UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, D. C. 20555

April 18, 1985

50-528

MEMORANDUM FOR: J. Ebersole, Chairman
Palo Verde Nuclear Station Subcommittee

H. Lewis, Member
G. Reed, Member
C. Wylie, Member

FROM: A. Wang, Staff Engineer A. Wang

SUBJECT: PROJECT STATUS REPORT FOR THE ACRS PALO VERDE SUBCOMMITTEE MEETING, APRIL 26, 1985, WINTERSBERG, ARIZONA

The ACRS Palo Verde Nuclear Station Subcommittee will hold a meeting on April 26, 1985. The purpose of this meeting will be to review the final reports for various construction deficiencies and the results of the preoperational testing as requested in the ACRS letter report dated December 15, 1981. A Project Status Report and Tentative Agenda are attached.

The Meeting will begin at 9:00 a.m., on Friday, April 26, 1985, at the Administration Building at the Palo Verde Site in Wintersberg, Arizona. Reservations have been made for the following:

Name	Hotel	Date
J. Ebersole	Best Western Airport Inn	4/25
H. Lewis	Best Western Airport Inn	4/25
G. Reed	Best Western Airport Inn	4/25
C. Wylie	Best Western Airport Inn	4/25-26

Please call Ms. Barbara Jo White (202) 634-1046, if you need to change or cancel these reservations.

If you have any questions or comments, please call me at (202) 634-3267.

Attachments:
Project Status Report and
Tentative Agenda with Attachments

cc: M. W. Libarkin
G. R. Quittschreiber

B/3

4/18/85

ACRS PALO VERDE NUCLEAR STATION SUBCOMMITTEE
APRIL 26, 1985 - WINTERSBERG, ARIZONA
- Project Status Report -

Purpose: The Subcommittee will meet with Arizona Public Service (APS) to close out several items noted in the ACRS letter report dated December 15, 1981 (Attachment A) and discuss various items regarding the operation of the Palo Verde Nuclear Station.

Background: In our letter report dated December 15, 1981, the Committee requested the Staff to provide a report "describing significant construction deficiencies and their disposition, effectivess of the quality assurance program, and results of the preoperational test program." On August 10, 1984, Region V gave the Committee an oral report on the status of their issues. However, at that time there were several outstanding issues which were not yet resolved. Attached to a memorandum from G. Quittschreiber to J. Ebersole, dated April 15, 1985, are the final deficiency reports and the Staff SER regarding the major construction deficiencies noted during the August 10, 1985 briefing. This memorandum was just recently sent to you as background information.

J. Ebersole has requested this meeting to review some of these reports and the results of the preoperational testing. He has noted in several meetings that the design faults at Palo Verde would imply to him that the preoperational test have been exploratory rather than confirmatory. He is interested if the utility can explain why several failures (RCP, RTD's, LPSI pumps, HPSI valves, etc.) occurred only in the in-situ test program. I have enclosed (Attachment B) a list of items in which J. Ebersole has requested APS to discuss during this meeting. I have also requested Region V for a status of their conclusions and recommendations with regards to the Palo Verde full power license.

ACRS Action: The Subcommittee will report its findings to the full Committee in May 1985. Palo Verde is expected to be issued their full power license in mid- to late-May. The ACRS will need to decide if their original request has been satisfied and that the original conclusions stated in the letter report dated December 15, 1981 are still valid.

Attachments: As Stated

UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, D. C. 20555

December 15, 1981

Honorable Nunzio J. Palladino
Chairman
U. S. Nuclear Regulatory Commission
Washington, DC 20555

SUBJECT: ACRS REPORT ON THE PALO VERDE NUCLEAR GENERATING STATION UNITS 1, 2, AND 3

Dear Dr. Palladino:

During its 250th meeting, December 10-12, 1981, the Advisory Committee on Reactor Safeguards reviewed the application of the Arizona Public Service Company, the Salt River Project Agricultural Improvement and Power District, the El Paso Electric Company, the Public Service Company of New Mexico, and the Southern California Edison Company (Applicants) for a license to operate the Palo Verde Nuclear Generating Station Units 1, 2, and 3. The joint applicants have designated the Arizona Public Service Company as the Project Manager and Operating Agent with full authority to construct and operate the power station. The project was considered at a Subcommittee meeting in Phoenix, Arizona on November 23-24, 1981, and members of the Committee toured the facility on November 23, 1981. In its review the Committee had the benefit of discussions with representatives of the Arizona Public Service Company, Combustion Engineering, Inc., Bechtel Power Corporation, the NRC Staff, and members of the public. The Committee also had the benefit of the documents listed. The Committee commented on the construction permit application for the Palo Verde Nuclear Generating Station Units 1, 2, and 3 in a report dated November 12, 1975 to the NRC Chairman.

