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R. J. GARY
EXECUTIVE VICE PRESIDENT
AND GENERAL MANAGER

July 22, 1983

Director of Nuclear Reactor Regulation
Attention: Mr. B. J. Youngblood, Chief
Licensing Branch No. 1
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

SUBJECT: COMANCHE PEAK STEAM ELECTRIC STATION
DOCKET NOS. 50-445 AND 50-446
ALTERNATE SHUTDOWN
INTERIM STAFF EVALUATION

REF: (1) NRC Staff letter from B. J. Youngblood, to R. J. Gary, entitled, "Submittal of Interim Staff Evaluation of the Alternate Shutdown Design for the Comanche Peak Steam Electric Station (CPSES), Units 1 and 2" dated July 6, 1983

Dear Sir:

Reference (1) provided an evaluation which represented an interim review by the NRC staff of the Alternate Shutdown capability of the Comanche Peak Steam Electric Station (CPSES). This letter was provided in response to an oral request by D. R. Woodlan (representing Texas Utilities Services Inc.) on June 17, 1983, for an appeal meeting during the week of July 11, 1983, to discuss the Staff position that RCS Cold Leg Temperature and Source Range Neutron Flux indicators must be included in the CPSES Alternate Shutdown design. Mr. Woodlan requested the appeal meeting because he had been informed that the Auxiliary Systems Branch would not consider acceptable any designs which do not comply with the Staff position approved on January 7, 1983, by Roger J. Mattson, Director, Division of Systems Integration, NRR. Mr. Woodlan was informed that alternate designs or exceptions to this position could only be approved through appeal.

In order to more clearly document both the NRC staff position and the CPSES position on this issue, the licensing project manager suggested that the Staff document its position on this issue as it relates to CPSES in a letter to Texas Utilities (TU). Texas Utilities could then provide the CPSES position in response to the Staff letter. The TU

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response could be treated as a written appeal. Should the resolution of the TU response still be unsatisfactory, the letters would serve as proper documentation to support an appeal meeting thereafter. An exemption request would not be appropriate because 10 CFR Part 50 Appendix R does not apply to CPSES. However, the proper appeal route can be investigated later.

The NRC staff position was provided in reference (1). The TU response is attached to this transmittal. In view of the potential impact of this issue on the CPSES fuel load date, please provide an expeditious consideration of our design.

Respectfully,

B R Clement
for R. J. Gary

DRW:grr
Attachment

CPSES
ALTERNATE SHUTDOWN
RCS COLD LEG TEMPERATURE
SOURCE RANGE NEUTRON FLUX

1.0 INTRODUCTION

This appeal has been prepared and submitted to help resolve NRC staff concerns with the Alternate Shutdown design at CPSES. As noted below, the CPSES Alternate Shutdown design was developed and implemented to meet fire protection requirements as they applied to CPSES. In this regard, while Branch Technical Position 9.5-1 Appendix A provides the regulatory framework for the CPSES fire protection program, we have attempted to be responsive to NRC staff questions with respect to 10 CFR part 50, Appendix R, even though it does not apply to CPSES.

The specific concerns of the NRC staff regarding this issue (as stated in its July 6, 1983 letter) are that "...the remote shutdown panel does not include the capability to monitor reactivity, nor to verify adequate core cooling while under natural circulation. Section III.L requires the capability for direct readings of process variables necessary to perform and control the reactivity control functions and the reactor heat removal functions. Therefore, it is [the NRC staff's] position that the applicant provide a source range neutron flux monitor and reactor coolant loop hot leg temperature (Th) and cold leg temperature (Tc) indication as part of the safe shutdown instrumentation independent of the control room and available in the event of a control room fire." It should be noted that reactor coolant loop hot leg temperature (Th) is already included on the CPSES Hot Shutdown Panel (HSP) as part of the CPSES Alternate Shutdown design (i.e., independent of the Control Room and Cable Spreading Room).

