Duquesne Light

Nuclear Construction Division
Robinson Plaza, Building 2, Suite 210
Pittsburgh, PA 15205

2NRC-5-031
(412) 787-5141
(412) 923-1960
Telecopy (412) 787-2629

February 21, 1985

United States Nuclear Regulatory Commission
Washington, DC 20555

ATTENTION: Mr. George W. Knighton, Chief
Licensing Branch 3
Office of Nuclear Reactor Regulation

SUBJECT: Beaver Valley Power Station - Unit No. 2
Docket No. 50-412
Responses to Mechanical Engineering Branch Questions

Gentlemen:

This letter forwards responses to FSAR Mechanical Engineering Branch (MEB) Questions 210.21, 210.34, and 210.39.

Attachment 1 provides a revised response for Question 210.21. This question was previously closed, however, it is being resubmitted to provide more details on the acceptable stress levels for steady state vibrations.

Attachment 2 provides the results for a SSE anchor motion study which has been performed as agreed upon in a meeting with the MEB personnel. In the October 2, 1984, meeting, two action items were identified in order to close Question 210.34. The first action was to perform SSE anchor motion study and the second action was to revise Table 3.9B-15 to combine the faulted condition loads in a single equation with an allowable stress limit of 0.95 Sy. Table 3.9B-15 has been accordingly revised and it was submitted with FSAR Amendment 9.

Attachment 3 provides a revised response for Question 210.39 which gives additional information on the treatment of stresses produced by seismic anchor point motion of piping and the thermal expansion of piping. As supplementary information, a list of Westinghouse Class 2 and 3 equipment for which they have also supplied supports is given in Attachment 4.

Please inform us of the "closed," "conformatory," or "open" Safety Evaluation Report status of these items by February 28, 1985. If Question 210.39 remains "open" because the MEB considers the position stated in the question to be a requirement, DLC intends to request that the proposed requirement be submitted to NRC management for approval, in accordance with the Office of Nuclear Reactor Regulation procedure for management of plant specific backfitting.

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Upon your concurrence, the attached responses will be included in a future FSAR Amendment.

DUQUESNE LIGHT COMPANY

By E. J. Woolever
E. J. Woolever
Vice President

JJS/wjs
Attachment

cc: Mr. B. K. Singh, Project Manager (w/a)
Mr. G. Walton, NRC Resident Inspector (w/a)

COMMONWEALTH OF PENNSYLVANIA)
) SS:
COUNTY OF ALLEGHENY)

On this 21st day of February, 1985, before me, a Notary Public in and for said Commonwealth and County, personally appeared E. J. Woolever, who being duly sworn, deposed and said that (1) he is Vice President of Duquesne Light, (2) he is duly authorized to execute and file the foregoing Submittal on behalf of said Company, and (3) the statements set forth in the Submittal are true and correct to the best of his knowledge.

Anita Elaine Reiter
Notary Public

ANITA ELAINE REITER, NOTARY PUBLIC
ROBINSON TOWNSHIP, ALLEGHENY COUNTY
MY COMMISSION EXPIRES OCTOBER 20, 1986

ATTACHMENT 1

Question 210.21:

Provide the acceptance criteria that will be used to determine if the vibration levels observed or measured during the preoperational testing are acceptable. Specifically address how the vibration amplitudes will be related to a stress level and what stress levels will be used for both steady-state and transient vibration.

Response:

Vibration levels are observed or measured during preoperational testing for both steady state and transient vibration conditions. The program used to monitor these conditions are described below.

Steady-State Vibrations:

Visual observations are used for judging acceptability of steady-state vibration. Visual observations may be aided by hand-held instruments (e.g., vibrometers) when considered appropriate by engineers experienced in piping design.

A screening velocity or displacement will be established for use with hand-held instrument results. If the measurement indicates that the velocity or displacement limit is exceeded, the measured values are reconciled with the respective analyses by considering the specific piping configuration, velocity or displacement amplitude measured, stress indices, and the endurance strength of the material properly accounting for high cycle effects. If system modifications are required, the applicable ASME design calculations are reconciled to assure acceptable system characteristics for all applicable design conditions.

The maximum alternating stress intensity (S_{alt}) will be used to establish the acceptance stress criteria for steady state vibrations.

For ASME Class 1 piping:

$$S_{alt} = C_2 K_2 \frac{M}{Z} \leq \alpha S_{el}$$

where: α = 0.615 for materials covered by Figure I-9.1 of ASME III
α = 1.0 for materials covered by Figure I-9.2.2 of ASME III
C_2 = Secondary stress index defined in the ASME Code
K_2 = Local stress index defined in the ASME Code
M = Maximum zero to peak dynamic moment loading due to vibration displacement
Z = Section Modulus of pipe
S_{el} = Alternating stress at 10^6 cycles from Figure I-9.1 of ASME Section III or alternating stress at 10^{11} cycles from Figure I-9.2.2 of ASME Section III. The appropriate curve (A, B, or C) will be used for Figure I-9.2.2 in accordance with ASME III definitions

For ASME Classes 2 and 3 piping, and for ANSI B31.1 piping, the above equation is applicable, setting

$C_2K_2 = 2i$

where: i = Stress intensification factor, as defined in the ASME Code, Subsection NC, ND, or B31.1

Transient Vibrations

Transient vibration conditions are subjected to visual and instrumented observations as defined in Table 3.9B-1. When instrumented observations are taken, the acceptance criteria are based on the applicable fluid system transient analysis (stress, deflection, etc.) results. Instrumented observations are considered acceptable if they are within the transient analysis results acceptance criteria. If instrumented results exceed the acceptance criteria, the results are reconciled with the design analysis. When system modifications are required to achieve acceptable levels of transient vibration, the ASME design calculations are reviewed and modified as necessary to assure acceptable system characteristics.

