

# TENNESSEE VALLEY AUTHORITY

CHATTANOOGA, TENNESSEE 37401  
400 Chestnut Street Tower II

February 28, 1985

Director of Nuclear Reactor Regulation  
Attention: Ms. E. Adensam, Chief  
Licensing Branch No. 4  
Division of Licensing  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555

Dear Ms. Adensam:

In the Matter of the Application of ) Docket Nos. 50-390  
Tennessee Valley Authority 50-391

On December 4, 1984, TVA and NRC representatives met to discuss the Detailed Control Room Design Reviews (DCRDR) being performed for all TVA nuclear facilities. The meeting primarily focused on the efforts being taken at the Watts Bar Nuclear Plant to resolve human factors concerns.

As a result of the December 4, 1984 meeting, TVA committed to the following: (1) to issue a nonconformance report to determine the cause of the presence of inaccurate information in the commitment tracking record (CTR) system; (2) to identify those modifications taken or to be taken in resolution of the deficiencies listed in Appendix D "Evaluation of the Applicant's Control Room Design" of the Watts Bar Safety Evaluation Report (SER) (NUREG-0847), and (3) to verify the completion of the Appendix D modifications by fuel load through the use of the DCRDR team.

Accordingly, the following actions have been taken. TVA has issued a nonconformance report on the CTR system (NCR WBN NEB 8419, WBRD-50-390/85-02, WBRD-50-391/85-01). This nonconformance was found to be reportable under 10 CFR 50.55(e) and a final report was submitted to NRC Region II on February 1, 1985. A final status listing of the modifications derived from the Appendix D deficiencies has been completed with associated corrective measures being identified for each deficiency (see enclosure 1). Please note that this final status list supersedes all previous such listings submitted to the NRC Staff. The corrective measures identified in enclosure 1 have been verified by the DCRDR team.

In addition, enclosure 2 is being provided to assist the NRC resident inspectors at Watts Bar in the closure of human factors concerns identified separately by TVA. The subject enclosure is part of an internal TVA document and as such references various internal TVA documents by their unique document identifiers. These references are available at the site and will be provided to the resident inspectors as required. Please note that item HFC 079 of enclosure 2 has been completed to provide dual scales; however, field change request (FCR) NP-688 has been issued to correct a deficiency in the magnitude of the range. This will be completed before fuel load.

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Director of Nuclear Reactor Regulation

February 28, 1985

If you have any questions concerning this matter, please get in touch with K. Mali at FTS 858-2682.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

*D. L. Lambert*

D. L. Lambert  
Nuclear Engineer

Sworn to and subscribed before me  
this 28<sup>th</sup> day of Feb 1985.

*Bryant M. Lowery*  
Notary Public

My Commission Expires 4/8/86

Enclosures (2)

cc: U.S. Nuclear Regulatory Commission (Enclosures)  
Region II  
Attn: Dr. J. Nelson Grace, Regional Administrator  
101 Marietta Street, NW, Suite 2900  
Atlanta, Georgia 30323

ENCLOSURE 1  
APPENDIX D ITEMS

ENCLOSURE 1  
WATTS BAR SAFETY EVALUATION REPORT (SER) (NUREG-0847)  
APPENDIX D

This section contains a description of those deficiencies identified in Appendix D of the Watts Bar SER. Following each deficiency (or following several related deficiencies) is a statement of the TVA corrective action.

1.0 CONTROL ROOM WORKSPACE

1.1 Several problems exist with regard to emergency equipment protective clothing:

- Donning is difficult.
- Changing air tanks is a two-person operation.
- With the 5-minute warning bell, there is perhaps too little time to change.
- The mask virtually prohibits the wearer from speaking to anyone.
- Too many steps are necessary to don gear.

TVA Corrective Action(s)

All operations personnel are trained annually in the proper donning and use of breathing apparatus (BAT-1 of AI-10.1). The training includes the cooperative changeout of air bottles as they are depleted. The training for operators not included on the plant fire brigade will be completed by March 1, 1985. All brigade members (ASEs and AUOs) are currently trained.

The breathing apparatus training includes the use of communication devices which amplify speech inside the facepiece and an adequate supply of such devices are located inside the control room for use with the stored breathing apparatus.

TVA has evaluated and selected a communications device which will enable the operators to communicate more effectively when wearing the emergency breathing apparatus.

The conversational speaker microphone device is designed to allow two or more persons, wearing face masks and working in the same general area, to carry on normal conversation.

After a person is fitted with a face mask, the microphone mask mounting device can be stuck to the outside of the mask by removing the adhesive backing and pressing it onto the surface area of the mask. The microphone can then be inserted into the mounting device and plugged into the speaker unit. The vibration pickup microphone reproduces the voice behind the mask clearly, and it is then amplified through the speaker unit. The volume control on the speaker unit can be adjusted for the desired level depending on ambient noise in the work area. The

speaker unit can be clipped to the belt or fastened to other parts of the clothing.

This speaker microphone device is powered by a rechargeable battery and can be used for a normal working day without requiring a recharge. The device is moisture resistant and can be easily cleaned. As there is no wiring entering the face mask, its integrity is maintained throughout the duration of any work operation. This device is now being used successfully at TVA's Sequoyah Nuclear Plant (SQN).

- 1.2 There are no labels on the six area sound-powered jacks to identify the area to which they are hard wired.

TVA Corrective Action(s)

Nameplates have been added on sound-powered jacks SP1-SP6 to identify the system operating instruction (SOI) for operator use. To identify the many areas to which each jack is hard wired would require an excessively large nameplate at each jack location. The intent of Appendix D is met by the availability of SOI 100.

- 1.3 No headsets are located on any of the back cabinets.

TVA Corrective Action(s)

All sound-powered jacks SP1-SP6 in the unit 1 side of the main control room (MCR) have a permanent hanger with a headset located near them.

Reference: Engineering change notice (ECN) 3265 and drawing 47A348-250R0.

- 1.4 Distance and noise interfere with voice communication between the unit 1 control room operator at the panels and the operator at the common panels. The problem is particularly acute when a breathing apparatus is worn by both.

TVA Corrective Action(s)

Carpet has been installed (ECN 3343) and the radiation monitoring cabinet has been moved outside the horseshoe area. Additional noise measurements will be submitted 120 days after fuel loading in accordance with TVA's revised commitment submitted by letter dated July 27, 1983.

2.0 WORKSPACE ENVIRONMENT

- 2.1 The control room lighting design appears to be for general illumination purposes and not specifically for effective man/machine interface. (See items 2.4 and 2.7.)
- 2.2 The plastic prismatic luminous ceiling diffusers minimize indirect glare throughout the control room, but they contribute to direct glare on panel meters, records, printers, and polished surfaces. (See item 2.4.)

2.3 The standby lighting illumination level is too low for optimum reading of displays. (See item 2.4.)

2.4 The ratio of luminosity (background luminous ceiling and the green painted metal reading surface of panels/consols), 140-ft lamberts/ 18-ft lamberts, is 8/1. This ratio is three times the recommended standard.

TVA Corrective Action(s)

TVA control room lighting is divided into three categories: normal, standby, and emergency. The normal lighting system is powered by offsite ac power. The present normal control room lighting consists of a spare luminous ceiling that provides general illumination to the control panels, walkways, and so forth.

The emergency lighting system is powered by the 125V vital batteries and functions on the loss of all ac power. It activates before operator action is required and operates until the diesel generators start and the standby lighting system is energized. (See response to item 2.7 below for further information.)

Based on the results of a preliminary control room review, lighting glare is not a problem.

A luminosity ratio of below 8/1 is recommended in a TVA control room. This ratio is acceptable for luminaire versus the surfaces adjacent to them, according to the NRC guidance provided in NUREG-0700, "Guidelines for Control Room Design Reviews," September 1981. However, it is not an acceptable ratio for a task area versus adjacent lighter surroundings. (See chronological list of tasks in item 2.7.)

Photographs of main and auxiliary control room panels have been transmitted to NRC by letter dated January 9, 1985.

2.7 DC emergency lighting incandescent lamps are not located for optimum reading of displays.

TVA Corrective Action(s)

The dc emergency lighting system has been tested and found to provide 1 footcandle of light from one train of emergency lighting and 3 footcandles of light from both trains of emergency lighting in designated areas of the control room (1-M-1, 2-M-1, O-M-26, i.e. those areas requiring control or monitoring in the event of loss of all ac power). The system is designed to provide the above light levels for a period of 2 hours as the vital battery voltage decays to 105V. The light level readings were taken parallel to the face of the board or working surface. Recently several light fixtures were added to the system, a number of light fixtures were relocated, and the wattage of some of the incandescent bulbs was increased to ensure that the 1- and

3-footcandle requirement could be met as documented in the 125V dc emergency lighting preoperational test (TVA-36).