It is TU's position that the CPSES Alternate Shutdown design provides adequate indication of the proper variables needed to perform and control the reactivity control and reactor decay heat removal functions and CPSES should not be required to backfit its Alternate Shutdown design to add source range neutron flux and reactor coolant loop cold leg temperature (Tc).

2.0 HISTORY

The preconstruction review of CPSES was reported in the Staff's SER dated 9-3-74 and its supplement #1 dated 11-15-74. The CPSES construction permits were issued on 12-19-74.

The Operating License application for CPSES was submitted on 2-27-78 and docketed on 4-24-78. At that time the fire protection design at CPSES was based on, among other things, General Design Criterion 3 of Appendix A to 10 C.F.R. Part 50 and applicable Staff guidance including that set forth in BTP APCSB 9.5-1 Appendix A and Regulatory Guide 1.120, as well as applicable fire codes, insurance requirements and standard practices in the nuclear industry. With specific regard to shutdown capability, CPSES was designed to assure that safe shutdown (hot shutdown) could be achieved even if control room evacuation was necessary.

In 1979, TU became aware that the NRC Staff was attempting to impose as requirements new guidance criteria on other near term OL applicants. Meetings with these other applicants revealed that this new guidance was significant. In order to learn the substance and extent of this new guidance, TU requested a meeting with the NRC Staff. This meeting was held on 1-10-80. The information provided at that meeting included guidance on an alternate shutdown design.

After consideration of this new guidance, it became clear that implementation would require a significant resource commitment for study, analysis, and backfits. In an attempt to resolve outstanding questions before establishing further resource commitments, TU requested a second meeting, which was held on 5-13-80.

As a result of the second meeting, TU again considered the new guidance. Although not agreeing with the Staff on all issues, TU determined that, in all likelihood, the Staff guidance could be implemented without delaying fuel load. In view of the NRC Staff's "ratchet" and the fact that opposing the "guidance" could result in

lengthy appeals and possibly hearings (and could eventually even delay the fuel load date), TU decided to implement this guidance on the good faith belief that the NRC Staff would not alter or add to its "guidance" criteria. Implementation of such guidance included the design and implementation of a new alternate shutdown capability remote from the control room.

The design, reviews and analysis by TU of the new alternate shutdown capability continued through the first half of 1981, and included evaluation of modifications to the Hot Shutdown Panel (HSP) and redesign of the required control circuits and instrumentation channels. As designs were finalized and conceptually approved, implementation of the hardware changes began. As part of the hardware modifications, the Hot Shutdown Panel was removed and returned to the manufacturer for modifications. (Actually, the Unit 2 panel was modified first and then installed in Unit 1 to save time and shipping costs). Of course, qualification of the HSP, which had been previously qualified, had to be re-analyzed.

In order to close out the open SER item regarding this issue, TU submitted to the NRC Staff on 5-7-82 documentation reflecting the final design of the alternative shutdown capability, to include an update of the appropriate sections of the CPSES FSAR, and urged the Staff to expedite its review of this information. Throughout the remainder of 1982 and early 1983, on numerous occasions, TU requested a review of the CPSES alternate shutdown capability submittal. However, during this time no Staff review was initiated and no meaningful dialogue between the Staff and TU occurred (e.g., the Staff did not request responses to questions as is normally the case). During early 1983 all modifications were completed and the alternative shutdown capability design was tested during hot functional testing.

Finally, in early 1983, TU was informed that Greg Harrison of the Auxiliary Systems Branch had begun to review the submittal. Shortly thereafter, a meaningful exchange of information occurred and several items were resolved. On March 3, 1983, while in Bethesda for another

meeting, D. R. Woodlan, a licensing engineer for TU, called Mr. Harrison to discuss any open items. Mr. Harrison referred Mr. Woodlan to another member of the NRC Staff who provided Mr. Woodlan with an NRC Staff position paper entitled "Statement of Staff Position Regarding Source Range Flux, Reactor Coolant Temperature, and Steam Generator Pressure Indication to Meet Appendix R, Alternate Shutdown Capability" which was approved by Roger J. Mattson on 1-7-83. Even though the position paper was related only to activities concerning compliance with Appendix R to 10 C.F.R. Part 50, and was thus applicable only to operating plants, Mr. Harrison stated that this position paper (which was never formally transmitted to CPSES) established new criteria which CPSES must meet. Further, Mr. Harrison stated that any deviation from the position set forth in the paper would have to be appealed to higher levels in the Staff.

