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April 26, 1982

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; Control of Heavy Loads - SER

Gentlemen:

We have completed our review of your Safety Evaluation Report (SER) for Control of Heavy Loads at the Beaver Valley Power Station, Unit No. 1, as transmitted by your letter of February 25, 1982. Each item identified in the SER requiring additional information or requiring additional actions have been addressed in this submittal. The attachment to this letter includes each open item as identified in the SER followed by our response.

If you have any questions, please contact my office.

Very truly yours,

J J Carey

J. J. Carey
Vice President, Nuclear

cc: Mr. D. A. Beckman, Resident Inspector
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2.1.1 SAFE LOAD PATHS [GUIDELINE 1, NUREG-0612, Article 5.1.1 (1)]

DLC has identified safe load paths which will minimize the potential for heavy loads to impact irradiated fuel in the reactor vessel and in the spent fuel pool and to impact safe shutdown equipment. However, no physical indication such as floor markings has been provided for safe load paths. Therefore, DLC partially complies with guideline 1. This remains as an open item, however, because the licensee has to provide additional information on physical marking of load paths.

RESPONSE:

The goal of determining safe load paths, as stated in NUREG-0612, is to minimize the potential for heavy loads, if dropped, to impact irradiated fuel in the reactor vessel and in the spent fuel pool, or to impact safe shutdown equipment. The methods of satisfying this goal are identified as defining safe load paths by procedures, equipment layout drawings and by clearly marking on the floor the path the heavy load is to follow while being transported from one location to another.

During the site visit by your representatives, it was verified that drawings identifying safe load paths had been included in our procedure for handling heavy loads and that the safe load paths followed, to the extent practical, structural floor members. As discussed in the Safety Evaluation Report (SER), the areas considered for floor markings defining the safe load paths have been determined to be the areas covered by the polar crane and the screenwell crane. This item has remained open on the basis of our commitment to review the issue of physical marking of safe load paths for these remaining areas and to provide the Staff the results of this review. We have completed our review of this item and have determined that the physical markings of safe load paths in these areas would not further strengthen our program with regards to handling heavy loads. Our basis for this decision is as follows:

1. The SER states floor markings could substantially supplement operator training by marking load paths on floor areas or structural members visible to the operator. In the case of the polar crane, crane operator training and checkout is generally accomplished during periods of plant operation so that when an outage begins, we have qualified crane operators. The polar crane is a cab-controlled crane and hands on training is accomplished utilizing the turbine building cab-controlled crane because the containment is not accessable for training functions while the plant is operating. In the case of the screenwell crane it may be utilized for training however, this crane is a pendant controlled crane and due to the physical layout of the building structures and components, the load path in the vicinity of safe shutdown equipment cannot be seen by the crane operator. It is our maintenance practice that the crane operator should always be watching the signalman and controlling the load based on his instructions. The signalman is equipped with the procedure that includes the preplanned load path.

2. The containment building has little area available for load path selection. The containment building is congested with equipment, and load paths established via our procedures follow the only possible load paths which exist due to physical restrictions such as the steam generators and their shield walls, the manipulator crane, the pressurizer cubicle and the refueling cavity. Physical restrictions make it impossible to handle all heavy loads outside the refueling cavity perimeter and would therefore require load markings through the refueling cavity and these would not benefit the crane operator.

3. As stated above, it is our practice to teach the crane operator to follow instructions provided by his signalman. The signalman has a much better perspective of the load in relationship with any equipment in close proximety to the load and is in a better position to determine the best load path to be followed than the crane operator. Additionally, many loads handled in these areas will not be easily observable by the crane operator making it more difficult to try to follow marked load paths and therefore making it more important to watch his signalman, who provides direction in accordance with the written procedure.

4. The NRC approach of defense-in-depth has resulted in many improvements to existing programs which will result in improved load handling reliability which will reduce the likelihood of a load drop from occurring. These improvements in our plant include:

   - load handling procedures with safe load paths identified

   - improved crane operator training resulting in better trained operators with procedures providing guidance for the control of heavy loads

   - an evaluation of the reliability of all lifting devices with the end result being an improved program on the basis ANSI standards and a reduction in the maximum allowed load handling capacity of general load handling devices, both of which improve load handling reliability.