The following is a chronological listing of tasks intended to improve the MCR lighting:

Before the MCR luminous ceiling panels were replaced (for fire protection purposes), the lighting levels in the MCR were more than adequate to meet the design goals of NUREG-0700. After the ceiling panels were replaced, TVA performed a preliminary lighting survey. Illumination measurements were made for the normal, standby, and emergency lighting systems. The preliminary lighting data was recorded throughout the MCR at safety-related, non-safety-related, and back row panels. The data was near or below the minimum values specified in NUREG-0700. This was due to the increased opacity of the new fireproof ceiling system, an abnormal amount of accumulated dusts on the ceiling panels from ongoing construction, and installed fluorescent lamps of mixed tube types. A retesting of a selected area of the MCR with the ceiling panels cleaned and relamped light fixtures showed that the normal lighting levels would be increased above the recommended levels specified in NUREG-0700 for most areas.

Therefore, TVA does not anticipate any problems in meeting the minimum illumination level for the lighting systems at safety-related panels.

A summary of the results of the preliminary lighting survey was transmitted to NRC on September 29, 1983.

Modifications to the 125V dc emergency lighting systems to upgrade illumination levels at safety-related panels to meet preoperational test (TVA-36) requirements were accomplished under ECN 4455.

Photometric measurement data on the normal, standby, and emergency lighting modes taken in August of 1984 show that the normal light levels increased approximately 100 percent from the preliminary lighting survey data taken in June 1983 and in most cases for critical locations, meets or exceeds the minimum illumination levels as specified in Electrical Design Standard DS-E17.1.1, which is based on illumination levels from the IES Lighting Handbook for critical locations. This improvement was due to relamping with the proper type fluorescent lamp (F40WW) and after cleaning the suspended ceiling. The standby lighting levels increased approximately 80 percent from the preliminary survey.

The 125V-dc emergency lighting levels are less than the specified 3 footcandle minimum at the end of the two-hour discharge period (minimum battery voltage) and further modifications have been accomplished. Installing high lumen output incandescent lamps rated for 120V have increased the illumination level at reduced voltage.

The following modifications have been made to the emergency lighting system on field change request (FCR) No. A-877.

1. Increase the lamp wattage of one train A and one train B emergency light at panel 1-M-1 from 150 watts to 300 watts.
2. Increase the lamp wattage of one train A and one train B emergency light at the right side of panel 2-M-1 from 150 watts to 300 watts.
3. Add an additional emergency lighting fixture with a 300-watt lamp at the center of panel O-M-26.
4. Replace the 130V rated incandescent lamps in the 125V dc emergency lighting system with 120V rated lamps having the highest lumen output available.

A mini-task analysis report on standby and emergency lighting was documented with the objective of determining whether the reactor operators (ROs) and senior reactor operators (SROs) can perform their assigned MCR job functions under substandard and marginal DC emergency lighting conditions. After conducting the subject task analysis, the following conclusions have been made:

- ROs can read meter scales and labels on controls at critical panels even though the emergency DC lighting levels are less than 3.0 footcandles.
- Emergency operating procedures, black lettering on yellow paper, can be read by the RO under DC emergency lighting.
- The only marginal human factors conditions found was that color rendition of blue, green, and red pen recordings on gray chart paper is difficult to decipher under low level illumination.
- Panels 1-M-1, 2-M-1 (generator and auxiliary power), and O-M-26 (diesel generator control) are critical in the event of the loss of all ac power.
- The readability of fine graduations on the containment pressure meter, panel 1-M-6 (engineered safeguards and auxiliary systems) and the recorder pen tracings are marginal.

The final lighting survey was conducted June 21, 1984, for normal and standby and August 15, 1984, for emergency. Luminance measurements for normal will be taken in conjunction with the detailed control room design review. The results of these surveys and any changes will be included in the submittal of the control room design review summary report and implementation plan.

### 3.0 ANNUNCIATORS

- 3.1 The auditory alarms that were functional were barely detectable above the ambient background noise.

TVA Corrective Action(s)

Because the alarms have been partially disabled during construction, it is possible that they are at times difficult to hear during construction activities. However, all annunciator alarms will be operational before fuel load. Also efforts are underway to reduce the background noise level (such as installing carpet, and relocating the radiation monitoring equipment) before fuel load. (See item 1.4)

- 3.2 The poor organization of many annunciator tiles makes them difficult to locate in the SOI. No cross references are provided.

TVA Corrective Action(s)

A window numbering scheme was devised and implemented in the MCR to aid the operator. (See item 8.7.) The only exception to this is XA-55-30, which is located on M-30. Reference: ECN 3264 and drawing 47B601-55-100R0.

- 3.3 Alarms are not prioritized.

TVA Corrective Action(s)

High-priority alarm windows have been color coded red to distinguish them from all non-emergency alarms. Reference: ECN 3513 and the 47B601-55 series of annunciator drawings. The only exception to this is XA-55-30, which is located on M-30 (windows 10 and 11 on XA-55-12A and -12D, respectively, were deleted on R3 and R6, respectively, by ECN 3744).

The following list indicates by annunciator the windows which were prioritized by red color coding:

XA-55-1A: Windows 1, 2, 7, 10, 16, 17, 21, 22, 23, 24, & 26  
XA-55-1B: Windows 8-13, 18, 21, 22, 23, 26, 27, 31, & 32  
1-XA-55-1C: Windows 3, 7, 14, 21, 23, 24, 28, 33, & 35  
XA-55-12A: Windows 1, 3, 5, 7, 8, 10, 12, 15, 17, 19, 21, 22, 24, 26, 29, 31, 33, & 35  
XA-55-12B: Windows 1, 2, 4, 6, 8, 10, 13, 15, 17, 18, 19, 21, 25, & 26  
XA-55-12D: Windows 1, 2, 4, 6, 8, 9, 11, 13, 16, 18, 20, 23, 25, 27, 29, 31, 33, & 35  
XA-55-27A: Windows 3, 10, 15, 20, 22, & 27  
XA-55-26A: Windows 1, 2, 3, 4, 10, 11, 12, 15, 17, 18, 20, 21, 23, 24, 27, 33, & 34  
XA-55-26B: Windows 1, 2, 3, 4, 10, 11, 12, 15, 17, 18, 20, 21, 23, 24, 27, 33, & 34  
XA-55-26C: Windows 1, 2, 3, 4, 10, 11, 12, 15, 17, 18, 20, 21, 23, 24, 27, 33, & 34  
XA-55-26D: Windows 1, 2, 3, 4, 10, 11, 12, 15, 17, 18, 20, 21, 23, 24, 27, 33, & 34  
XA-55-27B-A: Windows 25, 29, 37, & 48  
XA-55-27B-B: Window 17

XA-55-27B-C: Windows 46, 32, & 43  
 XA-55-2A: Windows 5, 6, 7, 8, 10, 15, 22, 23, 24, 25, 28, 32, & 35  
 XA-55-2C: Windows 14, 20, 27, & 35  
 XA-55-3A: Windows 6, 7, 12, 13, 14, 20, 21, 33, 34, & 35  
 XA-55-3B: Windows 1, 8, 12, 13, 25, 26, 27, & 29  
 XA-55-3C: Windows 3, 4, 6, 10, 11, 12, 13, 16, 17, 18, 19, 20, 21, 23,  
 24, 25, 26, 27, 31, 32, 33, & 34  
 XA-55-4B: Windows 6, 14, 8, & 24  
 XA-55-5A: Windows 4, 7, 14, 22, 23, & 30  
 XA-55-5B: Windows 3, 5, 10, 12, 19, 24, 26, 29, 30, 31, & 32  
 XA-55-5C: Windows 10, 11, 13, 19, 20, 26, & 27  
 XA-55-6A: Windows 2, 5, 8, 9, 10, 12, 15, 16, 19, 22, 23, 24, 26, 30,  
 31, 32, & 33  
 XA-55-6B: All windows except 29-35  
 XA-55-6C: Window 33  
 XA-55-6D: Windows 7, 14, 17, 21, 28, 29, 30, & 35  
 XA-55-6E: Windows 15, 16, 20, 22, 23, 28, 29, 30, and 35  
 1-XA-55-15A: Windows 12, 14, 19, 21, 26, & 33  
 1-XA-55-15B: Windows 4, 11, 22, 24, 29, & 30  
 XA-55-L4A: Windows 1, 2, 3, 4, 8, 9, 10, 11, 13, 14, 17, 18, 23, 24,  
 25, 28, 31, 32, & 33  
 XA-55-L4B: Windows 1, 2, 3, 4, 8, 9, 10, 11, 13, 14, 17, 18, 23, 24,  
 25, 28, 31, 32, & 33  
 XA-55-L4C: Windows 1, 2, 3, 4, 8, 9, 10, 11, 13, 14, 17, 18, 23, 24,  
 25, 28, 31, 32, & 33  
 XA-55-L4D: Windows 1, 2, 3, 4, 8, 9, 10, 11, 13, 14, 17, 18, 23, 24,  
 25, 28, 31, 32, & 33

3.4 The contrast between illuminated and nonilluminated tiles is too high.

TVA Corrective Action(s)

Contrast of annunciator windows was improved by painting the internal reflective surfaces with high reflective white paint. (See item 8.7.)