The additional backfits required by this new Staff position were considered by TU in terms of safety, cost and schedule. TU determined that the current CPSES alternate shutdown capability was adequate with respect to safety and that the resources required for the new backfits could not be justified based on the previous efforts and the CPSES schedule. TU, therefore, chose to appeal the CPSES design and on 6-17-83 requested an appeal meeting for early in July 1983.

3.0 ALTERNATE SHUTDOWN DESIGN

The CPSES Alternate Shutdown design is described in detail in Texas Utilities Services Inc. letter from H. C. Schmidt to the NRC Staff dated May 7, 1982, (log number TXX-3515). The design was based on the CPSES Alternate Shutdown study which was attached to that submittal.

The Alternate Shutdown study was based on an analysis of the functions required for hot standby and cold shutdown. A series of logic diagrams were developed to determine the equipment, controls and monitored variables needed to perform these functions. "Mini" system flow diagrams were developed to allow assessment of the various fire scenarios on the systems of concern.

In the course of this study, it was determined that a new Shutdown Transfer Panel (STP) was needed. This panel is in a separate fire zone from the Hot Shutdown Panel, the Cable Spreading Room and the Control Room. The STP contains the switches needed to isolate from the Control Room and Cable Spreading Room the controls required for Alternate Shutdown.

Shutdowns were evaluated for fires in the Control Room, the Cable Spreading Room, the Hot Shutdown Panel and the Shutdown Transfer Panel fire zones.

The spurious operation of equipment was considered on all equipment which could be affected by the fire including train equipment affecting opposite train performance. Of particular concern were high to low pressure interfaces where spurious operation could result in a LOCA. In addition to defining the actions required to prevent spurious operation, the design provided for status lights on the Hot Shutdown Panel for Train B equipment whose status is important to Train A performance.

The functional logics were examined to determine which equipment might be lost due to the fire. When necessary to reestablish a lost shutdown

path, control systems and instrumentation systems were redesigned to allow control or indication independent of the Cable Spreading Room and Control Room. The layout of the Hot Shutdown Panel was re-engineered as equipment was added and removed (i.e., moved to the Shutdown Transfer Panel). Equipment was both added and removed. An entire new section was added to the panel. Human factors, as described by NUREG-0700, were considered as part of the redesign of this panel.

Further, the panel was expanded beyond the minimal requirements. Controls or indicators which did not have to be on the panel, but rather could have been operated or observed at other plant locations (such as those for the Steam Generator Power Operated Relief Valves), were added to the panel to provide a well engineered design that truly allows proper control of the functions required for safe shutdown and on to Cold Shutdown.

4.0 OPERATIONAL CONSIDERATIONS

The operational considerations of the Alternate Shutdown design at CPSES include items such as human factors, training, the CPSES simulator and operating procedures.

As mentioned above, the Hot Shutdown Panel (HSP) and the analysis/design of Alternate Shutdown for CPSES included human factors criteria and took into consideration the guidance of NUREG-0700. In addition, when the HSP was modified to comply with new Staff guidance (as noted above), the arrangement of the panel, the type of hardware selected, the method of labeling, etc., were all selected to meet the human factors guidelines.

Training on the HSP has already been conducted. During Hot Functional Testing in early 1983, the HSP was operated to demonstrate its capability to maintain hot standby, control the plant, control cooldown and transfer cooling to RHR. Numerous operators had the opportunity to operate the HSP during this testing.

