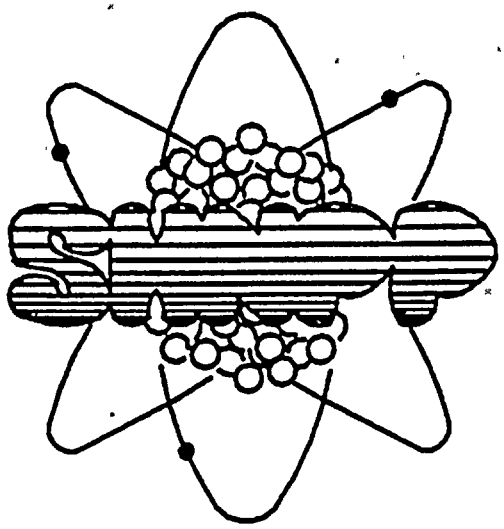
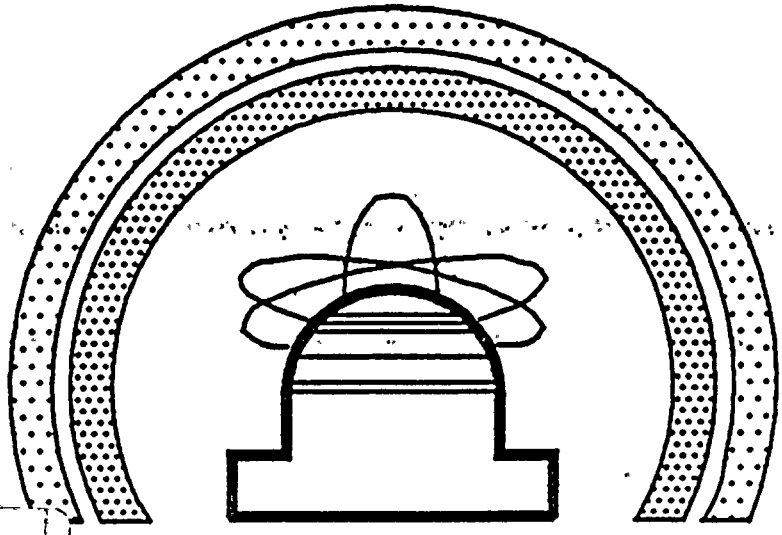


SHEARON HARRIS NUCLEAR POWER PLANT

SPDS DYNAMIC OPERATIONAL/ HUMAN FACTORS EVALUATION

MAY 1988

BY: RMS ASSOCIATES



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CAROLINA POWER & LIGHT COMPANY

SPDS DYNAMIC OPERATIONAL/HUMAN FACTORS EVALUATION

for

HARRIS NUCLEAR PROJECT

May 1988

FINAL
REPORT

RMS DOCUMENT NUMBER

113-001

Prepared for Carolina Power & Light

BY

RMS ASSOCIATES

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SPDS DYNAMIC OPERATIONAL/HUMAN FACTORS EVALUATION

1. SUMMARY

1.1 OBJECTIVES AND SCOPE

OBJECTIVE: The objective of the Dynamic Operational/Human Factors Evaluation is to ensure the CP&L Harris Nuclear Project (HNP) SPDS is designed and operated using the principles of human factors engineering and is interfaced properly with the Emergency Operating Procedures (EOPs).

SCOPE: This evaluation included four major areas of the SPDS:

1. SPDS parameter selection
2. SPDS display format
3. SPDS specific location
4. Integration with specific EOPs.

1.2 VERIFICATION AND VALIDATION

The NRC recommends as part of the SPDS design and fabrication process an ongoing Verification and Validation program in NUREG-0800 (Reference 1). The program should encompass the entire design cycle beginning with the identification of the specific system capabilities required for the system to accomplish its functional goals (as outlined in Supplement 1 to NUREG-0737, Reference 2) and continuing through the final operational tests that ensure the system effectively accomplishes the desired goals.

VERIFICATION: The first step is to identify the presence (or absence) of instruments/equipment that provide the information and control capabilities necessary to implement each task. The second step is to determine whether the man-machine interfaces provided by the displays, controls, and other SPDS features are effectively designed to support task accomplishment.

VALIDATION: The objective of the validation process is to determine whether the SPDS functions allocated to the control room operating crew can in fact be accomplished effectively within (1) the structure of defined operating and emergency procedures and (2) the design of the control room as it exists. In addition, the process of validation provides an opportunity to identify human engineering discrepancies that may not have become evident in other processes of the system review.

This type of approach is outlined as well in NSAC/39 (Reference 3), a document prepared by SAI. A review of the documentation prepared by SAI for the HNP SPDS Verification and Validation (Reference 4) indicates the effort followed a separate approach.

1.3 SAI/CP&L ACTIVITIES

The vendor for the HNP Safety Parameter Display System (SPDS) is Science Applications, International (SAI). CP&L and SAI worked together on the design, construction, installation, and testing of the system. In addition, an independent division of SAI was contracted to perform a concurrent V&V effort to assure compliance with NRC human factors guidelines. As of this writing the SAI V&V report has not been issued and is not available for review by RMS.

1.4 RMS/CP&L SPDS SPECIFIC ACTIVITIES

CP&L contracted RMS Associates (RMS) to perform a Dynamic Operational/Human Factors Evaluation on their SPDS as a basis for formally declaring the system operational. The basis for the evaluation was the SPDS Test Plan for HNP (Reference 5).

The methodology selected for the evaluation involved observing the SPDS first in a static mode and then in a dynamic mode. Static mode, in this case, means that the SPDS was operating, allowing for selection of screens at different levels and paging through screens at the third level, but the data reflected by the system was normal power operations data for the plant. The static review provided the observers with an opportunity to familiarize themselves with the screen design in detail and determine if the screens were identical for the plant and simulator systems. The dynamic mode means the SPDS was operating and the plant/simulator was operating in some transient condition(s).

The evaluation of the SPDS screen design and dynamic operational performance for incorporation of good human factors engineering followed the guidelines presented in Reference 1 in determining conformance to Section 4.1 of Reference 2. Section 6 of NUREG-0700 (Reference 7), Control Room Human Engineering Guidelines, provided additional human factors guidance. Specifically, the following subsections were consulted: control room workspace (6.1), visual displays (6.5), labels and location aids (6.6), process computers (6.7), and panel layout (6.8).

1.5 PLANT EVALUATION

This evaluation is provided for the HNP SPDS as installed and operated at the plant site. The CRDR HEDs, Operator questionnaire results and comments as well as other systems, plant documentation, plant procedures, parameter selection, display format, specific SPDS location, parameter reliability, parameter promptness of update, information continuity, and display conciseness were evaluated during the course of the evaluation.

Plant data was collected during steady state and slow transient conditions. In addition, the plant SPDS was reviewed in a static state for display considerations. Collection of additional data related to operator usage, such as described in Appendix F, was considered to be of little value due to the lack of training of the operators, lack of system integration with procedures and due to the system lag.

Whether the ERFIS/SPDS has been declared in operation formally or not, is not questioned. The system is perceived by management as operational and thus RMS has treated it as such. There is a general consensus among the operators that they like the SPDS, believe that it is a valuable asset in the control room, and it should be operable and responsive at both the plant and the simulator. The operators do, however, have concerns with the current status of the system. The areas of improvement below address their concerns.

AREAS OF IMPROVEMENT

The items listed below are intended to provide an overview of the HEDs listed in Appendix C of this report.

1. Training for operators on the use and definition of the computer-based SPDS providing consistency with the plant EOPs (Reference 6) should be provided.

2. Interfaces between SPDS and systems, abbreviations, procedures, etc. should be consistent.

3. The demonstrated system slow response or lag problem needs to be improved to acceptable levels.

4. Mode dependency for the SPDS should be provided.

5. A concise SPDS display. Consideration should be given to decimal places, vertical scales on trends, color selection, and purity/quality of the parameters.

6. Procedures, manuals, cross indices and general documentation for the SPDS should be provided.

[illegible]

1.5.1 SIMULATOR

1.5.1.1 Role of the HNP Simulator

The HNP simulator was utilized as an evaluation tool, in that, all RMS transients, fast and slow, as well as steady state SPDS operations were evaluated. The simulator evaluation provided the dynamic 'man-in-the-loop' data for evaluating dynamic system performance. This type of evaluation presumes that the two systems (simulator SPDS and plant SPDS) perform similarly in a dynamic run. Holding to this assumption, RMS could then generalize the conclusions drawn from the simulator to the plant system.

The steady state and slow transient data were compared by RMS with the data collected at the plant under similar conditions. This comparison allowed RMS to draw conclusions based on the simulator and link them directly to the plant. The fast transient data was collected only at the simulator but the results have been linked directly to the plant based on the favorable steady state and slow transient comparisons.

1.5.1.2 Simulator Status

The RMS personnel found that the simulator SPDS had a significant number of the variables presented on the "top-level" display were constantly out-of-range during normal operation. The responsiveness of the system, however, proved to be its primary handicap. Coupling the out-of-range variables, the responsiveness handicap, the constant color changing, the "red" branches being either red during normal operation or green during normal operation and the fact that the operators had no formal training on the SPDS presented RMS with a substantial challenge.

The major interface problems present at the simulator SPDS have been corrected. There are lingering responsiveness concerns, non-standard abbreviations, lack of consistency between EOPs and the CSFST Board (manual SPDS), no training, no operating procedures, some operator concerns, and glare problems in the simulator. All of these concerns directly apply to the plant as well.

1.5.2 DIFFERENCES

At the time the first dynamic evaluation was completed (07/87), the SPDS as a system was incomplete. The installation of the system at the plant was somewhat ahead of the simulator. The status at the simulator is summarized as lagging behind the plant. RMS could not extend the conclusions obtained from the first set of evaluations to the plant due to the state of completeness of the simulator and its number of data inconsistencies.

The simulator SPDS was characterized (07/87) by the operations personnel as not the same as the plant; slower, different assigned CRT's, not as reliable and more out-of-range values. In addition, the operators had received no training on the use of the computer-based SPDS.