3.5 The poor relationship between the acknowledge-reset controls and their associated annunciator displays could result in the incorrect acknowledgment of an alarm. (See item 3.6).

3.6 Location of acknowledge-reset controls is not standardized on each panel.

TVA Corrective Action(s)

Yellow striping (demarcation) was placed around each annunciator acknowledge reset switch on an annunciator system basis and a note to that effect was put on each drawing per FCR E-3594. All annunciator switches in the horseshoe area have been located midway up and to the left side of each panel. Panel M-4 has two annunciator switches located to the left and right sides of the panel (reference: ECN 2604 and drawings 47W605-4 R4 and R8, 47W605-6 R4 and R10, 47W605-8 R8 and R12, 47W605-10 R6 and R13, 47W605-13 R4 and R6, 47W605-14 R8 and R11). These

drawings cover the arcuation of yellow striping around the annunciator switches within the horseshoe area and as will be noted from these drawings, they are all located in a similar fashion on each panel. An exception to the above is XA-55-30 which is a qualified assembly with built in acknowledge and reset switches.

The vertical board, being somewhat different than panels within the horseshoe, could not have their acknowledge controls to "mid-left" as was done in the latter. To have done so would, in several instances, put handswitches away from their associated indicators making control more difficult. ECN 2604 and FCR E-3594 which affected the horseshoe panels also affected the vertical boards. Reference: drawings 47W605-19R4, R7, & R9, 47W605-21R15, 47W605-25R7 & R8, 47W605-28R9 & R11 and 47W605-30R12.

- 3.7 Replacement of annunciator bulbs frequently subject the operator to a shock.

TVA Corrective Action(s)

An insulating shield has been placed over the buss contacts next to the holdown screws inside each annunciator panel. This guards the operator from a shock hazard. The fuses on the status monitor light panels are removed before changing burned out bulbs so a similar shock hazard does not exist.

4.0 CONTROLS

- 4.1, The location of some controls disregards the capabilities of the fifth percentile person.

TVA Corrective Action(s)

The present system can accommodate a fifth percentile female even though some operator movement may be required to accomplish tasks involving controls located on the vertical portion of panels M-1 through M-6. The addition of a guard rail along the edge of the horizontal portion of the control board will preclude accidental actuation of controls.

Guard rails were added to the horseshoe area panels. Reference: ECN 3265 and drawings 47W605-3 R9 and 47A348-249 R0 and R1

- 4.2 Labeling on many valve controllers does not consistently or clearly associate direction of movement with resulting action. A clockwise movement does not always result in opening the valve.

TVA Corrective Action(s)

Directional arrows for forward and reverse acting controllers were added. (See list below.) Reference: ECN 3270 and drawing 47W605-39R0 and R4. Also, FCR A-912 for R5 of the drawing:

<u>Panel</u>	<u>Controller</u>	<u>Arrow</u>	<u>Direction</u>
M-5	HIC-62-56A		LEFT
M-5	HIC-62-89A		LEFT
M-6	HIC-62-237		LEFT
M-6	HIC-62-241		LEFT
M-6	HIC-62-83A		LEFT
M-6	HIC-63-65A		LEFT
M-6	HIC-74-16A		RIGHT
M-6	HIC-74-32A		RIGHT
M-6	HIC-74-28A		RIGHT

- 4.3 Controls located near the front edges of sloping consoles create a potential for inadvertent actuation, if they are not guarded.

TVA Corrective Action(s)

Guard rails were added to the horseshoe area panels. Reference: ECN 3265 and drawings 47W605-3 R9 and 47A348-249 R0.

- 4.4 Direction of control movement on "Trip" controllers is not standardized.

TVA Corrective Action(s)

The switch on panel 1-M-4 follows the convention "Trip" to right, "Close" to left. The controller on panel 1-M-6 "Trips" to the right; movement to the left is not used and is blocked from movement.

The "reset" function labeling on RT-2 located on M-6 was deleted. Reference: FCR E-3517 and drawing 47W605-17 R9.

- 4.5 The reactor trip-reset controller on panel 1-M-6 is incorrectly labeled. The controller functions only as a trip control.

TVA Corrective Action(s)

It has been relabeled as trip only (see item 4.4).

- 4.6 Specific control handles were not easily distinguishable when they were in a bank of controls (such as a string of five with one different).

TVA Corrective Action(s)

This has been corrected by the addition of functional nameplates and demarcation lines. (See Attachment No. 2.)

- 4.7 Valve control handles which must be held for many seconds are difficult to hold.

TVA Corrective Action(s)

Most of the valve control circuits have seal-in features which automatically drive the valves to the desired position after momentary actuation of the control switch. Some valve control circuits intentionally do not have such a feature, but in such cases complete valve travel is generally accomplished within 5 seconds. This feature will be noted by additional coding.

"Hold to operate" tags were added to valve control switches that needed that description and a table of affected devices was added. (See list below.) Reference: ECN 3435 and drawing 47W605-39 R1.

<u>Panel No.</u>	<u>Switches Tagged</u>
M-2	HS-47-190
M-2	HS-47-191
M-2	HS-47-180
M-2	HS-47-181
M-3	HS-46-13A
M-3	HS-46-40A
M-3	HS-46-56A
M-4	HS-1-7/181)
M-4	HS-1-14/182) Moved to M3 per
M-4	HS-1-25/183) 47W605-39 R3
M-4	HS-1-32/184)
M-5	HS-87-17D
M-6	HS-62-138A
M-6	HS-62-72A
M-6	HS-62-73A
M-6	HS-62-74A
M-6	HS-87-12
M-6	HS-87-13
M-6	HS-87-16
M-6	HS-87-5
M-6	HS-87-15

- 4.8 The function (that is, use of the pull out/in feature) of some J-handle switches is not clearly labeled (see item 4.9).
- 4.9 The meaning of "Pull to ---" labels associated with some "J-handles" is not always clear with regard to their rotary position.

TVA Corrective Action(s)

Operators have been instructed and trained in the uses and functions of all switches. They have not identified any switches in the horseshoe area that are confusing.

- 4.10 There are no protective guards over the emergency "Start" and "Stop" pushbuttons on the diesel generator panel.

TVA Corrective Action(s)

Protective guards are not required because the emergency "Start" and "Stop" switches have raised bezels to prevent inadvertent actuation.

- 4.11 The vertical cabinets along the walkway between units 1 and 2 contain numerous protruding controls which could be inadvertently actuated.

TVA Corrective Action(s)

A red carpet has been installed at the base of the vertical panels to designate an off-limit area to personnel not performing a required task.  
Reference: ECN 3343

5.0 DISPLAYS

- 5.1 Scale divisions and ranges are not always immediately obvious.

