Duquesne Light
Nuclear Division
P.O. Box 4
Shippingport, PA 15077 0004

Telephone (412) 456-6000

October 9, 1984

Director of Nuclear Reactor Regulation
United States Nuclear Regulatory Commission
Attn: Mr. Steven A. Varga, Chief
Operating Reactors Branch No. 1
Division of Licensing
Washington, DC 20555

Reference: Beaver Valley Power Station, Unit No. 1
Docket No. 50-334, License No. DPR-66
NUREG-0612, Supplemental Response to SER

Gentlemen:

Attached is a supplemental response to our submittal dated April 26, 1982, which responded to your Safety Evaluation Report (SER) on the control of heavy loads at Beaver Valley Power Station, Unit No. 1. That submittal identified two items for which additional work was necessary in order to address staff concerns. These are:

1. NUREG-0612; Section 5.1.1, Guideline 4 (Special Lifting Devices)
2. NUREG-0612; Section 5.3(1) Interim Protection Measure 1 (Technical Specification restriction on loads carried over the Spent Fuel Pool)

Item 1 above has been addressed and the results are documented in the Attachment to this submittal. These results include the evaluation of our special lifting devices with respect to specific sections of ANSI N14.6-1978.

Our special lifting devices were designed and built for Beaver Valley Unit 1, circa 1969-1973, by the Westinghouse Electric Corporation. They used the design criteria that the resulting stresses in the load carrying members, when subjected to the total combined lifting weight, should not exceed one fifth of the ultimate strength of the material. The comparison of our special lifting devices, when compared to the criteria of ANSI N14.6, shows that they meet the intent of the ANSI document for design, fabrication and quality assurance. Although a specific design specification was not written, the assembly and detailed manufacturing drawings and purchase order documents contain the equivalent to the related ANSI criteria. A stress report has been prepared for these devices and the design criteria is considered satisfied. These devices were manufactured under Westinghouse surveillance with identified hold points, procedure review and personnel qualification which adequately meet these related ANSI criteria.

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These special lifting devices are not in strict agreement with the criteria of ANSI N14.6 for acceptance testing, maintenance and verification of continuing compliance. Acceptance testing as defined in the ANSI standard was not performed, but an initial 125 percent load test was conducted on all three special lifting devices followed by non-destructive testing of critical welds. Current maintenance and inspection procedures include a visual check of critical welds during lifting and also provide a method for documenting related maintenance activities. These activities are considered sufficient to demonstrate compliance with the intent of the ANSI criteria. Additional details are provided in the attachment.

Based on the information contained in the Attachment, we conclude that our special lifting devices meet the intent of NUREG-0612, Section 5.1.1, Guideline 4.

In regard to item 2 above, we have continued our investigation into the basis for our current technical specification limit of 3,000 pounds. During the site visit by NRC and FRC engineers on November 23 and 24, 1981 and documented in your SER, it was stated that the current limit was based on the fuel handling accident reported in our Final Safety Analysis Report. However, a specific load could not be identified which would form the basis for the weight limit. As such, our submittal of April 26, 1982, stated that we would change this limit to address the staff's concerns. Subsequent to that submittal, while preparing the safety evaluation in support of a technical specification change, relevant information was obtained in support of the existing 3000 pound limit.

The UFSAR, Section 9.12.4, describes the handling of failed fuel assemblies in the spent fuel pool. Any fuel assembly which is suspected to be defective may be placed in a damaged fuel storage container and sealed to provide an isolated chamber for testing for the presence of fission products. There are two damaged fuel storage containers presently stored in the spent fuel pool. In the event it became necessary to utilize this container to transfer fuel to a fuel cask in the pool cask storage area, this container would be lifted and moved using the spent fuel handling tool. The total combined weight of a fuel assembly, the damage fuel storage container and the spent fuel handling tool is approximately 3000 pounds.

Additionally, the vertical lift range of the spent fuel hoist and the length of the spent fuel handling tool are designed to limit the maximum lift of a spent fuel assembly as well as the damaged fuel storage container. This is to assure a sufficient depth of water for safe shielding above the fuel being handled. As a result, the maximum distance between the bottom of the damaged fuel storage container and the top of the fuel storage racks is kept small (less than 1½ feet). Normal handling of fuel in the spent fuel pool is below the upper most limit switch on the crane which further reduces the distance maintained between the container and the storage racks.