ATTACHMENT 2

Question 210.34

Confirmatory. This item will become closed upon the completion of the following two actions. (The second action was incorporated in FSAR Amendment 9, December 1984.)

1. DLC will deomonstrate that pipe and equipment supports are inherently designed for the effects of SSE anchor motion. This will be demonstrated by a comparison of typical support strains for the normal/upset and faulted conditions including the effects of 1/2 SSE anchor motion and SSE anchor motion, respectively.

Results:

Though we do not concur with the above being a requirement of our licensing basis, the following has been undertaken in response.

In order to demonstrate pipe and equipment supports inherent capability to withstand effects of full SSE anchor motion, 100% of the large bore pipe supports for the emergency core cooling system were selected as a sample basis. This system includes a substantial number of large bore piping supports and is representative of the piping and equipment most critical to plant safety. All ECCS pipe supports in the safety injection and recirculation spray piping include SSE anchor motion effects and are designed against 0.95 Sy in accordance with FSAR Table 3.9B-15. The remaining ECCS piping contains 70 large bore supports which were not originally designed to include SSE anchor motion. These have been evaluated to include the effect of SSE anchor motion. The resulting stresses were compared to 0.95 Sy, and were to be found to be acceptable in all cases.

An additional 91 large bore supports were selected from various safety related systems to establish the capability of pipe supports to withstand the effects of SSE anchor motion on piping between buildings. When stresses were calculated for design loads which include SSE anchor motion and compared to 0.95 Sy, all supports were found to be acceptable.

The equipment supports sample included the following equipment from ECCS:

recirculation spray cooler support
recirculation spray pump support

Additional equipment supports included were the following:

neutron shield tank cooler support
degasifier recovery heat exchanger support
degasifier steam heater support

For the equipment supports above, a comparison was made of support strains for the normal/upset and faulted conditions incuding the effects of 1/2 SSE anchor motion and SSE anchor motion, respectively. Results ranged from a 10-20 percent increase in strain; however, stress values remained well below yield.

The above component supports are SWEC supplied supports and they were used in the sample study in order to utilize detailed calculations that were readily available to the architect engineer. However, several Westinghouse supplied component suports, the RHR pump support, and the RHR heat exchanger support were reviewed by the architect engineer and the results show a similar percent change in strain and stresses below yield. The component supports included in this sample study are representative of those most critical to plant safety.

ATTACHMENT 3

Question 210.39

Does the design criteria for component supports in the BVPS-2 systems categorize the stresses produced by seismic anchor point motion of piping and the thermal expansion of piping as primary or secondary? It is the staff's position that for the design of the component supports, the stresses produced by seismic anchor point motion of piping and thermal expansion of piping should be categorized as primary stresses.

Response:

The design criteria for the component supports in the BVPS-2 system do not categorize the stresses produced by seismic anchor point motion of piping and the thermal expansion of piping as primary or secondary.

Mechanical loads and thermal expansion loads produced by piping are combined and imposed upon the piping supports. Combined load effects on the supports are maintained within the limits provided as described in the response provided for Question 210.34.

In the initial design phase of auxiliary equipment supplied by Westinghouse, the design external nozzle loads imposed on the equipment are treated as primary loads. If Westinghouse is requested by the applicant to evaluate calculated piping loads on auxiliary equipment subsequent to the design phase, the composition (i.e., deadweight, seismic, thermal, etc.) of the loads is considered in the evaluation in accordance with the requirements of the applicable edition of the ASME code, Subsection NF, which in certain editions does recognize the self-relieving nature of loads arising from seismic anchor motion and thermal expansion of attached piping.

The treatment of stresses produced by seismic anchor point motion of piping and thermal expansion of piping as primary stresses is not applicable to BVPS-2 component supports because it originated with the 1982 winter adenda of the ASME code. All components for BVPS-2 have supports designed to code editions covering the years from 1971 through 1981. The applicable dates for specific component supports depends on the procurement date as described in the response to Question 210.34 and as detailed in the ASME code baseline document.

Since piping routed to such equipment has been installed, the configuration of piping is finalized which in turn finalizes thermal loadings. In order to lower loadings to meet the latest ASME code criteria, additional snubbers would have to be incorporated into the BVPS-2 piping system design. However, due to the concern of hardware reliability and maintenance requirements, the addition of the snubbers would inherently detract from the safety qualifications of such systems.

ATTACHMENT 4

Supplementary Information

Westinghouse has supplied the following Class 2 and 3 tanks, heat exchangers, and pumps and their supports:

boric acid batching tank
volume control tank
pressurizer relief tank
accumulator tanks
letdown heat exchanger
regenerative heat exchanger
excess letdown heat exchanger
RHR heat exchanger
seal water heat exchanger
low head safety injection pumps
RHR pumps
boric acid transfer pumps
charging pumps