UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
PORTLAND GENERAL ELECTRIC COMPANY, ET AL	)	Docket No. 50-344 (Control Building)
	)	
(Trojan Nuclear Plant)	)	

TESTIMONY OF JAMES E. KNIGHT OFFICE OF NUCLEAR REACTOR REGULATION ON LICENSING BOARD'S QUESTION REGARDING EFFECTS OF A SEISMIC EVENT ON FEATURES IMPORTANT TO MAINTAINING THE SAFETY OF THE TROJAN FACILITY

October 13, 1978

LICENSING BOARD'S QUESTION:

In the event that any failure due to the reduced shear capacity caused by a seismic event were to occur, what are the most likely events, and what plant features important to safety may not be left functional, in particular, those plant features necessary to assure the integrity of the reactor coolant pressure boundary, the capability to shutdown the reactor and maintain it in a safe shutdown condition, and the capability to prevent or mitigate the consequences of accidents that could result in potential outside exposures comparable to the guideline exposures of 10 CFR Part 100.

That is all of number one, and the concern there is to seek out what modes of failure might be occurring and its effects upon the most important features to maintain the safety of the plant.

It has been pointed out in the testimony of Mr. K. S. Herring that no gross failure of the control building or walls is expected as a result of the Safe Shutdown Earthquake for the Trojan Plant. However, increased story-to-story displacement may occur as well as some increase in the relative motion between the control building and the turbine building and between the control building and the containment building. PGE estimates that the maximum story-to-story displacement will be about 0.5".

The maximum relative displacement between the control building and turbine building is estimated to be about 2.5" (at the control building roof). The maximum relative displacement between the control building and the containment building is estimated to be about 0.76" (at el. 77'). The control building itself contains safety-related cables, switchgear, controls in control panels and consoles, batteries, some service water piping and air conditioning and ventilation equipment. The safety-related pumps and valves for ECCS and safe shutdown are not located in the control building. Since this equipment (i.e., the safety-related pumps and valves) is not located

within the control building, my concern was directed toward the effect of the earthquake-caused deflections on cables and piping within the control building and between the control building and other buildings to which safety-related cables and piping pass. The effect of the postulated earthquake on such equipment as batteries, switchgear, control panels, etc., located within the control building was not a part of my evaluation, but has been addressed as a part of Mr. Herring's testimony.

On September 27 and 28, 1978, I visited the Trojan plant to examine the safety-related cable runs and piping passing between the turbine building safety-related areas and the control building, control building and containment, and the vertical cable runs within the control and auxiliary building. The purpose of the visit was to determine by inspection whether the cables and piping would be affected by the displacements between buildings or within buildings in such a way as to cause their failure.

The area of greatest concern was in the turbine building at elevation 69 ft. where safety-related cables pass from the safety-related switchgear room located in the turbine building (a second redundant switchgear room is located in the control building) to the adjacent control building. This is the area where safety-related cables would be subject to the greatest displacement for the postulated seismic event. This displacement should be less than 2.5", since this elevation is lower than the roof of the control building where maximum displacements are expected. My investigation

determined that the cable trays carrying the safety-related cables between the buildings in this area are discontinuous; that is, the cable trays are not rigidly connected between the buildings. There is a minimum gap of 4 inches between the trays with one side attached to the turbine building and the other to the control building. At the gap, slack has been provided in the cable to accommodate relative motion between the buildings. On this basis, the cables in this area would be unaffected by the postulated displacement.

I examined the cable runs passing between floors in the control building in such areas as the switchgear room, the cable spreading room, mechanical equipment room, control room and in the auxiliary building to determine if a 0.5 inch interstory displacement would affect safety related cables. Where cables pass through floors in trays or conduit there is ample slack and flexibility in the cables to accept in excess of this displacement (a few inches) with no harm to the cables. There is also a space around the tray between the trays and concrete floor of approximately 2 inches which has been grouted with silicone foam rubber fire stop material. This would also provide protection and cushioning for the trays and cables at this point, although it would not be necessary considering the small displacement. The cable runs between the control building and the containment building were also examined and found to have a 4 inch gap in the trays with sufficient excess cable length for flexibility to allow displacements to occur between the control and containment buildings without damage to the cables.