TVA Corrective Action(s)

The scales of the following indicators have been color-coded to identify the abnormal operating ranges:

1-M-2 Panel -

0-LI-2-230A	1-EI-6-112
0-LI-2-233A	1-EI-6-117
1-EI-6-191	1-EI-6-122
1-EI-6-197	1-EI-47-50

# 1-M-3 Panel -

1-EI-2-97	1-EI-2-33
1-EI-2-91	1-EI-2-26
1-EI-2-84	1-EI-2-20

1-M-4 Panel -

1-PI-68-301	1-LI-68-320
1-LI-68-300	1-EI-3-200
1-TI-68-309	1-EI-3-119A
1-LI-68-339A	1-EI-3-129A
1-LI-68-335A	

1-M-5 Panel -

1-PI-68-334	1-TI-68-44E
1-PI-68-323	1-TI-68-67E
1-PI-68-322	1-FI-62-1A
1-PI-68-340A	1-PDI-62-8A
1-FI-68-6A	1-FI-62-14A
1-FI-68-6B	1-PDI-62-21A
1-FI-68-6D	1-FI-62-27A
1-FI-68-29A	1-PDI-62-34A
1-FI-68-29B	1-FI-62-40A
1-FI-68-29D	1-PDI-62-47A

1-FI-68-48A  
1-FI-68-48B  
1-FI-68-48D  
1-FI-68-71A  
1-FI-68-71B  
1-FI-68-71D  
1-TI-68-2E  
1-TI-68-25E  
1-M-6 Panel -  
1-PI-62-122  
1-LI-62-129  
1-TI-63-37  
1-LI-63-46  
1-LI-63-49  
1-TI-63-131  
1-TI-63-132  
1-EI-74-5A  
1-EI-74-17A  
1-EI-72-12A  
1-EI-72-26A

1-M-9 Panel -  
1-PDI-30-133

1-M-15 Panel -  
1-EI-27-1  
1-EI-27-2

\* O-M-27A Panel -  
O-EI-67-39A  
O-EI-67-31A  
O-EI-67-35A  
O-EI-67-27A

1-FI-62-93A  
1-EI-68-8A  
1-EI-68-31A  
1-EI-68-50A  
1-EI-68-73A  
1-EI-62-108A  
1-EI-62-104A

1-EI-63-12A  
1-EI-63-16A  
1-LI-63-60  
1-LI-63-81  
1-LI-63-82  
1-LI-63-89  
1-LI-63-99  
1-LI-63-109  
1-LI-63-119  
1-LI-63-129

1-EI-27-7  
1-EI-27-8

O-EI-67-46A  
O-EI-67-54A  
O-EI-67-50A  
O-EI-67-58A

- 5.2 Some meters required for postaccident monitoring are intermixed with other meters (see item 5.3).
- 5.3 All of the postaccident monitor (PAM) displays are labeled with temporary red tape.

#### TVA Corrective Action(s)

PAM instrumentation in the MCR has been uniquely identified to facilitate recognition by the operators. The PAM identification method is black tags with silver lettering. Each tag contains in the upper right-hand corner the PAM symbol, which is a square with an inscribed P1 or P2. A technology has been used so that the tag surface is even or almost even, thus eliminating the possibility of dirt accumulation within the lettering that would reduce contrast and legibility.

Below is a list of instruments that have been tagged with PAM tags:

LI-3-43A  
LI-3-56A  
LI-3-98A  
LI-3-111A  
LI-3-42  
LI-3-39  
LI-3-38  
LI-3-55  
LI-3-52  
LI-3-51  
LI-3-97  
LI-3-94  
LI-3-93  
LI-3-110  
PI-1-2B  
\* PI-1-5  
PI-1-9A  
PI-1-9B  
\* PI-1-12  
PI-1-20A  
PI-1-20B  
LI-3-107  
LI-3-106  
FI-3-163A  
FI-3-155A  
FI-3-147A  
FI-3-170A  
PI-1-2A  
\* PI-1-23  
PI-1-27A  
PI-1-27B  
\* PI-1-30  
LI-68-339A  
LI-68-335A  
LI-68-320  
LI-68-367  
LI-68-368  
LI-68-369  
LI-68-370  
LI-68-371  
LI-68-372  
TI-68-324  
TI-68-319  
TI-68-1  
TI-68-24A  
TI-68-43  
TI-68-65  
TI-68-18  
TI-68-41  
TI-68-60  
TI-68-83  
PI-68-68A

PI-68-69  
LI-62-238  
LI-62-242  
LI-63-50  
LI-63-51  
TI-74-14  
TI-74-25  
LI-63-180  
LI-63-181  
PDI-30-42  
PDI-30-43  
PDI-30-44  
PDI-30-45  
O-LI-77-134  
O-LI-77-135  
FI-67-61  
FI-67-62  
FI-70-159A  
FI-70-165A  
LI-70-63A  
LI-70-99A  
\* TI-70-161  
\* O-TI-70-162  
1-PI-70-24A  
FI-3-163B  
FI-3-155B  
FI-3-147B  
FI-3-170B  
2-PI-70-17A  
\* RI-90-106A  
\* RI-90-106B  
\* RI-90-106B  
\* RI-90-112A  
\* RI-90-112B  
\* RI-90-112C  
\*\* RI-90-271A  
\*\* RI-90-272A  
\*\* RI-90-273A  
\*\* RI-90-274A

\*Presently PAM to be downgraded per ECN 5434.

\*\*Not presently PAM to be upgraded per ECN 5434.

5.4 Displays indicating sequential information are not always located sequentially or grouped together for ease in visual scanning (see item 5.7).

5.5 Meters indicating parameters that must be compared are not grouped for ease in distinguishing similar or different values. (See item 5.7.)

- 5.6 Meters that indicate different parameters look alike have similar scales, and are similarly labeled. Reading errors could result. (See item 5.7.)

TVA Corrective Action(s)

- 5.7 Identification of a specific meter is not always obvious among a string of meters.

These items have been corrected by the addition of functional nameplates and demarcation lines. (See attachment 2.)

- 5.8 Meters labeled "B" left and "A" right violate stereotypical convention.

TVA Corrective Action(s)

On M-2, LI-2-230A and LI-2-233A were swapped to correct the A-B order of convention. Reference 47W605-6 R12 (ECN 5274 for FCR A-962).

On M-3, LI-3-172 and LI-3-174 were swapped to put the four indicators in a 1-2-3-4 fashion. Reference 47W605-8 R11 (ECN 3647) per NCR WBN SWP 8267.

On M-4, six neutron indicators were moved: NI-31B, NI-32B, NI-31D, NI-32D, NI-35B, and NI-36B. Also, swap PIC-3-132A with -122A. Reference: 47W605-10 R6 (ECN 2710).

On M-5, charge pump indicators EI-62-104A and EI-62-108A were swapped physically (ECN 2710) and the designation was also moved. ECN 4981 corrected this. Reference: 47W605-13 R4 and R8.

On M-6, EI-72-12A and EI-72-26A were swapped as was FI-72-13 and FI-72-34. Reference: FCR A-962 for ECN 5274.

- 5.9 The subcooling margin monitor is not installed or on site. Readouts and displays could not be observed.

TVA Corrective Action(s)

A dual scale was added to PI-68-69 to read temperature scaled from 212°F - 695.5°F. Reference: ECN 4135 and drawing 47B601-68-29 R19.

- 5.10 Control position indicator bulbs have single-failure filaments and no lamp-test capabilities (see item 5.11).

- 5.11 A lamp-test capability is provided only for the overhead annunciator panels and status panels.

TVA Corrective Action(s)

The control boards are under constant surveillance by the operators and burned out bulbs are replaced upon detection. Administrative

Instruction AI-2.10 has been revised (in Revision 7) instruct the operators to check for burned out lamps at shift change. (See attached for Appendix B, page 1 of 9).

- 5.12 The valve position indicator on the EH fluid operator's subpanel (1-M-2) is not clear. A green lens indicates "Valve Open."

TVA Corrective Action(s)

This has been corrected by replacing the green lens with a red lens.

- 5.13 In the matrix of indicator lights, failure to achieve a proper system status is often given by a light "off." No check is made during EP for failed lights. This could lead the operator to assume that an operating system has failed.

TVA Corrective Action(s)

This has been corrected by revising the emergency procedures (EOI-0) to instruct the operators to use the lamp test feature on the status monitoring panels to verify that a lamp is not burned out. (See attached E01-OR7, page 2 of 8.)

- 5.14 In the matrix of lights, spares are intermixed with operating lights. Because the operator's task is to determine "all on," "spares off" creates a requirement for the operator to review all lights to ensure that only the spares are off.

TVA Corrective Action(s)

Spare windows in status light boxes have been blacked out. Reference: ECN 3264.

- 5.15 Recorder scales and paper scales are not always compatible.

TVA Corrective Action(s)

Appropriate chart paper has been ordered. However, due to the special scales required for some recorders, we may not receive all the shipments before fuel loading. As each is received it will be promptly installed in the recorder with all recorders having correct scaled paper by initial criticality.

- 5.16 Labels indicating the color code of pens are not always compatible with the color of the pen trace indicating that parameter.

TVA Corrective Action(s)

Special tags were made to indicate pen numbers and color code. (See description and list below.)

SAFETY INJECTIONIII. IMMEDIATE ACTIONS

NOTES: o IF auto actions do NOT occur, THEN they must be initiated manually or locally to ensure at least one train of the system's auto actions.

o IF the reactor does NOT trip, THEN the reactor must be tripped by other means. (See EOI-13, ATWS, if needed.)

