DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Water Resources Division
1201 Pacific Avenue - Suite 600
Tacoma, Washington 98402

June 20, 1983

Mr. Ronald L. Ballard, Chief
Environmental & Hydrologic Engineering Branch
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Ballard:

Subject: Preliminary findings on potential Spirit Lake mudflow impact on Columbia River and Trojan Nuclear Plant

As requested, we are furnishing you a brief summary of our preliminary findings on the impact of a mudflow from Spirit lake near Mount St. Helens on the Trojan nuclear power facility. These findings are provisional and are subject to review and approval of the Director of the Geological Survey and therefore should not be released outside your agency.

As a result of these findings we recommend that you approve some limited work in Phase II of our original proposal--to evaluate some of the assumptions originally made in the mudflow analysis. We would propose to investigate further:

1. Deposition of sediment from the mudflow during its flow from Spirit Lake to the mouth of the Cowlitz. Our original analysis carried almost all of the entrained sediment to the mouth of the Cowlitz River. A more realistic analysis--following the pattern of other mudflows--would be to deposit part of this sediment in "ponding" areas along the route of the flow. This adjustment will lessen the sediment deposition in the Columbia and the calculated water level at Trojan.

2. Slope of sediment deposits in the Columbia River. General slope of sediment deposits upstream of the Cowlitz following the May 18-19, 1980 mudflow was about 2.5 feet per mile--exceedingly flat when compared to similar flows. The gradient in the Cowlitz River above the Toutle River for the same mudflow was about 8 feet per mile. This slope of deposit could have an appreciable effect on backwater and the elevation at Trojan--thus we believe this deserves additional analysis.

The above two elements can be easily accomplished within the original work plan and funding estimates.

Sincerely yours,

L. B. Laird
District Chief

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Enclosure

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PRELIMINARY FINDINGS IN TROJAN STUDY, PHASE I, June 1983

Phase I of the study was conducted by USGS for the Nuclear Regulatory Commission. In Phase I a mudflow as described in WRI Report 82-4125 was applied to the Columbia River, assuming a number of conditions for the mudflow, to determine potential flood elevations at the Trojan Nuclear Powerplant. Several scenarios were assumed for conditions in the Columbia River during and following the mudflow. The flood elevations were determined using the General Purpose Dam-Break Flood Simulation Model (K-634), modified by L. DeLong (K-599), with the Columbia River at several different steady-state discharge magnitudes.

Clear Water Flow Evaluation

1. A Cowlitz mudflow flood, applied with "clear-water" friction and no deposits in the Columbia, did not produce peak elevations at Trojan in excess of 45 ft, which is the flood design elevation at Trojan:

    a. Peak at Trojan = 22 ft with Columbia at low flow
    b. Peak at Trojan = 38 ft with Columbia in 100-yr flood

Mudflow - Sediment Deposit Impact Evaluation

2. A Cowlitz mudflow flood, with "mudflow" friction in the Columbia downstream from the Cowlitz, "clear-water" friction upstream, and no deposits could exceed 45 ft at Trojan during a concurrent major flood of the Columbia, but did not exceed 45 ft during low flow, slack tide, or less severe (<50-yr) floods of the Columbia:

    a. Peak at Trojan = 31 ft with Columbia at low flow
    b. Peak at Trojan = 44 ft with Columbia in 10-yr flood
    c. Peak at Trojan = 48 ft with Columbia in 100-yr flood

3. About 30 percent of the mudflow from the Cowlitz would travel upstream in the Columbia if the Columbia were at low flow and slack tide, according to the routing model.

4. If 70 percent of the mudflow moving upstream were to deposit, the volume of the deposit would be 500 million cubic yards, assuming out of the Cowlitz a total solids volume of 2.4 billion cubic yards and 30 percent of that was "fines" remaining in suspension.

5. If the gradient of the deposit were -2.5 ft/mi. in the upstream direction, as occurred in May 1980, the elevation of the 500 Myd^3 deposit would be about 30 ft at the mouth of the Cowlitz and about 20 ft at Trojan. Steeper adverse gradients have been observed and, if they occurred, would produce higher deposit elevations.

6. Winter floods can occur on the Columbia within a few days of low flows. The peak of December 1964, discharge about 1 million cfs and recurrence about 100 yr, followed within 3 days of a low flow.

