Project No. 669

August 2, 1990

Mr. E. E. Kintner, Chairman
ALWR Utility Steering Committee
GPU Nuclear Corporation
One Upper Pond Road
Parsippany, New Jersey 07054

Dear Mr. Kintner:

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION ON EPRI ALWR REQUIREMENTS DOCUMENT

As a result of our review of Chapter 10 of the EPRI ALWR Requirements Document, the staff has determined that it needs additional information in order to complete our review of the design criteria. The additional information is needed in the area of electrical systems. In addition, the staff has reviewed EPRI's Topic Paper that was submitted with Chapter 10 which presents arguements for not including a requirement for reactor vessel level instrumentation systems for the advanced light water reactor. The staff's concerns are discussed in the enclosure to this letter.

Please resond to this request within 60 days of the date of this letter. If you have any questions regarding this matter, call me at (301) 492-1120.

Sincerely,

Original signed by T. Kenyon
Thomas J. Kenyon, Project Manager
Standardization Project Directorate
Division of Reactor Projects - III,
IV, V, and Special Projects
Office of Nuclear Reactor Regulation

Enclosure:
As stated

cc w/enclosure:
See next page

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REQUEST FOR ADDITIONAL INFORMATION
CHAPTER 10, ALWR REQUIREMENTS DOCUMENT

1. Paragraph 6.2.7.3 specifies that Class 1E motor operated valves shall have their thermal overloads bypassed continually per Regulatory Guide 1.106, and the only time the overload bypass shall be removed is during maintenance and testing of the valves. This, however, seems to conflict with paragraph 6.5.2 in Chapter 11 which specifies that bypassing features for the purpose of restricting operator protection shall not normally be provided. Please clarify this apparent discrepancy and provide some examples of thermal overload system designs that would satisfy this requirement.

2. Paragraph 6.2.7.3 specifies required characteristics for motor operated valves. NRC Branch Technical Position (BTP) ICSB 18 (PSB) "Application of the Single Failure Criterion to Manually-Controlled Electrically-Operated Valves" provides guidance on the design and acceptability of Mannually-controlled Electrically-Operated valves when it is necessary to remove power from them in order to meet the single failure criterion. The positions established in BTP ICSB 18 (PSB) should be referenced in paragraph 6.2.7.3; however, it should first stipulate that the number of valves that require power removal in order to meet the single failure criterion should be minimized. It should require that this provision be limited to only those situations where design of the piping system to eliminate the need to remove power from the valve would result in a less safe design than the design that requires power removal.

3. Paragraph 6.2.8.2 specifies that "the M-MIS shall be designed to operate within performance limits when the dc input is at the level required to charge the batteries" and at the "low dc voltage when batteries are fully loaded and charge is depleted." Although we think we understand the intent here, it is not entirely clear from the way the paragraph is worded what specific battery and dc system voltages the M-MIS equipment should be designed to. The M-MIS equipment should be designed to operate properly at a maximum voltage equal to the battery maximum equalizing

discharge voltage minus the voltage drop from the battery to the M-MIS equipment terminals during worst case system loading. Please clarify this paragraph accordingly.

4. Paragraph 6.2.8.3 specifies that surge protection features on the power inputs of I&C power supplies shall be designed and tested to withstand the worst case surge limits of appropriate standards. It does not, however, specify what the standards are. In paragraph 6.2.2.18 a comparable requirement references IEEE 472-1974 for the limits. Is this same standard or any additional standards intended to be used here? In either case the standards that are intended to be for these limits should specifically be listed in this paragraph.

5. Paragraphs 6.2.8.1, 6.2.8.2, 6.2.8.3, 6.2.2.17, and 6.2.2.18 specify, in a piecemeal fashion, M-MIS equipment performance requirements when operating under a range of various power supply system variations and perturbations. We recommend that a requirement be included that the ALWR designer develop a comprehensive interface specification between the M-MIS equipment and the external power supply systems that support them in order to ensure their compatibility. A similar recommendation was made in the staff's questions on Chapter 11.

6. Paragraph 6.2.8.9 specifies that "non-Class 1E system instrumentation and controls and all the equipment required to make them function, which is powered from a Class 1E division, shall be powered from the same division or system." This paragraph directly conflicts with paragraph 2.3.9 in Chapter 11 which specifies that the design of the plant electric power distribution systems shall be such that non-safety circuits are not connected to safety circuits or power sources. Paragraph 6.2.8.9 should therefore be changed to specify that non-Class 1E system instrumentation and controls shall only be connected to non-Class 1E power supplies and distribution systems, and shall <u>not</u> be connected to Class 1E supplies or distribution systems.

7. Paragraph 6.2.12.1 specifies the characteristics that field wire termination and splices should have. In order to avoid any misunderstanding this paragraph should also note that splices shall not be allowed in raceways in accordance with position C.9 of Regulatory Guide 1.75, Revision 2.

