EXHIBIT 19

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In The Matter Of	)	
	)	
PACIFIC GAS & ELECTRIC COMPANY	)	Docket Nos. 50-275 O.L.
	)	50-323 O.L.
(Diablo Canyon Nuclear Power	)	
Plant - Units 1 & 2)	)	

AFFIDAVIT OF GREGORY C. MINOR

Concerning

ISSUES RELATED TO VESSEL LEVEL MEASUREMENT

STATE OF CALIFORNIA)
) ss.
COUNTY OF SANTA CLARA)

GREGORY C. MINOR deposes and says under oath as follows:

I. BACKGROUND OF AUTHOR

1. My name is Gregory C. Minor. I have twenty years of experience in the design, development, research, start-up, and management of nuclear reactor systems. I worked for sixteen years for the General Electric Company and for the past four years as an independent technical consultant. I was a founder in 1976,

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and I am now vice president of MHB Technical Associates. I received a B.S. in electrical engineering from the University of California, Berkeley, and an M.S. in electrical engineering from Stanford University. My sixteen years with G.E. involved the design, development, and testing of safety and control systems for nuclear plants. Since 1976, I have participated in a variety of reactor studies addressing nuclear safety issues. I am presently a consultant on several nuclear plant cases concerning the adequacy of current designs to meet existing regulations. I am a member of the Nuclear Power Plant Standards Committee for the Instrument Society of America. Also, I participated in a Peer Review Group of the NRC/TMI Special Inquiry Group investigating the TMI accident. My complete experience record is appended to this affidavit as Attachment A.

II. PURPOSE

2. The purpose of this affidavit is to define the substantive issues related to the proposed vessel level measurement technique for discerning inadequate core cooling at Diablo Canyon,

III. INTRODUCTION

3. The TMI-2 operators' inability to detect low vessel water level was exacerbated by lack of a direct reading water level measurement and thus directly contributed to the accident. Diablo Canyon presently has no installed instruments to directly

measure the water level in the reactor pressure vessel. The lack of direct measurement greatly limits the ability of the operator to unambiguously detect the approach of low water level in the reactor core. The NRC's requirements for correction of this deficiency have been expressed in the Lessons Learned Task Force Report (NUREG-0578), the TMI Action Plan (NUREG-0660), and also the Requirements for NTOL's (NUREG-0737). The Applicant's proposed solution is to install a Westinghouse system which is still developmental and has several deficiencies which may prevent it from providing an unabiguous easy-to-interpret indication of low water level and inadequate core cooling. The following information describes the technical issues related to the Applicant's proposed system.

IV. DISCUSSION OF ISSUES

4. The presently installed instruments Diablo Canyon operators will rely upon for indications of inadequate core cooling (ICC) are the same type of instruments relied upon during the TMI-2 accident, but with a wider range of readout; namely: wide range reactor coolant pressure, wide range reactor coolant temperature and core exit thermocouples. 1/. There is general agreement that present displays do not provide an indication of vessel water level.

1/ Affidavit of Hoch & Shiffer, at page 2.

5. By themselves, the coolant pressure and temperature measurements are not an unambiguous and easy-to-interpret indication of ICC. Considerable analysis and judgement would be needed to determine if ICC conditions existed based on these two parameters.

6. The Applicant plans to use the core exit thermocouple readings as an indication that ICC has already occurred,[2/] in which case the core may already be uncovered and fuel damage may already be occurring. They would then use the thermocouples as an indication of the success of their recovery or mitigation processes.

7. Thus, the existing devices for ICC indication are inadequate to give the operator warning of pending ICC but are more of a general indication or after-the-fact ICC indication.

8. To augment these instruments, the Applicant plans to add a Subcooling Margin Meter (SMM) [3/] and a Reactor Vessel Level Instrumentation System (RVLIS). The subcooling monitor will provide only a gross indication of coolant conditions to warn the operator when there is the possibility of boiling and void formation in the primary loop. This by itself is not an indication of the core being uncovered or the fuel being inadequately cooled.

2/ Affidavit of Muench at page 2.

3/ The NRC cites this instrument as existing instrumentation (see SER Supplement 14 at page 3-18), whereas, the Applicant cites it as equipment to be added (see Muench at page 2).

9. Thus, aside from the RVLIS, there is no instrument present or planned for Diablo Canyon which provides an unambiguous indication of the approach to uncovering the core.

