Palo Verde Nuclear
Generating Station

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10 CFR 2.790

102-04931-GRO/SAB/TNW
April 25, 2003

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Mail Station P1-37
11555 Rockville Pike
Rockville, MD 20852

Reference: Letter 102-04864-CDM/TNW/DWG, "Request for Amendment to Technical Specifications: 3.2.4, Departure From Nucleate Boiling Ratio (DNBR), 3.3.1, Reactor Protective System (RPS) Instrumentation - Operating, 3.3.3, Control Element Assembly Calculators (CEACs)" , dated November 7, 2002, from C.D. Mauldin, APS to USNRC

Dear Sirs:

**Subject: Palo Verde Nuclear Generating Station (PVNGS)
Units 1, 2, and 3
Docket Nos. STN 50-528/529/530
Response to Request for Additional Information to Proposed Amendment to Technical Specifications 3.2.4, Departure From Nucleate Boiling Ratio (DNBR), 3.3.1, Reactor Protective System (RPS) Instrumentation - Operating, 3.3.3, Control Element Assembly Calculators (CEACs)**

During a phone conversation on March 6, 2003, between Arizona Public Service Company (APS) and the NRC, APS was asked to provide the following information for NRC Review:

- a summary of activities completed by APS in evaluating human factors associated with the implementation of the Common Q Core Protection Calculator System (CPCS) at PVNGS
- a summary of activities still to be performed by APS in regards to human factors associated with the implementation of the Common Q CPCS at PVNGS
- a copy of the Westinghouse Common Q CPCS human factors report

In response, the enclosure to this letter provides a summary of the human factors activities that have been completed and those yet to be performed by APS in regards to implementation of the Common Q CPCS at PVNGS.

AP01

In addition, Attachment 1 to this letter contains four copies of the Westinghouse human factors report WCAP-16076-P, Requirements Phase Human Factors Review for the Common Q Phase 3 Core Protection Calculator System Project (proprietary). Westinghouse Electric Company, the owner of this information, requests that the information in Attachment 1 be withheld from public disclosure in accordance with 10 CFR 2.790.

Attachment 2 contains two copies of WCAP-16076-NP, Requirements Phase Human Factors Review for the Common Q Phase 3 Core Protection Calculator System Project (non-proprietary).

Attachment 3 contains Westinghouse Authorization letter, CAW-03-1613, which provides the accompanying affidavit, Proprietary Information Notice, and Copyright Notice associated with the use of documents in Attachment 1 and 2. Correspondence with respect to the copyright or proprietary aspects of the items contained in Attachment 1 and 2 or the supporting Westinghouse Affidavit should reference CAW-03-1613 and should be addressed to H. A. Sepp, Manager of Regulatory and Licensing Engineering, Westinghouse Electric Company, P.O. Box 355, Pittsburgh, Pennsylvania 15230-0355.

No new commitments are being made to the NRC by this letter. Should you have any questions, please contact Thomas N. Weber at (623) 393-5764.

Sincerely,

David Spaulding

CDM/SAB/TNW

Enclosure Summary of APS Human Factor Related Activities

Attachments:
1. Proprietary Version: WCAP-16076-P, Requirements Phase Human Factors Review for the Common Q Phase 3 Core Protection Calculator System Project, Revision 0, dated March 2003
2. Non-Proprietary Version: WCAP-16076-NP, Requirements Phase Human Factors Review for the Common Q Phase 3 Core Protection Calculator System Project, Revision 0, dated March 2003
3. Westinghouse Authorization letter, CAW-03-1613 (Proprietary Affidavit Pursuant to 10 CFR 2.790 and Copyright Notice)

cc: E. W. Merschoff
J. N. Donohew
N. L. Salgado
A. V. Godwin

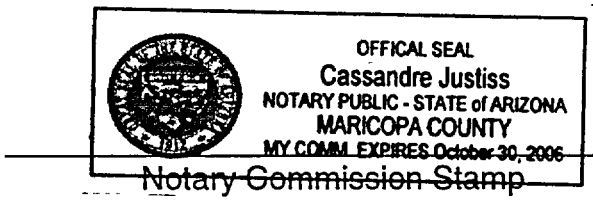
STATE OF ARIZONA)
) ss.
COUNTY OF MARICOPA)

I, David Mauldin, represent that I am Vice President Nuclear Engineering and Support, Arizona Public Service Company (APS), that the foregoing document has been signed by me on behalf of APS with full authority to do so, and that to the best of my knowledge and belief, the statements made therein are true and correct.

