Duquesne Light

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August 17, 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. 173

Gentlemen:

This letter forwards the attached response to the NRC Geotechnical Engineering Section's Draft SER Open Item No. 173.

DUQUESNE LIGHT COMPANY

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

JDO/wjs
Attachment

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

COMMONWEALTH OF PENNSYLVANIA)
) SS:
COUNTY OF ALLEGHENY)

On this 17th 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

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Draft SER Open Item No. 173 (Sections 2.5.4.3.1, 2.5.4.3.4, 2.5.5.1, 2.5.5.2, 2.5.5.3, and 2.5.5.4) - Stability Analyses:

Section 2.5.4.3.1:

The staff requires that the applicant must also consider the loading combination of OBE and standard project flood in all stability analyses, as recommended in SRP 2.4.4. We expect to report our evaluation of this matter in the final SER.

Section 2.5.4.3.4:

The applicant has determined that the undensified area immediately north of the intake structure might liquefy under the SSE causing unanticipated stability problems. Therefore, the applicant has performed a static slope stability analysis for the dredged slopes (shown in FSAR Fig. 2.5.4-32) on the west and east sides of the intake structue, assuming that the liquefied soil north of the intake structure had weight but no shear strength. The results of the static slope stability analysis for both normal groundwater and 25-year flood conditions indicate that the dredged slopes are stable if the upper 10 feet of soil north of the intake structure liquefies. The applicant has also performed a dynamic slope stability analysis for the above side slopes, in response to an OL review question. Before docketing this analysis, the applicant must ensure that loading combinations include the OBE and Standard Project Flood and SSE and 25-year flood.

Section 2.5.5.1:

In response to the OL review question 241.18, the applicant has considered additional failure surfaces through the silty clay layer as shown in FSAR Fig. 2.5.4-57. This figure also shows the soil properties of various layers used in the analysis. The ground water table is taken at el 705 corresponding to the standard project flood. The minimum safety factor of 1.29 was obtained in this dynamic slope stability analysis. The applicant will docket the results of this analysis in the forthcoming amendment of the FSAR. We will report our evaluation in the Final SER.

Section 2.5.5.2:

The stability analysis of the side slopes east and west of the intake channel in front of the intake structure has been discussed in Section 2.5.4.3.4 above. The staff will review the dynamic stability analysis of these slopes when furnished by the applicant with the forthcoming amendment of the FSAR.

Section 2.5.5.3:

The applicant analyzed the static and dynamic slope stability of the riverward slope north of the EOS for the combined loading of SSE and the normal water level at el 665 ft. The safety factors in the static and dynamic cases were 1.6 and 1.2, respectively. The SRP, Section 2.4.4, recommends that analyses be made for two combined

loading conditions, namely, SSE + 25-year flood (el 690 ft), and OBE + standard project flood (el 705 ft). The applicant has stated that groundwater levels in the clay layer of the riverward slope would not change substantially during the relatively short duration of the 25-year flood. Therefore, the applicant has assumed that it is acceptable to consider failure surfaces through the clay layer with the groundwater level corresponding to the normal river water level at el 665 ft. rather than 690 ft. Because of the presence of cohesionless soil layers with greater permeability than that of clay layer in the riverward slope, the staff requires that the applicant perform stability analyses for the two loading conditions described above. We will report the results of our evaluation of this matter in the final SER.

Section 2.5.5.4:

Based on a review of the applicant's design criteria and the results of his analyses, the staff has concluded that the slopes at the site are generally stable for the loading conditions considered by the applicant. However, the applicant must reevaluate the stability of each of these slopes for two loading conditions, namely, (1) SSE + 25-year flood and (2) OBE + standard project flood, as recommended by SRP Section 2.4.4. The applicant must also docket the stability analyses of all slopes where revised seismic coefficients have been used.

Response:

The stability analyses of slopes near the river resulted in adequate factors of safety. The analyses of the riverward slope supporting the service water system (SWS) pipelines, the dredged intake channel slopes, and the emergency outfall structure (EOS) riverward slope are described below.

Riverward Slope Supporting the SWS Pipelines:

FSAR Fig. 2.5.4-57 presents the results of the stability analysis of the riverward slope supporting the 30-inch SWS lines. The analysis was performed assuming that the safe shutdown earthquake (SSE) loading condition and the standard project flood occur simultaneously. This combination is the most conservative loading condition which could be analyzed. Since the results provide a satisfactory factor of safety, it was decided that analyses of the slope under the less severe loading conditions of the operating basis earthquake (OBE) + standard project flood and the SSE + 25-year flood are unnecessary.