RMS can now state that the observations and HEDs, not specifically noted as simulator-based, apply to both locations. This is based on the fact that 'most* of the simulator system interfaces have been upgraded.

The simulator SPDS has a time delay of about 10 seconds and does not closely follow the simulator MCB or computer output during fast transients. In fact, the response of the SPDS during transients lags the simulator from 10 to 30 seconds. The latest data taken from the simulator computer output was compared to the input data to the simulator SPDS. The comparison was a real-time evaluation. Previous comparisons (Reference 8) provided evidence that the SPDS screens lagged the simulator MCB by as little as 10 seconds. Adding the delay attributed to data transfer to the delay of screen update results in an average of about 15 to 20 seconds during normal operation and slow transients. During fast transients (example: restart event), the SPDS lagged the simulator by 1 to 2 minutes and was a factor of about 2 behind in magnitude (ie. IR SUR and SR SUR). Other data lags were in evidence as a result of the latest RMS evaluation (Pressurizer level, Thot, and SG (narrow & wide) range level.

* the Radiation Monitoring System interface has not been corrected as noted during the last RMS evaluation (04/88).

1.5.3 SYSTEM INTEGRATION

Consistency in the use of color display, abbreviations, terminology, location and priorities aids the operators in use of the SPDS in both locations, plant and simulator. Integrating these items with procedures, operation, and training provide the operator with a complete system to work within.

SPDS inconsistencies in the use of color display, abbreviations, and terminology are one conclusion of the RMS evaluation. The difference in the location of the designated/dedicated SPDS CRT between the plant control room and the simulator is another conclusion. The interface between the plant system and the simulator system and their respective priorities for completion have been out-of-sync until recently.

Integration of this effort and the Control Room Design Review (CRDR) and the resulting Final Report (Reference 9) has provided the "carry-over" of several HEDs (Observation 23) into this report. Although Reference 9 focused moderately on SPDS, final review by the NRC of SPDS was delayed due to its incomplete status at the time of the NRC CRDR review (1985).

2. DYNAMIC OPERATIONAL/HUMAN FACTORS EVALUATION

2.1 INTRODUCTION

DYNAMIC EVALUATION DEFINITION: INTENDED VS ACTUAL

The Dynamic Operational/Human Factors Evaluation examined four major areas of the SPDS for good human factors engineering principles and operation by control room personnel:

1. SPDS parameter selection
2. SPDS display format
3. SPDS location
4. Integration with procedures (FRP'S ONLY)

A four step method was used for the Dynamic Operational/Human Factors Evaluation of SPDS. These four steps consisted of the following:

1. Documentation Review
2. System Inspection (static)
3. Operator Interviews/Written Questionnaires
4. SPDS System Observations (dynamic)

An overall summary of the RMS effort is presented in Section 1. Observations from the entire RMS evaluation can be found in Section 3. Results and comments from the Written Operator Questionnaires can be found in Appendices D & E. Observations from the simulator exercises can be found in Appendix F.

2.2 DOCUMENTATION REVIEW

The Documentation Review consisted of first checking the SPDS parameter selection. Reference 2 lists the Critical Safety Functions (CSFs) that must be adequately examined, but lets the licensee select the actual parameters to be used. The Westinghouse Owners Group (WOG) Background Document (Rev.1 High Pressure Version - Reference 10) gave specific guidance on plant parameters and instrumentation to be used for monitoring the CSFs, so it was included in the review.

The second portion of the Documentation Review involved checking the integration of SPDS with Reference 6. This was performed by comparing the parameters and values in the EOPs with the parameters displayed on the SPDS. All plant parameters used in the EOP network are not displayed on SPDS (by design), attention was mainly directed at plant parameters used in the Function Restoration Procedures (FRPs). The FRPs are the procedural responses for challenges to the CSFs, so more importance was placed on the SPDS/FRP parameter integration than with the Flow Paths or End Path Procedures (EPPs). The FRPs were compared to SPDS on a step by step basis.

As the final part of the Documentation Review, administrative procedures and documents relevant to SPDS were checked (References 11 & 12). These procedures involve configuration control for any hardware and software changes to the system.

2.3 SYSTEM INSPECTION

A system inspection of SPDS examined three areas: parameter selection, display format, and console operation. These areas were evaluated for what information is presented to the operator, the manner in which it is presented, and how the system is operated. This was done using the SPDS console in the Technical Support Center (TSC) and the STA's station at the simulator. In addition, RMS obtained screen printouts from both the plant SPDS and the Simulator SPDS for comparison and for a detailed evaluation in the above areas.

2.4 INTERVIEWS

Interviews with control room operators took on two forms. Oral interviews and written questionnaires (two sets) were used to solicit opinions about SPDS from the actual SPDS operators. Questions asked included all areas examined by this evaluation: SPDS parameter selection, SPDS display format, SPDS location, SPDS responsiveness and integration with procedures. In addition, any general comments concerning SPDS were noted. Some observations in this report are from the first questionnaire, however the results of the second questionnaire are presented as it provided a greater sample of the operating personnel. (See Appendix D for questionnaire results and Appendix E for comments solicited with questionnaire number two)

2.5 OBSERVATIONS

The final portion of the evaluation consisted of observing how SPDS was used by operators during casualties run on the simulator. This involved using scenarios (See Appendix F) that exercised the most severe CSFST branches during the simulator time allotted for this evaluation. Emphasis was placed on using the SPDS for evaluating plant conditions and performing the FRPs. The EOPs utilized during this exercise are listed in Appendix B.

In addition to observing the SPDS function during preselected (by RMS) scenarios, RMS observed the simulator SPDS three times subsequent to the 7/87 exercises and the plant SPDS during a power reduction evolution. The additional (8/87, 11/97 & 4/88) observances were conducted to collect data under controlled conditions for comparison with plant SPDS data (11/87) and to provide feedback to CP&L as to system performance.

2.6 HUMAN ENGINEERING DISCREPANCIES (HEDs)

The HEDs listed in Appendix C provide documentation as to the discrepancies in the HNP SPDS as compared to Reference 7. HEDs have also been written when the HNP SPDS as compared to the Reference 1 guidelines.

2.7 DYNAMIC EVALUATIONS

The plant and the simulator were evaluated during three dynamic evolutions without operating personnel. These evolutions were performed to provide assurance that a direct correlation could be drawn between the plant and the simulator.

3. OBSERVATIONS

The observations provided in this section are the direct result of the total evaluation process by RMS. Each observation, or set of observations, is presented with a unique numeric designation. A listing of the applicable observation mode is placed below each observation. This listing is presented in the example below:

REVIEW	SPDS OBSERVATION	DATE	HED NO.
DOCUMENTATION REVIEW	C	07/87	31G1-6033 A
PROCEDURE REVIEW	C	07/87	31G1-6012 B,C&D
DISPLAY FORMAT REVIEW	ABC	07/87	31G1-6010 A
PHYSICAL LOCATION REVIEW	C	07/87	31G1-6107 D
OPERATOR INTERVIEWS (2)	CD	07/87	31G1-6009 D
DYNAMIC REVIEW (1)	ABCD	07/87	
SIMULATOR REVIEW	ABCD	11/87	
PLANT REVIEW	ABCD	11/87	
SIMULATOR REVIEW	ABCD	04/88	

The example assumes that the particular observation has four parts A, B, C, & D. Each review mode is noted under the "SPDS OBSERVATION" column with its specific letter designation. In addition to the review mode and observation denotation, the HEDs specific to the observation is/are also presented. Each HED is annotated with the letter designation, same as for the observation. If no letter is used the HED applies to the whole observation. If an "X" is used to indicate the review applicability the review applies to the entire observation. An "X" is only used for single or one part observations.

As an explanation, Observation "D" was observed in Operator Interviews, Dynamic Review, Simulator Review, Plant Review, and the second Simulator Review. Observation "D" also has three HEDs that apply to it: 31G1-6012, 31G1-6107 & 31G1-6009.

The date is provided to indicate when the particular review was performed.

Although the complete RMS review listing is provided above, only the applicable reviews are listed for each observation.

OBSERVATION FOOTNOTES:

(1) REVIEW PERFORMED WITH OPERATIONS PERSONNEL
(2) ORAL INTERVIEWS (7/87), FIRST QUESTIONNAIRE (9/87) AND THE SECOND QUESTIONNAIRE (12/87).
X APPLIES TO TOTAL OBSERVATION

1. Observation: Section 5.2.2 of Volume 13 of the ERFIS SPDS Subsystem indicates that the average hot leg temperature is used for calculating subcooling when in fact the average core exit thermocouple (TC) temperature is used. The WOG Background Document Core Cooling Status Tree Section gives the guidance that core exit TC temperature is to be used for the subcooling calculation.

REVIEW	SPDS OBSERVATION	DATE	HED NO.
DOCUMENTATION REVIEW	X	07/87	31G1-6032

***** ***** ***** ***** *****

2. Observation: HNP uses the average of the five hottest, good quality core exit TCs (out of a total of 51) to calculate average core exit TC temperature. The WOG Background Document Core Cooling Status Tree Section gives the guidance that the five core exit TCs to be used should be based on geometrical considerations (one TC located near the geometric core center and one TC in each core quadrant near the highest power assembly). The HNP method is better because the possibility exists for a hot region of the core to exist away from the fixed TCs in the WOG.

REVIEW	SPDS OBSERVATION	DATE	HED NO.
DOCUMENTATION REVIEW	X	07/87	31G1-6032

***** ***** ***** ***** *****

3. Observation: Volume 13 of the ERFIS SPDS Subsystem does not include a description of the plant parameters and source points used in the Top Level display. It only describes the SPDS status blocks and their use.

REVIEW	SPDS OBSERVATION	DATE	HED NO.
DOCUMENTATION REVIEW	X	07/87	31G1-6032

4. Observation: SPDS does not distinguish between narrow range SG levels and wide range SG levels. It is RMS' understanding (from NED) that the wide range instrumentation provides input when the narrow range is out of range. RMS has also learned that the simulator provides NO wide range SG level information.