David Mauldin

Sworn To Before Me This 25th Day Of April, 2003.

Notary Public



Notary Commission Stamp

ENCLOSURE

Summary of APS Human Factors Related Activities

Summary of APS Human Factors Related Activities

The following is a description of the human factors related activities evaluated in the Core Protection Calculator System (CPCS) replacement/upgrade at Palo Verde Nuclear Generating Station (PVNGS):

Summary of Human Factor Activities Completed By APS

The replacement of the existing CPCS with a new upgraded CPCS involves the use of new hardware. The Operator's Module provides the primary human interface with this system and therefore, is the focus of the PVNGS human factors evaluation. This upgrade is considered a permanent modification. Risks associated with operational tasks to be performed with the new CPCS are considered low based on the following:

- There are no CPCS related operator functions credited in the PVNGS Updated Final Safety Analysis Report (UFSAR) to prevent or mitigate an accident.
- There are no CPCS related operator tasks that have been identified as significant contributors to plant risk and therefore none are modeled in the plant Probability Risk Assessment (PRA).

The PVNGS Quality Assurance (QA) Plan, Chapter 17 of the PVNGS Updated Final Safety Analysis Report (UFSAR), provides comprehensive information regarding the normal process for modification to plant design, including configuration control, procedure development, and the establishment of personnel training and qualification. These processes are captured in PVNGS site specific procedures. Since these controls are not changing, it is not the intent of this letter to revisit the guidance provided in the QA plan, but rather to describe PVNGS human factors related activities associated with the implementation of the new CPCS.

Human Factors Engineering (HFE) Program Management

As required per PVNGS procedures, the development of design modifications require the formation of a project team consisting of members from affected onsite organizations (e.g., engineering, maintenance, operations, training, procedure groups, etc.). This team determines the most effective means of designing, procuring, installing, testing, turning over, and closing out the modification.

At PVNGS, an evaluation of human factors is a key element of the design modification process, especially for Control Room modifications. In accordance with the PVNGS design change procedure, the development of a design change requires a comprehensive evaluation of design input requirements. Approximately 35 topical areas are evaluated which include, but are not limited to, the following:

- Operations (e.g., evaluation of needed staff, training, procedures, etc.)
- Instrumentation and Control (e.g., evaluation of proper range/accuracy, appropriate alarms, etc.)
- Failure Modes and Effects (e.g., evaluation of failure modes, probabilistic risk assessments, etc.)
- Additional Human Factors (e.g., evaluation of NUREG-0700 criteria, vendor supplied human factor design and review, etc.)

The project team has determined that the best time for installation of the new CPCS is during a refueling outage when this system is neither required nor in service and where minimal impact to control room staff is expected. Implementation of the design will include numerous tests that confirm the proper performance of the new CPCS. Until the time of implementation, regularly scheduled CPCS project team meetings serve to identify, track, and resolve issues associated with this design change.

As required by the design modification procedure, all impacts (e.g., drawings, procedures, maintenance tasks, training, etc.) are identified and coordinated for proper implementation during the development phase. To date, these impacts have already been identified and are documented in the CPCS design modification work package. These impacts have been scheduled to be implemented when installation of the CPCS has been completed. Training of licensed operators has already begun and is described in more detail later.

Operating Experience Review

Although the existing CPCS at PVNGS has had almost 20 years of acceptable performance, some changes will be made to the new CPCS based on PVNGS operating experience to enhance plant and operator performance.

For example, at the request of Operations, changes to the CPCS will include the addition of CPCS Auxiliary Trip pre-trip alarms. PVNGS has experienced reactor trips due to actuation of Auxiliary Trips on the CPCs (i.e., Axial Shape Index and Variable Over Power Trip). In some cases, the operators had the potential to correct the condition if adequate warning had been provided. The proposed pre-trip alarms will assist in minimizing the potential for future plant transients caused by actuation of the CPCS Auxiliary Trips.

Another example, also at the request of Operations, involves improvements to the time required to perform the linear power calibrations required by Technical Specification Surveillance Requirement 3.3.1.4. Currently these calibrations take approximately two hours to complete and are performed numerous times during a regular plant startup, occupying many hours of a dedicated operator's time to complete. Improvements to the information gathering and calculation activities performed using the new CPCS would allow for a much more simplified and streamlined process, reducing the overall time to complete the task.