   - an improved crane inspection, testing and maintenance program which will also improve load handling reliability.

   - an evaluation of crane design against current standards confirming adequacy of design.

5. During heavy load movement, the load height is to be kept to a minimum to reduce the potential for a dropped load to penetrate the floor surface.

6. The NRC's efforts to require sound load handling practices has resulted in increased awareness of the potential of a dropped load which by itself will result in an improvement of load handling reliability.

2.1.2 LOAD HANDLING PROCEDURES [GUIDE 2, NUREG-0612, ARTICLE 5.1.1 (2)]

The licensee has developed procedures to cover load handling operations for heavy loads which satisfy the criteria of guideline 2. However, an explanatory note in this procedure is inconsistent with the intent of NUREG-0612; this note indicates that the general procedure for heavy load handling need not be implemented during certain modes of plant operation. Therefore, this remains an open item because the licensee should modify this statement. We request that the licensee eliminate this inconsistency in the procedures.

RESPONSE:

We have re-evaluated our use of the explanatory note in our general heavy load handling procedure (CMP-1-75-212). As a result, we have deleted this note from this procedure and included a statement that this procedure is in effect during all modes of operation when handling heavy loads over safety-related equipment or systems. These actions directly reflect the interest of the Staff and as such should be acceptable for closing this open item.

As a matter of clarification, in the event a deviation from a safe load path is necessary or a determination of the applicability of this procedure on a special case basis is required, a decision will be made by the Onsite Safety Committee, with a supporting safety analysis performed by the Station Engineering Group, as to whether or not approval should be granted for the activity in question.

2.1.3 CRANE OPERATOR TRAINING [GUIDELINE 3, NUREG-0612, ARTICLE 5.1.1 (3)]

Programs for training, qualification and conduct for the crane operators developed by DLC satisfy guideline 3. This conclusion is based on a combination of written and oral information provided by the licensee during the site visit on November 23-24, 1981.

RESPONSE:

Our submittal of June 23, 1981, stated our training is in accordance with ANSI B30.2 - 1976. We expanded on this response during the site visit with your representatives and based upon that presentation the determination was made that our Crane Operator Training Program satisfied guideline 3. At that time you requested that we provide this information in a follow-up response when the Safety Evaluation Report was issued.

The course outline and the training handout was made available at the meeting. It was verified that the course content was developed directly from the ANSI standard. This program includes presentations on Crane Safety, rigging, standard hand signals, operator conduct, specific statements concerning handling the load and a check-off sheet for each crane operator. This check-off is a practical demonstration, under supervisor observation, of each crane operators ability to safely handle loads on each type of crane, and his knowledge of load handling through oral questioning during operating demonstrations. Successful completion of the practical portion of the crane operator training program demonstrates the crane operators qualifications for operating each type of crane.

It was also verified at the site meeting that NUREG-0612 had been added to the training program. Its' influence on the handling of heavy loads is presented to crane operators as part of the training program handout material and is included as part of the program presentation.

2.1.4 SPECIAL LIFTING DEVICES [GUIDELINE 4, NUREG-0612 ARTICLE 5.1.1 (4)]

Insufficient information was provided by the licensee to determine compliance with guideline 4. This remains an open item because the licensee has to obtain the necessary information from the original vendor to evaluate these devices with respect to Guideline 4.

RESPONSE:

Shortly after the on-site meeting with your representatives, efforts were put forth to determine our degree of compliance with guideline 4. In early December, 1981, this issue was presented generically to the Westinghouse Owners Group in an effort to obtain the necessary information on a cost sharing basis with other utilities. It was determined that due to the variety of special lifting device designs, an investigation on a generic basis was impractical. Rather, utilities were grouped by like design and are entering into a program through which the original vendor (Westinghouse) will provide the necessary investigations, by special lifting device design, to determine each designs compliance with guideline 4.

We have been in close contact with the Westinghouse representatives and expect to enter into a contractual obligation in the near future. The preliminary schedule for providing the results and evaluation of this investigation is September 30, 1982.

