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SUBJECT: Submits results of final control room surveys per Section 6.1.3.2 of CRDR final summary rept.

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NOTES: Application for permit renewal filed. 05000400

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United States Nuclear Regulatory Commission
ATTENTION: Document Control Desk
Washington, DC 20555

SHEARON HARRIS NUCLEAR POWER PLANT
UNIT NO. 1 - DOCKET NO. 50-400
CONTROL ROOM DESIGN REVIEW - FINAL CONTROL ROOM SURVEYS

REFERENCE: CP&L Letter from Mr. S. R. Zimmerman to Mr. H. R. Denton (NRR),
dated September 29, 1986, Serial: NLS-86-373

Gentlemen:

Carolina Power & Light Company hereby submits the results of the final Control Room surveys as committed by Section 6.1.3.2 of the Shearon Harris Nuclear Power Plant Control Room Design Review (CRDR) Final Summary Report. The four Control Room surveys consist of the following:

- Ambient Noise
- Communications
- Illumination
- Control Room Environment (HVAC)

Due to construction activities in the Control Room, these surveys could not be conducted during the CRDR assessment/reassessment phase. Per discussions with Dr. S. N. Saba (NRR), preliminary surveys of these items were conducted as an interim measure to ensure that no gross inadequacies existed until the surveys could be conducted under normal plant operating conditions. The preliminary surveys were completed with no substantial inadequacies found and the results were submitted by the referenced letter.

As committed, Control Room surveys have been performed under normal plant operating conditions. The results of the final Control Room surveys are provided as an attachment. The survey results indicate that no significant discrepancies with the NUREG-0700 guidelines exist. We, therefore, consider the SHNPP License Condition 2.C(6) to be closed.

Should you have any questions with regard to this issue, please contact Mr. Arnold Schmich at (919) 836-8759.

Yours very truly,

L. J. Loflin
Manager

Nuclear Licensing Section

AWS/lah (5464AWS)

Attachment

cc: Mr. W. H. Bradford
Mr. B. C. Buckley
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Attachment to NLS-88-226
Final Control Room Surveys

- Ambient Noise
- Communications
- Illumination
- Control Room Environment

Final Ambient Noise Survey for SHNPP-1 Control Room

Introduction:

The ambient noise survey addressed the listening environment, the sound level of annunciator horns and warning systems, and the operators' comments on their ability to communicate in the control room. Sound level readings were also taken for the control room alarms.

The survey consisted of sound level readings taken at seven locations in the control room during a normal day shift. At each of the seven locations, sound level readings were taken on a wide band, dB(A) scale and for one octave bands centered at the following frequencies: 31.5 Hz, 63 Hz, 125 Hz, 250 Hz, 500 Hz, 1 KHz, 2 KHz, 4 KHz, 8 KHz, and 16 KHz. Readings for the fire alarm, annunciator alarm, first out panel alarm, cooling tower makeup panel alarm, and the paging system were taken for the wide band, dB(A) scale only.

Results:

The NUREG-0700 guideline for ambient noise recommends that background noise in the control room not exceed 65 dB(A) and for auditory signals to not exceed 90 dB(A).

- a. Sound level readings were below the recommended background noise level of 65 dB(A) on the wide band dB(A) scale and all other frequencies. Four locations, one along the auxiliary equipment panel, one along the generator relay panel, one at the senior reactor operator's desk, and one along the seismic monitoring panel showed sound level reading at 31.5 Hz of 72 to 79 dB(A).
- b. Sound level readings for the paging system were recorded at 70 dB(A), 74 to 76 dB(A) for the cooling tower makeup panel alarm, 84 to 87 dB(A) for the first out panel alarm, 78 dB(A) for the fire alarm, and 67 to 71 dB(A) for the annunciator alarms.