A. VERIFY THE FOLLOWING AUTO ACTIONS AND SYSTEM STATUS:1. Verify Reactor Trip

a. All rods - FULLY INSERTED

2. Verify Turbine Trip

a. Turbine stop valves - CLOSED

3. Verify Electrical Buses Energized

a. Shutdown Bds

b. Generator PCB open (30 second delay if no electrical fault)

c. 6.9kV Unit and RCP Bds

4. Verify ECCS Status

a. CCPS - RUNNING

b. SI Pumps - RUNNING

c. RHR Pumps - RUNNING

d. Flow through BIT

e. IF RCS press < 1500 psig, THEN verify SI Pump flow (FI-63-20 & 151)f. IF RCS press < 180 psig, THEN verify RHR Pump flow (FI-63-91A & 92A)5. Verify QA & Contmt Vent Isolation, and ECCS Alignmenta. Test and check status lights as follows:

1) Panel 6C - DARK

2) Panel 6D - DARK

3) Panel 6E - LIGHT (except outlined area)

4) Panel 6F - LIGHT (except outlined area)

5) Panel 6G - DARK

6) Panel 6H - DARK

\* b. Check all leak-test valves - CLOSED on XS-63-100. (M-6)



Reference: ECN 510 or FCR FS-503.

AT-7.10

(A) Nameplates have been installed, for two- and three-pen recorders, in the MCR that indicate the parameter being monitored and the associated pen and pen color by which the parameter is being indicated. In addition, parameter units are indicated on the recorder scale except for special cases where it is not feasible due to the limited space available on the scale. For these special cases, the parameter units are indicated on the recorder nameplate. The following is a list of the subject two and three-pen MCR recorders. (Reference: 47B601-0-3 R6.)

1-M-2 panel -

1-XR-47-151

1-M-3 panel -

1-FR-2-200

1-P/TR-2-2

1-VR-3-63

1-VR-3-77

1-M-4 panel -

1-PR-1-2

1-PR-1-23

1-FR-3-35

1-FR-3-48

1-FR-3-90

1-FR-3-103

1-LR-3-43

1-LR-3-98

1-LR-68-367

1-M-5 panel -

1-TR-68-2A

1-TR-68-2B

1-LR-68-339

1-PR-68-66

1-TR-68-1

1-TR-68-24

1-TR-68-43

1-TR-68-65

1-FR-62-23

1-FR-62-24

1-FR-62-49

1-FR-62-50

1-M-6 panel -

1-LR-62-238

1-FR-62-139

1-TR-74-14

1-TR-74-25

1-PR-30-45

1-M-10 panel -  
1-LR-63-50  
1-TR-68-319

0-M-12 panel -  
0-RR-90-102  
\* 0-RR-90-101  
0-RR-90-133  
\* 0-RR-90-132  
1-RR-90-120  
0-RR-90-134  
\* 1-RR-90-100  
1-RR-90-119  
1-RR-90-123  
\* 1-RR-90-112  
\* 1-RR-90-106

\*For these recorders, every pen does not have a dedicated scale. One scale is applicable to two identical parameters' units and range.

0-M-25 panel -  
0-XR-90-181  
0-XR-90-182  
0-TR-90-177

0-M-27B panel -  
1-TR-70-161

(B) Nameplates have been installed for the multipoint recorders in the MCR indicating the parameter being monitored and the point number for each recorder point being used. In addition, parameter units are on the recorder scale or as indicated below. The following is a list of the subject multipoint recorders in the MCR. (Reference: 47W605-41 R1 and FCR NP-689)

1-M-1 panel -  
1-TR-57-110  
1-TR-47-1  
1-TR-47-2  
1-XR-47-3

1-M-10 panel -  
1-TR-61-138

1-M-31 panel -  
1-RR-90-254  
1-RR-90-253  
1-RR-90-268

Units are on recorder cover

0-M-12 panel -  
1-RR-90-1  
0-RR-90-12A

0-M-25 panel -  
0-RR-90-175  
0-RR-90-176

1-M-4 panel -  
ZR-412 - Note: The parameter pen position for ZR-412 is on a tag placed on the recorder due to the limited space available to install a nameplate on the panel.   
have a dedicated scale. (see scale is

(C) The MCR single pen recorders have nameplates indicating the parameter being monitored and the parameter units for each recorder are on the recorder scale or as indicated below. The following is a list of the subject single pen recorders in the main control room:

1-M-1 panel -  
1-XR-57-107  
1-XR-57-108

1-M-2 panel -  
1-FR-6-107

1-M-3 panel -  
1-LR-2-12  
1-FR-2-35  
1-VR-46-25

1-M-5 panel -  
1-PR-68-340

1-M-6 panel -  
1-XR-43-94  
1-TR-72-31  
1-TR-72-6

1-M-9 panel -  
0-PR-30-310  
0-PR-30-311

1-M-10 panel -  
1-MR-30-240  
1-MR-30-241

1-M-15 panel -  
0-FR-27-98  
0-TR-27-99  
0-LR-77-134 (Units are on recorder cover)

0-M-12 panel -  
1-RR-90-170  
0-RR-90-118

0-RR-90-103  
1-RR-90-104  
0-RR-90-125  
0-RR-90-126  
0-RR-90-225  
0-RR-90-205  
0-RR-90-206

0-M-25 panel -  
0-TR-90-179  
0-TR-90-180

0-M-27B panel -  
0-PDR-65-21) Units are on recorder cover  
0-PDR-65-40)

- 5.17 Some recorders do not identify the parameter units indicated on both the scales and paper.

TVA Corrective Action(s)

Parameter units have been added to the MCR recorders scales except for special cases where it is not feasible. For these special cases, the parameter units are indicated on the recorder nameplate or as noted in item 5.16.

- 5.18 In some instances the test and calibration labels cover meter faces or paper-scale indication.

TVA Corrective Action(s)

Test and calibration labels have been removed from meter faces and paper scales.

- 5.19 Some dual function recorders do not have nameplates indicating the parameters being monitored. (See item 5.16.)

- 5.20 Regarding steam generator strip charts, labels on chart windows contradict those under chart units. It appears that recorders were reinstalled incorrectly after maintenance.

TVA Corrective Action(s)

Chart recorders are presently in their correct locations. (See list of recorders below.) Reference: ECN 4981 and drawing 47W605-10 R18.

<u>Panel No.</u>	<u>Recorder No.</u>
M-4	FR-3-35
M-4	FR-3-48
M-4	FR-3-90
M-4	FR-3-103

## 6.0 PANEL LAYOUT

- 6.1 Controls are not arranged in logical order (that is, by function or sequentially).

### TVA Corrective Action(s)

This has been corrected. (See attachments No. 1 and 2.)

- 6.2 Demarcation between units 1 and 2 and common controls and displays is not clearly indicated. Units are on a single panel.

### TVA Corrective Action(s)

Demarcation and summary tagging has been added to distinguish unit 1 from unit 2. (See Attachment No. 2.)

- 6.3 Large string/matrices of switches are located at several places on panels, specifically for component cooling water, water service systems, essential raw cooling water, and ventilation.

### TVA Corrective Action(s)

This has been corrected. (See item 6.2.)

- 6.4 The feedwater and condensate system had a sequence of valves (left to right) CBABA.

### TVA Corrective Action(s)

On M-2, HS-6-110A, -109A, and -108A were arranged vertically in a C-B-A sequence as was HS-6-184A, -163A and -143A. This was corrected. (See attachment No. 1.)

- 6.5 There are several long strings (greater than 4) of vertical meters. Mounting in strings increases the likelihood that the operator will read the wrong display if it is near the middle of the string.

### TVA Corrective Action(s)

Meters were given demarcation and/or summary tags to distinguish them from adjacent displays. (See Attachment No. 2.)

## 7.0 CONTROL/DISPLAY (C/D) ARRANGEMENT

- 7.1 Some displays are not located directly above the controls that relate to them. Some are even located on different panels. Effective control/display relationships do not exist (see item 7.2).

- 7.2 There are many instances where controls and displays are arranged "B" on left and "A" on right (not typical stereotype).

TVA Corrective Action(s)

Many devices have been moved to correct violations of conventional arrangements. (See attachment No. 1.) Functional nameplates and demarcation lines have been added. (See attachment No. 2.)

- 7.3 Maintenance and test C/D are located on some panels that contain important operating functions.

TVA Corrective Action(s)

Upper head injection (UHI) test valve handswitches HS-87-7, -8, -9, -10, -11 were arranged as in item 7.2, demarcated and summary tags added. Also, SIS test valve handswitches HS-63-71A and -84 were demarcated and given a summary tag. In addition, 20 SIS test switches were incorporated into a matrix switch/light box on M-6. Those affected were: HS-63-21, -158, -167, -163, -24A, -174, -116, -96, -78, -68, -121, -117, -97, -79, -69, -111, -112, -165, -164, and -166. Reference: ECN 3390 and drawing 47W605-15 R7 and R10.