Functional Requirements Analysis and Allocation

The new CPCS will have no impact on existing functional requirement analysis or allocation. There are no CPCS related operator functions credited in the PVNGS Updated Final Safety Analysis Report (UFSAR) to prevent or mitigate an accident. Also, there are no CPCS related operator tasks that have been identified as significant contributors to plant risk and therefore none are modeled in the plant Probability Risk Assessment (PRA).

Task Analysis

Existing procedures identify the applicable tasks associated with the CPCS. These tasks, in some cases, will need to be modified due to new hardware. However, it is not expected that any new tasks will need to be developed for the new CPCS. The affected procedures primarily include those owned by Operations, Maintenance, and Reactor Engineering. Operator tasks will continue to be performed from the same locations.

In late 2002, with the display screens and software close to being 100% complete, steps were begun to change the procedures affected by the new CPCS. Individuals representing the two areas most affected (Operations and Maintenance) traveled to Westinghouse in early 2003 to evaluate the new equipment and walk through draft procedures on the hardware to be installed at PVNGS.

For Operations, this walk through included an evaluation of routine operator tasks (e.g., displaying point IDs, paging through window displays, bypassing trips, interpreting indications/alarms, performing power calibrations, etc.), as well as an evaluation of expected equipment responses during abnormal events (e.g., loss of power, failed components, etc.). For Maintenance, this walk through included an evaluation of routine maintenance tests (e.g., rod drop response timing, calibrations, functional checks, etc.), as well as an evaluation of test equipment compatibility.

Human System Interface Design

During the initial planning phase of the CPCS design change, prior to awarding any contracts, the Operations representative on the project team, a licensed senior reactor operator, evaluated Operations Department human factors considerations. The Operations staff was queried to determine desires for information display and user-interface interactions associated with the new system. This query produced a list of desired features and screen displays that would assist operators in their performance of routine activities using the new system. This list was used as input for the contract with Westinghouse which calls out many of the new features desired by Operations. The Operations representative on the project team has been actively involved throughout the entire project, including traveling to Westinghouse on numerous occasions to evaluate development of displays, identify problems, and assist in resolving issues.

During the development of the upgraded CPC Flat Panel display screen, feedback from the end users (Operations, Maintenance and Reactor Engineering) was routine and constructive. Some of these comments resulted in revisions to the contract and the system requirements specification such as providing Operations with an additional eleven fixed group displays to match eleven routine operational situations. Other feedback included general comments on all display screens produced by Westinghouse, format of the printed trip buffer report, and the addition of a previously undisplayed CPC parameter.

During the initial involvement of APS with Westinghouse engineering, it was also determined that one of the primary display screens should mimic the existing Remote Operators Module (ROMs), strictly for human factors purposes. In this way, Operations personnel would always have a familiar interface.

Per contractual requirements, Westinghouse performed a formal human factor review and completed the associated report (Reference Attachment 1 to this letter). This report reviewed the interim state of the CPC displays, provided recommendations, and identified items to be followed up on in the future by APS.

As required by PVNGS procedure, a formal site specific CPC/CEAC Replacement Human Factor Review plan has been developed to address the approach and methodology for final acceptance of the new design. This also includes a comprehensive checklist to confirm that applicable NUREG-0700 criteria have been properly implemented. Human factor issues that are not resolved are tracked and evaluated for significance to determine the course of action (up to and including correction prior to placing the system in operation).

Procedure Development

As stated previously, all impacts (e.g., drawings, procedures, maintenance tasks, training, etc.) are required to be identified and coordinated for proper implementation during the development phase. To date, impacted procedures have been identified and are documented in the CPCS design modification work package. All applicable procedure changes are scheduled to be issued in coordination with the placing in service of the new CPCS in each PVNGS unit.

In accordance with the PVNGS procedure change process, changes are evaluated and reviewed for technical accuracy and consistency with existing human factors guidance which include, but are not limited to, the following:

- procedures are written such that the language and style are suited to the end user
- terms that can be broadly interpreted are avoided
- specific and descriptive phrases are used
- the language is as simple and direct as possible

Impacted procedures are in the process of revision and review, including Verification and Validation (V&V) activities. Typical procedure V&V activities include, but are not limited to, the following:

- walkdowns
- simulations
- interviews
- performance or use

Training Program Development

PVNGS implements the five phases of the Systematic Approach to Training (SAT) (i.e., process of analysis, design, development, implementation, and evaluation of training) in accordance with INPO recommendations. The PVNGS Training Department, with input from Operations, evaluates and addresses training needs for implementation of plant modifications, including the new CPCS, in accordance with the SAT process.