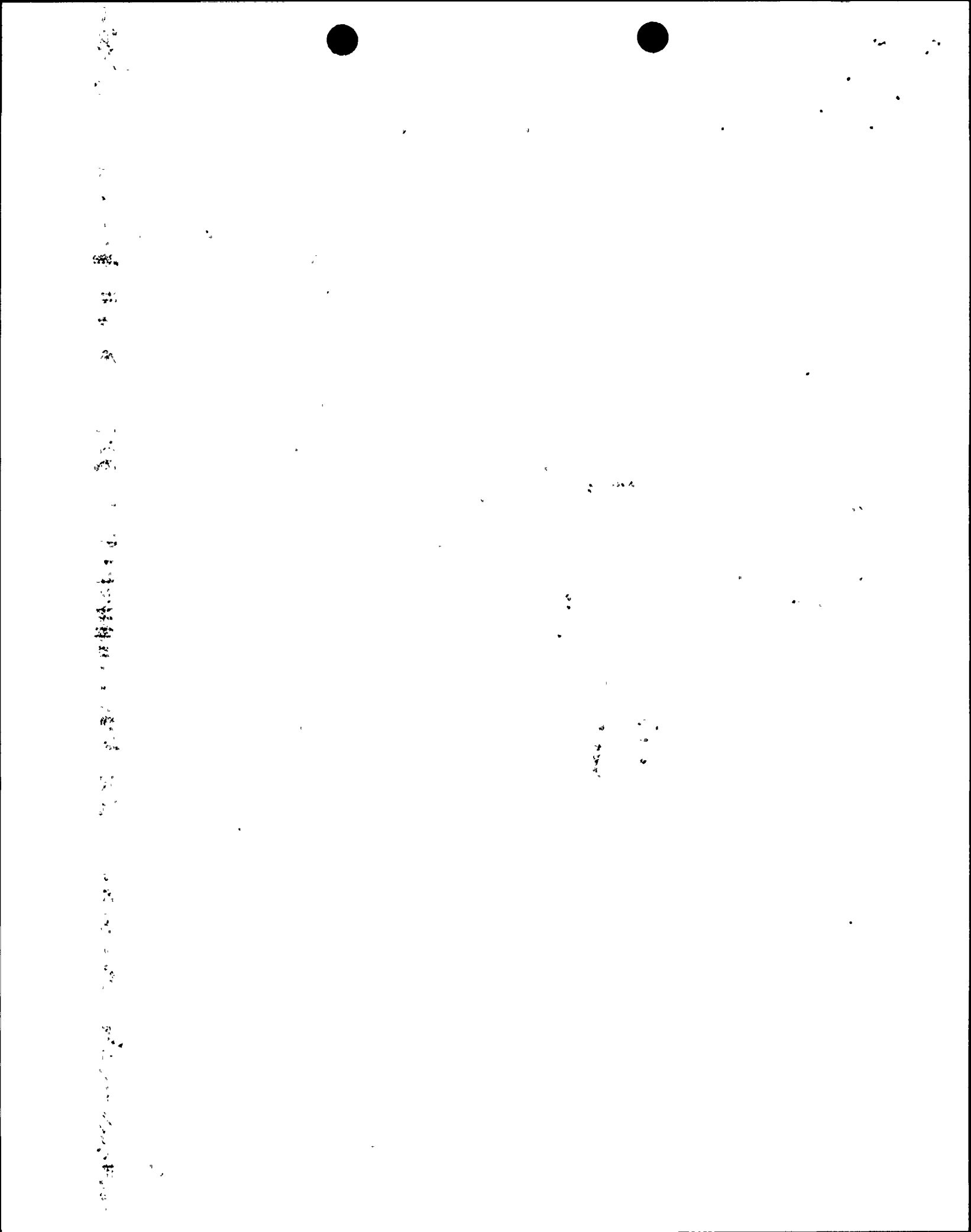
Conclusion:

The background noise in the control room was recorded between 55 to 63 dB(A), which complies with the recommended criteria. The sound level readings at the four locations above criteria at 31.5 Hz does not create problems in the control room. These deviations are well below the frequencies (500 to 4,000 Hz) where communication might be degraded or interfered with, therefore no further action is required.

The sound level readings for the control room paging system and alarms were recorded between 67 to 87 dB(A) which is below the maximum criteria of 90 dB(A), therefore no further action is required.

Please note that these survey results resolve the final dispositions for the following HEDs:

1. HED Number 3100-0203 (A17-8)
Title - Excess feedback and volume interferences with alarms and messages to and from the control room
2. HED Number 31F8-2120 (A17-18)
Title - Cooling tower makeup panel alarm too loud.



Final Communications Survey for SHNPP-1 Control Room

Introduction:

The final communications survey addressed the operators' ability to communicate throughout the control room and in the plant. The PA system, the walkie-talkie system, the sound-powered phone system, and the conventional phone system were evaluated.

The communication survey was conducted using the communications task plan and by questioning the control room operators about the systems.

