PDR

United States Department of the Interior

GEOLOGICAL SURVEY
RESTON, VA. 22092

In Reply Refer To:
FCS-223701
Mail Stop 905

MAY 21 1979

Honorable S. I. Hayakawa
United States Senator
3080 East Olive Street
Fresno, California 93701

Dear Senator Hayakawa:

This letter is in response to your request of May 2, 1979, for information concerning a constituent's letter in which he asks for you:

> "(i) to produce a copy of the seismic studies performed by the United States Geological Survey pertaining directly to the design and construction of the Trojan Nuclear Power Plan."

The U.S. Geological Survey has not performed such seismic studies and such site specific studies are not within the scope of our responsibility. We do review, under a cooperative agreement with the U.S. Nuclear Regulatory Commission (NRC), reports submitted by the applicant utility. It is within this area of responsibility that the Survey reviewed the geological portions of Portland General Electric's application for a Construction Permit for the Trojan Nuclear Plant. This review, dated July 9, 1970, was submitted as an administrative letter to the Atomic Energy Commission (AEC) and as such should be obtained from their public document room. However, to save that additional effort, we are enclosing a copy of the report and notifying the NRC by a carbon of this letter of the action taken.

The seismological portion of that application was reviewed by the U.S. Coast and Geodetic Survey (C&GS). For

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convenience, we are also enclosing a copy of the Administrative letter from Admiral Don A. Jones to the Atomic Energy Commission which includes the C&GS review.

The second request for you:

> "(ii) to produce a copy of the calculations alleged to have established the stability of the structure of the Trojan Nuclear Power Plant under lateral forces caused by strong earthquakes."

Such calculations were accomplished by the Portland General Electric Company and its consultants and are available in the NRC Public Document Room. These data were reviewed for the then Atomic Energy Commission by John A. Blume & Associates, Engineers. Again for your convenience, we are enclosing a copy of the Blume review to save the time in requesting it from the NRC.

I hope that this information fulfills your needs.

Sincerely yours,

(Sgd) J. R. Balsley

(Acting) Director

Enclosures

Copy to: Richard Denise, NRC

Copy to your Washington, D.C. office

S. I. HAYAKAWA
CALIFORNIA

GENE PRAT
ADMINISTRATIVE ASSISTANT

COMMITTEES:
AGRICULTURE, NUTRITION AND FORESTRY
HUMAN RESOURCES
BUDGET

1127

United States Senate

WASHINGTON, D.C. 20510

May 2, 1979

U. S. Geological Survey
Department of Interior
N tional Center
1-?01 Sunrise Valley Drive
Reston, Virginia 22092

Dear Sirs:

Enclosed please find a letter from a constituent of mine, C. D. Calsoyas, of Fresno. I would appreciate any information you could provide in regards to his request.

Please forward your response to Kathy Ellis of my Fresno Office at the below address:

3080 East Olive
Fresno, California 93701

Thank you for your assistance in this matter.

Sincerely,

S. I. Hayakawa

S. I. Hayakawa
United States Senator

SIH:caf

Enclosure

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SENATOR S. I. HAYAKAWA
RECEIVED
APR 30 1979
Fresno, California 93721

835 West Cornell Avenue
Fresno, California 93705
April 30, 1979

Senator S. I. Hayakawa
United States Senate
Washington, D. C.

Dear Senator Hayakawa:

I refer to my letters of April 28, 1979, to Mr. Jack K. Horton, Chairman of the Board, Southern California Edison Company, to the Engineer-in-Chief, Trojan Nuclear Power Plant, and to Major General Charles I. McGinnis, Director of Civil Works, Office of the Chief of Engineers, Department of the Army. I also refer to my letter of April 30, 1979, to President Carter in which I made the following statement:

> "You are now informed concerning the collusion of Chairman Joseph Hendrie, Nuclear Regulatory Commission, and Dr. Thomas Pigford, University of California at Berkeley and Presidential Commission on the Three-Mile Island Nuclear Power Plant Accident, with Governor E. G. Brown, Jr. and the Pacific Gas and Electric Company in the matter of the low-level radiation hazards and the seismic hazards of the PGandE Diablo Canyon Nuclear Power Plant and the Sacramento Municipal Utility District Rancho Seco Nuclear Power Plant."