The spent fuel pool is divided into three areas; fuel transfer mechanism area, spent fuel storage area and the spent fuel cask laydown area. These areas are separated by concrete walls having slots (2) in them to permit transfer of fuel from one area to another. These slots can be closed using gate dams which are located on the fuel storage area side of the concrete dividing walls. The heaviest gate dam weighs approximately 3000 pounds and is used to isolate the fuel transfer area from the spent fuel storage area. The fuel handling crane is used to make this lift and install the gate dams in position when needed. It is not necessary, however, to travel over stored fuel assemblies to install the gate dam.

Based on this information, we will not submit a technical specification change request to decrease the under-hook weight limit on this crane. It should be noted that our current procedures restrict the handling of a heavy load in areas where fuel is located and where safety-related equipment is installed. As such, present administrative controls exist which will accomplish the same task as would a change to our Technical Specifications.

Should you have any questions concerning this submittal, please contact my office.

Very truly yours,

J. J. Carey
for Vice President, Nuclear

cc: Mr. W. M. Troskoski, Resident Inspector
U. S. Nuclear Regulatory Commission
Beaver Valley Power Station
Shippingport, PA 15077

U. S. Nuclear Regulatory Commission
c/o Document Management Branch
Washington, DC 20555

ATTACHMENT

NUREG-612; Section 5.1.1, Guideline 4
Special Lifting Devices
Supplemental Response to SER dated April 26, 1982

NOTE: The SER identified several specific sections of ANSI N14.6 to be addressed when evaluating special lifting devices. The following identifies those specific sections with supporting information for our special lifting devices (head lift rig, internals lift rig, reactor coolant pump (RCP) motor lift sling spreader assembly).

ANSI N14.6 Section 3.1; Designers Responsibilities

a. limitations on the use of the lifting device (3.1.1)

Response

The standard states that the designer of the lifting device is to prepare a design specification containing in part a definition of performance criteria, requirements for drawings and materials, inspection and testing to be performed and limitations on the use of the device with respect to temperature, corrosive environments, etc. At the time these devices were procured and fabricated, a requirement for a design specification did not exist and therefore one was not written by the designer, who in this case, is the Westinghouse Electric Corporation. However, assembly and detailed manufacturing drawings and purchasing documents contain the following information:

- Material specification for most of the critical load path items to ASTM, ASME specifications or special listed requirements.
- Welding, weld procedures and welds to be in accordance with ASME Boiler and Pressure Vessel Code - Section IX.
- Special NDT for specific critical load path items to be performed to written and approved procedures in accordance with ASTM or specified requirements.
- All coatings to be performed to strict compliance with specified requirements.
- Letters of compliance for materials and specifications were required for verification with original specifications.

No limitations were identified as to the use of these devices under specific environmental conditions. The conditions under which the lifting devices are stored and used were considered and accounted for in their design and fabrication. This can be demonstrated by the use of protective coatings applied in accordance with the designers specified requirements.

b. identification of critical components and definition of critical characteristics (3.1.2)

Response

A critical items list of parts and welds has been prepared for the reactor vessel head lift rig, the reactor vessel internals lift rig and the RCP motor lift rig. The information contained on this list includes material identification and the applicable volumetric and surface inspections that were performed in the fabrication of these special lifting devices. In some instances, non-destructive testing was not specified since the material selection and strength result in very low tensile stresses and thus, non-destructive testing was not justified.

The material selection for most critical load path items was made to ASTM, ASME or special material requirements. However, the non-designed items of the RCP motor lift sling were selected based on their load carrying capabilities. These include "U" bolts, wire rope slings, shackles, turnbuckles and hooks. The material requirements were supplemented by Westinghouse imposed non-destructive testing, and/or special heat treating requirements for all of the critical items. Westinghouse required all welding, welders and weld procedures to be in accordance with ASME Boiler and Pressure Vessel Code Section IX for carbon steel welds. They also required a certificate, or letter of compliance that the materials and processes used by the manufacturer were in accordance with the purchase order and drawing requirements. Westinghouse also performed final inspections on these devices and issued quality releases.

c. signed stress analyses which demonstrate appropriate margins of safety (3.1.3).