There was only one point where safety-related piping was found to have insufficient space to accommodate the reported displacements: in the turbine building at elevation 69 feet. In this area, service water lines feeding the switchgear room coolers pass between the control building and turbine building and are rigidly attached to both buildings. Relative motion between the buildings at this point would tend to bend or stretch the lines. However, if we assume for conservatism the worst case failure to be that the lines are broken between the buildings, the room coolers for the switchgear room in the turbine building would be lost. Water coming from these lines in the turbine building would flow down in to the building drains and would not affect safety-related equipment. There would be no immediate affect on the equipment in the switchgear room due to the slow rise of temperature; no action would be necessary for a few hours, during which time fans could be placed in the doorway of the switchgear room to circulate air for cooling. However, even if the equipment in this room were affected, the redundant safety-related equipment in the switchgear room in the control building would be unaffected by the loss of these service water lines and, therefore, there would be no affect on safe shutdown of the plant.

CONCLUSION

It is my conclusion, based on the above stated observations, that the capability to achieve and maintain a safe shutdown condition, to assure the integrity of the reactor coolant system pressure boundary, and to prevent

or mitigate the consequences of accidents would be unaffected since the systems required for these functions would not be damaged by the estimated displacements which may occur for the safe shutdown earthquake at the Trojan Plant, and, in fact, substantially higher displacements can be accommodated without damage.

James E. Knight

Division of Operating Reactors

U. S. Nuclear Regulatory Commission

PROFESSIONAL QUALIFICATIONS

I am an Engineering Systems Analyst in the Plant Systems Branch, Division of Operating Reactors, Office of Nuclear Reactor Regulation, U. S. Nuclear Regulatory Commission. I am responsible for technical aspects of safety reviews of plant safety systems associated with licensing actions related to operating power reactors.

I received a Bachelor of Science degree in Electrical Engineering from Lawrence Institute of Technology in 1967. Additional graduate studies were subsequently performed at Wayne State University. Other educational background includes:

1. Air Force electronics school, one year.
2. Nuclear Engineering course covering Boiling and Pressurized Water Reactors - sponsored by Detroit Edison (6 months) 1974.
3. Fire Protection fro Nuclear Power Plants - NRC sponsored (2 weeks) 1974.
4. Boiling Water Reactor Simulator school - NRC sponsored (2 weeks) 1978.

I am a registered professional engineer of the State of Michigan, having been qualified by written examination. I have been certified since October 1, 1970.

From 1960 to 1967 I was employed by Atomic Power Development Associates Incorporated as a test facility supervisor responsible for design, installation, maintenance and calibration of instrumentation, control and electrical equipment for special process loops and test rigs (involving nuclear technology) related to the Fermi I fast breeder reactor.

From 1967 to 1973 I was employed as a senior electrical engineer for Atomic Power Development Associa.es Incorporated responsible for electrical, instrumentation, and control designs and modifications to the Enrico Fermi I power plant, the development of electrical testing and analysis of the Fermi I emergency power systems, and the development of specialized tools and instrumentation for liquid metal cooled reactors.

From 1973 to 1975 I was employed by the Detroit Edison Company as a senior electrical engineer, acting as system engineer in the project amangement office of the Enrico Fermi II Boiling Water Reactor. As a system engineer, I was responsible for management of the design of instrumentation and control systems for safety and balance-of-plant systems from concept to final design. Responsibilities included design review and approval, resolution of safety and technical problems, and the development of the safety analysis report on instrumentation and control.

From 1975 to present I have employed by the Nuclear Regulatory Commission as a Reactor Engineer (Instrumentation); 1975-1976 in the Division of Technical Review, and from 1976 to present as an Engineering Systems Analyst in the Division of Operating Reactors. In these capacities, I have been responsible for numerous safety reviews on boiling and pressurized water reactors.

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CERTIFICATE OF SERVICE

I hereby certify that copies of

(1) NRC Staff's Letter to the Licensing Board, dated October 13, 1978,

(2) Testimony of Kenneth S. Herring, Office of Nuclear Reactor Regulation, on Structural Adequacy of the Trojan Control Building for Interim Operation,

(4) Testimony of Robert T. Dodds, Office of Inspection and Enforcement, on Inspections of Nuclear Facilities After a Seismic Event,

(4) Testimony of James E. Knight, Office of Nuclear Reactor Regulation, on Licensing Board's Question Regarding Effects of a Seismic Event on Features Important to Maintaining the Safety of the Trojan Facility, and

(5) Professional Qualifications of Kenneth S. Herring, Robert T. Dodds and James E. Knight

have been served on the following by delivery to a messenger for service or, as noted by an asterisk (*), by deposit in the NRC's internal mail system or, as noted by a double asterisk (**), by deposit in the United States mail, this 13th day of October, 1978:

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