I now request you

(i) to produce a copy of the seismic studies performed by the United States Geological Survey pertaining directly to the design and construction of the Trojan Nuclear Power Plant.

(ii) to produce a copy of the calculations alleged to have established the stability of the structure of the Trojan Nuclear Power Plant under lateral forces caused by strong earthquakes.

Thank you.

Cordially,

C. D. Calsoyas

C. D. Calsoyas, Ph.D.

Copy to the Board of Governors
British Broadcasting Corporation

Copy to Terrill Lynn Castaneda
Copy to President James Carter
Copy to Governor Babbit, Mr. McBride, and Dr. Pigford, Presidential Commission on the Three-Mile Island Nuclear Power Plant Accident
Copy to the Board of Regents, University of California

307 099

U.S. DEPARTMENT OF COMMERCE
Environmental Science Services Administration
COAST AND GEODETIC SURVEY
Rockville, Md. 20852

JUL 3 1970

Reply to
Attn of: C23

Mr. Harold L. Price
Director of Regulation
U. S. Atomic Energy Commission
Washington, D. C. 20545

Dear Mr. Price:

In accordance with your request, we are forwarding 10 copies of our report on the seismicity of Columbia County, Oregon. The Coast and Geodetic Survey has reviewed and evaluated the information on the seismic activity of the area as presented by the Portland General Electric Company in the "Preliminary Safety Analysis Report," for use in the evaluation of the site of the proposed Trojan Nuclear Power Plant, Units 1 & 2; and we hereby submit our conclusions concerning the seismicity factors.

If we may be of further assistance to you, please contact us.

Sincerely,

Robert B. Rollins
for Don A. Jones
Rear Admiral, USESSA
Director, Coast and Geodetic Survey

10 Enclosures

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REPORT ON THE SITE SEISMICITY FOR THE TROJAN NUCLEAR POWER PLANT UNITS 1 & 2

At the request of the Division of Reactor Licensing of the Atomic Energy Commission, the Seismology Division of the Coast and Geodetic Survey has evaluated the seismicity of the area around the proposed Trojan Nuclear Plant near Prescott, Oregon. The Survey has also reviewed a similar evaluation presented by the Portland General Electric Company in their "Preliminary Safety Analysis Report."

This proposed site is located in a region that has experienced moderate to strong earthquakes at frequent intervals. There are two major areas of seismic activity to be considered in the evaluation of this region. The first area consists of the Olympia-Seattle, Washington region where several large earthquakes, intensity VIII, have occurred. The second area of seismic activity, located around Portland, Oregon, includes many events of intensity IV to VII. An additional consideration is the fact that this site is located within the Circum-Pacific Seismic Belt with great earthquakes having occurred both to the North in the Queen Charlotte Islands, Canada area, and to the South, in the Cape Mendacino-San Francisco area.

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The Olympia-Seattle, Washington area has experienced many earthquakes of considerable size. The most noteworthy of these events are the 1949 Olympia earthquake and the 1965 Puget Sound earthquake, both of which produced intensity VIII damage. The epicenter of the 1949 event has been placed at approximately 70 miles from the area of the proposed plant site. However, the zone of maximum intensity, VIII, is quite large and elongated in the North-South direction. Intensity VIII was reported from such towns as Longview and Kelso, Washington, and Clatskanie and Ranier, Oregon, which are located near the plant site and on alluvium. The zone of intensity VII and VIII resulting from the 1965 event also shows a North-South elongation. An earthquake similar to or larger than (i.e., intensity IX) these events must be considered as having the potential of occurring in the Puget Sound area and as near as 50 miles from the plant site. This would result in an estimated intensity VII-VIII at the plant site.

The second area of seismic activity consists of the small but quite active zone around Portland, Oregon, which has experienced approximately 20 earthquakes with intensities as high as VII. The seismic structure associated with these events is now well known. However, in a report to the Atomic Energy Commission the U. S. Geological Survey has briefly

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detailed in the following quotation the structure of the Trojan site area. "A postulated branch of the Portland Hills fault is shown on the recent 'Tectonic Map of North America' (King, 1969), following a topographic lineament that extends northward from Portland for more than 50 miles down the Columbia River and up the Cowlitz Valley into Washington. Detailed photo-geologic and areal-geologic studies along the Columbia River Valley, and a helicopter reconnaissance along the Cowlitz River Valley by the applicant, however, failed to detect any direct evidence to support the existence of a fault along this lineament. Nor was any evidence found to indicate that surface rupture has occurred in the area at any time during late Pleistocene or Holocene times."