As stated in the Safety Evaluation Report, the reactor coolant pump (RCP) motor handling fixture was not identified in our June submittal. The RCP motor lifting rig is a three legged wire rope sling and as such is not a special lifting device and is in the category of lifting devices, not specially designed, guideline 5.

2.1.5 LIFTING DEVICES (NOT SPECIALLY DESIGNED) [GUIDELINE 5, NUREG-0612, ARTICLE 5.1.1 (5)]

DLC is expected to satisfy the requirements of guideline 5 in that the licensee has indicated that sling selection is based on the maximum working loads identified in ANSI B30.9-1971, and procedures will be revised to meet the guideline 5. The licensee has committed to document procedural compliance in a subsequent submittal. This remains an open item until the documentation has been reviewed by the staff.

RESPONSE:

Our June submittal did not address non "special" lifting devices and we committed to provide the necessary information in response to this guideline in this submittal. This guideline requires lifting devices that are not specially designed to be used in accordance with the guidelines of ANSI B30.9-1971, Slings. However, the NRC has provided a more conservative definition of the safe working load rating for slings than the ANSI standard.

In selecting the proper sling, the load used should be the sum of the static and maximum dynamic load and the rating identified on the sling should be in terms of the "static load" that produces the maximum static and dynamic load. The ANSI standard requires a minimum safety factor of five based on the minimum breaking strength of the sling. The effects of incorporating a dynamic load factor into sling selection will result in the down grading of our slings safe working load.

Since the site visit of your representatives, we have reviewed our procedures concerning the use and selection of slings to determine conformance with the ANSI standards and your requests. Our procedures presently meet the intent of the ANSI standard; however, some revisions will be required to provide the correct references and modify our program for the handling of slings so that sling ratings are determined in accordance with your request.

In order to determine a dynamic load factor, we are incorporating the following criteria defined by the Franklin Research Center. The dynamic load will be based upon ½% of the load times the hoist speed (feet per minute). This factor will be taken into consideration when assigning the safe working load to our slings. We are translating this dynamic factor into the rating identified on the sling in the following manner. The sling rating will be multiplied by ½% times the hoist speed and this number will be subtracted from the sling rating and will represent the safe working load in accordance with NRC concerns. The hoist speed for this consideration will be the maximum hoist speed determined for those cranes for which NUREG-0612 requirements apply.

Procedure revisions and sling de-rating will be accomplished by September 30, 1982, at which time we will be in full compliance with guideline 5.

## 2.1.6 CRANES (INSPECTION, TESTING AND MAINTENANCE) [GUIDELINE 6, NUREG-0612 ARTICLE 5.1.1 (6)]

The licensee has committed to revise the crane inspection, testing and maintenance program to be in accordance with ANSI B30.2. On the basis of this commitment, we conclude that the program at Beaver Valley Unit 1 will satisfy guideline 6. This item will be closed upon verification that these program revisions have been made.

RESPONSE:

Based on our submittal of June 23, 1981 and the site visit by your representatives, it was determined that we are in compliance with guideline 6. Our preventative maintenance procedures have been revised in accordance with ANSI B30.2 - 1976.

## 2.1.7 CRANE DESIGN [GUIDELINE 7, NUREG-0612, ARTICLE 5.1.1 (7)]

DLC partially complies with guideline 7 for the polar crane, screenwell crane, and potential contaminated area shop crane. In order to fully comply with this guideline for these cranes, the licensee should provide additional information to demonstrate that these cranes were designed in accordance with CMAA-70.

RESPONSE:

It was determined, based on the review of our June 23, 1981 submittal, that sufficient information should be provided to demonstrate these cranes comply with the additional CMAA-70 criteria which were not a consideration in the specification under which the cranes were purchased, specifically EOCI-61. The following are those statements with responses for which information is needed to demonstrate compliance with guideline 7.

Verify that:

1. Hoist speeds do not exceed 30 feet per minute.

   Response: The hoist speeds for the above cranes do not exceed 30 feet per minute.