The Palo Verde application is submitted in accordance with the Commission's regulations as described in Appendix O to Part 50, "Licensing of Production and Utilization Facilities," and Section 2.110 of Part 2, "Rules of Practice," of Title 10 of the Code of Federal Regulations. NRC policy stated in the Federal Register (42 FR 34395 and 43 FR 38954) allows for a reference system that involves an entire facility design or major fraction of a design outside the context of a license application. For this application the reference system is the Combustion Engineering standard nuclear steam supply system known as its Standard Reference System 80. This design has been reviewed by the ACRS and discussed in its report dated December 15, 1981, "Final Design Approval for Combustion Engineering, Inc. Standard Nuclear Steam Supply System (Standard Reference System 80)".

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This power station is located in a sparsely populated section of Maricopa County, Arizona, about 36 miles west of the nearest boundary of Phoenix, Arizona. The nearest densely populated center is Sun City, Arizona, about 35 miles east-northeast of the site, which had a 1980 population of about 57,800 persons. Palo Verde is the first commercial nuclear power station to be operated by Arizona Public Service Company and the first in the state of Arizona.

The Palo Verde Nuclear Generating Station uses three System 80 pressurized water nuclear steam supply systems designed by Combustion Engineering, Inc. Each of these has a design core power output of 3800 MWt. The turbine generators are oriented so as to minimize plant damage should turbine failure occur. The containment is a steel-lined, prestressed concrete cylindrical structure with a hemispherical dome and a design pressure of 60 psig. The cooling tower makeup is supplied from treated sewage effluent from the city of Phoenix.

The Committee's review included consideration of the management organization and capability, and the operator training program. The organizational plan for technical support of the operating plant is still being formulated. The Committee notes that the Arizona Public Service Company management personnel have extensive experience in both commercial and other nuclear plant operation and construction. The utility anticipates using many of its installation surveillance staff members as part of the technical support team. The ACRS encourages this organizational arrangement, but believes the Applicant should promptly analyze the skill requirements needed to support operations and make certain that the necessary capabilities will be available when needed. In order that the Committee be kept informed, we request an update on the organizational arrangement in about one year from this date.

The Committee notes that Arizona Public Service Company has a training simulator in operation at the Palo Verde site. The Committee's review indicated that the training program is being developed and that use of the plant simulator is still in the process of being integrated into the program. The Committee recommends that Arizona Public Service Company examine industry-sponsored programs concerning effective use of simulators for training and make certain that its approach takes account of current understanding of simulator training limitations.

Discussion with the Arizona Public Service Company staff indicated that emergency operating procedures for dealing with off-normal plant behavior are incomplete. Development of such procedures should be expedited to provide maximum time to make use of them in the operational training program.

In the Palo Verde design the primary system does not include capability for rapid, direct depressurization when the plant has been shut down. This places extra importance on the reliability of the auxiliary feedwater

system and makes it necessary that the NRC Staff and the Applicant assure the availability and dependability of this system for a wide variety of transients. It also places extra requirements on the continued integrity of the two steam generators as the only method of heat removal immediately after shutdown. The ACRS recommends that the NRC Staff and the Arizona Public Service Company give additional attention to the matter of shutdown heat removal for Palo Verde and develop a detailed evaluation and justification for the position judged to be acceptable. The Committee wishes to be kept informed.

Arizona Public Service Company should expand its studies on systems interactions and systems reliability.

A number of items have been identified as Outstanding Issues, Confirmatory Issues, and proposed License Conditions in the NRC Staff's Safety Evaluation Report dated November 1981. The ACRS is satisfied with the progress on these topics and believes that they should be resolved in a manner satisfactory to the NRC Staff.

Our approval of the operation of this plant is contingent upon the satisfactory completion of construction and preoperational testing. For this reason, we request that, prior to fuel loading on Unit 1, a report be provided to the Committee describing significant construction deficiencies and their disposition, effectiveness of the quality assurance program, and results of the preoperational test program. In addition, a review of the startup experience on Unit 1 should be made prior to fuel loading on Unit 2 and the Committee kept informed.

We believe that if due consideration is given to the recommendations above, and subject to satisfactory completion of construction, staffing, and preoperational testing, there is reasonable assurance that Palo Verde Nuclear Generating Station Units 1, 2, and 3 can each be operated at power levels up to the design core power output of 3800 MWt without undue risk to the health and safety of the public.

Additional comments by ACRS member M. Bender and ACRS members H. W. Lewis and M. S. Plesset are presented below.