"Although other hypotheses might be presented to explain the origin of this topographic lineament, to be conservative it has been assumed that the lineament may be structurally controlled. As a consequence, it is presumed that earthquakes, with intensities comparable to those that have occurred in the Portland area in historic time, also could occur anywhere along this lineament, including in the immediate vicinity of the site." Therefore, in order to apply a reasonable degree of conservatism in arriving at design acceleration values, it must be assumed that such a structure exists and, consequently, earthquakes with intensity VII which is similar to or slightly greater than those having occurred in Portland could occur in the vicinity of the plant site.

As a result of this review of the seismological and geological characteristics of the area around the plant site, the Coast and Geodetic Survey recommends that an acceleration of 0.15 g, as a result of a nearby earthquake with intensity VI on rock and a more distant but greater earthquake which causes intensity VI on rock at the plant site, would be adequate for representing seismic disturbances likely to occur within the lifetime of the facility. The Survey also recommends that an acceleration of 0.25 g, as a result of a nearby earthquake with intensity VII on rock and a more distant but greater earthquake (epicentral intensity IX) which causes intensity VII to VIII on rock at the plant site, would be adequate for representing the ground motion from the maximum earthquake likely to affect the site. It is believed that these values would provide an adequate basis for designing protection against the loss of function of components important to safety.

U. S. Coast and Geodetic Survey
Rockville, Maryland 20852

July 8, 1970

GEOLOGICAL SURVEY
WASHINGTON, D.C. 20242

JUL -9 1970

Mr. Harold Price
Director of Regulation
U.S. Atomic Energy Commission
7920 Norfolk Avenue
Bethesda, Maryland 20545

Dear Mr. Price:

Transmitted herewith, in response to a request by Mr. Roger S. Boyd, is a review of the geologic and hydrologic aspects of the Trojan Nuclear Plant--AEC Docket No. 50-344--proposed by the Portland General Electric Company.

This review was prepared by H. H. Waldron and P. J. Carpenter and has been discussed with members of your staff. We have no objections to your making this review a part of the public record.

Sincerely yours,

W T Pecora

Acting Director

Enclosure

Copy to Mr. Walter G. Belter, AEC

307 105

Portland General Electric Company
Trojan Nuclear Plant
AEC Docket No. 50-344

The planned location of the Trojan Nuclear Plant is in Columbia County, Oregon, on the left (west) bank of the Columbia River, 72.5 miles upstream from its mouth. It is approximately 1-1/2 miles south of Prescott, Oregon, 3 miles northwest of Kalama, Washington, and 31 miles north of Portland, Oregon. The plant will use a pressurized-water reactor with an ultimate output of 3,570 megawatts thermal or 1,198 megawatts electrical. Condenser cooling will be accomplished by use of a natural draft cooling tower.

The analyses of the geology and hydrology of the site as presented in the "Preliminary Safety Analysis Report" and "Amendments" were reviewed and compared, independently, with other available data and literature. Geologic conditions were inspected at the site on February 26, March 19, and April 28, 1970, and hydrologic conditions on May 20, 1970. The analyses of the geology and hydrology as presented by the applicant appear to adequately appraise those geologic and hydrologic conditions significant to the safety evaluation of the site.

Geology

The site is located on a bedrock knob on the left bank of the Columbia River in the Lower Columbia Valley part of the Willamette-Puget Lowland section of the Pacific Border physiographic province. At the plant site a thin residual soil a few inches to a few feet thick overlies the Goble Volcanic Series, a thick sequence of upper Eocene volcanic rocks that strike generally west-northwest and dip southward 10-25 degrees. The rocks consist principally of interbedded basaltic pyroclastic rocks and lesser amounts of thin basaltic flows. The pyroclastics include tuff, tuff breccia, and agglomerate, of which tuff is the most predominant rock type. The tuff is commonly massive, soft to moderately hard, and lightly to moderately fractured; most of the joints and fractures, however, appear to be tight. Compressional wave velocities in the rocks range from 7,100 to 9,650 ft/sec.