2. Nonsymmetrical girder sections were not used in construction of the cranes.

   Response: The above cranes bridge girder sections were constructed with welded box sections.

3. Installation of any longitudinal stiffeners used complies with the requirements of CMAA-70, including verification that h/t ratios in box girders using longitudinal stiffeners do not exceed ratios specified in CMAA-70.

   Response: Longitudinal stiffeners have been supplied on the following cranes as indicated complying with all requirements of CMAA-70:

| | $\frac{h}{t}$ | $C(K+1)\sqrt{\frac{17.6}{fc}}$ | M | No. of Stiffeners required by CMAA-70 | No. of Stiffeners provided |
|---|---|---|---|---|---|
| Polar Crane | 219 | 486 | 564 | one | two |
| Scrnwl Crane | 212 | 324 | 376 | one | one |
| PCA Shop | 128 | 162 | 188 | None | None |

Note that the most conservative approach has been used, which is the case where the maximum stresses are assumed to equal the basic allowable stresses. Using this approach the $C(K+1)\sqrt{\frac{17.6}{fc}}$ equation governing longitudinal webb plate stiffeners reduces to 2C, which is the smallest possible value for this equation.

4. Girders with b/c ratios greater than 38 were not used.

   Response: The girder designs of the following cranes have b/c ratios as indicated below:

| | b/c |
|---|---|
| Polar Crane | 22.9 |
| Screenwell Crane | 40.0 |
| PCA Shop Crane | 37.5 |

The screenwell crane is the only crane to exceed a b/c ratio of 38. In accordance with the requirements of CMAA-70 the maximum allowable compressive stress, for a b/c equal to 40, requires a 7.4 percent stress reduction. The bridge girders of this crane have been desi ed for a 25 ton trolley, however, a 15 ton trolley is being used. With this reduced rating, the actual girder compressive stresses are far below the maximum allowable less the 7.4 percent.

5. Fatigue failure was considered in design of the crane and the number of design loading cycles at or near rated load was less than 20,000 cycles.

   Response: The cranes will perform only a limited number of lifts (several hundred) near rated load throughout the life of the plant; therefore, fatigue failure is unlikely.

6. Drum design calculations were based on the combination of crushing and bending loads.

   Response: The drum designs of the Polar Crane, Screenwell Crane, and PCA Shop Crane were based upon the combination of of crushing and bending loads thereby complying with the requirements of CMAA-70.

7. Drum groove depth and pitch substantially conform to th recommendations of CMAA-70.

   Response: The drum groove depth and pitch of the following cranes are as indicated, complying with all recommendations of CMAA-70:

| | Drum Groove Depth(in) | Drum Groove Pitch(in) | Hoisting Cable Diam(in) | CMAA-70 Recommended Min.Depth(in) | CMAA-70 Recommended Min.Pitch(in) |
|---|---|---|---|---|---|
| Polar Crane | | | | | |
| Main Hoists | 7/16 | 1.250 | 1-1/8 | 27/64 | 1.250 |
| Aux Hoists | 15/64 | .750 | 5/8 | 15/64 | .713 |
| Screenwell Crane | 7/32 | .667 | 9/16 | 27/128 | .641 |
| PCA Shop Crane | 5/32 | .470 | 3/8 | 9/64 | .428 |

8. Gear horsepower ratings were based on design allowables and calculation methodology equivalent to those incorporated in CMAA-70.

Response: The gear horsepower ratings of the Polar Crane, Screenwell Crane and PCA Shop Crane were based upon the American Gear Manufacturers Association (AGMA) standards referenced in CMAA-70. The design allowables for strength horsepower and durability horsepower specified by the formulas in CMAA-70 were also not exceeded.

9. Cab-control, cab-on-trolley configurations were not used.

Response: The control station arrangement with the cab located on the trolley was not provided for the following cranes as indicated below:

| | Control Station Location(s) |
|---|---|
| Polar Crane | Cab mounted on bridge |
| Screenwell Crane | Pendant station suspended from trolley |
| PCA Shop Crane | Pendant station suspended from trolley |

10. A mechanical load brake was used or hoist holding brakes have torque ratings of approximately 125 percent of the hoist motor torque.