More operator training will occur during the initial startup testing. During this testing, the ability to perform several functions from outside the control room will be demonstrated including reactor trip, maintaining hot standby for at least 30 minutes with a minimum shift crew, cooling down the plant and placing RHR in service. Again, many operators will have the opportunity to operate and/or observe operations of the plant from the HSP. The training on Alternate Shutdown at CPSES also includes the Cold License Training and continuing operator training, to specifically include training on the CPSES procedures that relate to Alternate Shutdown.

An additional and somewhat unique feature at CPSES is its simulator. The CPSES simulator, which is expected to be operational in about a year, will include a Hot Shutdown Panel in an adjacent room. This

panel is a reproduction of the panel in the plant and will allow for routine operator training on this HSP simulator. This training will include potential instrument failures.

The CPSES procedures that relate to Alternate Shutdown include:

ABN-905A Loss of Control Room Habitability

IPO-008A Plant Shutdown for Hot Standby to Cold Shutdown Outside the Control Room

EOP-0.0 Reactor Trip or Safety Injection

When the transfer of control from the Control Room to the HSP is required, these procedures require immediate actions, such as:

- Trip the reactor

- Implement the immediate actions of EOP-0.0

  Verify reactor trip, rods on the bottom, flux decreasing on the IR nuclear instrumentation
  Verify turbine trip, stop valves closed
  Verify emergency AC buses energized
  Check if Safety Injection initiated

- Proceed immediately to HSP and Shutdown Transfer Panel (STP)

Follow up actions include in-plant verification of any of the immediate actions that may be in doubt - for example, reactor trip can be verified locally by verifying that the reactor trip breakers are open and that the ammeter indicates zero current flow. Turbine trip can be verified locally in the turbine building.

Communications are established between operations personnel at the HSP, STP, and other locations in the plant. Hot Standby is maintained through actions, such as:

- Establishing & maintaining S/G water level and pressure by:
  - Operation of the Auxiliary Feedwater Pumps
  - Controlling of auxiliary feedwater flow to maintain S/G level at 86% wide range
  - Local operations to obtain control of S/G PORV's at HSP
  - Maintaining S/G pressure at 1092 psig
- Establishing and maintaining pressurizer pressure and level by:
  - Operation of station service water
  - Operation of component cooling water
  - Operation of centrifugal charging pump
  - Controlling pressurizer level at 25%
  - Controlling pressurizer heaters to maintain 2235 psig
- Isolating sources of unborated makeup water by:
  - Closing two manual valves and checking a third manual valve closed to isolate all sources of reactor makeup except the Boric Acid Storage Tanks
- Borating to at least cold shutdown concentration by:
  - Operation of the Boric Acid Transfer Pump
  - Opening the Emergency Boration Valve
  - Monitoring the amount of boric acid charged into the RCS
  - Obtaining primary plant samples approximately every 30 minutes until the cold shutdown boron concentration is obtained
- If all Reactor Coolant Pumps are lost, verifying and controlling natural circulation by:
  - Verifying that the difference between Reactor Coolant System (RCS) hot leg (Th) and cold leg (Tc)* temperature is less than 120% of full power delta T and is slowly decreasing.
  - Verifying that Th is lower than the saturation temperature for the pressurizer pressure and that this subcooling is slowly increasing.
  - Verifying that Th is slowly decreasing as the generation of decay heat falls off.

Trending the parameters above (Th is displayed on a recorder to assist in this trending).

*In case of fire, Tc may not be dependable and should be compared to S/G saturation temperature based on SG pressure which is an accurate representation of actual Tc.

These procedures continue on to allow cooldown, transfer to RHR and establishment of cold shutdown.

In summary, the operational considerations of the CPSES approach to Alternate Shutdown include hands-on operator training, simulator training on a duplicate HSP, training on the CPSES procedures for shutdown outside the control room, and a control panel which was designed to human factors criteria.

5.0 REACTIVITY CONTROL / SOURCE RANGE NEUTRON FLUX

Proper reactivity control to achieve and maintain cold shutdown reactivity conditions is one of the primary functions necessary for safe shutdown. This function has been addressed by CPSES for normal, accident and alternate shutdown.