REVIEW	SPDS OBSERVATION	DATE	HED NO.
DOCUMENTATION REVIEW	X	07/87	31G1-6100
DISPLAY FORMAT REVIEW	X	07/87	31G1-6025

***** ***** ***** ***** *****

5. Observation: FRP-S.2 asks the operator to check intermediate range flux for 5 x 10^{-11}amps, while the SPDS Subcriticality third level display shows IR flux from 0 to 1000000 nanoamps.

REVIEW	SPDS OBSERVATION	DATE	HED NO.
PROCEDURE REVIEW	X	07/87	31G1-6011
DYNAMIC REVIEW (1)	X	07/87	31G1-6008
SIMULATOR REVIEW	X	11/87	
SIMULATOR REVIEW	X	04/88	

***** ***** ***** ***** *****

6. Observation: The Containment second level display directs the operators to the Z series FRPs. The letter "Z" is not used at HNP. The letter "J" is actually used at HNP to indicate the containment FRP. The CSFTS board used at the simulator and the plant both use "J" for the Containment FRP.

REVIEW	SPDS OBSERVATION	DATE	HED NO.
DOCUMENTATION REVIEW	X	07/87	31G1-6011
PROCEDURE REVIEW	X	07/87	
DISPLAY FORMAT REVIEW	X	07/87	
DYNAMIC REVIEW (1)	X	07/87	
SIMULATOR REVIEW	X	11/87	
SIMULATOR REVIEW	X	04/88	

7A. Observation: The Limit A curve on the RCS Integrity third level display of Plant Operational Limits is not labelled.

7B. Observation: The Plant Operating Limits graph on the RCS Integrity third level display is called the PTS Limits Curve on the CSFST board.

7C. Observation: Misleading and confusing terminology can be found in some third level displays. The Average RCS Temperature used in the RCS Integrity CSF is really the average cold leg temperature. It could become confused with Tave, which is a different parameter and is not displayed on SPDS. RCS Pressure is actually Average PRZ Pressure and should be labelled as such. The Heat Sink third level display shows "TOTAL FW FLOW TO STM GEN A" when the words "TOTAL FW FLOW" are already used to mean to all SGs.

7D. Observation: The RCS Integrity third level display of the Plant Operating Limits graph is supposed to display a pressure vs. temperature plot of the coldest cold leg. The display uses a light blue trace to indicate the recent history of the trend. When the display is initially called up, the trend consists of a single pixel, which is difficult to discern. If the trend is in the MAGENTA region, the trend is virtually impossible to detect. Also, the length of the line displayed can be very short, if the trend has not changed.

REVIEW	SPDS OBSERVATION	DATE	HED NO.
PROCEDURE REVIEW	AB	07/87	31G1-6033 A, B & C
DISPLAY FORMAT REVIEW	CD	07/87	31G1-6011 B & C
OPERATOR INTERVIEWS (2)	C	07/87	31G1-6013 D
DYNAMIC REVIEW (1)	ABCD	07/87	31G1-6107 D
SIMULATOR REVIEW	A C	11/87	
PLANT REVIEW	A C	11/87	
SIMULATOR REVIEW	BC	04/88	

8A. Observation: The SPDS uses math symbols on the second level displays while the CSFST board uses words (≥ vice GREATER THAN).
Observation: The SPDS uses STARTUP RATE > 0 on the Subcriticality second level display while the CSFST board uses SUR POSITIVE.

8B. Observation: In many cases, the CSFST board does not include an OR EQUAL TO when the SPDS second level display has a parameter that can be equal to a value.

8C. Observation: The SPDS uses ALL RCPs STOPPED compared to NO RCPs RUNNING on the CSFST board.

8D. Observation: The CNMT Sump Level value used in the Containment CSF is 196 inches on SPDS vs. 192.5 inches on the CSFST board.

8E. Observation: The PRZ Level used in the RCS Inventory CSF is 90% on SPDS vs. 92% on the CSFST board.

8F. Observation: On the CSFST board the axes are labeled "PRESSURE" and "COLD LEG TEMPERATURE," but on the SPDS the axes are labeled "RCS PRESSURE" and "LOW COLD LEG TEMPERATURE."

8G. Observation: The vertical scale on the CSFST board spans 0 - 3000 PSIG in 500 PSIG increments. The SPDS alters the vertical range scale to give the pressures at the "knee" on the LIMIT A curve (2050 psig) and the top of the graph (2560 psig).

8H. Observation: The horizontal scale on the CSFST board spans 0 - 500 °F in 100 °F increments. The SPDS scale spans 0 - 400 °F, but the horizontal axis is marked off at 0, 100, 184, 215, 240, 270, 300, and 400 DEGF increments.

REVIEW	SPDS OBSERVATION	DATE	HED NO.
PROCEDURE REVIEW	ABCDEFGH	07/87	31G1-6011 A - H
DYNAMIC REVIEW (1)	ABCDEFGH	07/87	31G1-6033 B
SIMULATOR REVIEW	ABCDEFGH	11/87	

9. Observation: The SPDS uses standard HNP administrative procedures for configuration control. RMS understands that a separate document is currently being written to direct how the standard administrative procedures are to be used. It is not known whether this document will include a section on ensuring that changes to the plant SPDS also get incorporated into the simulator SPDS.

REVIEW	SPDS OBSERVATION	DATE	HED NO.
DOCUMENTATION REVIEW	X	07/87	31G2-6003
PROCEDURE REVIEW	X	07/87	
OPERATOR INTERVIEWS (2)	X	07/87	

***** ***** ***** ***** *****

10A. Observation: Screen generation time is slow, especially when calling up third level displays.

10B. Observation: The SPDS will not accept any command until the selected screen is fully generated. Should the operator inadvertently select the wrong screen or desire to view a nested third level display, he would have to wait for the undesired display to fully generate before the SPDS would accept another command. This situation is aggravated by the previous observation concerning the long screen generation times.

10C. The plant SPDS has been reported to lag up to twenty (20) minutes when all terminals were being used.

REVIEW	SPDS OBSERVATION	DATE	HED NO.
OPERATOR INTERVIEWS (2)	ABC	07/87	31G1-6019
DYNAMIC REVIEW (1)	A	07/87	
SIMULATOR REVIEW	AB	11/87	
PLANT REVIEW	AB	11/87	
SIMULATOR REVIEW	AB	04/88	

11A. Operator Observation: The lag in the SPDS Response was greater for the simulator than for the plant system.

11B. Observation: During several return to criticality scenarios, the YELLOW and MAGENTA Subcriticality branches (both using IR SUR) failed to trigger when power turned. Only the RED Subcriticality branch worked, but power was already greater than 5%. SPDS failed to alert the operators of the potential of a restart (IR SUR more positive than -0.2 DPM) and of the return to criticality (IR SUR positive). During the most recent review (4/88), the IR SUR on SPDS lagged the IR SUR on the Simulator control board by a factor of two (2) and by approximately one (1) minute.

11C. Observation: SPDS parameters lag the indications on the main control board and other panels by several seconds. Plant status as displayed by the status boxes lagged behind actual plant status by as much as 5 minutes. The operators know this and use the main control board or other indications when they need to know current values.

11D. Observation: Cursor movement was so slow that the parameter update rate was faster than the rate which the cursor could be moved with the Left button. In addition, the cursor remains on a specific point in time on the graph, not on a specific parameter point. This means the operator cannot place the cursor to read a set of values before the plot updates, moving the cursor off the points of interest.

11E. Observation: The button arrangement for the cursor control in the third level displays is unusual:

FUNCTION ASSIGNMENT		ARRANGEMENT
F1 - Fast left	F4 - Center	F4 F5 F6
F2 - Left	F5 - Right	F1 F2 F3
F3 - Not used	F6 - Fast right	

Most standard cursor controls have the left movement and right movement buttons on the same line, sometimes with the "home" or center button between them.

REVIEW	SPDS OBSERVATION	DATE	HED NO.
DOCUMENTATION REVIEW	C	07/87	31G2-6027 A
PHYSICAL LOCATION REVIEW	C	07/87	31G1-6102 B & C
OPERATOR INTERVIEWS (2)	ABCDE H	07/87	31G1-6102 B & C
DYNAMIC REVIEW (1)	ABCDEFGH	07/87	31G1-6019 D
SIMULATOR REVIEW	AB EF H	11/87	31G1-6101 A,B,C & D
PLANT REVIEW	AB E H	11/87	31G0-6029 E
SIMULATOR REVIEW	AB EF H	04/88	

12. Observation: Critical Safety Functions are valid for plant operating Modes 1 through 4. Some normal operating conditions (such as greater than 5% power during Mode 1) trigger non-applicable branches of the Critical Safety Function Status Trees. The present solution for this is to cause the non-applicable branch to be green; however, the SPDS has a RED Subcriticality CSF (greater than 5% reactor power) and YELLOW Core Cooling CSF (less than 42°F subcooling) during power operation. During an ATWS scenario, the Subcriticality CSF went directly from an invalid RED to a valid RED. Although the operators were aware of the ATWS condition, the SPDS could not fulfill its function of showing a change in the status of a CSF. In addition, the "forced" green branch continues to "point" toward the corresponding RED procedure and uses the word "RED" and the symbol "G".

REVIEW	SPDS OBSERVATION	DATE	HED NO.
OPERATOR INTERVIEWS (2)	X	07/87	31G2-6119
DYNAMIC REVIEW (1)	X	07/87	31G1-6005
SIMULATOR REVIEW	X	11/87	
PLANT REVIEW	X	11/87	
SIMULATOR REVIEW	X	04/88	

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13A. Observation: All displays showed parameters with an excessive number of decimal places.

13B. Observation: When a displayed parameter had a value of zero in the tenth and hundredth decimal place, the trailing zero was not displayed and the entire parameter shifted to the right (reading 123. vice 123.00). This right justification causes numbers to jump back and forth, and made comparison with like parameters more difficult.