10. The Westinghouse system of vessel level measurement proposed for Diablo Canyon is still under development with ongoing testing not scheduled to be completed until November, 1981, and reports to be provided to the NRC by January, 1982. 4/ Despite its untested and unproven status, the RVLIS is planned for installation in Diablo Canyon before fuel load.

11. The NRC Staff has conducted only a review of the RVLIS description and concludes it meets the "documentation requirements." However, they do not make a finding of acceptability of the total ICC system; postponing that review to some time after January, 1982. 5/

12. The RVLIS indication of reactor vessel level does not meet the requirement of being unambiguous and easy to interpret. There are conditions where the system is described as providing erroneous or uncertain reading of water level. 6/

4/ Letter, Crane to Miraglia (NRC) re: additional clarification of PG&E's resolution of NUREG-0737, Item II.F.2, Mar. 19, 1981, page 3.

5/ NUREG-0675, SER Supplement 14, April, 1981, page 3-70.

6/ Affidavit of Muench at pages 4 and 5.

13. The RVLIS system does not provide coverage for all types of transients or accidents and thus might provide ambiguous or misleading information to the operator. Specifically, readings may be misleading under conditions of void redistribution, level swell, coolant pumps being turned on or off, small breaks in the vessel head, and severe accidents such as anticipated transients without scram (ATWS).

14. During LOCA's of greater than 6-inch break size, the Applicant admits that both the RVLIS and the core exit thermocouples may provide ambiguous indications of ICC. 7/ There is no assurance that operators will not be taking manual action during this period. Also, there is no way for the operator to know if he is in a period of ambiguous, erroneous, or reliable indication from his ICC instruments.

15. The RVLIS design may have the same single-failure problem as the SMM which relies on a single data processor fed by redundant inputs and feeding to redundant readout devices. However, withholding of "proprietary" information makes the Applicant's description of the RVLIS unclear as to the number of data processors and the algorithm used to create the displays. If there is only one data processor, it is vulnerable to single failure and/or causing erroneous indications on each of the

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7/ Ibid 6 at page 4.

redundant displays. If there are two processors, there is no indication of how the operator is to deal with a discrepancy in the two output displays. This is an ambiguous condition which could easily mislead or confuse the operator. The system has two additional points of potential single-failure at the vessel penetration points used for sensing pressures for the differential pressure instruments. Plugging or blockage of these points could provide an ambiguous and erroneous indication.

16. The RVLIS data processor(s) and the displays are not required to be qualified for seismic conditions which the plant may be expected to experience. Thus, there is no assurance that the system will survive a severe earthquake. In the event the data processor fails or one of the redundant displays fails, there appears to be no failure indication or indication as to which of the redundant display devices the operator is to rely upon. 8/ The result is an ambiguous and/or misleading indication at a time when the operator may need to rely on the RVLIS.

17. I disagree with the Staff's position that vessel water level indication is not needed for reactor operation at low power. There is no other instrument that the operator can

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8/ The NUREG-0737 requirements for Item II.F.2 exempt the data processing device and displays from the full qualification requirements applicable to post-accident monitoring equipment. This is not consistent with the need to provide a reliable and unambiguous indication for the operator in post-accident conditions.

rely upon for indicating an approach to ICC. One cannot rule out the possibility of accidents, even at low power, which will require swift and accurate operator responses. The Staff's judgement is that there will be time for the operator to make the necessary diagnoses for mitigation of an accident. 9/ Considering the fact that some safety systems will be disabled for the low power tests 10/ and the plant is in the shake-down phase, the RVLIS should be available for the operators' use. Further, if the low power test phase is to be used by the Applicant as additional training for their operators, they should have the RVLIS available to experience its capabilities and deficiencies before full power operation.

V. CONCLUSION

18. Vessel water level measurement is one of the best indicators of the approach of ICC conditions and is therefore a necessary addition to Diablo Canyon. However, the proposed design for Diablo Canyon RVLIS is still unproven and appears to have serious deficiencies in its design and its ability to provide unambiguous, easy-to-interpret indications of ICC over

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9/ Affidavit of Phillips at page 7.

10/ Affidavit of Goesner at page 2.

the full range of operating and accident conditions. A vessel level device of proven capability should be added to Diablo Canyon before the plant operates.

Further the deponent sayeth not.