The applicant proposes to found all major plant structures in the volcanic rocks. Boring logs and test data indicate that the rocks are sound and will provide an adequate foundation for the proposed facility. Some minor modifications of foundation design may be necessary during construction, however, due to variations in rock type encountered at proposed foundation levels, but any such modifications should be within the limits of standard engineering design and practice.

The applicant has concluded that the possibility of an eruption of one of the Cascade volcanoes significantly endangering the plant is very unlikely. The principal hazard would be from a major ash eruption from Mt. St. Helens, which lies about 40 miles east-northeast of the site. The applicant has agreed, however, to take whatever protective measures are necessary--including shutting down of the plant--if renewed volcanic activity from Mt. St. Helens seems imminent or occurs during the lifetime of the plant.

No active faults or other major young geologic structures, that might be expected to localize seismicity at or near the site, have been positively identified in the immediate vicinity of the site. However, tectonically and geologically this part of Oregon and adjoining Washington is very poorly known, principally due to the thick cover of soil and vegetation but also owing to the paucity of subsurface data and the lack of detailed geologic mapping.

The site is situated in the Willamette-Cowlitz structural trough near its western edge where it merges with the eastern flank of the Coast Range of Oregon. The Willamette-Cowlitz trough is believed to be part of a major north-trending downwarp that extends throughout most of Oregon and Washington, separating the Cascade Range on the east from the Coast Ranges on the west. The general structure of the northern part of the Oregon Coast Range has been described by Snavely and Wagner (1964, p. M2-3) as a north-plunging anticlinorium, on which are superimposed numerous, broad, elongate anticlines and synclines that trend generally northwestward. These same northwestward structural trends are apparent in the adjoining Willamette-Cowlitz trough. Most of this deformation appears to have occurred in middle to late Miocene time, but some lesser movements continued intermittently up to the close of the Pliocene.

The closest known major fault is the Portland Hills fault, an ancient northwest-trending fault that borders the northeast flank of the Tualatin Mountain anticline. According to Schlicker and Deacon (1967, p. 36), this fault can be traced for at least 50 miles, and it may extend for more than 150 miles in northwest Oregon and southwest Washington. The projected trace of this fault in northwest Oregon would approach to within approximately 15-18 miles southwest of the site. A postulated branch of the Portland Hills fault is shown on the recent "Tectonic Map of North America" (King, 1969), following a topographic lineament that extends northward from Portland for more than 50 miles down the Columbia River and up the Cowlitz Valley into Washington. Detailed photo-geologic and areal-geologic studies along the Columbia River Valley, and a helicopter reconnaissance along the Cowlitz River Valley by the applicant, however, failed to detect any direct evidence to support the existence of a fault along this lineament. Nor was any evidence found to indicate that surface rupture has occurred in the area at any time during late Pleistocene or Holocene times.

Although other hypotheses might be presented to explain the origin of this topographic lineament, to be conservative it has been assumed that the lineament may be structurally controlled. As a consequence, it is presumed that earthquakes, with intensities comparable to those that have occurred in the Portland area in historic time, also could occur anywhere along this lineament, including in the immediate vicinity of the site.

Hydrology

The plant grade will be at elevation 45 feet MSL (mean sea level). In addition the plant is to be put into a safe shutdown mode before the river reaches an elevation of 25 feet MSL. The elevation of the maximum observed flood (June 1894) is given by the U.S. Army Corps of Engineers as approximately 26 feet MSL. In 1973, after completion of all dams now under construction in the Columbia River system, the elevation at the site for the probable maximum flood (2,200,000 cfs--cubic feet per second) computed by the Corps of Engineers is 36 feet MSL. It is stated that all dams on the Columbia or its tributaries, except the Bonneville Dam, are designed to pass the probably maximum flood; additional flooding at the site due to failure of Bonneville Dam would, according to the Corps of Engineers, be negligible. The applicant states that the flood at the site resulting from the failure of three dams (Swift, Yale, and Merwin) on the Lewis River would be 3,300,000 cubic feet per second. In addition, the flood at the site resulting from a seismically induced failure of Grand Coulee Dam is also given as 3,300,000 cubic feet per second. The flood at the site due to the sudden, massive failure of Grand Coulee Dam, as computed by the Corps of Engineers, could range from 3,600,000 to 4,400,000 cfs. The conditions for this failure would involve more conservatism than that previously required by the Atomic Energy Commission, i.e., a seismically induced failure. Although the computations of discharges for the probable maximum flood and dam failures were not reviewed, they appear to be of a reasonable magnitude. The stage-discharge curve for the Columbia River at the site, developed by the Corps of Engineers by extrapolation of a rating curve based on historical floods, shows the discharge corresponding to a flood stage at the plant grade (45 feet MSL) as about 4,350,000 cfs. The applicant has verified the stage-discharge extrapolation by additional hydraulic computations based on surveys of the river cross section at and near the site and observed velocity and slope data. These computations have shown the elevations obtained from the extrapolation to be reasonable. For floods which would exceed elevation 20-25 feet MSL it appears that the site would be isolated from the upland. Alternate means of site access should be considered under these circumstances.

