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August 8, 1984

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
Response to Draft SER Open Item No. 177

Gentlemen:

The response to the NRC Geotechnical Engineering Section's Draft SER Open Item No. 177 is provided in Attachment 1. The associated revision to FSAR Section 2.5.4.13 is provided in Attachment 2.

DUQUESNE LIGHT COMPANY

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

JDO/wjs
Attachments

cc: Ms. M. Ley, Project Manager (w/a)
Mr. E. A. Licitra, Project Manager (w/a)
Mr. G. Walton, NRC Resident Inspector (w/a)

SUBSCRIBED AND SWORN TO BEFORE ME THIS 7th DAY OF August, 1984.

Elva G. Lesondak
Notary Public

ELVA G. LESONDAK, NOTARY PUBLIC
ROBINSON TOWNSHIP, ALLEGHENY COUNTY
MY COMMISSION EXPIRES OCTOBER 20, 1986

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COMMONWEALTH OF PENNSYLVANIA)
) SS:
COUNTY OF ALLEGHENY)

On this 7th day of August, 1984, 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.

Elva G. Lesondak
Notary Public

ELVA G. LESONDAK, NOTARY PUBLIC
ROBINSON TOWNSHIP, ALLEGHENY COUNTY
MY COMMISSION EXPIRES OCTOBER 20, 1986

ATTACHMENT 1

Draft SER Open Item No. 177 (Section 2.5.4.3.3): Settlement Monitoring Program:

The applicant must include, in the forthcoming amendment of the FSAR, the following information:

... 3. A commitment to monitor the settlements of all Category I structures throughout the plant life.

Response:

Refer to revised FSAR Section 2.5.4.13 (Attachment 2). This revision will be incorporated into a future FSAR amendment.

Eleven borings performed after the final densification program indicated that the densification requirements had been achieved. The boring locations are given on Figure 2.5.4-32 and summary plots of relative density before and after densification are given on Figure 2.5.4-43. The densification program required that the mean relative density at each boring location be not less than 75 percent for the sands and gravels as determined by the Gibbs and Holtz (1957) relationships. In any one boring, not more than one sample within the sands and gravels was allowed a relative density less than 70 percent and none were allowed to be less than 65 percent.

The results of the after-densification borings are summarized on Figure 2.5.4-43. Only three of 93 sand and gravel samples have relative densities less than 65 percent, and of these, two are very close to the soil surface. Thus, it is concluded that adequate densification of the sands and gravels was achieved with a mean relative density of 92.3 percent and a mean-less-one-standard-deviation relative density of 79.8 percent.

2.5.4.13 Surface and Subsurface Instrumentation

Insert "A" (pg. 2.5.4-30a)

A comprehensive program was established in mid-1977 to monitor the settlement of the BVPS-2 structures during and after construction.

Insert "B" (pgs. 2.5.4-31 & 2.5.4-32)

Permanent bench marks were installed at various locations around the site to provide reliable survey reference points. Several piezometers were installed to monitor changes in ground-water elevation in order to evaluate possible correlations between settlement data and changes in ground-water elevation. In each structure a series of settlement markers were or will be installed during construction. They are so located that they can be monitored throughout the construction phase as well as after construction. The locations of the bench marks and piezometers are shown on Figure 2.5.4-14 and the locations of the settlement markers installed at present are shown on Figures 2.5.4-44 and 2.5.4-45.

The observed settlements to date (Figure 2.5.4-46) can be compared with the predicted total static settlements as shown on Figure 2.5.4-20.

2.5.4.13.1 Bench Marks

Six permanent bench marks were installed at the locations shown on Figure 2.5.4-14. A typical bench mark installation detail is shown on Figure 2.5.4-47. It consists of a 2-inch diameter extra strong steel pipe anchored into bedrock inside of a 3 1/2-inch diameter casing extending to the top of rock. The bench marks are identified by a brass monument inscribed with the bench mark number, elevation, coordinates, and date of initial survey.

