

SUPPLEMENT NO. 6
HUMAN FACTORS CONTROL ROOM DESIGN REVIEW
OF
COMANCHE PEAK STEAM ELECTRIC STATION
DECEMBER 18, 1992

CONTROL ROOM ENVIRONMENTAL SURVEYS

1.0 Introduction

Control Room and the Remote Hot Shutdown Panel Detailed Control Room Design Review (DCRDR) environmental surveys were conducted by CPSES personnel and specialists from Stone & Webster Engineering Corporation during December, 1992. The surveys were a combination of requirements covered by CPSES pre-operational tests and NUREG-0700 guidelines. A summary of the results follow with all tests and data available on site. All HEDs required for fuel load will be resolved prior to Unit 2 fuel load.

2.0 Auditory Environment

The survey showed that the acoustic design of the control room ensures that verbal communications between operators are not impaired; alarms are readily detectable and noise distractions, irritation, and fatigue are minimized.

Table 1 summarizes the sound survey results for the NUREG-0700 guidelines. One discrepancy was recorded as noted on the table.

* Human Engineering Discrepancy (HED 92-2-003)

The loudness of the Safety System Inoperable Indication (SSII) alarm horn was only 3 dB(A) above background sound level. Although discernible, the level will be increased for better detection from the Reactor Operator's work station. The disposition of the HED and tracking through closure will be accomplished by TU Evaluation from TUE 92-6954.

3.0 Illumination

The lighting surveys showed adequate levels of illumination to ensure that the operator's visual effectiveness is sufficient for task performance. Both normal (AC) and emergency (DC) lighting systems were surveyed.

Table 1 summarizes the lighting survey results for the NUREG-0700 guidelines. Two discrepancies were recorded as noted on the table.

* Human Engineering Discrepancy (HED 92-2-004)

Certain handswitch module position indicating lights for the Containment Ventilation System utilize Master Specialties Company (MSC) series 800 which were dimmer than similar MSC lights. This hinders the recognition of damper position and whether the lights have failed. Although distinguishable close up, the illumination

will be improved for better recognition. The disposition of the HED and tracking through closure will be accomplished by TUE Evaluation Form TUE 92-6953.

* Human Engineering Discrepancy (HED 92-2-005)

Emergency lighting (DC) levels for Unit 2 Reactor Operator's (ROs) desk and central Unit Supervisor's Workstation were less than the NUREG 0700 guideline minimum of 10 footcandles. In the ROs console area, the DC lighting fixtures have been re-aimed and diffusers removed to improve the level to 13.9 foot candles. With the loss of onsite and offsite AC power, the Unit Supervisor's emergency activities will be focused on the control board/ROs desk area. Lighting required for any tasks in the central administrative area can be accomplished with supplemental portable battery lights available in the control room.

4.0 Heating, Ventilating, and Air Conditioning (HVAC)

The thermal comfort survey of the Hot Shutdown Panel (HSP) was evaluated per MIL-STD-1472C since the HSP area HVAC design is basically for an equipment space. The NUREG-0700 guidelines for control room personnel comfort do not apply. The MIL-STD-1472C, "effective temperature", for winter comfort zone is 65-70°F. Effective temperature (ET) takes the effect of temperature, humidity, and air velocity into consideration for comfort. The average ET for the HSP area was 66.4°F. For summer cooling the effective temperature should be below 85°F, which is considerably above the NUREG-0700 guideline for the control room.

The Control Room HVAC was surveyed but the temperature was not maintained within the comfort zone.

Table 1 summarizes the HVAC survey results. One discrepancy was recorded as noted on the table.

* Human Engineering Discrepancy (HED 92-2-006)

The temperature of the control room was slightly below the comfort zone. The disposition of the HED and tracking through closure will be accomplished by Operations Notification and Evaluation (ONE) Form ONE 92-873.

TABLE 1

NUREG-0700	GUIDELINE	CONFORMANCE
6.1.5.1	TEMPERATURE AND HUMIDITY a. Comfort Zone b. Temperature Differential	(Note 3) No-HED 92-2-006 Yes
6.1.5.2	VENTILATION a. Air Quantity b. Air Velocity	Yes Yes
6.1.5.3	ILLUMINATION a. Levels b. Uniformity c. Supplemental Light d. Task Area Luminance Ratio e. Shadowing f. Glare g. Reflectance h. Color	Yes Yes N/A Yes Yes Yes (Note 1) Yes (Note 2) Yes
6.1.5.4	EMERGENCY LIGHTING a. Automatic Action b. Limit c. Lighting Levels	Yes Yes No-HED 92-2-005
6.1.5.5	AUDITORY ENVIRONMENT a. Background Noise b. Limit c. Further Reductions d. Noise Distractions e. Reverberation Time	Yes Yes Yes Yes Yes
6.2.2.3	AUDITORY CODING TECHNIQUES a. Distinctive Coding b. Pulse Coding c. Frequency Change Coding d. Discrete Frequency Coding e. Coding By Intensity	Yes Yes Yes Yes Yes
6.2.2.5	FRQUENCY a. Range b. Bandwidth	Yes Yes
6.2.2.6	SIGNAL INTENSITY a. General b. Comfort c. Maximum Intensity	No-HED 92-2-003 Yes Yes
6.3.2.1	SIGNAL DETECTION a. Signal Intensity	No-HED 92-2-003
6.5.3.1	CHARACTERISTICS AND PROBLEMS OF LIGHT INDICATORS a. ...Unambiguous Sensing...	No-HED 92-2-004

NOTES

1. Glare was noted on the curved surfaces of some vertical VX 252 indicators and plexiglass paper guides within several chart recorders. Although visible, the glare did not interfere with the operator's ability to read the engineering units, scale markings, or the association of pointer position with operating color bands when viewed from the normal viewing positions.
2. The control room utilizes two carpet patterns, a striped center area and a solid blue border adjacent to the boards to depict the floor area where only licensed operators are permitted. The striped carpet met the reflectance guideline, but the solid blue did not. This minor variance is offset by the effectiveness of the blue boundary and the contrasting high reflectance of the surrounding control board sand-tan color.
3. HSP evaluated per MIL-STD-1472C.