For Alternate Shutdown, reactivity control is established by controlling two variables - control rod position and RCS boron concentration. Rod position is established by reactor trip. As noted above, the reactor is tripped and shutdown is verified prior to evacuation of the Control Room. If this is not possible, the reactor will be tripped and/or verified as tripped at the Reactor Trip Switchgear. The switchgear can be opened or verified open and current can be verified to be zero at the local ammeters.

At the time of reactor trip, boron concentration is adequate to maintain the required shutdown margin. Boron concentration does not become a concern again unless boron dilution occurs or rapid reactor cooldown occurs. As noted in the procedures discussed above, the possibility of boron dilution has been eliminated by isolating all makeup paths except "emergency boration" from the Boron Acid Storage Tanks (or emergency makeup from the borated Reactor Water Storage Tank). In addition, one of the actions while at hot standby is to emergency borate (with samples about every 30 minutes) to at least the required cold shutdown boron concentration. Since the Boric Acid Storage Tanks and Reactor Water Storage Tank are the only sources of charging water, the boric acid concentration of the Reactor Coolant System will be further increased by the makeup required to account for shrinkage during cooldown.

In summary, direct readings of the process variables (rod position and boron concentration) necessary to perform and control the reactivity control function are obtained from the reactor trip switchgear and from RCS sampling for boron concentration. These direct readings are

adequate to assure that the reactivity control function is being performed for CPSES. In addition, RCS boron concentration is monitored by knowing the initial boron concentration and tracking the makeup concentration and volume and the letdown volume.

6.0 DECAY HEAT REMOVAL / RCS COLD LEG TEMPERATURE

Another important function in assuring safe shutdown is decay heat removal. Establishing and maintaining decay heat removal has been addressed by CPSES for normal, accident and alternate shutdown conditions.

For Alternate Shutdown, decay heat removal is accomplished using either the Reactor Coolant Pumps (RCP's) or natural circulation. The Reactor Coolant Pumps are preferred and will probably be available but cannot be guaranteed. Therefore, natural circulation cooling must be considered. Decay heat removal using natural circulation depends on three main factors - the temperature of the heat source (the decay heat from the reactor), the temperature of the heat sink (the steam generator) and the elevation difference between the two.

The elevation difference between the steam generators and the reactor is fixed by design and construction and cannot be considered a process variable.

The temperature of the heat source is monitored using RCS Hot Leg Temperature, Th. Th is not only an important variable for ensuring the driving head for natural circulation but it is also an important variable for ensuring adequate subcooling in the RCS loops and changes or trends in Th provide one of the best indications of actual decay heat removal and decay heat removal rate. For these reasons Th indications for all four loops are included in the CPSES Alternate Shutdown design. In fact, the Alternate Shutdown process monitoring of Th is being accomplished on two, 2-pen recorders to provide both real time and trend information to the operator.

The third factor needed for natural circulation decay heat removal is the temperature of the heat sink. Since the steam generator is at saturation, this variable is monitored by monitoring steam generator pressure. Indeed, the decay heat removal rate is controlled by

controlling steam generator pressure through control of the Steam Generator Power Operated Relief Valves (PORV's). As mentioned in the discussion above regarding procedures, the operator maintains a steady steam generator level by controlling auxiliary feedwater flow and a steady steam generator pressure by controlling the S/G PORV's. This assures a controlled decay heat removal rate. In order to cool down the RCS, the S/G PORV's are opened slightly to reduce steam generator pressure and to increase the decay heat removal rate. The decay heat removal rate and reactor cooldown rate are controlled by controlling the S/G PORV's and monitoring Th and its trends. It is convenient to compare RCS Cold Leg Temperature (Tc), when available, with Th to help assess the establishment of natural circulation cooling. However, Tc is not required as a direct process variable indicator necessary to control decay heat removal and RCS cooldown. The Westinghouse nuclear steam supply system is designed such that the cold leg temperature approximates the saturation temperature corresponding to steam generator pressure. Actual plant operations have verified that there would be only a small variance between the cold leg temperature and the saturation temperature corresponding to steam generator pressure during cooldown to cold shutdown.