- 7.4 Some functional groups of valves are not arranged according to operating sequence.

TVA Corrective Action(s)

This has been corrected. (See attachments No. 1 and 2.)

- 7.5 Pattern recognition requirements of statalarm panels are too complex for rapid verification.

TVA Corrective Action(s)

Annunciator trip status and monitor lights boxes were given functional nameplates and were demarcated for clarification. (See attachment No. 2.)

- 7.6 Although most control switches are color coded by system, associated displays are not color coded to aid in establishing control/display relationship.

TVA Corrective Action(s)

This has been corrected by functional nameplates and demarcation. (See attachment No. 2.)

- 7.7 Some annunciator windows for panel 1-M-9 are located above panels 1-M-3 and 1-M-5.

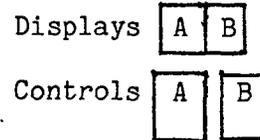
TVA Corrective Action(s)

Because panel 1-M-9 is outside the horseshoe and is not continuously monitored by the operator, the ventilation annunciators have been moved inside the horseshoe where they are readily observable by the operator.

- 7.8 Amps display for feedwater pump B is mounted over a vertical string of pump A-related switches.

TVA Corrective Action(s)

Amps display for auxiliary feedwater (AFW) pump A and B is located directly over AFW pump motor control for pump A. AFW motor control for B is located to the right. This is not a problem since left to right convention is maintained. (See sketch.)



8.0 LABELING AND CODING

- 8.1 Some control panels lack system, subsystem, and functional labels.

TVA Corrective Action(s)

This has been corrected. (See attachment No. 2.)

- 8.2 No hierarchical system of group labeling is used on controls/displays.

TVA Corrective Action(s)

A hierarchical system of nameplates was added in the following order (1) panel system(s), (2) functional and/or system groups, (3) device nameplates were existing. (See attachment No. 2.)

- 8.3 Many panels have temporary labels.

TVA Corrective Action(s)

An effort is underway to replace "temporary" labels on the control boards with permanent labels. Design change requests (DCRs) have been initiated to mount permanent labels where temporary labels now exist on both the annunciator panels (alarm set points) and handswitches (power supplies). Temporary labels will not be removed until the permanent labels are installed.

Over time it is anticipated that additional labels of both a short and permanent duration will be identified. Temporary labels will be utilized until either a permanent label is installed or the label is no longer needed. A procedure is currently being developed to control such temporary labeling. Human factors guidance on use and control of temporary labels has been provided by OE. This procedure will be in place by fuel load.

- 8.4 Control labels are placed below the control.

TVA Corrective Action(s)

The original design of these panels called for all device nameplates to be located on the device. If this was not possible, then they were located below the device. When it was decided to add function nameplates they were located above devices, if possible. (See attachment No. 2.)

- 8.5 Label legibility at normal viewing distances is marginal. Lettering is not sharp and contrast is low, especially for older labels where lettering is smaller and contrast is lower.

TVA Corrective Action(s)

The color of main control room panel nameplates has been changed from gray background with black characters to white background with black characters. The width of stroke of nameplate characters was enlarged by the use of flat groove instead of V-groove engraving. This has improved legibility. System and function nameplates added have larger characters (hierarchical scheme). (See attachment No. 2.)

- 8.6 Some groups of controls/displays have no function identification labels.

TVA Corrective Action(s)

System and function nameplates have been added using a hierarchical scheme. (See attachment No. 2.)

- 8.7 Annunciator panels are not functionally labeled, and individual tiles are not matrix number coded to assist in location.

TVA Corrective Action(s)

A numbering scheme has been developed for the annunciator windows, annunciator bezels have been painted black, internal reflective surfaces have been painted white, and all spare status light box windows have been blanked out. Reference: ECN 3264 and drawing 47B601-55-100 R0.

Function nameplates have been added to annunciators located on panels M-1 through M-6. (See attachment No. 2.)

- 8.8 Some labels contain erroneous information.

TVA Corrective Action(s)

Nameplates that contain erroneous information are corrected when identified.

- 8.9 The type font used for labeling was too small, contrast was poor, and placed on lines inconsistently.

TVA Corrective Action(s)

The color of MCR nameplates and the width of stroke of engraved characters on nameplates has been changed to improve contrast and legibility. (See item 8.5.)

Panel nameplates are engraved with alphanumerics and symbols in accordance with drawing 47B601-0-3 (nameplate details) and drawing 47B601-1 through series (instrument tabulation).

- 8.10 No demarcation is used to delineate systems, subsystems, or functional grouping on controls and displays.

TVA Corrective Action(s)

Demarcation lines have been added to the MCR panels. (See attachment No. 2.)

- 8.11 Most mimics are temporarily affixed to panels and are sometimes confusing.

TVA Corrective Action(s)

The temporary mimics on panel 1-M-1 have been removed or replaced with permanent mimics.

- 8.12 The number of colors used for switch backplates is excessive, and shading differences are sometimes difficult to discriminate (see item 8.13).

- 8.13 A color coding scheme has not been applied to displays.

TVA Corrective Action(s)

Color coding is applied to the backplates on a system basis, hence the large number of colors. Functional nameplates and demarcation lines have been added to aid in distinguishing between systems.

9.0 PROCESS COMPUTER, KEYBOARDS, AND CRT

- 9.1 To initiate a computer function requires a series of complex operator actions (see item 9.2).
- 9.2 Poor input/output indexing requires the operator to search through the complete document list to find specific data point address information.

TVA Corrective Action(s)

A computer reference index has been developed that alphabetically lists

by description, by point, and by system and is filed in the P2500 operators guide manual that is maintained in the MCR. In addition, the P2500 operators console has been modified to facilitate operator functions.

- 9.3 The process computer and the IBM Selectric typewriters are very limited in their ability to present pertinent real-time information.

TVA Corrective Action(s)

The IBM Selectric typewriter has been replaced with a General Electric Terminet Model 1200 typer and a data products line printer has been added to the main control to increase printing speed.

- 9.4 The filing of process computer documents is not systematic or clearly identified.

TVA Corrective Action(s)

The computer reference index documents are filed in the P2500 operator's guide manual that is maintained in the MCR.

ATTACHMENT NO. 1

operators guide manual that is maintained in the MCR. In addition, the

This attachment was written to scope the large changes due to ECN 2710. It is not an indication that no further revisions were made in this area due to additional ECNs.

The following changes were made in accordance with ECN 2710:

Corrective Action(s)

Panel M-1 and M-10

UDR's 762, 763, and 764 were moved from M-10 to M-1. Reference: 47W605-4 R4 and 47W605-34 R8.

Panel M-2

HS-54-9A1 and -9B1 were swapped putting 9A1 (pump A) on top and -9B1 (pump B) on bottom.

Condensate valve heater inlet and outlet handswitches were functionally grouped and tagged in a conventional manner (reference 47W605-6 R4). Six switches were affected: HS-2-110A, -128A, -130A, -147A, -149A, and -167A.

Twelve heater extraction isolation valve handswitches were rearranged to correct order of convention and were demarcated for functional grouping. Switches affected were as follows: HS-5-21A, -23A, -25A, -30A, -32A, -34A, -40A, -42A, -44A, -54A, -62A, and -70A. Reference: 47W605-6 R4.

Nine heater condensate flow control switches were rearranged that affected convention and functional grouping as follows: HS-6-108A, -109A, -110A, -143A, \*-163A, -184A, XS-6-295, -296, and HS-6-209A. Reference: 47W605-6 R4  
\*Actually stayed in location.

Six main steam handswitches were moved to correct convention and functional grouping as follows: HS-1-141A, -135A, \*-143A, \*-137A, -145A, and -139A. Reference: 47W605-6 R4. \*Actually stayed in location.

Panel M-3

Six low-pressure heater inlet and outlet handswitches were moved for order of convention as follows: HS-2-55A, -65A, -75A, -45A, -56A, and -66A. Reference: 47W605-8 R8.

Panel M-4

Swapped PIC-3-122A with PIC-3-132A; pressurizer heater control handswitches were moved to correct convention as follows: HS-68-341A, \*341D, -341F, -341H. Reference 47W605-10R6. \*Actually stayed in location.

Six neutron indicators were rearranged for functional grouping: N1-31B, -32B, -31D, -32D, -35B, and -36B. Reference: 47W605-10 R6.

Panel M-5

Swapped charging pump current indicators E1-62-104A and -108A (order of convention). Also, revised RCP handswitches HS-62-9A, -22A, -35A, and -48A for convention corrections. Reference: 47W605-13 R4 and R8.