8. Paragraph 10.2.1.4 provides general requirements for the portion of the M-MIS that control and monitor the electrical power systems. We recommend that EPRI consider requiring the ALWR designer develop an augmented integrated monitoring system for the ALWR electrical power systems. Such a system would have the advantage of making available to the operator in the control room, on a call-up basis a much broader and more indepth range of information on the electrical systems that was only previously available by local monitoring. It could also be made less confusing to the operator by continuously displaying only the most critical top level information. We suggest that such a system be capable of monitoring circuit breaker status down to the individual load level and monitoring voltages down to the power panel level. We also suggest the system have the capability of monitoring individual battery cell parameters parameters. A similar recommendation was made in the staff's questions on Chapter 11.

STAFF COMMENTS REGARDING TOPIC PAPER ON REMOVAL OF REACTOR PRESSURE VESSEL LEVEL INSTRUMENTATION FOR ALWRS CHAPTER 10

The staff has reviewed EPRI's topic paper submitted on October 25, 1989 with Chapter 10 of the ALWR Requirements Document which presents arguments for not including a requirement for reactor vessel level instrumentation systems (RVLIS) for the advanced light water reactor (ALWR). The staff has determined that the topic paper does not present a sufficiently new significant argument in order to alter the NRC position requiring RVLIS for existing PWR's. In addition, we have not found anything significantly different about the design of the EPRI evolutionary PWR which would alleviate the NRC's requirement for RVLIS for this plant design. On the contrary, some arguments appear contrary to the lessons learned for the TMI-2 event. The following are comments on some of the arguments presented. These comments are meant to aid EPRI in developing their requirements for a RVLIS and are not intended to be a list of items which, if satisfied, would allow removal of the RVLIS.

(1) It is stated that elimination of the RVLIS enhances plant safety by eliminating the diversion of operator attention from restoring reactor coolant system inventory and decay heat removal capability during core-threatening events while attempting to interpret ambiguous and unreliable RVLIS indications. It is further stated that elimination of RVLIS eliminates the complexity that such a system adds to the plant with no commensurate benefits.

It was the objective of the policies established by NUREG-0737 and Regulatory Guide (RG) 1.97 and the industry's development effort that reliable and unambiguous indication of inadequate core cooling (ICC) be provided. It is recognized that the systems developed in response to the need and to these guidance documents are not ideal, but nonetheless have been judged to satisfy the objectives to a satisfactory degree. EPRI's ALWR design criteria should require a system at least equal to those currently approved for current PWRs, and if they believe these systems to be insufficient, EPRI should require better system performance in their requirements document. Under most conditions, the RVLIS do provide the unambiguous indication sought. When supplemented by the subcooling margin monitor and core exit thermocouples, the staff has concluded that the total inadequate core cooling instrumentation meets the Commission's requirements. The same cannot be said for reliance on pressurizer level indication. As discussed in the subject document, the pressurizer level increases for breaks in some locations and decreases for breaks in other locations. The positive indication of RVLIS, rather than diverting the operator's attention, may be just the information he needs to make the proper judgement. Certainly this could have been a deciding factor in the TMI-2 event. There is no doubt that inadequate operator training was

a contributor to the event, but the lack of adequate indication of important conditions was also an important factor.

(2) That the RVLIS systems are somewhat complex and require maintenance is not a new persuasive argument. The same can be said for many other systems of equal or lesser importance.

(3) The statement is made in the EPRI document that "...the RVLIS which has been added to current plants, while promising potential benefit, has not proven to be useful." It has been recognized from the onset of deliberations about RVLIS that the indication would not be useful in normal plant operations. Its value lies in providing valuable information during loss of coolant or voiding events.

RVLIS has already been shown to be a useful instrument in operating reactors. For example, at North Anna Unit 1, during the time frame between June 17, 1987 and June 21, 1987, approximately 17,000 gallons of RCS inventory was removed from the reactor coolant system (RCS). The pathway for the loss was through the pump backseat of the "A" reactor coolant pump (RCP), up the shaft, and out through the seals into the containment sump. The pump had been decoupled from the motor for stator replacement. The inventory loss was not detected because the pressurizer had been allowed to cool down and go into a vacuum and a bubble had formed in the reactor vessel head. In this condition, pressurizer level indication did not provide an adequate representation of RCS inventory. Indication was available via the reactor vessel level indication system (RVLIS) portion of the Integrated Core Cooling Monitoring (ICCM) System which had been installed during the refueling outage. Even though the RVLIS had not been declared operational and operator action to terminate the condition was not taken based on that information, it did alert the operators and action was finally taken when vacuum in the pressurizer was also detected. At that time, RVLIS was used to trend the vessel level during venting of the reactor head and system refill.

The staff has also identified other design basis events where RVLIS (if it had been installed) could have resulted in better operator response. These included a natural circulation cooldown event with a bubble in the vessel head at St. Lucie 1 and a steam generator tube rupture event with a bubble in the reactor vessel head even though there was continued indication of adequate subcooling margin at Ginna.

(4) EPRI has stated that "Reactor vessel level instruments have proven to be unreliable." This argument is not substantiated with any evidence and there is no preponderance of reports to the NRC indicating that this is the case.

(5) EPRI's Topic Paper states that the "The level indications for currently installed systems have poor human factors and are potentially confusing to the operators." The human factors aspects of the RVLIS indications were evaluated both by the utilities in their control room design reviews and by the NRC. As with most systems, no perfect scores were awarded, but the applicant systems were judged to be acceptable with regard to human factors considerations.