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7. A Columbia winter flood subsequent to 500 Myd^3 deposited upstream of the Cowlitz at a -2.5 ft/mi gradient during Columbia low flow could produce a peak elevation at Trojan in excess of 45 ft:

   a. Peak at Trojan = 45 ft with Columbia in 2-yr flood
   b. Peak at Trojan = 49 ft with Columbia in 10-yr flood
   c. Peak at Trojan = 52 ft with Columbia in 50-yr flood

8. The evidence from May-June 1980 indicates that a deposit, once established, may not be scoured appreciably in the short term by clear-water flow over the deposit.

9. The volume and slope of deposit upstream from the Cowlitz are the controlling features for Trojan flood elevations.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

JUL 19 1983

Docket No.: 50-344

MEMORANDUM FOR: Robert A. Clark, Chief
Operating Reactor Branch No. 3
Division of Licensing

THRU: William V. Johnston, Assistant Director
Materials, Chemical and Environmental Technology
Division of Engineering

FROM: Ronald L. Ballard, Chief
Environmental and Hydrologic Engineering Branch
Division of Engineering

SUBJECT: PORTLAND GENERAL ELECTRIC SPIRIT LAKE FAILURE EFFECTS ON TROJAN

Plant Name: Trojan
Docket Number: 50-344

The report dated July 1, 1983 from Portland General Electric (PGE) to you concerning flood potential at the Trojan site has been reviewed by the Hydrologic Engineering Section. We found that the report is deficient in several respects. The PGE report seems also to be an abbreviated version of a more detailed report from the consultant. If this is the case, it would be far more useful for us to work from the original report. We have prepared a set of questions to elicit further information of the licensee. We would like to have the PGE report reviewed by the USGS, who is performing an independent review, but no decision has yet been made on extension of their contract. This review has been conducted by R. Codell, with input from M. Fliegel and myself.

Ronald L. Ballard
Ronald L. Ballard, Chief
Environmental and Hydrologic
Engineering Branch
Division of Engineering

Enclosure:
As stated

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HYDROLOGIC ENGINEERING SECTION

Additional Questions "Potential Mudflow from a Hypothetical Failure of Spirit Lake Blockage" (July 1, 1983 response from PGE)

1. The report appears to be a summary of a more detailed analysis and report. As such, however, it does not contain the information necessary to enable us to evaluate it. If you have a more complete report please provide it.

2. The important case of a mudflow during a low Columbia River flowrate, with consequent high sedimentation in the Columbia River, followed by a large flowrate has been neglected. Records have shown that high flowrates (1,000,000 CFS) have followed periods of low flow by only a few days. Analyse the potential for flooding of the site by this scenario, or justify why this case was not considered.

3. Item 1.3 The procedure used to reduce the sediment concentrations from 39, 52, and 65 percent to 20, 30, and 45 percent respectively, as summarized in Table 1 should be discussed and all assumptions should be justified. For example, what is the basis for reducing the volume of material into the Cowlitz by 40% (column 2)? What is the basis for the ratio of sand to finer material of 2 to 1 (columns 3 and 4)? Etc.

4. Item 1.4 Please explain the basis for the 30 percent moisture assumption. Is this figure based on available pore volume or on total volume of dry solid? What porosity was used and what is its basis?

5. Item 1.6 What is the basis for assuming a Columbia River sediment concentration of 500 ppm? What effect would varying this concentration have on your results?

6. Several references are used in the text, but are not documented. For example, the "Colby method" in item 2.4. Provide the references.

7. Item 2.5 Define the term "bulking Factor"

8. Item 2.6 Give basis for your assumption that the shape of the mudflow sediment deposit at the confluence of the Cowlitz and Columbia rivers can be ratioed from the configuration of the deposition following the May 18, 1980 mudflow. That mudflow deposition was rather flat compared to other known mudflow slopes. What is the sensitivety of your results to variations in the slope of deposited sediments?

9. Item 3.4 Give basis for calculations of sediment load. Were formulas employed derived from relationships for sediment transport in rivers? If so, justify that these formulas are acceptable for the very-high sediment loads of the present case?

10. Item 3.8 Why is 400,000 CFS the "most reasonable Columbia River flow to evaluate"? Is there a probabilistic basis for this conclusion (e.g., NRC safety goal)?

11. Table 1

(a) Column 8 is unclear. I believe that the expression should be (col 6 + col 4)/1.4. Explain the meaning of the value 1.4, and why it is used here.

(b) - Explain the difference between column 1 and 2. Also, why is "material" used in column 1 and "sand, silt and clay" used in column 2?