The elevations of the bench marks were checked at three-month intervals for the first year after installation and once per year thereafter. In addition, the elevations of bench marks in the

INSERT "A"

The settlements of all BVPS-2 Category I structures are being monitored during construction and will be monitored throughout the life of the plant. A comprehensive program was established in mid-1977 to monitor the settlements during construction and to aid in establishing the long-term, post-construction settlement monitoring program.

immediate vicinity of construction activities are monitored monthly and any bench mark that is disturbed or is suspected of being disturbed is resurveyed.

Bench marks are checked by running one or a series of leveling loops within the established bench marks. If, by comparison with the elevation measured during the original survey, it has been determined that a bench mark has been disturbed, a new brass monument is installed and the bench mark resurveyed.

All survey work performed in conjunction with checking and reestablishing bench marks is done using first order vertical control.

2.5.4.13.2 Piezometers

Six stand pipe piezometers were installed at the locations shown on Figure 2.5.4-14. Typical piezometer installation details are shown on Figure 2.5.4-27 and specific installation data are given in Appendix 2.5A. Tip elevations range between el 646 and el 651 feet and all of the piezometers are located within the in situ sand and gravel.

Piezometer data and Ohio River elevation data are recorded weekly and are included in Appendix 2.5A. With the exception of one period during February 1979, the ground-water levels recorded in the piezometers show very good correlation with the Ohio River elevations. During February 1979, the river rose to el 681 feet and the piezometer data indicate an apparent time lag. However, the piezometers were only read weekly during the period of high water and in the interim between readings the water level in the piezometers may have continued to rise, thereby reducing the apparent elevation difference between the ground-water levels and the Ohio River elevation.

2.5.4.13.3 Settlement Markers

The locations of the currently installed settlement markers are shown on Figures 2.5.4-44 and 2.5.4-45. Details of the several types of markers are shown on Figure 2.5.4-48. Construction activity in certain structures requires that settlement markers be relocated periodically in order to provide continuing access to the markers. In such structures, temporary markers have been installed instead of permanent markers. Temporary settlement markers have been installed on the reactor containment building, the safeguards area, the fuel and decontamination building, and the cooling tower. When construction activity diminishes to the point that markers are no longer subject to periodic relocation, the temporary settlement markers are replaced with permanent ones.

are being

During construction, settlement markers will be monitored monthly. When the individual structures are fully loaded and their settlement

Insert "B" (move to pg. 2.5.4-30)

Insert "B" (cont.)
(move to pg. 2.5.4-30)

profiles begin to level out, the period between readings will be increased.

Leveling loops run for settlement monitoring must close to one of the permanent bench marks with a maximum error of ±0.005 foot.

2.5.4.13.4 Data Processing

Data processing is accomplished using a SWEC computerized data storage system entitled Settlement Monitoring System (IS-233). The settlement marker elevations are input into the computer storage files and a computer printout providing the complete settlement record of each marker is produced. A specimen page of output is given on Figure 2.5.4-49.

For each settlement marker, settlement versus time plots have been prepared using arithmetic and log time scales. These plots are not included herein but are provided in the report on Settlement Monitoring Program (DLC 1980). A summary of the observed settlements to date is provided on Figure 2.5.4-46.

The Ohio River elevation and piezometer data is included in Appendix 2.5A.

2.5.4.14 Construction Notes

The removal of uncontrolled fill placed during the construction of SAPS and BVPS-1 is discussed in Section 2.5.4.5. The removal of a lens of stiff silty clay found during the reactor containment excavation is also discussed in Section 2.5.4.5.

A zone of loose granular material was discovered in the BVPS-2 area during the excavation for the reactor containment excavation. It was densified using the pressure injected footing technique. The densification program and its evaluation are fully described in the Report on Soil Densification Program, (DLC 1976).

2.5.4.15 References for Section 2.5.4

Bowles, J. E. 1977. Foundation Analysis and Design. McGraw-Hill Book Company, New York, N.Y.

Bullen, K. E. 1963. An Introduction to the Theory of Seismology. Cambridge University Press, Cambridge, England.

Christian, J. T. 1976. Relative Motion Between Two Points During an Earthquake. Journal of the Geotechnical Engineering Division, Vol. 102, No. GT11. November, ASCE.

Dravo Corporation 1974. Subsurface Investigation Routing of Sludge Transportation Pipes Around Beaver Valley Power Station, Little Blue