provided to absorb the kinetic energy of the rotation machinery and stop hoisting movement should failure of one rope or one of the dual reeving systems occur.

SUPPLY SYSTEM RESPONSE:

If a failure of one rope or one of the dual reeving systems should occur, the load will shift to the other rope and reeving system. The other rope and reeving system will retain the load but the equalizer bar will move and a warning light will be lit on the trolley. The electrical controls will not automatically stop the hoisting motion. This was not a requirement of the original design specification. The equalizer arm assembly was designed to absorb the energy of the load shift.

7) RECOMMENDATION:

Load blocks should be non destructively examined by surface and volumetric techniques.

SUPPLY SYSTEM RESPONSE:

Non destructive examination by surface and volumetric techniques has not been performed. Visual examination of the load block is performed annually per plant procedures.

8) RECOMMENDATION:

Incremental or fractional inch movements, when required, should be provided by items such as variable speed controls or inching motor drives.

SUPPLY SYSTEM RESPONSE:

Variable speed controls or inching motor drives were not specified by the original contract specification and were not furnished. Adequate control of the bridge and trolley can be obtained without these devices.

9) RECOMMENDATION:

The bridge and trolley should be designed to remain in place with their wheels prevented from leaving the tracks during a seismic event.

SUPPLY SYSTEM RESPONSE:

During a seismic event the stresses in the trolley upkick lugs exceed the allowable stress for the safe shutdown earthquake as specified in Section 9.1.4.2.2.1 of the FSAR. However, during the seismic event the trolley will remain supported by the bridge so that a load drop accident will not occur. The Supply System considers this a non-conforming condition and intends to replace the upkick lugs. A Problem Evaluation Request has been written to address this issue. The crane is considered operable but non-conforming until the upkick lugs are replaced.

10) RECOMMENDATION:

Means should be provided in the motor control circuits to sense and respond to such items as excessive electrical current, excessive motor temperature, overspeed, overload, and overtravel.

SUPPLY SYSTEM RESPONSE:

The main hoist motor circuit contains series-connected thermal overload heater/relays which provide protection against excessive electric current, and its resulting excessive motor temperature. The motor does not have additional devices such as internal thermocouples to sense excessive motor temperature. The controls for raising the main hoist include the following interlocks: oil cooler pumps, upper limit switch, and maximum load limit. The controls for lowering the main hoist include the following interlocks: overspeed switch, lower limit switch, and minimum load limit. Additionally, the main hoist is provided with solenoid operated brakes which de-energize (engage) when power to the motor is interrupted.

The four bridge motor circuits each contain series-connected thermal overload heater/relays which provide protection against excessive electric current, and its resulting excessive motor temperature. The circuits do not have additional devices such as internal thermocouples to sense excessive motor temperature. The controls-interlocks for bridge travel include: tornado-latch limit switches and East-West travel limit switches. Additionally, the bridge includes two solenoid operated service brakes and two solenoid operated parking brakes.

The trolley motor circuit contains a series-connected thermal overload heater/relay which provides protection against excessive electric current, and its resulting excessive motor temperature. The motor does not have additional devices such as internal thermocouples to sense excessive motor temperature. The controls-interlocks for bridge travel include: tornado-latch limit switches and North-South travel limit switches. Additionally, the trolley includes two solenoid operated service brakes.