Later, under S1 ECN for FCR E-3594 (dated for issue April 4, 1983) corrected pump number designation for above switches. See 47W605-13 R4 for ECN 2710 changes and R6 for latter changes. Switches HS-62-104A and 108A for indicators E1-62-104A and -108A were swapped due to convention.

PR-68-340 recorder was moved from far right to far left of panel. Reference: 47W605-13 R4.

The work described below was accomplished in accordance with ECN 2604, except as noted. This attachment was written to scope the large changes due to this ECN. It is not an indication that no further revisions were made in this area due to additional ECNs.

Panel 1-M-1 Drawing 47W605-4 R4

Added function and/or system demarcation lines. Added a hierarchical system of nameplates in the following order: (1) panel system(s), (2) functional and/or system groups, and (3) device nameplates (already existing on boards).

The color of MCR nameplates were changed from gray background with black characters to white background with black characters. The width of stroke of nameplate characters was enlarged by the use of flat groove instead of V-groove engraving. (See drawing 47B601-0-3 R4.)

Panel 1-M-2 Drawing 47W605-6 R4

Same as panel 1-M-1.

Panel 1-M-3 Drawing 47W605-8 R8 and R12 for FCR E-3594

Same as panel 1-M-1.

Panel 1-M-4 Drawing 47W605-10 R6

Same as panel 1-M-1.

Panel 1-M-5 Drawing 47W605-13 R4

Same as panel 1-M-1.

Panel 1-M-6 Drawing 47W605-14 R8 and 47W605-15 R7

Same as panel 1-M-1.

Panel 1-M-9 Drawing 47W605-32 R8, R11 for FCR E-10014 and R14 for FCR A-912

Added color coded unit demarcation and tags. Added panel system nameplate. Drawing 47W605-32 R10 - ECN 3324 added system demarcation and nameplates.

Panel 2-M-9 Drawing 47W605-35 R8

Added color coded unit demarcation and tags. Drawing 47W605-35 R10 - ECN 3324 added system demarcation and nameplates.

Panel 1-M-10 Drawing 47W605-34 R8

Added system demarcation and nameplates.

Panel 0-M-12 Drawing 47W605-28 R9

Added color coded unit demarcation and tags.

Panel 1-M-15 Drawing 47W605-21 R13

Added color coded unit demarcation and tags. Drawing 47W605-21 R15 - ECN  
3324 added system demarcation and nameplates.

Panel 2-M-15 Drawing 47W605-30 R9

Added color coded unit demarcation and tags. Drawing 47W605-30 R12 - ECN  
3324 added system demarcation and nameplates.

Panel 0-M-25 Drawing 47W605-21 R13

Added color coded unit demarcation and tags.

Panel 0-M-26 Drawing 47W605-19 R4

Added color coded unit demarcation and tags.

Panel 0-M-27A Drawing 47W605-23 R10

Added color coded unit demarcation and tags.

Panel 0-M-27B Drawing 47W605-25 R7

Added color coded unit demarcation and tags.

TO: DIRECTOR, FBI

FROM: SAC, MEMPHIS (44-1987) (P)

SUBJECT: MURKIN

RE: Memphis teletype to Bureau dated 4/23/68.

Enclosed for the Bureau are:

1. Copy of letterhead memorandum (LHM) dated 4/23/68.

ENCLOSURE 2

TVA INTERNAL HUMAN FACTOR CONCERNS (HFC)

- 001 - A relay was added to voltmeter E1-57-17 in order to read correct range of generator neutral voltage.  
Reference: TVA drawing 47W605-4 R7 for ECN 3625.
- 002 - To be evaluated during the detailed control room design review per NUREG-0700 (hereafter referred to as "0700 review").
- 003 - HS-2-128A & HS-2-110A were swapped  
HS-2-147A & HS-2-130A were swapped  
HS-2-167A & HS-2-149A were swapped  
Reference: 47W605-6 R4 for ECN 2710.
- 004 - HFC No. 004 and 008 were the same; so 004 was dropped HS-2-275A and HS-6-330A (M-2 and M-3, respectively), were swapped.  
Reference: 47W605-6 R9 and 47W605-8 R10 for ECN 3390.
- 005 - Change not implemented - Reference: SWP 820722 013 and DES 811117 029
- 006 - Indicating lights were added to M-3 at top left of panel. (Z1-14-3)  
Reference: 47W605-8 R10 for ECN 3390.
- 007 - See No. 005 - Change was not implemented exactly as stated but was done (see additional actions this HFC listed under HFC 077).
- 008 - See No. 004
- 009 - This was not implemented - Reference: WBP 830516 043
- 010 - No action taken - Reference: EEB 810827 915
- 011 - As in No. 010
- 012 - As in No. 010
- 013 - As in No. 010
- 014 - As in No. 010
- 015 - PIC-3-122A and PIC-3-132A were swapped.  
Reference: 47W605-10 R6 (M-4) for ECN 2710.
- 016 - PR-68-340 was moved from far right to far left of M-5.  
Reference: 47W605-13 R4 for ECN 2710.
- 017 - FIC-62-93A and 89A were not included in DCR-405 by NUC PR; therefore, no action was taken on these.
- 018 - As in No. 010
- 019 - As in No. 010

- 020 - These switches were rearranged.  
Reference: 47W605-14 R9 and R10 and 47W605-15 R9 and R10 (same as 074) and ECN 3060.
- 021 - This has been implemented.  
Reference: ECN S1 for FCR E-3594 47W605-17 R9 and R10.
- 022 - As in No. 021
- 023 - As in No. 021
- 024 - As in No. 010
- 025 - As in No. 010
- 026 - As in No. 010
- 027 - XS-55-15 was given yellow demarcation around it per ECN 2604 as was XS-55-12.  
Reference: 47W605-21 R12 and R13 and 47W605-28 R8 and R9.
- 028 - HS-27-39A had identification change on tag.  
Reference: FCR E-3594 and 47W605-22 R11 and R12.
- 029 - As in No. 010
- 030 - Red carpet has been installed to designate off limits area.  
Reference: ECN 3343.
- 031 - HS-67-146A had identification change on tag.  
Reference: E-3594 and 47W605-24 R7 and R8.
- 032 - 0700 Review
- 033 - Demarcation and summary tags were added to back-up control room.  
Reference: ECN 3223 and drawings listed in additional corrective action specified for this HFC as identified for HFC 077.
- 034 - 0700 Review
- 035 - 0700 Review
- 036 - As in No. 010
- 037 - 0700 Review
- 038 - Demarcation has been added around fire protection controls  
Reference: ECN 3324 and 47W605-21 R15 and 47W605-30 R12.

- 039 - HS-63-5A and -153A tag nomenclature was changed to agree with the 47B601 series and referenced description revised on 47W605-17 R10.  
Reference: FCR E-3594.
- 040 - HS-63-94A tag nomenclature was changed to agree with the 47B601 series and referenced description revised on 47W605-17 R10.  
Reference: FCR E-3594.
- 041 - HS-63-156A and HS-63-157A tag nomenclature was changed to agree with the 47B601 series and referenced description revised on 47W605-17 R10.  
Reference: FCR E-3594.
- 042 - HS-74-1A and HS-74-2A tag nomenclature was changed to agree with the 47B601 series and referenced description revised on 47W605-17 R10.  
Reference: FCR E-3594.
- 043 - HS-74-3A and HS-74-21A tag nomenclature was changed to agree with the 47B601 series and referenced description revised on 47W605-17 R10.  
Reference: FCR E-3594.
- 044 - HS-63-1A, -8A, and -11A tag nomenclature was changed to agree with the 47B601 series and referenced description revised on 47W605-17 R10.  
Reference: FCR E-3594.
- 045 - HS-63-72A tag nomenclature was changed to agree with the 47B601 series and referenced description revised on 47W605-17 R10.  
Reference: FCR E-3594.
- 046 - HS-63-64A and HIC-63-65A tag nomenclature was changed to agree with the 47B601 series and referenced description revised on 47W605-17 R10. Reference: FCR E-3594.
- 047 - 0700 Review
- 048 - Reference: Appendix D, Item No. 4.4 and ECN 3270 and ECN 4981.  
Also, 47W605-39 R0, R4, and R5.
- 049 - 0700 Review - Also see Appendix D, item 1.2.
- 050 - 0700 Review
- 051 - Red carpet has been installed to designate off limits area  
Reference: ECN 3343
- 052 - As in No. 010
- 053 - 0700 Review
- 054 - Reference: ECN 4233 for FCR FS-159 and 47W605-10 R14.