REVIEW	SPDS OBSERVATION	DATE	HED NO.
DOCUMENTATION REVIEW	B	07/87	31G1-6028
DISPLAY FORMAT REVIEW	AB	07/87	
OPERATOR INTERVIEWS (2)	A	07/87	
DYNAMIC REVIEW (1)	AB	07/87	
SIMULATOR REVIEW	B	11/87	
PLANT REVIEW	AB	11/87	
SIMULATOR REVIEW	AB	04/88	

14A. Observation: The vertical scaling on the trend plots in every third level display has widely separated maximum & minimum values and units.

14B. Observation: Vertical scales on the third level trends do not allow for easy or simple reading. The "Y" AXIS min and max values on some third level trends result in unusual incremental values. For example, the Core Exit TC trend has a min and max of 32 °F and 1500 °F, which results in the increments being at 32 °F, 399 °F, 766 °F, 1133 °F, and 1500 °F. If 0 °F and 2000 °F were used, the vertical increments would be at 0 °F, 500 °F, 1000 °F, 1500 °F, and 2000 °F which would give the operator a better relative feel for the core exit temperature trend.

The spacial organization of the vertical scales provide the operator with a nonstandard scheme.

14C. Observation: The scale markings on the range brackets to the left of the third level trend displays on the SPDS provide little useful information about the value of the trend line due to the distance of the brackets from the lines being read, and the need for the operator to interpolate from the end points of the range. The information is provided more readily in the table below the trend. The offset of the two brackets furthest from the true top and bottom of the plot makes the range information provided difficult to interpret and reduces the accuracy of interpolations.

14D. Operator Observation: The RVLIS trend lines on SPDS top out under expected operational conditions.

REVIEW	SPDS OBSERVATION	DATE	HED NO.
DOCUMENTATION REVIEW	C	07/87	31G1-6033 A
PROCEDURE REVIEW	C	07/87	31G1-6012 B,C&D
DISPLAY FORMAT REVIEW	ABC	07/87	31G1-6010 A
PHYSICAL LOCATION REVIEW	C	07/87	31G1-6107 D
OPERATOR INTERVIEWS (2)	CD	07/87	31G1-6009 D
DYNAMIC REVIEW (1)	ABCD	07/87	
SIMULATOR REVIEW	ABCD	11/87	
PLANT REVIEW	ABCD	11/87	
SIMULATOR REVIEW	ABCD	04/88	

15. Observation: In many cases, non-standard abbreviations are used along with the standard abbreviations. Examples include PRES, S/G, and PZR (vice PRESS, SG, and PRZ). The Containment second level display button on the keyboard reads CONT vice CNMT.

REVIEW	SPDS OBSERVATION	DATE	HED NO.
DOCUMENTATION REVIEW	X	07/87	31G0-6030
PROCEDURE REVIEW	X	07/87	31G1-6011
DISPLAY FORMAT REVIEW	X	07/87	
OPERATOR INTERVIEWS (2)	X	07/87	
DYNAMIC REVIEW (1)	X	07/87	
SIMULATOR REVIEW	X	11/87	
PLANT REVIEW	X	11/87	
SIMULATOR REVIEW	X	04/88	

***** ***** ***** ***** *****

16. Observation: In one scenario where the core was uncovered, RVLIS failed to show a bubble in the pressure vessel (RVLIS did not appear to function well either on SPDS or the RVLIS panel). The operator had to determine the core was uncovered based on the rapid increase in core exit TCs.

REVIEW	SPDS OBSERVATION	DATE	HED NO.
OPERATOR INTERVIEWS (2)	X	07/87	31G1-6019
DYNAMIC REVIEW (1)	X	07/87	

17A. Observation: Normal operating condition parameters should be GREEN unless the quality is bad. Tcold and MDAFW pump discharge pressure on the Top Level display were RED during power operation due to exceeding limits, yet the values were normal for power operation.

17B. Observation: The "NV" flag is displayed when the system detects that the point is producing "bad" data but leaves the last good reading to be used by the operator.

17C. Observation: Several operator comments (e.g. "bogus", "out to lunch") indicated a lack of operator faith in the system reliability.

17D. Observation: On numerous occasions, core exit TC temperature was displayed with bogus values, such as 10+10°F or 105000°F.

17E. Observation: The SPDS displayed containment temperature as -1000°F.

17F. Observation: During one scenario, a MAGENTA Containment CSF challenge alerted by SPDS was not valid because the CNMT sump level was declared "bogus" by the operator after verifying the validity of the MAGENTA condition from MCB indications. SPDS is designed to display a WHITE CSFST box if the CSF cannot be determined due to nonvalidated data.

REVIEW	SPDS OBSERVATION	DATE	HED NO.
DOCUMENTATION REVIEW	AB	07/87	31G1-6100 A - F
DISPLAY FORMAT REVIEW	AB	07/87	31G1-6105 A - F
OPERATOR INTERVIEWS (2)	BCDE	07/87	31G1-6104 A - F
DYNAMIC REVIEW (1)	ABCDEF	07/87	
SIMULATOR REVIEW	AB DE	11/87	
PLANT REVIEW	AB D	11/87	
SIMULATOR REVIEW	AB D F	04/88	

18. Observation: Various characters on the SPDS third level displays are 1/8 inch in height. This character height calculates out to a recommended viewing distance of 1.7 feet, with a maximum viewing distance of 2.6 feet.

REVIEW	SPDS OBSERVATION	DATE	HED NO.
DOCUMENTATION REVIEW	X	07/87	31G2-6002
DISPLAY FORMAT REVIEW	X	07/87	31G1-6024
PHYSICAL LOCATION REVIEW	X	07/87	

***** ***** ***** ***** *****

19A. Observation: The SPDS Top Level Display shows reactor power in megawatts thermal vice % in EOPs.

19B. Operator Observation: Total FW flow is not included on the top level display.

19C. Operator Observation: FW and AFW discharge pressures on the top level display are not as useful as RVLIS would be.

REVIEW	SPDS OBSERVATION	DATE	HED NO.
DOCUMENTATION REVIEW	A	07/87	31G1-6011 A
PROCEDURE REVIEW	A	07/87	31G2-6004 B & C
DISPLAY FORMAT REVIEW	ABC	07/87	
OPERATOR INTERVIEWS (2)	BC	07/87	
DYNAMIC REVIEW (1)	ABC	07/87	
PLANT REVIEW	A	11/87	
SIMULATOR REVIEW	A	04/88	

20A. Observation: The lighting installation in the simulator is different from the HNP control room. While the absence of a survey of the simulator lighting prevents quantification of the differences, the differences in the location of lighting fixtures insures differences in glare characteristics between the control room and the simulator. This difference, in conjunction with glare problems at both installations, provides for some man-machine interface problems.

20B. Operator Observation: Location of the RVLIS panel and strip chart recorders are inconvenient to the COs, SCO and STA. The STA was often required to monitor the strip chart recorders and RVLIS panel. The SPDS was not readily visible to him from that part of the control room.

20C. Observation: The CRT designated as the dedicated SPDS screen in the simulator is not in the same location on the control board as the dedicated CRT in the actual plant control room. On the A/B panel wing of the control board in the simulator, the CRT closest to the B panel is designated as the dedicated SPDS screen. In the control room, the CRT farthest outboard from the corner of the board is the designated dedicated SPDS screen. While the difference in location is not great, the impact of the difference on use of the SPDS and on readability of the display cannot be dismissed or evaluated. The difference in location also influences the evaluation of glare problems mentioned above.

20D. Observation: The STA was the primary user of the SPDS during the scenarios. The STA most often used the CRT closest to his workstation to monitor the SPDS, rather than the screen on the control board which was designated as the dedicated SPDS screen.

20E. Observation: The computer terminal in the Project's Vice President office provides access to the ERFIS/SPDS computer without the safeguards stipulated by Reference 1.

20F. Observation: The ERFIS has some terminals which are normally secured, RMS is concerned as to what effect the total terminal load has on the system responsiveness.

REVIEW	SPDS OBSERVATION	DATE	HED NO.
			31G2-6000 A
			31G2-6001 A
PHYSICAL LOCATION REVIEW	A CDE	07/87	31G2-6002 B & D
OPERATOR INTERVIEWS (2)	ABCD	07/87	31G2-6027 C
DYNAMIC REVIEW (1)	ABCD	07/87	31G2-6111 D
SIMULATOR REVIEW	A	11/87	31G2-6112 E
PLANT REVIEW	A	11/87	31G1-6019 F
SIMULATOR REVIEW	A	04/88	31G1-6103 F

21A. Observation: Status on the status boxes often changed rapidly between GREEN, YELLOW, RED, and WHITE. This made evaluation of plant status difficult.

21B. Observation: Data values were often invalid during the critical segments of the scenarios. Loop flow and steam flow values were almost always invalid throughout the entire validation. During one critical time when subcooling was needed, it was invalid and had to be calculated manually.

21C. Observation: In one instance, the Heat Sink status tree showed a WHITE path due to invalid SG NR level, yet the values displayed inside the dashed box showed valid, current SG NR levels at 0%.

21D. Observation: There were too many instances of WHITE CSFs. During one scenario, the procedure called for a determination of whether or not the ERFIS computer was available. The STA recommended "Let's say the computer is not available." Three WHITE CSFSTs existed at the time.

21E. Observation: The Core Cooling status tree lost its path for a period of time (e.g. no path, not even a WHITE one, was displayed on the status tree).

REVIEW	SPDS OBSERVATION	DATE	HED NO.
OPERATOR INTERVIEWS (2)	A	07/87	31G1-6031 A
DYNAMIC REVIEW (1)	ABCDE	07/87	31G1-6104 A
SIMULATOR REVIEW	D	11/87	31G1-6105 A - E

22. Observation: The following ERFIS/SPDS related CRDR Summary Report HEDs were indicated:

A. HED NO: 31G1-0302 (A-24) Complete set of computer system operating procedures are not in the control room.

B. HED NO: 3100-1102 (A-2) Use of abbreviations is not consistently applied across the control room.

C. HED NO: 3100-0601 (A-26) Operator training does not specify ERFIS as the source of required information.

D. HED NO: 3100-0602 (A-26) Operator training does not specify ERFIS as the source for required trend information.

Each HED was followed by a disposition that stated: 1) ready by fuel load; 2) corrected; or 3) will be added. As of this writing, the actions provided for in the Summary Report do not appear to have been completed for A and B. In addition, the actions in items C and D do not appear to have been started ... for SPDS. and as .... SPDS is considered a part of ERFIS, this leaves the commitment unsatisfied.