Dredged Intake Channel Slopes:

FSAR Fig. 2.5.4-37 presents the results of the stability analysis of the dredged intake channel slopes. A combination of normal water level and the SSE dynamic loading was analyzed. The top of the slope is at elevation 675 ft which is 10 feet above the normal water level (el. 665 ft.). Raising the water level to the level of the 25-year flood or standard project flood will not significantly change the

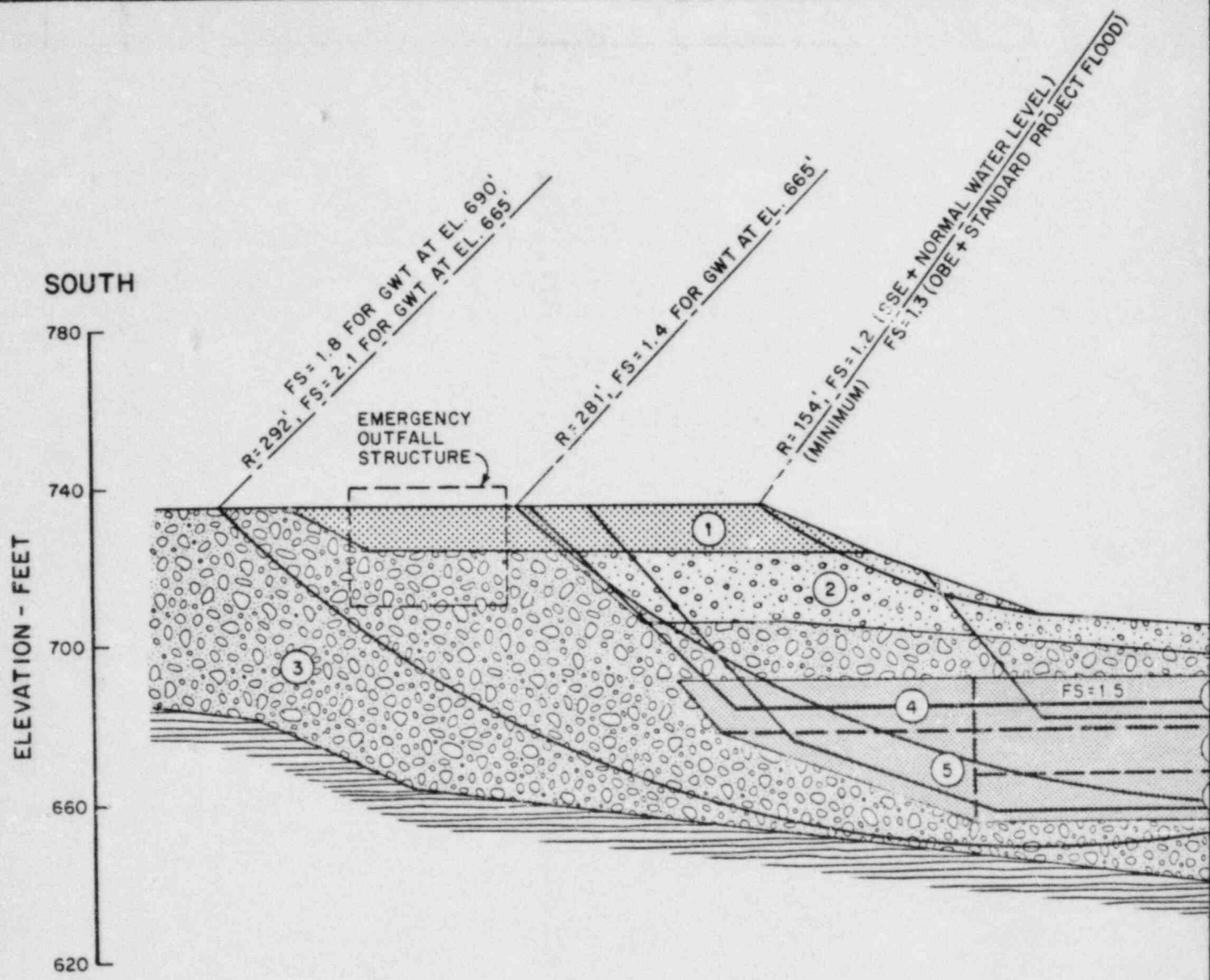
results of the previous analysis, since the slope is almost totally submerged under normal water conditions.

As discussed in FSAR Section 2.5.4.8.1, it has been determined from the results of the stability analysis that part of the slope has factors of safety less than the minimum acceptable of 1.1 and is potentially unstable under dynamic loading conditions. A liquefaction failure of the slope was postulated and the volume and final configuration of the soil that may flow toward the intake structure was found to be insufficient to block the intake channel even under extreme low water conditions. It was determined that analyses of the slope for the SSE + 25-year flood and the OBE + standard project flood conditions will yield results similar to those under normal water conditions, and, therefore, the worst case of the slope failing has already been investigated and reported in FSAR Section 2.5.4.8.1.