- 055 - HS-63-4A was moved from 74SYS boundary line.  
Reference: ECN 3060 on 47W605-14 R8 and R10.
- 056 - HS-63-172A and -93A tag nomenclature was changed to agree with the  
47B601 series and referenced description revised on 47W605-17 R10.  
Ref: FCR E-3594. Reference: FCR E-3594 and 47W605-17 R10.
- 057 - HS-63-47A and -48A tag nomenclature was changed to agree with the  
47B601 series and referenced description revised on 47W605-17 R10.  
Reference: FCR E-3594.

- 058 - Same as item 078 - stinginghouse determined this was not desirable. However, 20 test switches were grouped in a matrix light box on M-6 per ECN 3390 for DCR-405.  
Reference: 47W605-15 R10.
- 059 - HS-63-3A and -22A tag nomenclature was changed to agree with the 47B601 series and referenced description revised on 47W605-17 R10. Ref: FCR E-3594. HS-63-177A was not changed. Reference: 47W605-17 R10.
- 060 - The ventilation and ice condenser systems have been demarcated as have been the air conditioning, waste disposal, and auxiliary boiler systems.  
Reference: ECN 3324 for WB-DCR-406 and 47W605-32 R10.
- 061 - Protective covers were added to HS-3-116, -126, -136, and -179.  
Reference: ECN 3060 for DCR-405 and 47W605-8 R10.
- 062 - 0700 Review
- 063 - ECN 3264 - Blank windows have been blacked out.
- 064 - Located in MCR horseshoe as required by Regulatory Guide 1.97.
- 065 - As in 010.
- 066 - Corrected by MR No. A-418121
- 067 - Reference 3.1 in Appendix D - Once all construction activities cease, this should not prove a problem. Noise measurements will be submitted 120 days after fuel load.
- 068 - Reference 1.2 in Appendix D - Nameplates large enough to accommodate area identification would not be practical. Tags have been installed to identify SOI for operators.
- 069 - Reference 4.4 in Appendix D - Reset function for RT-2 was deleted.  
Reference: 47W605-17 R9 and FCR E-3517.
- 070 - 0700 Review
- 071 - Reference ECN 3390 for WB-DCR-405, CVCS control switches were rearranged.  
Reference: 47W605-14 R9 and R10.
- 072 - Reference ECN 3060 for WB-DCR-405, switches were moved for better functional grouping.  
Reference: 47W605-14 R9 and R10 and 47W605-15 R9 and R10.
- 073 - HS-63-25A, -26A, -38A, -39A, -40A, -41A, -42A were rearranged per DCR-405 for ECN 3060.  
Reference: 47W605-14 R9 and R10.

- 074 - HS-63-4A, -5A, -6A, -7A, -3A, -22A, -175, and -177A are rearranged per DCR-405 for ECN 3060. Reference: 47W605-14 R9 and R10.
- 075 - HS-63-174, -130A, -110A, -90A, -66A, and HIC-63-65A were rearranged per DCR-405 for ECN 3060. Reference: 47W605-14 R9 and R10 and 47W605-15 R9 and R10.
- 076 - Systems were demarcated and given summary tagging. Reference: ECN 2604 on 47W605-14 R7 and R8 and 47W605-15 R6 and R7. Also ECN 3060 on 47W605-14 R9 and R10 and 47W605-15 R7 and R8.
- 077 - System 72 control switches were rearranged and summary tags changed. Reference: ECN 3390 for DCR-405. Also, 47W605-15 R9 and R10.
- 007 - LIC-3-35A, -48A, -90A, and -103A (previously on M-3) were moved to M-4 and swapped with blowdown isolation valve switches HS-1-7/181, HS-1-14/182, HS-1-25/183, and HS-1-32/184.
- 033 - 47W600-50 R4, 47W600-51 R3, 47W600-52 R6, 47W600-54 R5, 47W600-55 R5, 47W600-57 R3, 47W600-58 R4, and 47W600-60 R3.
- 078 - 20 safety injection system (SIS) test switches were incorporated into a matrix switch/light box on M-6. Switches affected were: HS-63-21, -158, -167, -163, -24A, -174, -116, -96, -78, -68, -121, -117, -97, -79, -69, -111, -112, -165, -164, and -166. Reference: ECN 3390, DCR 405, and drawing 47W605-15 R10.
- 079 - A dual scale to read gallons and percent has been added to the following level indicators: LI-63-129, -119, -109, -99, -89, -81, -82, and -60. Reference: ECN 3390, DCR 405, and drawing 47B601-63 Series R13.
- 080 - Placing cubic feet graduation on UHI accumulator surge tank level indicator scales will not provide operators with information useful in verifying technical specification 3.5.1.2 and indeed may be misleading. Plant instruction TI-4 must be used to determine actual tank volume in gallons and cubic feet from indicated volume in present level. This method is required due to recalibration error associated with nitrogen density changes with system pressure.
- 081 - A dual scale to read gallons and percent has been added to the following level indicators: LI-62-238 and -242. Reference: ECN 3390, DCR 405, and drawing 47B601-62 series R19.
- 082 - A dual scale to read percent turbine power and lb/in<sup>2</sup> impulse chamber been added to the following pressure indicators: PI-1-72 and -73. Reference: ECN 3390, DCR 405, and drawing 47B601-1 Series R17.

- 083 - The percent scale has been replaced with a scale to read lb/in<sup>2</sup> for pressure indicator PI-68-301.  
Reference: ECN 3060, DCR 405, and drawing 47B601-68 Series R16.
- 084 - The percent scale to read inches of water and percent has been added to the following level indicators: LI-3-172, -173, -174, -175, -164, -156, -148, and -171.  
Reference: ECN 3390, DCR 405, and drawing 47B601-3 Series R13 (the 47B601-3 series will be revised for FCR A-1070 to change scales to 0-233 in. H<sub>2</sub>O and 0-100%).
- 085 - A dual scale to read gallons and percent has been added to the following level indicators: LI-63-50, -51, -52, and -53.  
Reference: ECN 3390, DCR 405, and drawing 47B601-63 Series R13.
- 086 - The feet of water scale has been replaced with a scale to read gallons on level indicators LI-2-230A and -233A.  
Reference: ECN 3390, DCR 405, and drawing 47B601-2 Series R15 (the 47B601-2 series will be revised for FCR A-1070 to change scales to 0-400,000 gal.)
- 087 - The inches scale has been replaced with a scale to read percent on level recorders LR-68-339 P001 and P002.  
Reference: ECN 3060, DCR 405, and drawing 47B601-68 Series R16.
- 088 - Containment pressure recorder PR-30-45 is now scaled in lb/in<sup>2</sup>. The instrument tabulation will specify scale for recorder in lb/in<sup>2</sup>.  
Reference: drawing 47B601-30 Series will be revised on FCR A-1070.
- 089 - EI-57-17 was added to correct this.  
Reference: ECN 3625, ECN 3324, SQ-DCR-1519, WB-DCR 406 and 47B605-4 R7.
- 090 - A new nameplate has been added.  
Reference: ECN 3324, DCR 406, and drawing 55W601 R4.
- 091 - A new nameplate has been added.  
Reference: ECN 3324, DCR 406, and drawing 55W601 R4.
- 092 - Corrected by MR No. 492367 (items 1 and 2 only).
- 093 - As in 092.
- 094 - 0700 Review
- 095 - A dual scale to read feet and percent has been added to the following level indicators: LI-63-180, -181, -182, and -183.  
Reference: ECN 3390, DCR 405, and drawing 47B601-63 Series R13.
- 096 - HS-30-65A has been swapped with HS-30-65B.  
Reference: ECN 3390, DCR 405, and drawings 47W605-15 R10 and 47W605-16 R10 and R11.

097 - HS-30-63E has been swapped with HS-30-63D and HS-30-64E has been swapped with HS-30-64D.

Reference: ECN 3390, DCR 405, and drawings 47W605-15 R10 and 47W605-16 R10.

Reference: ECN 3390, DCR 405, and drawings 47W605-15 R10 and 47W605-16 R10. (U-255 and U-100).

Reference: ECN 3390, DCR 405, and drawings 47W605-15 R10 and 47W605-16 R10.

Reference: ECN 3390, DCR 405, and drawings 47W605-15 R10 and 47W605-16 R10.

Reference: ECN 3390, DCR 405, and drawings 47W605-15 R10 and 47W605-16 R10.

Reference: ECN 3390, DCR 405, and drawings 47W605-15 R10 and 47W605-16 R10.

Reference: ECN 3390, DCR 405, and drawings 47W605-15 R10 and 47W605-16 R10.

Reference: ECN 3390, DCR 405, and drawings 47W605-15 R10 and 47W605-16 R10.

Reference: ECN 3390, DCR 405, and drawings 47W605-15 R10 and 47W605-16 R10.

Reference: ECN 3390, DCR 405, and drawings 47W605-15 R10 and 47W605-16 R10.