Low-flow discharges at the site (drainage area, approximately 253,800 square miles) are subject to upstream dam regulation and tidal flow. The minimum observed discharge for the period 1878 to 1960 at The Dalles, Oregon (drainage area, approximately 237,000 square miles) was 35,000 cfs on January 12, 1937. As the amount of water required for safe shutdown of the plant is less than 50 cfs, an adequate supply of cooling water is assured.

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The applicant has stated that operationally produced radioactive liquid wastes will be released to the environment with the cooling-tower outfall in accordance with 10 CRF 20 and that the liquid effluent will contain a minimum of radioactivity and significantly less than that allowed by applicable regulations. Because the radioactive waste system is located within the auxiliary building which is a Class I structure, the applicant states that accidental releases of radioactive liquids could enter the environment only by accidental discharge; plant design would insure that accidental leakage or spillage would be retained within the plant.

If radioactive liquids were spilled or leaked at the plant site, they could be expected to move overland directly to the river or percolate downward and move offsite with the ground water. The direction and rate of ground-water movement from the site as estimated by the applicant appears to be reasonable. The site is located on a volcanic rock knob which was at one time an island in the Columbia River. An old abandoned Columbia River channel west of the site, now filled with alluvium, separates the site from the upland. Ground-water gradients in the plant vicinity, at the site, and in the alluvium were determined by surveys of existing wells and springs and by water-level observations in some 37 drill holes and 6 piezometers. Ground water at the site can be expected to move eastward to the Columbia River or westward to the alluvial valley and then north or south to the Columbia River. Because the elevation of the water table in the bedrock on the upland west of the alluvial valley is considerably higher (40 to 100 feet MSL) than that in the valley (10 feet MSL), ground water at the site would not be expected to move across the valley and into the bedrock aquifer of the upland.

The rate of ground-water movement eastward to the river or westward to the alluvial valley has not been estimated by the applicant. However, as there appears to be a local perched water table in the volcanic rock underlying the site, ground water would either percolate slowly downward to the main water table or emerge as a spring from the side of the rock knob at the site and move downslope in a short period of time. The rate of ground-water movement in the alluvium has been estimated by the applicant to be approximately 15 feet per year. This estimate apparently was based on the average hydraulic gradient (1 ft vertical to 270 ft horizontal) toward the river and the results of four permeability tests (10 to 20,000 feet per year). The actual rate of ground-water movement may vary considerably because of changes in gradient produced by river-level fluctuations and the highly variable permeability of the alluvium. The activity of radioactive liquids moving with the ground water in the alluvium would be diminished as a result of some adsorption and ion exchange.

Although considered hypothetical, the applicant has evaluated the consequences of the simultaneous release of all radioactive materials contained in Class II tanks in the Class I auxiliary building. Based on a dye test, river-model studies, and theoretical calculations, the applicant has computed the dilution factors for continuous and slug releases to be expected at Rainier, Oregon (4.5 miles downstream), the only municipal water-supply intake downstream, as 620 and 83,000 respectively. Because the model study was based on a waste discharge of 2,000 cfs, whereas the actual discharge would be less than 100 cfs, it is unlikely that the actual discharge would be completely mixed at the intake. Therefore, the dilution factor computed for the continuous release appears to be overestimated. However, the town of Rainier has water-storage capacity for 8 days. It is judged unlikely, therefore, that this consideration would change significantly the applicant's conclusion that such a release would not result in any undue hazard. Warning and monitoring considerations, however, should be based on a more conservative estimate of the dilution to be expected.