Response

A stress analysis of the special lifting devices has been prepared by Westinghouse. This analysis documents the adequacy of our special lifting devices in that they can perform their function within appropriate margins of safety. The ANSI N14.6 criteria (3 and 5 for yield and ultimate strength, respectively) were demonstrated to have been met for tensile and shear stresses.

d. indication for permissible repair procedures (3.1.4)

Response

The standard states that the designer should indicate what repair procedures and acceptance criteria for repair are permissible. The following guidance will be used for repairs to these devices. Any repair to these special lifting devices is considered to be in the form of welding. Should pins, bolts or other fasteners need repair, they should be replaced, in lieu of repair, in accordance with the original or equivalent requirements for material and non-destructive testing. Weld repairs and examinations will be performed in accordance with current plant procedures.

ANSI N14.6 Section 3.2; Design Criteria

a. use of stress design factors of 3 for minimum yield strength and 5 for ultimate strength (3.2.1)

Response

The load bearing members of the special lifting devices are capable of lifting three times the combined lifting weight of the design lift without generating a combined shear stress or maximum tensile stress within the lifting device in excess of the corresponding minimum yield strength of the materials of construction. They also are capable of lifting five times that weight without exceeding the ultimate strength of these materials. This has been documented in the stress report prepared for our devices by Westinghouse. The ANSI N14.6 criteria (3 for yield, 5 for ultimate) has been met for tensile and shear stresses and other appropriate criteria for loading conditions that result in combined, bearing, and buckling stresses.

High strength materials were used in these devices. Although the fracture toughness was not tested, the materials used were selected based on their excellent fracture toughness characteristics. However, in lieu of a different stress design factor, the ANSI N14.6 stress design factors of 3 and 5 were used in the analysis and the resulting stresses are considered acceptable. NUREG-0612, Article 5.1.1 (4) further states that the stress design factor should be based on the combined maximum static and dynamic loads that could be imparted on the handling device based on the characteristics of the crane which will be used.

The dynamic characteristics of the crane would be based on the main hook and associated wire ropes holding the hook. Should the crane hook suddenly stop during lifting or lowering of a load, a shock load could be transmitted to the connected device. Because of the elasticity of the wire ropes, the dynamic factor for a typical containment crane is not much larger than 1.0. The maximum design factor that is recommended by most design texts is a factor of 2.0 for loads that are suddenly applied. The stress design factor of 3 for yield strength from the ANSI criteria certainly includes consideration of suddenly applied loads for cases where the dynamic impact factor may be as high as 2.0. Additionally, when applying the criteria defined by the Franklin Research Center for determining a dynamic load factor (as stated in our submittal of April 26, 1982), we have determined the dynamic load effect during the lifting of the reactor vessel head as being approximately 2¼ percent of the static load. This is in agreement with our earlier statement that this factor is not much larger than 1.0. Therefore, we conclude that the use of the design criteria in ANSI N14.6 satisfies the NUREG-0612 criteria.

b. similar stress design factors for load bearing pins, links and adapters (3.2.4).

Response

The stress design factors of ANSI N14.6 Section 3.2.1 of 3 and 5 were used in the analysis and the resulting stresses are acceptable. This is documented in the stress report. Where necessary, the weight of pins was considered for handling.

c. slings used comply with ANSI B30.9 - 1971 (3.2.5)

Response

The wire rope used on the RCP Motor Lift Sling complies with ANSI B30.9 - 1971. This standard is applied to slings used for lifting heavy loads as described in our submittal of April 26, 1982.

d. subjecting materials to dead weight testing or Charpy impact testing (3.2.6).

Response

Drop weight and Charpy impact tests were not required nor performed except for the upper and lower clevises of the internals lift rig. The applicable material specification for these items is an ASME specification which require Charpy tests. However, all material selection was based on its excellent fracture toughness characteristics.

ANSI N14.6 Section 3.3; Design Considerations

a. consideration of problems related to possible lamellar tearing (3.3.1)

Response

Lamellar tearing was considered in the design of the reactor vessel and internals lift rig sling blocks by adding a stiffener bolt and requiring non-destructive tests (ultrasonic, magnetic particle and radiograph) of the base material and assembly welds.

b. design shall assure even distribution of the load (3.3.4)

Response

These special lifting devices were designed to assure even distribution of the load.

c. retainers fitted for load-carrying components which may become inadvertently disengaged (3.3.5)

Response

Locking plates, pins, etc. are used throughout these special lifting devices.

d. verification that remote actuating mechanisms securely engage or disengage (3.3.6)

Response

Remote actuation is only used when engaging the internals lift rig with the internals. The reactor vessel internals lift rig employs a long handled tool to engage the rig and the internals. The tool depresses a spring loaded tube and turns the engaging screw into the internals. No specific position indication is identified, except for scribe marks on the tool, and the visual difference in the top of the spring loaded tube. This is considered sufficient indications that the internals are engaged.