Response: The braking arrangements of the following cranes exceed the requirements of CMAA-70 or indicated below:

| | Control Braking | Number of Holding Brakes | Minimum Torque Rating of Holding Brakes (% of Motor Torque) |
|---|---|---|---|
| Polar Crane | Eddy current brake | 2 | 150% each |
| Screenwell Crane | Mech load brake | 1 | 150% |
| PCA Shop Crane | Mech load brake | 1 | 150% |

11. Crane operation under load near the end of the bridge or trolley travel is not allowed or is compensated for by bumpers and stops in substantial conformance with the requirements of CMAA-70.

Response: Bumpers are provided for the bridge and trolley of the following cranes as indicated below:

| | Bridge Bumpers | Trolley Bumpers |
|---|---|---|
| Polar Crane | None provided, crane operates on a circular runway | Spring |
| Screenwell Crane | Rubber | Spring |
| PCA Shop Crane | Rubber | Spring |

As a result of the slow bridge and trolley speeds, all bumpers meet the deceleration requirements and energy absorbing capacity requirements of CMAA-70.

12. If used, static control systems substantially conform to the requirements of CMAA-70.

    Response: Static controls were not used on the Polar Crane, Screenwell Crane and PCA Shop Crane.

13. Controllers are of the spring-return or momentary-contact push-button types.

    Response: Controllers on the following cranes are either the spring-return type or the momentary contact types as indicated below:

| | Type of Controller |
|---|---|
| Polar Crane | Spring - return cab master switches |
| Screenwell Crane | Momentary - contact pendant pushbuttons |
| PCA Shop Crane | Momentary - contact pendant pushbuttons |

Additionally, we were requested to evaluate the following overhead load handling systems against the applicable industrial standards such as ANSI B30.11 and ANSI B30.16.

| | |
|---|---|
| CR-9 | 7.5-ton monorail system |
| CR-20 | 10-ton monorail system |
| CR-23 | 10-ton monorail system |
| CR-24A & B | 6-ton monorail system |
| CR-27 | movable platform hoiste |

Crane CR-27 movable movable platform with hoists is a top running gantry type double girder which meets all requirements of CMAA-70 and ANSI B30.2.0 (1967). Monorail systems CR-9, CR-20, CR-23, and CR-24A and B are patented track monorails which utilize a special rolled track having the following specifications:

a. 3.33 in width flat lower load carrying flange
b. minimum track carbon content of .60
c. minimum track manganese content of .75
d. minimum track Brinell hardness number of 225

These track systems meet all requirements of the Monorail Manufacturers Association (MMA) specification and ANSI B30.11 except that the capability to vertically adjust the track after the system was put into operation has not been provided. All hoists of the above monorail systems meet the requirements of ANSI B30.16.

The 6-ton monorail system, CR-21, has been omitted from this submittal because this system has not been installed.

INTERIM PROTECTION MEASURES

There are six interim protection measures to be implemented at operating nuclear power plants to provide reasonable assurance that no heavy loads will be handled over the spent fuel pool and that measures exist to reduce the potential for accidental load drops to impact on fuel in the core or spent fuel pool. DLC complies with interim measures 4, 5, and 6. But it does not comply with interim measures 1, 2 and 3. Interim protection measures 1, 2 and 3 cover heavy load technical specifications, the identification of safe load paths and the development of procedures for load handling.

RESPONSE:

Interium Protection Measure 1: An administrative control, through the heavy load handling procedure, presently restricts heavy loads from being handled over stored fuel in the fuel storage pool. The Technical Specification limit of 3000 pounds will be changed to reflect the Staff's concerns of handling heavy loads over the fuel storage pool.

Interium Protection Measure 2: The interium actions pursuant to guidelines 1 and 2, safe load paths and load handling procedures, respectively, have been addressed in the discussion of each guideline in this submittal. These actions are considered complete at this time and reflect long term compliance to these portions of NUREG-0612.

Interium Protection Measure 6: A review of load handling evolutions over the core has been completed as part of the development of the load handling procedures which were available prior to our second refueling outage. This procedure was in effect during this outage.