Sincerely yours,

J. Carson Mark

J. Carson Mark
Chairman

Additional Comments by ACRS Member M. Bender

The NRC requirements for instrumentation to follow the course of an accident have been generally outlined in Regulatory Guide 1.97. The ACRS has concentrated most of its attention on instrumentation to detect inadequate

core cooling, sometimes called pressure vessel coolant level measuring instrumentation. The Regulatory Guide 1.97 requirements and the emphasis on measurement of vessel coolant levels both seem to have confused the real accident diagnosis requirements.

The proposed coolant level indicators could only have value under quiescent conditions. The proposed devices, differential pressure indicators and heated junction thermocouples, require considerable information about hydraulic conditions, pressure distribution, and density variations in the primary coolant circuit to be useful for unambiguous interpretation of changing coolant inventory in the reactor core. A full understanding of mass and energy distribution and related physical behavior of the nuclear system would be needed to make such information diagnostically useful under most accident conditions. The main value would appear to be for conditions where the system has been depressurized and the coolant state is known, for example, prior to refueling. Such knowledge does not appear relevant to the circumstances of primary concern such as accident conditions comparable to the TMI-2 event.

Regulatory Guide 1.97 has a mixture of requirements, some directed to pre-accident symptom identification, some to actual surveillance of rapidly changing transients, and some to surveillance of accident recuperation conditions. Although all of these requirements could be justified under some circumstances, it is likely that, if everything listed in the guide were provided, the operators could be overwhelmed by the informational detail and their diagnostic capability actually impaired.

At a time when unambiguous accident diagnostic information is urgently needed, a maze of indicating and analytical devices that might confuse the operators hardly makes sense. I propose the following criteria as a basis for determining accident diagnostics adequacy.

1. Does the operator have a well-defined set of signals to guide his emergency response to important accidents?

2. Do the emergency procedures enable the operator to avoid misinterpretation of those signals under circumstances where accident diagnosis is needed in conjunction with emergency actions?

3. In accident recovery is the sensor capability adequate to enable the operators to establish whether a stable and safe operating condition is being maintained until the system can be brought to cold shutdown and reliable decay heat removal functions assured?

4. If fuel failures occur, is there capability to determine whether the failures are of minor or major significance (clad reaction

with water and fuel melting); whether bulk quantities of radioactive nuclides have been released to the primary coolant circuitry, the containment interior, or are leaking from containment; and whether the containment boundary is jeopardized by overpressure or overtemperature?

Only a few additions to the pre-TMI-accident instrumentation appear necessary to address these considerations. However, to be certain that necessary information is available, the actions required of operators during accidents must be thoroughly examined. Emergency procedure guidance is now being developed by the nuclear steam supply equipment vendors. This guidance must be converted into usable procedures that may be testable on nuclear plant simulators. Palo Verde and a few other installations have simulators that might be used for this purpose. Those operating organizations having appropriate simulation equipment should give priority attention to proving the effectiveness of the diagnostic equipment in conjunction with proposed emergency procedures in order to verify diagnostic adequacy. No serious effort in this direction appears to have been initiated up to this time.

Additional Comments by ACRS Members H. W. Lewis and M. S. Plesset

We do not wish to belabor the points we made in our addendum to the ACRS letter dated November 17, 1981 on the St. Lucie Plant Unit 2, but they are as relevant here as there. The Staff continues to accept instruments that do not provide an unambiguous measure of liquid level in the pressure vessel, and continues to lack an adequate rationale therefor. We do not find fault with the Applicants for their efforts to be responsive to the Staff, but are concerned about the proliferation of inadequately considered requirements, of which this is only one example. To sanctify an ambiguous indication of core water level is to play with fire. In this particular case (heated thermocouples in a separator tube), not only dynamic effects, but a pressure vessel full of high-void-fraction water will spoof the instrument, and tend to lull the operator into a false sense of security about the coolant inventory. In that specific case, the instrument will indicate that the vessel is nearly full.

None of the above is meant to suggest that we oppose the provision of instrumentation to follow the course of an accident or to detect the onset of inadequate core cooling - unambiguous diagnosis of accident conditions through improved instrumentation and training is a high priority. Our concern is a piecemeal and incoherent approach to the problem, as exemplified here.

References:

1. Arizona Public Service Company, "Palo Verde Nuclear Generating Station, Final Safety Analysis Report," with Amendments 1 through 6.
2. U.S. Nuclear Regulatory Commission, "Safety Evaluation Report Related to the Operation of Palo Verde Nuclear Generating Station, Units 1, 2, and 3," NUREG-0850, dated November 1981.

3. Combustion Engineering, Inc., "System 80 CESSAR FSAR," with Amendments 1 through 5.
4. U.S. Nuclear Regulatory Commission, "Safety Evaluation Report Related to the Final Design of the Standard Nuclear Steam Supply Reference System CESSAR System 80," NUREG-0852, dated November 1981.