REVIEW	SPDS OBSERVATION	DATE	HED NO.
DOCUMENTATION REVIEW	X	07/87	31G1-6110

APPENDIX - A

SPDS REFERENCES

APPENDIX A

REFERENCES

1. NUREG-0800, Appendix A of Section 18.2, Human Factors Review Guidelines for the Safety Parameter Display System, November 1984.

2. NUREG-0737, Supplement 1; Requirements for Emergency Response Capability (Generic Letter No. 82-33), December 17, 1982.

3. NSAC 39, Verification and Validation for Safety Parameter Display Systems, December 1981.

4. System Requirements Verification Report, Appendix B SAI-84/15610264, August 1984.

5. SPDS Test Plan for Shearon Harris Nuclear Power Plant Unit 1, RMS Associates #203-001, July, 1986.

6. Shearon Harris Emergency Operating Procedures.

7. NUREG-0700, Guidelines for Control Room Design Reviews, September 1981.

8. SPDS Evaluation report to CP&L from RMS Associates (Letter #: RMS-HNP-8801) dated 27 January 1988.

9. Carolina Power & Light - Shearon Harris Nuclear Power Plant - Control Room Design Review Final Summary Report, RMS Associates, September, 1884.

10. Westinghouse Owners' Group (WOG) Emergency Operating Procedure Background Documentation, Revision 1.

11. Safety Analysis for Shearon Harris Safety Parameter Display System, SAI Draft Report, September 1983.

12. SPDS Subsystem, Volume 13, Revision A, SAI Document No. 502-8203500-13, to be issued.

Appendices B, D, E, and F provide background data for this report. These Appendices are not essential to understanding the methodology and conclusions of this report and are therefore not attached. The HEDs contained in Appendix C "HEDs" are presented in Attachment 3 to NLS-88-288 with a disposition for each HED.

(5466AWS/che)

ATTACHMENT 3 TO NLS-88-228

SPDS HED Summary

- HEDs from Attachment 2

- HEDs from the DCRDR Final Summary Report

(5466AWS/che)

ERFIS/SPDS HEDs from Attachment 2 to NLS-88-228

HED NO.: 31G2-6000

HED TITLE: Control Room Lighting Survey

PROBLEM DESCRIPTION: While operators involved with the simulator exercises indicated no problems with glare when questioned after the exercises, operator questionnaires elicited three direct comments about glare in the plant control room.

NUREG-0700, Section 6.7.2.1 b.

DISPOSITION: The final control room illumination survey performed during normal operating conditions indicates that the current light levels are within the recommended criteria. Two areas exceeded the 50 ftC criteria maximum by 2 and 3 ftC. This difference is considered to be insignificant. Floor carpeting and new furniture installed after the preliminary survey resulted in improvements.

HED NO.: 31G2-6001

HED TITLE: Differences Between Lighting in the Simulator and the Control Room

PROBLEM DESCRIPTION: The simulator has different lighting installation from the control room, thus it is not possible to draw conclusions about lighting conditions from one to the other.

NUREG-0700, Section 6.8.2.4 b.

DISPOSITION: CP&L implementation of Regulatory Guide 1.149, "Nuclear Power Simulators for Use in Operator Training," is addressed in Section 1.8 of the SHNPP FSAR. The SHNPP simulator will be in full compliance with the requirements of ANSI/ANS 3.5-1981 as modified by Reg. Guide 1.149 by March 1991. Please note that due to the necessity of a viewing deck for observation of the simulator area, lighting in the control room cannot exactly match that of the simulator area, however, the lighting criteria of NUREG-0700 will be met.

HED NO.: 31G2-6002

HED TITLE: Workstation Layout Deficiency

PROBLEM DESCRIPTION: The STA has been designated as the primary user of SPDS. Typically, the screen adjacent to the STA's desk is used to display SPDS. During the scenarios run for validation the STA spent a considerable amount of time monitoring the RVLIS panel and the strip chart recorders, located at the opposite end of the raised floor area from the STA's desk. From that vantage, the SPDS is not readily visible, much less readable, to the STA.

NUREG-0700, Section 6.1.1.2 a.

DISPOSITION: Positioning requirements of the primary SPDS screen are described in NUREG-0696 (Section 5.2) and NUREG-0800, Section 18.2, Appendix A (Section 5.2.1). Nine ERFIS CRT screens are located throughout the control room, any of which can display SPDS information.

HED NO.: 31G2-6003

HED TITLE: Absence of Required Documentation from the Control Room

PROBLEM DESCRIPTION: Appendix A to Section 18.2 of the Standard Review Plan (SRP) calls for SPDS to be accompanied in the control room by a written user's manual.

DISPOSITION: An ERFIS user's manual is now available in the control room. The SPDS is discussed in Section 4.7.

HED NO.: 31G2-6004

HED TITLE: Display Parameter Selection Concerns

PROBLEM DESCRIPTION: Operator requests for RVLIS and Total FW Flow on SPTOP, for a more direct indication of containment integrity, and for additional radioactivity containment points indicates a gap between the information provided and the operator's perceived need for information. The method used for determining the information included relied heavily on previously documented needs as spelled out by the Westinghouse CSF network. The selection could benefit from a consideration of the specific requirements spelled out for SPDS.

NUREG-0700, Section 6.5.1.1 a.

DISPOSITION: This item was reviewed against the requirements of the EOP network and operational enhancements. Improvements are discussed in the dispositions for HEDs 31G2-6006 and 31G1-6011. The SPTOP screen is limited to the amount of information that can be displayed. Total FW flow indication has been added to SPTOP. RVLIS and other parameters are available on SPDS screens and are capable of being called up by an operator when these areas are of concern. The displayed parameters have been reviewed and found to meet the requirements of NUREG-0737, Supplement 1.

HED NO.: 31G2-6005

HED TITLE: Mode Dependent Information Display

PROBLEM DESCRIPTION: When the plant is at power operations (Mode 1) two SPDS status boxes display red and yellow status for normal operational conditions.

Many of the displays based on values which vary depending on whether containment conditions are normal or adverse use only the adverse containment values for operator guidance.

NUREG-0700, Section 6.5.1.1 b.

DISPOSITION: The problem of generating false warning signals has been corrected by incorporating logic into the status trees. This logic method is more direct and specific and resolves this concern.

HED NO.: 31G2-6006

HED TITLE: Unnecessary Information on SPTOP

PROBLEM DESCRIPTION: The FW and AFW Discharge Pressure values displayed on SPTOP were characterized as unnecessary in an operator comment.

NUREG-0700, Section 6.5.1.1 c.

DISPOSITION: The FW and AFW discharge pressures have been deleted from SPTOP.

HED NO.: 31G1-6007

HED TITLE: Display Failure Indication

PROBLEM DESCRIPTION: Operators report inability to determine if the SPDS is experiencing a display failure.

NUREG-0700, Section 6.5.1.1 f.

DISPOSITION: An ERFIS alarm/trouble display indicating ERFIS malfunction is located at the STA console. A complete system failure will result in the screens going blank. A failure to update ERFIS data is possible; however, the operators will easily identify this from the fact that none of the information displayed on a screen is being updated. Normal system functioning will result in several displayed values changing within approximately 10 seconds. The STA and operators have other instruments available which can be used to determine discrepancies with the SPDS. No further action is deemed necessary.

HED NO.: 31G6-6008

HED TITLE: Operator Display Conversion

PROBLEM DESCRIPTION: EOPs refer to IR Flux value of 5×10^{-11}. The SPDS third level display associated with Subcriticality shows IR Flux in values up to 1,000,000 nanoamps.

NUREG-0700, Section 6.5.1.2 b.

DISPOSITION: Displayed valves have been changed to read in exponential format.

HED NO.: 31G1-6009

HED TITLE: Inadequate RVLIS Range on SPDS

PROBLEM DESCRIPTION: Scale of RVLIS trend on RCS Inventory third level display spans 0-100%. RVLIS values can range up to 120%, leaving the value off-scale on the trend for an acceptable value.

NUREG-0700, Section 6.5.1.2 d.(1).

DISPOSITION: This has been corrected by changing the range of the SPDS calculated RVLIS points to 0 through 120%. This range is consistent with the ranges of the root input points from RVLIS and will allow the SPDS Trend Plot to trend the full scale values.

HED NO.: 31G1-6010

HED TITLE: SPDS Trend Scale Labels

PROBLEM DESCRIPTION: The third level trends on SPDS use a labeling technique where three scales are related to the vertical axis by means of off-set lines color coded to the digital value labels presented below the trends. Because the trend scales include values for the maximum and minimum values only with the units located about the midpoint of the color coded lines, the operator is faced with a complex scanning pattern covering most of the CRT in order to integrate the information of trend name, range and units.

NUREG-0700, Section 6.5.1.4 a.(2)

DISPOSITION: Trend displays are used for providing an operator the time-related changes in a given parameter. This is most easily accomplished by minimizing excess information displayed on the screen. The current value is displayed on the screen. Should the operator want to know a specific value at a previous point on the trend, it can be displayed on the bottom of the screen by appropriate operator action.

These screens, as is, are a clean, concise method of displaying the information which is required. It is also consistent with the other trend displays normally used by the operators during normal routine plant operations. The operator is not faced with a complex scanning pattern to integrate the information and no further action is necessary.

HED NO.: 31G1-6011

HED TITLE: Labeling Inconsistencies Between the SPDS and the EOPs

PROBLEM DESCRIPTION: Several parameters, status trees and plots present information essentially identical to information presented in the EOP network; however, the wording used for the labels or messages vary from the SPDS to the EOPs.