Results:

- a. The problems identified with the phone system in the preliminary communications survey have been resolved with the installation of new telephones. Phone lines ring on each phone regardless of whether the extension button is pushed in. The phone push buttons work well and no longer result in a break in connection when a line is put on hold. A phone has been put on each desk so it is easy to hear the phones ring and to determine which phone is ringing. The PA system which is accessed through the telephones has control of volume. Two push buttons on the phone are high volume page lines reserved for emergencies. For normal communications on the paging system, the operator dials 11 or 12. Sound level readings taken in the control room with incoming PA announcements were 70 to 73 dB(A).
- b. The operators reported the only problem that currently exists with the telephone system is the reduced volume and extensive background noise present on the phones.

Conclusions:

The conventional phone system problems identified in the preliminary survey were verified to have been corrected. Trouble tickets will be written to have the phone lines repaired.

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Final Illumination Survey for SHNPP-1 Control Room

Introduction:

The illumination survey addressed the illumination levels throughout the control room. Illumination levels were taken at various key locations at the control panels and operator work stations under normal and emergency lighting conditions.

Results:

The NUREG-0700 guidelines for illuminance vary depending on the work area. Most areas, including the primary and auxiliary operating panels, specify a range of from 20-50 footcandles (ftC) with a recommended level of 30 ftC. The guidelines reduce the minimum for emergency lighting to 10 ftC.

- a. Values for normal lighting on the benchboard range from 22 to 42 ftC. These values are lower than the values reported in the preliminary survey, which ranged from 61 to 103 ftC.
- b. Values for the main control board vertical panels range from 26 to 53 ftC, with the highest reading taken where the A and B panels meet the C panel. These values are consistent with the values reported in the preliminary survey, which ranged from 36 to 53 ftC.
- c. Under emergency lighting the benchboard values range from 14 to 28 ftC. The vertical panel values range from 19 to 39 ftC. These values are lower than the values reported in the preliminary survey for the benchboard, which ranged from 30 to 65 ftC. The final survey values for the vertical panels are consistent with the values reported in the preliminary survey, which ranged from 21 to 35 ftC.
- d. The Control Room back panels range from 14 to 38 ftC under normal lighting. This drops to 10 to 30 ftC under emergency lighting. These values are consistent with the values reported in the preliminary survey which ranged from 20 to 33 ftC under normal lighting and 9 to 21 ftC under emergency lighting.
- e. Computer work stations have a screen illuminance range of 18 to 28 ftC under normal lighting. The range drops to 10 to 16 ftC under emergency lighting. For the keyboards, the illuminance level ranges from 17 to 24 ftC for normal lighting and 14 to 20 ftC for emergency lighting. These values are lower than the values reported in the preliminary survey, which ranged from 25 to 50 ftC under normal lighting and 14 to 37 ftC under emergency lighting for screen illuminance. For keyboards, the values reported in the preliminary survey ranged from 45 to 65 for normal lighting and 25 to 43 ftC for emergency lighting.
- f. The NUREG-0700 guidelines for seated work stations where reading and writing will be done specify 50 to 100 ftC with a recommended level of 75 ftC. The recommended minimum drops to 10 ftC under emergency lighting conditions. Under normal lighting conditions, the desks have a range of illuminance of 38 to 52 ftC. This drops to 15 to 36 ftC under emergency