EOS Riverward Slope:

Fig. 173-1 presents the results of the stability analysis of the EOS riverward slope. This section corresponds to Fig. 6-5 of the SWEC report entitled, "Stability of Slopes at the Emergency Outfall Structure," June 1983. The OBE + standard project flood condition was not previously analyzed. Since the cohesionless material above the clay layer will be partially saturated during the standard project flood, the stability of the upper slope may be affected. Therefore, an additional analysis was performed for the OBE + standard project flood condition, as shown on Fig. 173-1, resulting in a minimum factor of safety of 1.3, which is satisfactory.

The stability of failure surfaces passing through the clay layer will not change by raising the water level from normal water conditions to the 25-year flood level. As stated in the 1983 SWEC report, the short-lived flood conditions will not reduce the strength properties of the clay nor will it affect the sand and gravel above the clay layer. A failure surface below the clay layer through the sand and gravel was analyzed for the SSE + 25-year flood condition and the factor of safety resulting from this analysis was also found to be satisfactory.



LEGEND

- FILL: COMPACTED GRANULAR
- FILL: UNCONTROLLED
- SAND, SILTY SAND, SANDY GRAVEL, GRAVELLY SAND
- SILTY CLAY
- BEDROCK

0 4

SCALE

NOTES

1. DATUM IS MEAN SEA
2. PSEUDO-STATIC FOR
3. DYNAMIC FACTORS O
CONDITIONS UNLESS

REF. "STABILITY OF SLOPES AT EMERGENCY OUTFALL STRUCTURE," SWEC, JUNE 1983, FIG. 6-5

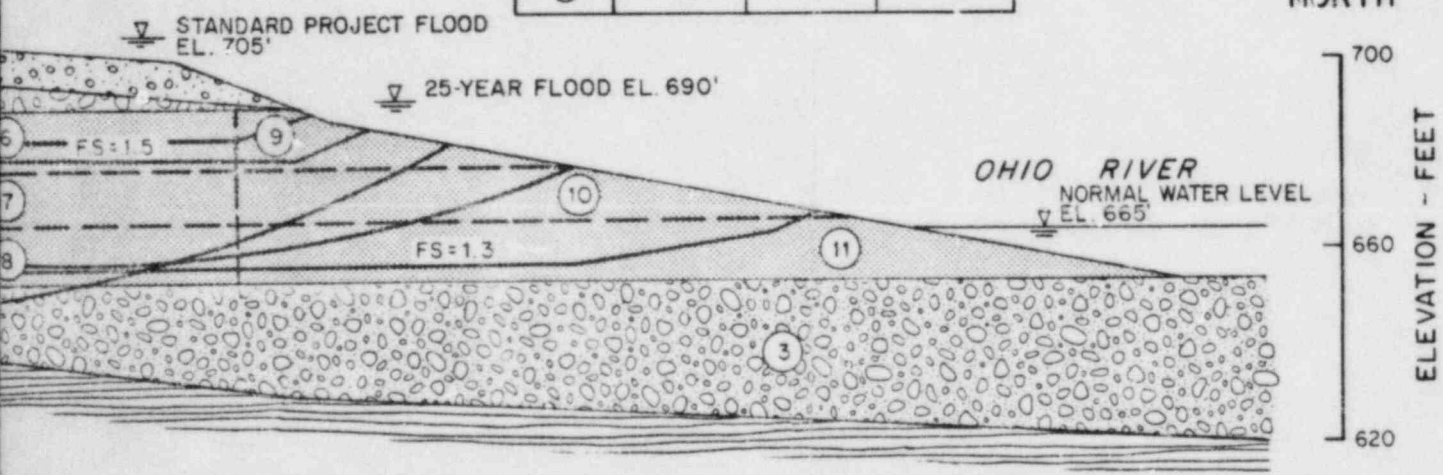
ENGINEERING SOIL PROPERTIES			
SOIL UNIT	TOTAL UNIT WEIGHT γ-lb/ft^3	FRICTION ANGLE ϕ-DEGREES	COHESION C-lb/ft^2
①	136	36	0
②	120	30	0
③	125	30	0
④	125	0	1900
⑤	125	0	2500
⑥	125	0	900
⑦	125	0	1500
⑧	125	0	1950
⑨	125	0	200
⑩	125	0	650
⑪	125	0	1050

SSE
PSEUDO-STATIC FORCES

0.125g

(SEE NOTE 2)

0.083g



0 80

FEET

LEVEL.
CES FOR OBE ARE 1/2 THE SSE FORCES.
SAFETY ARE DUE TO SSE LOADING
OTHERWISE NOTED.

FIGURE 173-1
RIVERWARD SLOPE STABILITY
DYNAMIC CASE
BEAVER VALLEY POWER STATION-UNIT 2
STONE & WEBSTER ENGINEERING CORPORATION