NUREG-0700, Section 6.5.1.4 e.

DISPOSITION: SPDS and SPTOP wording has been made consistent with the EOPs.

The following inconsistencies between SPDS and the EOPs are known to exist. They are due to the limited space on the computer screen. "T Exit" is used by the Westinghouse Owner's Group Procedures. Operators are aware of these and due to their uniqueness, human factors believes no confusion will result.

"T EXIT" for excore thermocouples.
"PRES" for pressure.
"CONTAINMENT RAD" for High Range Containment Post-LOCA Radiation.

HED NO.: 31G1-6012

HED TITLE: Poor Scale Graduation Increments on SPDS Displays

PROBLEM DESCRIPTION: Most of the third level trend displays incorporate three graduation marks on the vertical axis. For scales ranging from 0 - 700, 0 - 1300, or 0 - 3000, the increments do not meet the accepted standard.

NUREG-0700, Section 6.5.1.5 c.

DISPOSITION: As discussed in the disposition for HED 31G1-6010, an operator will not use the scale to determine a given value. Current values are displayed on the screen and previous values can be called up by the operator. These scales are used to provide the operator information on the relative change of a parameter over time. No further action is deemed necessary.

HED NO.: 31G1-6013

HED TITLE: Poor Color Selection for Trend Line

PROBLEM DESCRIPTION: The trend line on the Plant Operational Limits Curve is light blue. When the line falls in the magenta region of the plot the trend line is very difficult to pick up.

NUREG-0700, Section 6.5.1.6 e.(2)

DISPOSITION: Maintenance procedures have been revised to indicate the need to reinitialize the system when returned to operation. A flashing cyan asterisk is used to indicate the current position relative to the Operational Limit Curves.

HED NO.: 31G2-6014

HED TITLE: Labeling of the Primary SPDS Screen

PROBLEM DESCRIPTION: The screen designated as the primary SPDS screen has no label indicating it as the location where the operator can expect to find SPDS vs. ERFIS displays.

NUREG-0700, Section 6.6.1.1

DISPOSITION: The system hardware and software are designed to allow any console to be used for SPDS or other functions. Once the primary SPDS is assigned by the configuration manager, it will remain in this role. Operations cannot use the primary SPDS for any other purpose. The position is consistently assigned and is only changed in accordance with an approved plant procedure.

Since the SPDS is a subsystem of the ERFIS, any ERFIS screen can be used to display SPDS. No further action is therefore necessary.

HED NO.: 31G2-6015

HED TITLE: Operator Entry File

PROBLEM DESCRIPTION: No sequential file of operator entries is available to the operators at their request.

NUREG-0700, Section 6.7.1.3 e.

DISPOSITION: Operator may review each entry in the operator communication area of the CRT screen prior to command execution. If a trend file is being built, the operator may recall the file to review all entries.

HED NO.: 31G0-6016

HED TITLE: Lack of Positive Feedback of Key Actuation

PROBLEM DESCRIPTION: Operators report a lack of positive feedback of key actuation.

NUREG-0700, Section 6.7.1.4 f.

DISPOSITION: The SPDS is a single keystroke, menu-driven system. Actuation of a given key will result in the display of the corresponding screen. If an incorrect key is actuated, the operator will recognize the error due to a different screen being displayed. This can be easily corrected by proper key actuation.

HED NO.: 31G0-6017

HED TITLE: Presence of Irrelevant Keys

PROBLEM DESCRIPTION: The keyboards used are standard QWERTY keyboards with several sets of function keys. One set of function keys are dedicated to SPDS. The remaining keys (including the alpha-numeric keys) are used for ERFIS or maintenance.
NUREG-0700, Section 6.7.1.4 i.

DISPOSITION: The main keyboard is a standard QWERTY type with three groups of function keys. These function keys are consistently assigned and grouped. They afford many single keystroke functions and are labeled to indicate their use. Extra keys can be used to compensate for a malfunctioning key. By using a standard keyboard for all consoles, training and usage are simplified. Also by using a standard keyboard for each ERFIS display, the operator can rapidly display SPDS on any console along with the other functions.

HED NO.: 31G0-6018

HED TITLE: Nonstandard Abbreviations Used on Keys

PROBLEM DESCRIPTION: Key engraved with nonstandard abbreviation.

NUREG-0700, Section 6.7.1.5 b.

DISPOSITION: On the standard IBM keyboard and the ERFIS/SPDS terminals used at SHNPP, the Control key is labeled "CTRL". Operators are aware of this and have been trained in the use of SPDS and these keyboards. Human factors believes that due to the uniqueness of the situation, differences in color coding and key position, and operator training the potential for confusion between the Containment key (labeled "CONT") and the Control key (labeled "CTRL") will be minimal.

HED NO.: 31G1-6019

HED TITLE: Computer Response Times

PROBLEM DESCRIPTION: Computer response time exceeds recommended standards.

NUREG-0700, Section 6.7.1.7 a.

DISPOSITION: Dead bands have been added to filter out small, insignificant process variations. This minimizes the number of displayed parameters requiring updating, thereby reducing system loading and improving response time. In addition, three enhancements have been tested on the ERFIS simulator and will be installed on the plant ERFIS.

HED NO.: 31G1-6020

HED TITLE: Lack of Response Delay Message

PROBLEM DESCRIPTION: SPDS does not provide a message informing the operator that the input is being processed.

NUREG-0700, Section 6.7.1.7 b.

DISPOSITION: Operator experience gained from usage of the SPDS has made them aware of this minimal response lag. The system provides feedback as data is entered, when a command is entered, and when a command is executed. The delay between command entry and display is not long enough (< 15 seconds) to require a delay message. Advisories of this type can therefore only add to overall system loading without providing a real benefit.

HED NO.: 31G1-6021

HED TITLE: Lack of Operating Procedures in Control Room

PROBLEM DESCRIPTION: There is not a set of operating procedures for the SPDS in the control room.

NUREG-0700, Section 6.7.1.8 a.(1)

DISPOSITION: The system is menu driven with adequate prompts for operator use. An ERFIS user's manual is available in the control room. The SPDS is discussed in Section 4.7.

HED NO.: 31G1-6022

HED TITLE: Lack of Data Point Indices

PROBLEM DESCRIPTION: There is no cross-indexed list of data points and trends provided by SPDS.

NUREG-0700, Section 6.7.1.8 b.(1) & (2)

DISPOSITION: The system is menu driven. A user's manual providing display access information is available in the control room. The operators have been trained on the simulator to interpret and use SPDS features as necessary.

HED NO.: 31G1-6023

HED TITLE: Lack of Controls for Screen Color and Contrast

PROBLEM DESCRIPTION: There are no controls available on the SPDS console for adjusting display color or contrast.

NUREG-0700, Section 6.7.2.1 h.(1)

DISPOSITION: CRT brightness controls are available for operator control. The remaining controls are interactive and require training to properly adjust. A system technician can easily make adjustments in response to operator concerns.

HED NO.: 31G1-6024

HED TITLE: Alpha-Numeric Character Size

PROBLEM DESCRIPTION: The characters used to provide information about the trend axes are 1/8th inch in height. This calculates out to a maximum viewing distance of 2.6 feet.

NUREG-0700, Section 6.7.2.2 b.(1)

DISPOSITION: CRT displays are designed and organized such that symbol size is relative to required viewing distance. Critical safety function status boxes are large, color-filled rectangles that can be seen from any position in the operating area. For detailed review of data, there are nine CRTs in the Control Room, six of which are mounted on the control board. This allows the operator to have a screen within required viewing distance for examining detailed data. The average expected viewing distance at any screen is approximately two feet.

HED NO.: 31G1-6026

HED TITLE: Lack of Printer in Control Room

PROBLEM DESCRIPTION: There is not a printer available to the operators in the control room.

NUREG-0700, Section 6.7.3.1 a.(1)

DISPOSITION: Printers are not necessary for the retention of SPDS data. The SPDS parameters are archived on both system discs. However, there are two printers available in the control room and a line printer and video copier in the adjacent computer room.

HED NO.: 31G2-6027

HED TITLE: Differences Between Simulator and Control Room

PROBLEM DESCRIPTION: Different screens are designated as primary SPDS screens in the simulator and the control room.

NUREG-0700, Section 6.8.2.4 b.

DISPOSITION: Refer to the disposition for HED 31G2-6001.

HED NO.: 31G1-6028

HED TITLE: Display Data Format Concerns

PROBLEM DESCRIPTION: The presentation of the data on SPDS generally includes a level of precision beyond what is required for operator decision making. Also, data presented in decimal format use a floating format that allows the decimal to move as many as two places relative to the data field.

NUREG-0700, Section 6.7.2.4 a.(1)

DISPOSITION: Data that requires exponential notation is now displayed using exponential notation. Data displayed with more precision than appears warranted is due to its use for trending and historical records. This is not considered significant.

HED NO.: 31G0-6029

HED TITLE: Poor Cursor Control Layout

PROBLEM DESCRIPTION: The six function buttons used for cursor control (refers to trend line control) are poorly laid out relative to their functions.

NUREG-0700, Section 6.7.1.5 a.

DISPOSITION: The control room keyboards are the same as those in use at the simulator. Cursor control and the function keys which can be uniquely defined for each display gives the consoles the ability to access many displays and system features using single or a series of single keystrokes. The keys enabled for each display are indicated on the bottom of the display. No further action is necessary.

HED NO.: 31G0-6030

HED TITLE: Labeling of the Cursor Control Buttons

PROBLEM DESCRIPTION: The six cursor control buttons (refers to trend line control) are not labeled according to their function, but rather as F1 - F6.

NUREG-0700, Section 6.7.1.5 b.

DISPOSITION: As stated in HED 31G0-6029, the "F" keys can be uniquely defined for each display and the definition is displayed on the bottom of each screen. To label the keys with specific functions would limit their use. No further action is necessary.