Initial training for licensed operators has already begun. In the Spring of 2002, licensed operators received one hour of classroom training in which the new CPCS was

discussed and where samples of the new CPCS Flat Panel Displays (FPDs) were shown. In addition, the licensed staff reviewed the proposed Technical Specification changes. Early in 2003, licensed operators attended a second training class on the new CPCS. In this session, four Operating Modules (OMs) and one Control Element Assembly Position Display System (CEAPDS) FPD were running, simulating a complete configuration in one unit. During this session, the operators were shown the final CPCS displays and allowed to manipulate them as desired. These displays were running on an actual CPCS module flat panel display just like that which would be found in each unit. The plant training simulator provided live data. These OMs and CEAPDS have since been installed in one of PVNGS's two plant training simulators in preparation for crews to be trained to respond to plant events with the new CPCS.

Currently, Operations is working with the Training Department to identify appropriate Job Performance Measures (JPMs) associated with the new CPCS to be performed by operators in the plant's simulators.

Verification and Validation (V&V)

V&V is an ongoing process in the design and implementation of the new CPCS at PVNGS. It is a key part of the design, training, and procedure development process. V&V activities to date include the following:

Operational Conditions

- involvement of a licensed senior reactor operator on the project team
- identification of operator tasks
- walkdown of a number of operational and maintenance procedures with the vendor
- initial practice with functional equipment in the plant's simulators for increased operator exposure and feedback
- scheduled training of licensed operators on routine CPCS tasks under normal and adverse conditions in the plant's simulators prior to implementation of the modification in the unit
- scheduled review and dry runs of draft procedures in the plant's simulators with licensed operators prior to implementation of the procedures

Design

- development of a formal site specific CPC/CEAC replacement human factor review plan to address the approach and methodology for final acceptance of the new design
- development of a comprehensive checklist to confirm that applicable NUREG-0700 criteria have been properly implemented

Integrated System Validation

- scheduled training of licensed operators on routine CPCS tasks under normal and adverse conditions in the plant's simulators to help identify inconsistent approaches to plant operations
- development of a comprehensive checklist to confirm that applicable NUREG-0700 criteria have been properly implemented, including consistency with other plant systems

Human Engineering Discrepancy Resolution

- regularly scheduled CPCS project team meetings that serve to identify, track, and resolve issues associated with this design change
- development of guidance for tracking and resolving human factor issues identified during performance of the comprehensive checklist to confirm that applicable NUREG-0700 criteria have been properly implemented. This guidance includes identifying the significance of the discrepancy to determine the course of action (up to and including correction prior to placing the system in operation)

Design Implementation

Design implementation is governed by PVNGS procedures. These procedures coordinate the activities for design installation, operator training, procedure issuance, and startup monitoring for minimal human impact. Factors ensuring design implementation will result in a minimal impact to Operations include the following:

- The schedule for installation of the new CPCS ensures that work will be performed when this system is neither required nor in service and where minimal impact to Control Room staff is expected.
- The schedule for licensed operator training ensures that Operations crews will have been fully trained on the new CPCS prior to their implementation in the unit.
- The schedule for updating all applicable procedures ensures revisions are made in coordination with the placing in service of the new CPCS.
- The schedule for startup testing ensures Engineering staff oversight to monitor and evaluate the use and performance of the new CPCS.

Summary of Human Factor Activities to be Performed By APS

There are a number of open items that remain relating to human factors and the implementation of the new CPCS at PVNGS.

Procedures

As required by the plant modification procedure, all applicable procedure changes are planned to be issued in coordination with the placing in service of the new CPCS in each PVNGS unit.

Training

Prior to the new CPCS being installed in the units, training for the Operations crews is planned on applicable tasks associated with the new CPCS, including the associated Technical Specifications and procedure changes. Job performance measures (JPMs) will be completed by each licensed operator. There is additional classroom training to be provided by Westinghouse at the PVNGS site that is scheduled prior to design implementation for applicable Engineering and Maintenance personnel. This training includes three distinct, week long classes.

Final Human Factors Review

The final human factors review will be accomplished as part of the modification process, using the methodology and checklist developed for implementation of the modification. The applicable groups will perform a final evaluation of the installed CPC configuration against the CPC human factors checklist criteria. Critical or important issues resulting from the checklist responses will be resolved prior to turnover to Operations. Complete resolutions to all the identified discrepancies that need remedial actions shall signify satisfactory completion of human factors review of the CPC replacement project.

Testing and Monitoring

Testing and monitoring activities are scheduled during startup activities to ensure no adverse impact to the plant or personnel due to the implementation of the design.