Gregory C Minor

April 22, 1981 Gregory C. Minor

Subscribed and sworn to before me this 22nd day of April, 1981.

Linda L. Roberson

NOTARY PUBLIC

My commission expires: 8-29-1983

OFFICIAL SEAL
LINDA L ROBERSON
NOTARY PUBLIC - CALIFORNIA
SANTA CLARA COUNTY
My comm. expires AUG 29, 1983

ATTACHMENT A

PROFESSIONAL QUALIFICATIONS OF GREGORY C. MINOR

GREGORY C. MINOR
MHB Technical Associates
1723 Hamilton Avenue
Suite K
San Jose, California 95125
(408) 266-2716

EXPERIENCE:

1976 - PRESENT

Vice-President - MHB Technical Associates, San Jose, California. Engineering and energy consultant to state, federal, and private organizations and individusals. Major activities include studies of safety and risk involved in energy generation, providing technical consulting to legislative, regulatory, public and private groups and expert witness in behalf of state organizations and citizens' groups. Was co-editor of a critique of the Reactor Safety Study (WASH-1400) for the Union of Concerned Scientists and co-author of a risk analysis of Swedish reactors for the Swedish Energy Commission. Served on the Peer Review Group of the NRC/TMI Special Inquiry Group (Rogovin Committee). Actively involved in the Nuclear Power Plant standards Committee work for the Instrument Society of America (ISA).

1972 - 1976

Manager, Advanced Control and Instrumentation Engineering, General Electric Company, Nuclear Energy Division, San Jose, California.

Managed a design and development group of thirty-four engineers and support personnel designing systems for use in the measurement, control and operation of nuclear reactors. Involved coordination with other reactor design organizations, the Nuclear Regulatory Commission, and customers, both overseas and domestic. Responsibilities included coordinating and managing the design and development of control systems, safety systems, and new control concepts for use on the next generation of reactors. The position included responsibility for standards applicable to control and instrumentation, as well as the design of short-term solutions to field problems. The disciplines involved included electrical and mechanical engineering, seismic design and process computer control/programming.

1970 - 1972

Manager, Reactor Control Systems Design, General Electric Company, Nuclear Energy Division, San Jose, California.

Managed a group of seven engineers and two support personnel in the design and preparation of the detailed system drawings and control documents relating to safety and emergency systems for nuclear reactors. Responsibility required coordination with other design organizations and interaction with the customer's engineering personnel, as well as regulatory personnel.

1963 - 1970

Design Engineer, General Electric Company, Nuclear Energy Division, San Jose, California.

Responsible for the design of specific control and instrumentation systems for nuclear reactors. Lead design responsibility for various subsystems of instrumentation used to measure neutron flux in the reactor during startup and intermediate power operation. Performed lead system design function in the design of a major system for measuring the power generated in nuclear reactors. Other responsibilities included on-site checkout and testing of a complete reactor control system at an experimental reactor in the Southwest. Received patent for Nuclear Power Monitoring System.

1960 - 1963

Advanced Engineering Program, General Electric Company; Assignments in Washington, California, and Arizona.

Rotating assignments in a variety of disciplines:

- Engineer, reactor maintenance and instrument design, KE and D reactors, Hanford, Washington, circuit design and equipment maintenance coordination.
- Design engineer, Microwave Department, Palo Alto, California. Worked on design of cavity couplers for TWT's.
- Design engineer, Computer Department, Phoenix, Arizona. Design of core driving circuitry.
- Design engineer, Atomic Power Equipment Department, San Jose, California. Circuit design and analysis.
- Design engineer, Space Systems Department, Santa Barbara, California. Prepared control portion of satellite proposal.

- Technical Staff - Technical Military Planning Operation. (TEMPO), Santa Barbara, California. Prepare analysis of missile exchanges.

During this period, completed three-year General Electric program of extensive education in advanced engineering principles of higher mathematics, probability and analysis. Also completed courses in Kepner-Tregoe, Effective Presentation, Management Training Program, and various technical seminars.

EDUCATION

University of California at Berkeley, BSEE, 1960.

Advanced Course in Engineering - three-year curriculum, General Electric Company, 1963.

Stanford University, MSEE, 1966.

HONORS AND ASSOCIATIONS

- Tau Beta Pi Engineering Honorary Society.
- Co-holder of U.S. Patent No. 3,565-760, "Nuclear Reactor Power Monitoring System," February, 1971.
- Member: American Association for Advance of Science.
- Member: Nuclear Power Plant Standards Committee, Instrument Society of America.