References

King, P. B., 1969, Tectonic map of North America: U.S. Geological Survey, 1:5,000,000.

Schlicker, H. G., and Deacon, R. J., 1967, Engineering geology of the Tualatin Valley region, Oregon: Oregon Dept. of Geol. and Mineral Industries Bull. 60, 103 p.

Snavely, P. D., Jr., and Wagner, H. C., 1964, Geologic sketch of northwestern Oregon: U.S. Geol. Survey Bull. 1181-M, 17 p.

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REVIEW OF THE SEISMIC DESIGN CRITERIA

FOR THE

TROJAN NUCLEAR PLANT

June 23, 1970

JOHN A. BLUME & ASSOCIATES, ENGINEERS
San Francisco, California

307 111

1976

REVIEW OF THE SEISMIC DESIGN CRITERIA

FOR THE TROJAN NUCLEAR PLANT

(Docket No. 50-344)

INTRODUCTION

This report summarizes our review of the engineering factors pertinent to the seismic design criteria for the Trojan Nuclear Plant. The plant will be located in Columbia County on the Columbia River 72.5 miles from the mouth and 31 miles North of Portland, Ore_on. The design and construction of the plant will be performed by Becntel Corporation under the direction of the applicant, Portland General Electric Company. The nuclear steam supply system will be manufactured by Westinghouse Electric Company. Application for a construction permit has been made to the U. S. Atomic Energy Commission (AEC Docket Nos. 50-344) by Portland General Electric Company. A Safety Analysis Report has been submitted in support of the application to show that the plant will be designed and constructed in a manner which will provide for safe and reliable operation. Our review is based on the information presented in the Safety Analysis Repor and is directed specifically towards an evaluation of the seismic design criteria for Class 1 structures, systems, and components. The list of reference documents upon which this review has been based is given at the end of this report.

DESCRIPTION OF FACILITY

The Trojan Nuclear Plant site is underlain by a north-south trending steep-sided ridge of volcanic rock which borders the river on the left bank and rises to a maximum elevation of 134 feet above mean sea level.

All Class 1 structures and Class 2 structures housing Class 1 equipment are founded on this rock ridge. The remainder of the site is underlain by a flat alluvial plain with elevations ranging between 10 and 12 feet. To the west of the ridge is alluvium to a depth of 340 feet filling in the old river channel. The Columbia River, which forms the boundary between Oregon and Washington, flows in a northerly direction at the site, but turns to the west several miles downstream.

The bedrock is volcanic in origin and consists of soft to moderately hard tuff. The rock in the ridge is often broken by closely spaced fractures most of which are at least partially rehealed by deposition of secondary minerals producing essentially impervious material. The alluvial deposits include considerable amounts of decomposed wood fragments and vegetation along with silty sand and clay down to 50 feet. Fine sand fills in the region below 50 feet to the bedrock.

The containment structure will be a steel-lined prestressed-concrete cylinder and dome supported on a 9'-6" thick reinforced concrete foundation slab placed on bedrock at finished grade. Both the cylinder and dome are post-tensioned by tendons placed in two orthogonal directions. The height of the containment structure is 207'-0" measured from the top of the foundation mat to the top of the dome. The interior radii of the cylindrical portion of the structure and the dome section are the same and equal to 62'-0". The vertical wall thickness is 3'-6" and the dome thickness is 2'-6". The steel liner will consist of 1/4-inch thick plates along the entire interior of the containment structure including the dome, walls, base mat, and reactor well area. Reinforced-concrete construction will be used for the Auxiliary Building. A steel-framed structure will enclose and support the fuel handling crane which passes over the fuel pool, chemical storage, and filter areas adjacent to and northeast of the containment structure. The Turbine Building will consist primarily of steel frame construction with concrete slabs and a massive concrete turbine support structure.