ANSI N14.6 Section 4.1; Fabricator's Responsibilities

a. verify selection and use of material (4.1.3)

Response

The critical load carrying members of these special lifting devices were designated by Westinghouse, the designer, as requiring letters of compliance to document the use of the correct materials.

b. compliance with fabrication practices (4.1.4)

Response

General good manufacturing processes were followed in the manufacture of these devices. Assembly and detailed manufacturing drawings contained information regarding the fabrication of these special lifting devices. Westinghouse performed certain checks and inspections during various steps of manufacturing to assure good practices were being followed.

c. qualification of welders, procedures, and operators (4.1.5)

Response

The manufacturer's welding procedures and non-destructive testing procedures, as well as personnel qualifications, were reviewed by Westinghouse.

d. provisions for a quality assurance program (4.1.6)

Response

A formal quality assurance program for the manufacturer was not required for all items. The assembly and detailed manufacturing drawings and purchase order documents contain the equivalent to the AN i criteria. The manufacturers welding procedures and non-destructive testing procedures were reviewed by Westinghouse prior to use.

e. provisions for identification and certification of equipment (4.1.7)

Response

Most of the critical load carrying members require letters of compliance for material requirements. In addition, Westinghouse performed certain checks and inspections during various steps of manufacturing to verify correctness of equipment and work practices.

f. verification that materials or services are produced under appropriate controls and qualifications (4.1.9)

Response

Westinghouse Quality Assurance personnel performed improcess and final irspections on the materials, work and finished product. These devices

Response, (Continued)

were manufactured under Westinghouse surveillance which included identified hold points. Final Westinghouse review includes visual, dimensional, procedural, cleanliness, qualifications of personnel and issuance of a quality release to ensure conformance with drawing requirements.

ANSI N14.6 Section 5.1; Owner's Responsibilities

a. implementation of a periodic testing schedule and a system to indicate the date of expiration (5.1.3)

Response

The special lifting devices at Beaver Valley Unit 1 are used infrequently, normally only during refueling outages which will be occurring on a frequency of approximately 18 months. During refueling outages, these devices may only be used for 2 to 3 lifts each. For this reason, it is considered impractical to implement a periodic testing schedule. The ANSI Standard was written for special lifting devices which could easily be used at a much greater frequency, therefore, a periodic testing schedule would appear to be appropriate.

In order to verify our special lifting devices capability of reliability performing their function, our procedures require a visual check of critical welds and parts prior to use and as an initial step when performing a lift.

b. provisions for establishing operating procedures (5.1.4)

Response

Instructions on the use of our special lifting devices are contained in plant refueling and maintenance procedures.

c. identification of subassemblies which may be exchanged (5.1.5) and,

d. suitable markings (5.1.5)

Response

It is obvious, from their designs, that these rigs are specific lifting devices and can only be used for their intended purpose and parts are not interchangeable. Therefore, labeling each special lifting device for its intended purpose is not necessary.

e. maintaining a full record of history (5.1.6)

Response

A record of the history of the special lifting devices is maintained in accordance with current plant procedures. Records are available

documenting the inspections performed on these devices, pre-lift and during lift, as well as the completed procedures which were followed during their use. If maintenance is required on these devices, plant procedures provide for the documenting of the repairs performed.

f. conditions for removal from service (5.1.7)

Response

Any special lifting device which has experienced any incident causing doubt as to its being able to perform acceptably, or which has been damaged will be removed from service until it is repaired or it has been demonstrated to be capable of performing its intended function. These devices will not be used until the required visual inspections have been performed in accordance with plant procedures.