In summary, decay heat removal via natural circulation cooling is performed and controlled by two basic variables - reactor temperature and steam generator pressure/temperature. Direct readings of these variables are provided at CPSES using Th recorders and S/G Pressure Indicators. Tc for one Reactor Coolant System loop is also provided for convenience on the Hot Shutdown Panel, but since it is not required for decay heat removal control, Tc has not been protected to guarantee operation for Alternate Shutdown.

7.0 CPSES UNIQUE CONSIDERATIONS

Several aspects of the CPSES approach to Alternate Shutdown might be considered somewhat unique. For example, TU actively pursued determining the new fire protection and alternate shutdown guidance on its own several years ago. TU actively sought clarification to this guidance and, in good faith, established a program to meet this guidance as best as reasonably possible.

The CPSES simulator is another rather unique aspect. As noted under Operational Considerations above, the Hot Shutdown Panel (HSP) at CPSES has been reproduced as part of the CPSES simulator. The HSP simulator will allow regular operator training using the panels including training for unusual events such as loss of an instrument.

The CPSES design and procedures allow and call for the isolation of all possible dilution paths to the primary coolant system for shutdowns from outside the control room.

The CPSES procedures for shutdown outside the control room call for emergency boration to cold shutdown conditions while still at hot standby.

When the Hot Shutdown Panel was redesigned, the criteria of NUREG-0700, "Guidelines for Control Room Design Reviews" was considered to ensure that the human factors aspects of the panel had been properly addressed in accordance with the most recent guidance.

A group of status lights was provided as part of the Alternate Shutdown design for equipment whose operability is not required but whose status is important to safe shutdown or safety.

The plant operators have been and will be used extensively during testing to obtain hands-on experience at the HSP.

The Alternate Shutdown design for CPSES allows for direct control of the Steam Generator Power Operated Relief Valves at the Hot Shutdown Panel to give the operator control of steam generator pressure and thus the decay heat removal/cool down rate. The operator at CPSES need not depend only on the cycling of the Steam Generator Safety Valves. This should allow for a more stable situation at CPSES in which the operator is in full control of the pertinent variables required.

The Alternate Shutdown design provides for the support equipment required to operate the Reactor Coolant Pumps (RCPs). This means that in all likelihood the RCP's will not be lost in the event of a Control Room or Cable Spreading Room fire unless the fire is accompanied by a loss of offsite power. Some other alternate shutdown designs go to natural circulation immediately and do not provide for the protection of the RCP support equipment so that the pumps could not be run even if they were available.

The recording of Th on the Hot Shutdown Panel is somewhate unique and very valuable. As noted in section 6.0 above, Th and its trend are possibly the most important information for the operator. Having immediate indication of the trend of Th allows the operator to more easily and quickly assess the status of the plant.

These somewhat unique aspects reflect the good faith effort put forth by TU to provide a well designed Alternate Shutdown system for CPSES and to meet the guidance that had been provided by the staff.

8.0 CONCLUSION

In conclusion TU maintains that the CPSES Alternate Shutdown design provides adequate process variable indication to achieve and maintain a safe shutdown condition and cold shutdown.

In addition, even though Appendix R of 10 CFR part 50 does not apply to CPSES, the Alternate Shutdown design of CPSES does provide direct readings of the process variables necessary to perform and control the reactivity control and reactor heat removal functions required for alternate shutdown and the design is therefore in compliance with these aspects of section III.L of this rule.

On this basis, and considering the good faith efforts of TU, and the unique aspects of CPSES as noted above, CPSES should not be required to backfit Source Range Neutron Flux and RCS Cold Leg Temperature into the CPSES Alternate Shutdown design.