STRUCTURAL DESIGN CRITERIA AND LOADS

All structures, equipment, systems, and piping are classified according to function or consequence of failure as either Class 1 or 2 as defined in Appendix B, Section B.2 of the Safety Analysis Report. Class 1 structures, systems, equipment are those whose failure could cause uncontrolled release of radioactivity or are those essential for immediate and long-term operation following a loss-of-coolant accident. They are designed to withstand the appropriate seismic loads simultaneously with other applicable loads without loss of function. Structures and equipment considered to be Class 2 are those whose failure would not result in the release of radioactivity and would not prevent reactor shutdown. The failure of Class 2 structures, systems, and equipment may interrupt power generation.

The design loads for the Trojan Nuclear Plant containment are based on ultimate strength design criteria as presented in ACI 318-63. Structure design loads are increased by load factors based on the probability and conservatism of the predicted design loads. Yield capacity reduction factors are applied to the stresses allowed by the applicable building codes and publications as listed in Appendix B, Section B.1 of the Safety Analysis Report.

The containment structure will be designed for a leak rate of not more than 0.2 percent in 24 hours at 60 psig. All structures are designed for a 25 psf roof load.

Wind loading will be based on a 105 mph wind at 30 feet above grade and modified as indicated in ASCE Paper 3269 with regard to shape, gusting, and velocity variation due to height. The structure will not be designed for tornado or tsunami conditions.

ADEQUACY OF THE SEISMIC DESIGN CRITERIA

We have reviewed the Preliminary Safety Analysis Report and Amendments No. 1 through 7, and have discussed the various aspects of the seismic design criteria for the Trojan Plant with the applicant and members of the AEC regulatory staff at a site visit on March 19, 1970, and at meetings on May 19 and June 19, 1970. We have the following comments regarding the adequacy of the seismic design criteria:

1. The data submitted by the applicant has included detailed discussions and analyses of the seismicity of the area, volcanic hazards, and the possibility of flooding.

2. The applicant has selected values of maximum ground accelerations of 0.15g and 0.25g for the Design Earthquake and Maximum Hypothetical Earthquake respectively. The response spectra selected are those published in TID 7024. We concur with the selection of these maximum ground accelerations. However, we do not believe that the selected spectra adequately represent possible seismic motions at the reactor site and as a result may not be conservative. (See comment number 5.)

3. The applicant has stated that he will use the response spectrum method of dynamic analysis for Class 1 structures, piping, and equipment. The structures will be analyzed for response in both the horizontal and vertical directions. Time-history analyses will be performed to develop response spectra in vertical and horizontal directions at the points of support of piping and equipment. We concur in general with the proposed approach to the design of Class 1 structures, piping, and equipment. The analytical techniques proposed by the applicant are satisfactory and if properly implemented will result in a conservative design.

4. The applicant has stated that the results of the Palisades and Turkey Point containment tests are currently being evaluated. When the evaluations are completed we would like to review the results of these tests and evaluations as they relate to the structural qualification of the Trojan Plant. This need not be a condition for the issuance of a construction permit.

5. The applicant has not demonstrated that the response spectra proposed are applicable to the site or that they are conservative. It is our opinion that the use of response spectra that are "smooth" and do not exhibit peaks and valleys is reasonable and appropriate for seismic design criteria. However, the "smooth" spectra selected must be conservative and relatable to the seismic history of the regional area. In addition, spectra from time-histories of ground motion used in time-history analyses of structures must not deviate below approved smooth spectra.

6. At the June 19, 1970 meeting commitments were made by the applicant with regard to the seismic analysis of the Turbine Building, the justification of assumptions regarding rock-structure interaction, and the application of response spectra in the analysis of piping systems. We concur with the agreements reached at the meeting, but we would like to review the written documentation submitted by the applicant prior to recommending final approval.

CONCLUSIONS

On the basis of the information presented by the applicant in the Safety Analysis Report and Amendments, and provided that Comments 5 and 6 above are satisfactorily resolved, it is our opinion that the seismic design criteria and approach to seismic design as outlined in the SAR and Amendments, if properly implemented by the applicant, will result in a design

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that is adequate to resist the earthquake conditions postulated for the site. Comment 6 is of a minor nature and should involve only documentation by the applicant of the commitments made at the June 19, 1970 meeting. However, Comment 5, which involves the response spectra for the site is extremely important and must be resolved before we can concur with the seismic design criteria for the Trojan Plant.

Roland L. Sharpe

Roland L. Sharpe

Garrison Kost

Garrison Kost