ANSI N14.6 Section 5.2; Acceptance Testing

a. load test to 150% and appropriate inspections prior to initial use (5.2.1)

Response

All three special lifting devices were load tested after field assembly to 125% maximum load followed by non-destructive testing of critical welds. Load testing to 125% is considered adequate in view of the safety factors designed into these devices.

b. qualification of replacement parts (5.2.2)

Response

Replacement parts, should they be required, will be made of identical or equivalent material and inspected as originally required. Only pins, bolts, and nuts are considered replacement parts for the reactor vessel head and internals lift rigs. Some of the items comprising the reactor coolant pump motor lift sling are catalog items. Wire rope slings used to replace the sling assembly will comply with ANSI B30.9-1971.

ANSI N14.6 Section 5.3; Testing to Verify Continuing Compliance

a. satisfying annual load test or inspection requirements (5.3.1)

Response

These special lifting devices are used during plant refueling which will be approximately every 18 months. During plant operation, these devices are inaccessable since they are permanently installed and/or remain in the containment. It is considered impractical to attempt to remove these devices from containment for load testing. Likewise, load testing to 150% of the total weight before each use would require special fixtures and is impractical to perform.

In order to demonstrate continuing compliance, a visual examination by qualified personnel of critical welds and parts will be conducted prior to lifting and at the initial lift prior to moving to full lift and movement for all three devices. This will be accomplished by raising the load slightly above its support and holding it for 10 minutes. During this time, critical welds and parts will be visually inspected. If no problems are apparent, the lift will continue. Additionally, a non-destructive examination of major load-carrying welds will be performed as part of our ten-year inservice inspection outage. This testing interval is justified because of the low usage these special lifting devices receive during this period.

Non-destructive testing on an annual basis is not considered practical for the following reasons:

- Access to the welds for surface examination is difficult. These rigs are in containment and some radioactive contamination may be present.

- All tensile and shear stresses in the welds are well within the allowable stresses.

- The items that are welded remain assembled and cannot be misused for any other lift other than their intended function.

- To perform non-destructive tests would require the following which from an ALARA standpoint is not justified.

  1. Removal of paint around the area to be examined which is contaminated.

  2. Performance of either magnetic particle inspection or liquid penetrant inspection and

  3. Repainting after testing is completed.

  4. Clean-up of contaminated items

- The frequency of use and, therefore, the wear on the special lifting devices is much lower than for shipping containers for which the Standard was written.

Performing non-destructive tests on these welds every refueling would increase the critica. path refueling time. In the event major repairs would be necessary or it was determined that the critical welds and parts were damaged, additional examination would be justified.

Dimensional checking is not included since these structures are large and the results of dimensional checking would always be questionable. Other checks on critical load path parts such as pins, are also not included since an examination of these items would require disassembly of the special lifting devices.

This ANSI standard was written for special lifting devices for shipping containers weighing 10,000 pounds or more. Lifting devices for this application are typically far less complicated in design and therefore,

meeting this standard would be easily achieved. Application of this part of the standard to the special lifting devices at Beaver Valley is not considered practical. The activities as described in this response should meet the intent of the standard in determining that the lifting device is capable of performing its intended function safely.

b. testing following major maintenance (5.3.2)

Response

Any major maintenance which may be needed on these special lifting devices is considered to be in the form of welding. Weld repairs will be performed in accordance with current plant procedures. The repaired area will be non-destructively examined to determine acceptability of the repairs, it will then be subjected to loading to the level expected to be carried within the repaired area and then another non-destructive examination will be performed.

c. testing after application of substantial stresses (5.3.3)

Response

If during a prelift examination or it is observed on the load cell readout while making a lift that the load-bearing components of these special lifting devices have been subjected to stresses substantially in excess of those for which it was qualified, the following will be performed. Replaceable parts will be tested in accordance with approved procedures to determine if they are acceptable for continued use or they will be replaced as described in our response to ANSI N14.6 Section 5.2.2. Welds will be non-destructively examined in accordance with plant procedures to determine if they are acceptable for continued use or they will be repaired and tested in accordance with our response to ANSI N14.6 Section 5.3.2.

d. inspections by operating (5.3.6) and non-operating or maintenance personnel (5.3.7)

Response

Plant procedures require these special lifting devices to be visually inspected prior to use by maintenance personnel. These devices are also visually inspected at critical welds while under load by holding the load slightly above its support for 10 minutes.

For any lift of a heavy load with a special lift device, present procedures provide for a Quality Control Inspector to provide surveillance of the lift activity. This includes proper installation of rigging and a visual inspection of critical welds on these devices.