HED NO.: 31G1-6031

HED TITLE: SPTOP Display Sensitivity

PROBLEM DESCRIPTION: The status boxes used as SPTOP will fluctuate rapidly between status levels when the plant status is close to the level transition.

NUREG-0700, Section 6.5.1.2 f.

DISPOSITION: The fluctuations were caused by input variables on the plant simulator. These problems have been corrected. Where appropriate, dead bands have been added to filter out small, insignificant process variations.

HED NO.: 31G1-6032

HED TITLE: Data Points Incorrectly Identified in Documentation

PROBLEM DESCRIPTION: Documentation of the values for calculating subcooling, average core exit thermocouple temperature, and the top level data points for Volume 13 of the ERFIS SPDS Subsystem documentation are incorrect or incomplete.

NUREG-0700, Section 6.6.3.3

DISPOSITION: The saturation monitor was to use "T Hot" rather than the core exist thermocouples. Prior to start-up, the design was changed to use the five hottest TCs. The documentation (one vendor's manual) was not revised to reflect this change. The vendor manual is being revised. "T Exit" is used by the Westinghouse Owners Group procedures. ERFIS manual Volume 13 is used by computer maintenance technicians, not the operators.

HED NO.: 31G1-6033

HED TITLE: Limit Curve Labeling Missing

PROBLEM DESCRIPTION: The Limit A curve on the RCS Integrity third level display of Plant Operational Limits is not labeled.

NUREG-0700, Section 6.6.1.1

DISPOSITION: This is the only X-Y plot used by the SPDS. No other ERFIS display uses an X-Y plot. This curve is unique. Therefore, no confusion or delay will be introduced by this item. Operators are trained to recognize this.

HED NO.: 31G1-6100

HED TITLE: Displayed Data Does not Represent the Current and Correct Status of Critical Plant Variables

PROBLEM DESCRIPTION: Data displayed during "NV" status is "last known good data" and is on CRT for some time rendering this displayed data as not current.

Data displayed is represented as "good" but value is out of range (example: .650+10 for RCS PRESS).

NUREG-0800, Section 18.2, Appendix A, paragraph 5.1.3

DISPOSITION: When SPDS cannot calculate a value, the "NV" quality code is displayed, along with the last known "good" value. This condition will remain until SPDS has enough information to calculate the required value. The "NV" quality code is a flag to the operator that a problem exists with the field inputs and requires attention. SPDS also considers values which are out of range, but not "BAD," to be valid for determining the SPDS status tree status. This is a conservative approach and is consistent with other installed plant instrumentation. Thus, as long as the input signal can be converted to engineering units, SPDS will use that value. When the signal goes beyond sensor range, the last good value is retained and quality coded "NV." Should all of the SPDS inputs for a given parameter be unavailable, the display will be white, indicating to the operator that the value is unknown. No further action is deemed necessary.

(3419NED/kov)

HED NO.: 31G2-6101

HED TITLE: The Delay Time Between the Display of Data on the Control Board and the SPDS Tends to be Excessive

PROBLEM DESCRIPTION: Plant status as displayed by the SPDS status boxes lagged behind actual plant status by as much as five (5) minutes.

During emergency drills, it may take 20 minutes for the system to update.

NUREG-0800, Section 18.2, Appendix A, paragraph 5.1.3.c

DISPOSITION: This delay was solely simulator related. The following corrections were made to ensure consistency with the plant. The original data concentrator software performed scan frequency-based processing which introduced delays in the updating of data being transmitted to the ERFIS simulator. The simulator's data concentrator software has been rewritten. The data concentrator now uses portions of the ERFIS simulator data base to create files containing data necessary to convert simulator values into signals the ERFIS simulator can interpret. When the data concentrator is running (i.e., transmitting data to ERFIS), data is being shipped to ERFIS once per second. Subsequently, ERFIS can perform each point's engineering unit conversion at that point's scan frequency. This action has corrected the time lag.

HED NO.: 31G1-6102

HED TITLE: The Display Gives False Indications of Plant Status at Times

PROBLEM DESCRIPTION: Intermediate and Source Range Startup Rate were both positive and above the CSF alarm for a Yellow or Magenta condition.

Power range went about five minutes from the time the Control Board indicated > 5% power until the SPDS indicated > 5% power with a Red condition.

NUREG-0800, Section 18.2, Appendix A, paragraph 5.1.3.e

DISPOSITION: Refer to the disposition for HED 31G2-6101.

HED NO.: 31G1-6103

HED TITLE: SPDS Display is not Responsive to Transient and Accident Sequences

PROBLEM DESCRIPTION: Operators use the control board versus the SPDS during transient conditions. The SPDS lags in nontransient conditions, therefore, the argument that there is no way the system will function properly during a transient.

NUREG-0800, Section 18.2, Appendix A, paragraph 5.1.3.f

DISPOSITION: Refer to the disposition for HED 31G2-6101.

HED NO.: 31G1-6104

HED TITLE: The Operator is not able to Determine a Change in Plant Safety Status in a Matter of Seconds

PROBLEM DESCRIPTION: With all of the fluctuating colors and values, values reading Red and Yellow during power operations, out of range numbers, etc., the operator can make little determination of plant status.

NUREG-0800, Section 18.2, Appendix A, paragraph 5.1.3.g

DISPOSITION: Invalid or nonsensical data was transmitted between the plant simulator and ERFIS simulator causing the SPDS to sporadically change states. The data problem has been corrected.

HED NO.: 31G1-6105

HED TITLE: The Display does not Indicate to the Operator Whether the Data is Valid, Invalid, or Invalidated

PROBLEM DESCRIPTION: The data presented is confusing to the operator. Data has been on the screen with an "NV" but the data is good (per HPES). Data has been unmarked but is obviously out of specification as well as normal range (Containment Temp -1000°F). Status trees show a "White" path, SG NR Level invalid, yet the dashed box on the tree showed no "NV" or other tag for the data in question (SG Level).

NUREG-0800, Section 18.2, Appendix A, paragraph 5.1.3.i

DISPOSITION: The data concentrator software has been rewritten. The data concentrator uses portions of the ERFIS simulator database to create files containing data necessary to convert simulator values into signals the ERFIS simulator can interpret. Refer to the disposition for HED 31G1-6100.

HED NO.: 31G2-6106

HED TITLE: The Control Room Operating Crew Cannot Perform an Operability Evaluation of the SPDS to Ensure it is Functioning Properly

PROBLEM DESCRIPTION: There are no procedures available for such a test.

NUREG-0800, Section 18.2, Appendix A, paragraph 5.1.3.j

DISPOSITION: Operating experience during Cycle 1 has shown that the operators are very aware of any discrepancy between an SPDS displayed value and the corresponding plant variable. While a formal SPDS test is not available for operator use, the computer system contains means by which an input in question can be verified. Maintenance performs periodic tests on the SPDS to ensure proper functioning of the system logic and displays. The loss of all SPDS input for a given parameter results in a white display for that parameter. The disposition for HED 31G1-6007 addresses the possibility of SPDS failures. No further action is necessary.

HED NO.: 31G1-6107

HED TITLE: The Trend Data is not Displayed in Sufficient Resolution in Time and Magnitude to Accurately Portray Changing Variables

PROBLEM DESCRIPTION: The trend data often is "topped out" and any perturbation cannot be seen. In addition, the scales or axes do not allow the operator to discern the relative value of the trend.

NUREG-0800, Section 18.2, Appendix A, paragraph 5.1.4.b

DISPOSITION: Data limits for SPDS parameters have been evaluated and revised as necessary to provide adequate range. Relative value discernability for scales and axes is addressed in the disposition for HED 31G1-6010.

HED NO.: 31G2-6108

HED TITLE: The SPDS is not Located Convenient to the Control Room Operators

PROBLEM DESCRIPTION: The location of the "primary" SPDS CRT is on the control board, not where any of the primary users can adequately use it. HED 31G1-6024 indicates that the maximum viewing distance is 2.6 ft. Therefore, only the Control Operators are able to use this display. The Control Operators are on the lowest level of priority to use the SPDS.

NUREG-0800, Section 18.2, Appendix A, paragraph 5.2.1.a

DISPOSITION: Refer to the disposition for HED 31G1-6002.

HED NO.: 31G2-6109

HED TITLE: The Primary SPDS is not Easily Distinguishable from Other Displays

PROBLEM DESCRIPTION: The operators only know (?) that a SPDS display is on the MCB and the other SPDS display is located at the STA's desk. There are no markings, guidelines, or other specific directions as to how to designate the present CRTs or how to change this designation for the operating crew.

NUREG-0800, Section 18.2, Appendix A, paragraph 5.2.1.b

DISPOSITION: Any operator can call up SPDS by a single keystroke from any ERFIS console keyboard which is desired. Specification of a "secondary SPDS screen" is not necessary. The concern regarding the primary SPDS screen is discussed in the disposition for HED 31G2-6002.

HED NO.: 31G1-6110

HED TITLE: The Display Does not Meet the Intent of the Guidelines in NUREG-0700

PROBLEM DESCRIPTION: See HED #31G1-6024.

NUREG-0800, Section 18.2, Appendix A, paragraph 5.2.1.c

DISPOSITION: Refer to the disposition for HED 31G1-6024.

HED NO.: 31G2-6111

HED TITLE: The SPDS Display is not Located so that the Control Operators Responsible for Avoiding Degraded and Damaged Core Events can Observe the SPDS Display

PROBLEM DESCRIPTION: The location of the "primary" SPDS CRT is on the control board, not where any of the primary users can adequately use it. HED 31G1-6024 indicates that the maximum viewing distance is 2.6 ft. Therefore, only the Control Operators are able to use this display. The Control Operators are on the lowest level of priority to use the SPDS.

NUREG-0800, Section 18.2, Appendix A, paragraph 5.2.1.d

DISPOSITION: Refer to the disposition for HED 31G2-6002.