PERSONAL DATA

Born: June 7, 1937
Married, three children
Residence: San Jose, California

PUBLICATIONS AND TESTIMONY

1. G.C. Minor, S.E. Moore, "Control Rod Signal Multiplexing," IEEE Transactions on Nuclear Science, Vol. NS-19, February, 1972.

2. G.C. Minor, W.G. Milam, "An Integrated Control Room System for a Nuclear Power Plant," NEDO-10658, presented at International Nuclear Industries Fair and Technical Meetings, October, 1972, Basle, Switzerland.

3. The above article was also published in the German Technical Magazine, NT, March, 1973.

4. Testimony of G.C. Minor, D.G. Bridenbaugh, and R.B. Hubbard before the Joint Committee on Atomic Energy, Hearings held February 18, 1976, and published by the Union of Concerned Scientists, Cambridge, Massachusetts.

5. Testimony of G.C. Minor, D.G. Bridenbaugh, and R.B. Hubbard before the California State Assembly Committee on Resources, Land Use, and Energy, March 8, 1976.

6. Testimony of G.C. Minor and R.B. Hubbard before the California State Senate Committee on Public Utilities, Transit, and Energy, March 23, 1976.

7. Testimony of G.C. Minor regarding the Grafenrheinfeld Nuclear Plant, March 16-17, 1977, Wurzburg, Germany.

8. Testimony of G.C. Minor before the Cluff Lake Board of Inquiry, Regina, Saskatchewan, Canada, September 21, 1977.

9. The Risks of Nuclear Power Reactors: A Review of the NRC Reactor Safety Study WASH-1400 (NUREG-75/0140), H. Kendall, et al, edited by G.C. Minor and R.B. Hubbard for the Union of Concerned Scientists, August, 1977.

10. Swedish Reactor Safety Study: Bärsebäck Risk Assessment, MHB Technical Associates, January, 1978. (Published by Swedish Department of Industry as Document SdI 1978:1)

11. Testimony by G.C. Minor before the Wisconsin Public Service Commission, February 13, 1978, Loss of Coolant Accidents: Their Probability and Consequence.

12. Testimony by G.C. Minor before the California Legislature Assembly Committee on Resources, Land Use, and Energy, AB 3108, April 26, 1978, Sacramento, California.

PUBLICATIONS AND TESTIMONY

13. Presentation by G.C. Minor before the Federal Ministry for Research and Technology (BMFT), Meeting on Reactor Safety Research, Man/Machine Interface in Nuclear Reactors, August 21, and September 1, 1978, Bonn, Germany.

14. Testimony by G.C. Minor, D.G. Bridenbaugh, and R.B. Hubbard, before the Atomic Safety and Licensing Board, September 25, 1978, in the matter of the Black Fox Nuclear Power Station Construction Permit Hearings, Tulsa, Oklahoma.

15. Testimony of G.C. Minor, ASLB Hearings Related to TMI-2 Accident, Rancho Seco Power Plant, on behalf of Friends of the Earth, September 13, 1979.

16. Testimony of G.C. Minor before the Michigan State Legislature, Special Joint Committee on Nuclear Energy, Implications of Three Mile Island Accident for Nuclear Power Plants in Michigan, 10/15/79.

17. A Critical View of Reactor Safety, by G.C. Minor, paper presented to the American Association for the Advancement of Science, Symposium on Nuclear Reactor Safety, January 7, 1980, San Francisco, California.

18. The Effects of Aging on Safety of Nuclear Power Plants, paper presented at Forum on Swedish Nuclear Referendum, Stockholm, Sweden, March 1, 1980.

19. Minnesota Nuclear Plants Gaseous Emissions Study, MHB Technical Associates, September, 1980, prepared for the Minnesota Pollution Control Agency, Roseville, MN.

20. Testimony of G.C. Minor and D.G. Bridenbaugh before the New York State Public Service Commission, Shoreham Nuclear Plant Construction Schedule, in the matter of Long Island Lighting Company Temporary Rate Case, September 22, 1980.

21. Testimony of G.C. Minor and D.G. Bridenbaugh before the New Jersey Board of Public Utilities, Oyster Creek 1980 Refueling Outage Investigation, in the matter of Jersey Central Power and Light Rate Case, February 19, 1981.