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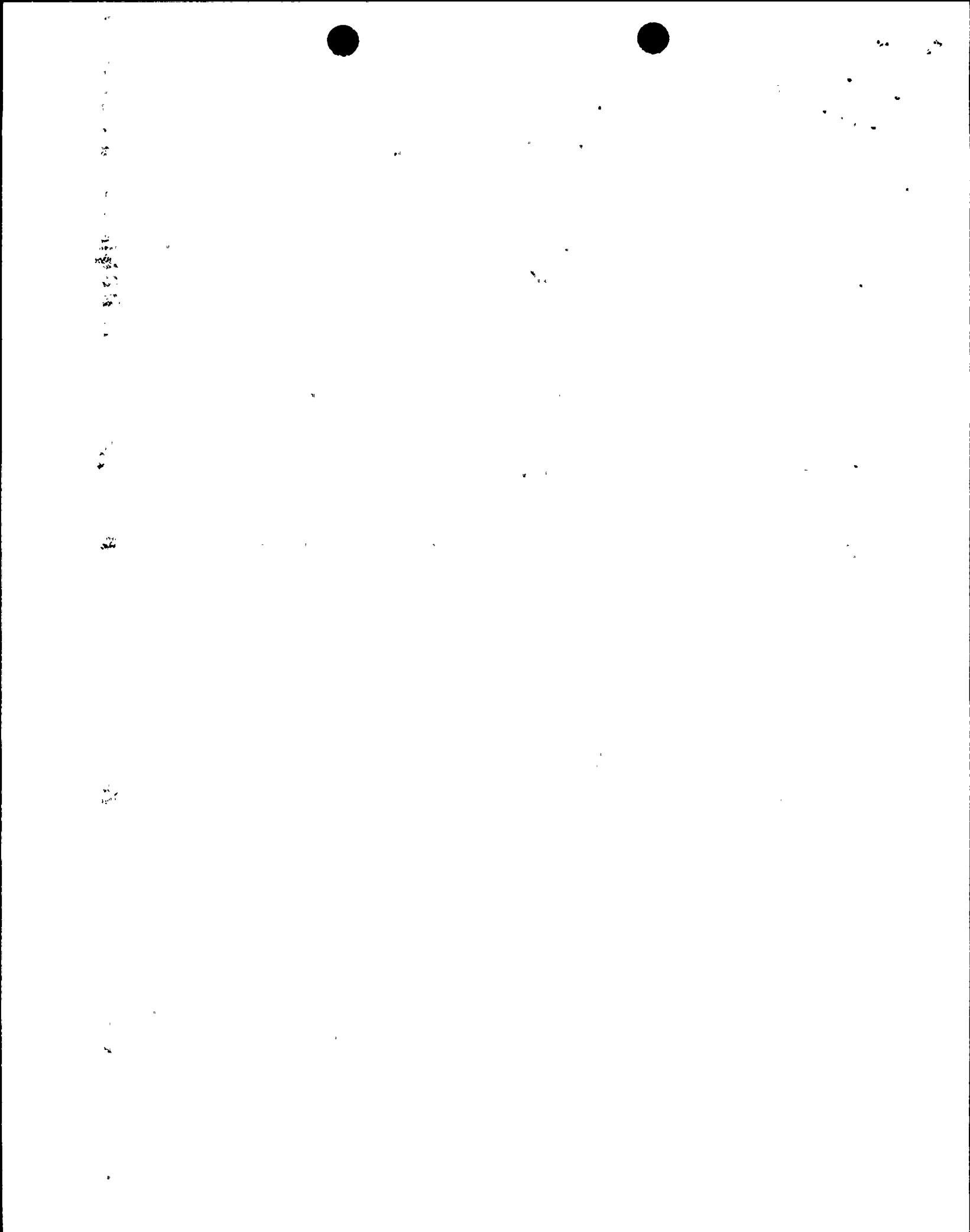
lighting. These values are lower than the values reported in the preliminary survey, which ranged from 57 to 85 ftC under normal lighting conditions and 40 to 55 ftC under emergency lighting.

- g. Operators reported that they had no problems with glare affecting the reading of indicators/labels. Some glare was observed on the main control board CRTs, but at a reduced level from the preliminary survey.

Conclusion:

The majority of the light levels taken during the final illumination survey are lower than the readings taken during the preliminary survey. This is due primarily to the installation of dark-colored carpeting on the floors (the original flooring was an off-white waxed linoleum) and new control room furniture that has a flat matte finish on the desk surfaces. The current light levels are within the recommended criteria with two locations exceeding 50 ftC by 2 and 3 ftC. Several locations were below the minimum recommended illumination of 20 ftC. Human factors believes the differences to not be significant. The operators reported no problems with the current levels, therefore it was determined no further action is required.

The light levels for emergency lighting are within criteria with just two locations at 10 ftC, the minimum acceptable level. The other levels exceed 10 ftC. The operators reported no difficulty with the emergency lighting levels and had no problems reading labels or indicators. No further action is therefore required.



**Final Heating, Ventilation, and Air Conditioning
Survey for SHNPP-1 Control Room**

Introduction:

The final HVAC survey addressed operator comments concerning the temperature and humidity levels in the control room. Hot/cold spots, drafts, and system reliability were assessed. Additionally, the post-operational test of the control room HVAC has been completed and demonstrates that the system meets design temperature and humidity levels.

Results:

Operators were questioned to determine if there were any problems with the HVAC in the control room. No problems were reported and no drafts or hot/cold spots were observed.

Conclusions:

The operators report that after initial adjustments were made to regulate the control room temperature the control room environment has been comfortable. They have no problems with the temperature and humidity levels, therefore no further action is required.



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