EBERSOLE
4/13/85

AGENDA ITEMS FOR PALO VERDE SUBCOMMITTEE MEETING
APRIL 27, 1985 - PHOENIX, AZ - SOMEWHERE NEAR AIRPORT

Meeting in morning. Plant tour by those who wish (not JCE) after meeting. I have a plane out to return about 4:00 P.M.

Suggest start at 8:30 A.M., close for lunch, and subsequent field trip about 12:30 P.M.

TOPICS

A.

1. Current Plant Status - Projection of work to be completed before escalation to full power.

2. Full Power Escalation Program

3. Chronological List of Significant Unexpected Findings during Hot testing and 5% Power Testing. Include all Valve Malperformance Findings.

4. In view of the extreme reliability required of the main and auxiliary feedwater system:

   a. Describe why applicant believes he will not experience those cases of complete loss of feedwater at PWRs which have actually occurred.

   b. Discuss anticipated frequency of use and frequency of real need of auxiliary feedwater system.

5. As a topic to focus on valve reliability, provide a discussion of the isolation valves for the chemical volume and control system. Include:

   a. Reading the specifications for the valves as they relate to power supply, trip signals, and design basis to close on open discharge at full system pressure.

   b. Describe arguments for ability to close while delivery faulted flow. If only analytical, describe analysis. If by test, describe test.

c. If outboard piping fails and flow is not intercepted until interior or exterior valve is manually closed (if it can be) describe ultimate consequence in context of equipment damage in auxiliary building and core damage, if any. If core damage occurs, define off-site dose.

B. Discussion with Operating Staff

1. Describe (on a personal basis) the most critical accident situation you are required to mitigate by operator action. Name about six of these and include multiple steam generator tube failures, loss of service water, loss of component cooling water, and loss of DC power to the "safety" systems. What will be the visible effects of loss of the two most critical DC system in respect to control room indications.

2. Discuss and express your view as operators, having been handed a given engineering design, your opinion as to whether you have adequate assets (or perhaps too much information) to perform the above emergency functions in respect to the following areas:

   a. adequate (and not too complex) instrumentation for the initial conditions

   b. an appropriate degree of automatic response of equipment

   c. Reasonably simple accident recovery procedures

   d. Adequate time to perform the recovery function

   e. Instrumentation which will accurately confirm or deny that proper recovery action has occurred, and

   f. Adequate prerogatives to reverse corrective actions in case human error has occurred.

3. Describe the difference, as you understand it between direct and indirect instrumentation indications. Include both process parameters (pressure, temperature, etc.) and equipment functional performance indications. List the "indirect" indications for which some confirmatory evidence of correct actual system or equipment response must be invoked.

4. There are two broad classes of safety-related systems in the plant. One of these is the specialized set of systems designed to mitigate the classical "LOCAs." What are the "others?" Which do you consider to be more important to safety?

5. How did you determine the existence of the "other" systems. Are all of these systems on something equivalent to "Q" list?

6. In your plant, when one of these "other" systems fail, does an operations disturbance occur which requires even more rigorous performance of the residual equipment performing the same critical function?

7. If the residual equipment is on standby (an example might be service water or component cooling pumps) and the first "channel" failure demands auto-start of the backup equipment:

   a. Do you have redundancy after the first failure (as you do with the on-site diesel generators)?

   b. If you do not, how much time do you have, in the most critical cases, to restore the needed function in case the standby system fails to respond to the start-up challenge?

   c. Redundancy is always provided in the ECCS systems which respond to a LOCA. How do you rationalize the absence of redundancy (if such cases exist) in the light of critical service system functional failures which will be much more frequent than LOCAs?

4/22/85

ACRS Palo Verde Nuclear Station Subcommittee Meeting
April 26, 1985 - Phoenix, Arizona

- Tentative Schedule -

ACRS Contact: Alan Wang (634-3267)

	ITEM	SPEAKER	TOTAL PRESENTATION TIME	ACTUAL TIME
I.	Chairman's Opening Statement	J. Ebersole	10 min	9:00 am
II.	APS Opening Statement	APS Staff	10 min	9:10 am
III.	Power Ascension Program		40 min	9:20 am
IV.	Current Plant Status			
V.	Specific Mechanical Component Discussions (Primary System Damage, LPSI Pumps, HPSI Valves, Auxiliary Feedwater System and CVCS)			
	*** Break ***		15 min	10:30 am
VI.	Discussion of How APS Developed Emergency Plant Procedures		60 min	10:45 am
VII.	Resident Inspector's Perspective of APS Capabiltiy to Operate Palo Verde at Full Power		15 min	11:45 am
	*** Lunch ***			12:00 pm
	Plant Tour			1:00 pm