HED NO.: 31G2-6112

HED TITLE: The ERFIS/SPDS Computer can be Accessed and Controlled from an Unguarded Terminal/Microcomputer

PROBLEM DESCRIPTION: The placement of an unguarded link to the ERFIS/SPDS computer, although not for the purpose of taking control of the displays in the control room, violates the purity of the computer system.

NUREG-0800, Section 18.2, Appendix A, paragraph 5.2.1.e

DISPOSITION: Various mechanisms, both in the computer operating system and in the application software, control access and privileges available for each terminal connected to the system. Requests/commands made at one terminal cannot impact another terminal. Therefore, an out-of-control situation in the control room could not be caused. No further action is deemed necessary.

HED NO.: 31G2-6113

HED TITLE: No Operator Training has Occurred on SPDS Except for Operation Without the SPDS Computer

PROBLEM DESCRIPTION: No operator training has occurred that covers SPDS or the ERFIS computers. SPDS is operating in the control room. Operation of such a system without training normally results in negative training.

NUREG-0800, Section 18.2, Appendix A, paragraph 5.3.1.b

DISPOSITION: Operator training has been completed.

HED NO.: 31G2-6114

HED TITLE: There is No User's Manual Available for Reference in the Control Room or at All

PROBLEM DESCRIPTION: With no user's manual available for operation of the SPDS computer, there is no guidance for system operation. Without system operating guidance the operators, users, and others have a tendency to develop their own operating methodology, thereby establishing hearsay operating practices and additional negative training.

NUREG-0800, Section 18.2, Appendix A, paragraph 5.3.1.d

DISPOSITION: An ERFIS user's manual is available in the control room. The SPDS is discussed in Section 4.7.

HED NO.: 31G1-6115

HED TITLE: Pattern and Coding Techniques Sometimes Give the Operator the Opposite Indication than what was Intended (Red Reactor Power During Power Operations)

PROBLEM DESCRIPTION: Red branch of CSFSTs in some instances during power operation are constantly red.

Several of the six (6) status boxes are other than green during power operation.

NUREG-0800, Section 18.2, Appendix A, paragraph 5.4.2.a

DISPOSITION: The data concentrator software has been rewritten, the RVLIS link to the ERFIS simulator corrected, and the reinitializing process for the ERFIS simulator properly established. Reinitializing the ERFIS simulator will then cause the sequence of events points, rod position indications, and other applicable addressable points to be initialized with proper values for the given initial condition thereby ensuring correct display color.

HED NO.: 31G1-6116

HED TITLE: Limits on Some SPDS Variables are not Based on Actual Setpoints

PROBLEM DESCRIPTION: The limits on the SPDS display are not the same as the CSFST board, the SPDS limits are not based on the EOP setpoints.

The SPDS displayed an "out-of-normal" or "in-the-alarm" range variable and did not "mark" it as out-of-normal.

NUREG-0800, Section 18.2, Appendix A, paragraph 5.4.2.b

DISPOSITION: The quality tag indicated on a trend display is not a function of EOP decision values but of operational limitations. The value at which these quality tag decision steps are made varies depending on various plant conditions. An SPDS setpoint procedure exists and has been updated based upon the SPDS review. The wording of the "alarm" values on the third level displays have been changed to "alert" to avoid confusion with the alarm and warning setpoints associated with these computer points.

HED NO.: 31G2-6117

HED TITLE: The SPDS is not Readily Perceived and Comprehended from the Emergency Station of the Control Room Operator Responsible for Evaluating the safety Status of the Plant

PROBLEM DESCRIPTION: The primary user for the operating crew is the STA. The primary SPDS is on the control board.

The STA leaves his station to monitor the RVLIS and various strip chart recorders. The action hinders his ability to monitor the SPDS adequately.

NUREG-0800, Section 18.2, Appendix A, paragraph 5.4.2.d

DISPOSITION: Refer to the disposition for HED 31G2-6002.

HED NO.: 31G1-6118

HED TITLE: The Critical Plant Parameters Should Inform Operators of the Designated Critical Safety Functions

PROBLEM DESCRIPTION: RCS Integrity Limit A curve is difficult to read the current plant status on the curve.

RCS Integrity third level trend uses "Average RCS Temperature" which is not Tave.

Paragraph 5.5.1.a.iv - Radioactivity Control is only covered on SPTOP (not officially a part of SPDS) and one "R/HR" decision point in the CONTAINMENT Status Tree.

Paragraph 5.5.1.a.v - Containment conditions are very sketchy due to a very limited amount of radiation inputs to the status tree; poor sump level input; poor Phase A/B indications and inconsistent treatment of radiation indications (mR vs MR vs R).

NUREG-0800, Section 18.2, Appendix A, paragraph 5.5.1.a.iii

DISPOSITION: SPDS parameter selection was reviewed by the NRC and found to be acceptable per NUREG-1038, Supplement No. 4. Abbreviations and nomenclature have been reviewed and corrected. No further action is necessary.

HED NO.: 31G2-6119

HED TITLE: The SPDS does not Contain a Mode Dependent Scheme or Set of Displays

PROBLEM DESCRIPTION: There are SPDS items that show other than green in the power mode (1).

There are SPDS items that are only applicable in a mode other than 1 (power operations) and the SPDS does not take this into account.

NUREG-0800, Section 18.2, Appendix A, paragraph 5.5.1.b

DISPOSITION: Refer to the disposition for HED 31G2-6005.

HED NO.: 31G1-6120

HED TITLE: SPDS Should Consist of a Minimum Set of Variables Necessary to Evaluate the Safety Status of the Plant

PROBLEM DESCRIPTION: SPTOP does not give a proper picture of the plant status . . . it is missing several important plant parameters: RVLIS & TOTAL FEED WATER.

NUREG-0800, Section 18.2, Appendix A, paragraph 5.1.2.a

DISPOSITION: Refer to the disposition for HED 31G2-6004 and HED 31G1-6118.

HED NO.: 31G1-6121

HED TITLE: There is no Way on SPDS to Discern "Normal" from Conditions Which Would Indicate a Critical Plant Status

PROBLEM DESCRIPTION: There are times when the various items of the SPDS may add up to a potential critical plant status of a particular variable is not portrayed on SPDS in a manner to give the operator the proper status . . . RVLIS failed to show that the core was uncovered, operator had to determine this by examining the core exit TCs.

NUREG-0800, Section 18.2, Appendix A, paragraph 5.1.3.d

DISPOSITION: The RVLIS link to the ERFIS simulator was malfunctioning on an intermittent basis and has been corrected.

ERFIS/SPDS HEDs from the DCRDR Final Summary Report

HED NO.: 31G1-0304

HED TITLE:	No corrective action instructions follow error messages on CRT displays.
CATEGORY:	III
DISPOSITION:	Written instructions for reentering data following an error message will be provided. An operator's instruction guide is dependent on the final software to be used for the ERFIS. These instructions will be available when ERFIS is operational. This HED will be addressed in the SPDS Human Factors Review.
STATUS:	The operators have been trained on actions to be taken when receiving an error message. An ERFIS user's manual is available in the control room and provides written instructions for reentering data. The manual also lists the valid codes. The SPDS is discussed in Section 4.7 of the ERFIS user's manual.

HED NO.: 31G0-3422

HED TITLE:	Legend pushbuttons are not easily distinguishable from legend lights.
CATEGORY:	III
DISPOSITION:	These two pushbuttons are used to activate either the left or right CRT for use with the single keyboard at this dual display terminal. A decision has been made to physically separate these into two separate and complete ERFIS/SPDS terminals. These pushbuttons will be deleted as they will not longer be needed.
STATUS:	Pushbuttons have been deleted.

(3419NED/che)

HED NO.: 31G1-5069

HED TITLE:	Increasing, decreasing, and stable arrow symbol on SPDS display is hard to discriminate.
CATEGORY:	III
DISPOSITION:	The arrow symbol is controlled by the computer software. The feasibility of enlarging the arrow to improve discrimination is being reviewed. This HED will be addressed in the SPDS Human Factors Review.
STATUS:	Human Factors has re-reviewed the arrow symbol and believes that based on operator distance from the screen, the arrow direction is easily discernable. Operators have reported no difficulty in reading the symbol. No further action is necessary.

HED NO.: 31G1-5071

HED TITLE:	Menu not displayed when a function has been selected on third level SPDS displays. Operator has to remember acronym for the display desired.
CATEGORY:	III
DISPOSITION:	Problem is currently being reviewed to select the appropriate solution. The results will be addressed in the SPDS Human Factors Review.
STATUS:	Access to third level displays has been changed from a directory format to a paging structure. In addition, third level displays are grouped with their corresponding second level displays.

(3419NED/che)

ATTACHMENT 2

NUREG-0654 COMPARISON WITH SHNPP

EMERGENCY ACTION LEVEL

FLOWPATH

(Revised to Reflect Revision 16 of Emergency Plan)

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FISSION PRODUCT BARRIER ANALYSIS

Preface:

The philosophy applied, directed by NUREG-0654, while building the SHNPP Emergency Action Level Flowpath is that the classification of emergencies should be anticipatory to allow early notification for events that could escalate into major specific events and major releases.

A comparison of the events recommended by NUREG-0654 and the events included in the SHNPP EAL Guidelines is provided, in the next attachment.

In many cases the NUREG-0654 recommendation was based upon the Actual or predicted loss of one or more of the Fission Product Barriers. Instead of attempting to develop a group of procedures that would address the specifics recommended in NUREG-0654, SHNPP took the approach that the loss of a Fission Product Barrier should be analyzed. Action should be taken based upon the number of Barriers that have been breached or are in jeopardy of being breached.

In order to accomplish this task, the plant had to determine what indications would show that any single Fission Product Barrier had breached or potentially could breach (is in jeopardy). This task was accomplished and resulted in the development of the first forty-seven steps of the flowpath.

The Site Emergency Coordinator can quickly access the status of the three Fission Product Barriers by answering the questions listed on the flowchart. In this manner, if the Fission Product Barriers are breached or in jeopardy (potential for breach is present), the event can be quickly escalated to the correct classification.

Once all of the Fission Product Barriers are examined, the flowpath is completed to determine if any other reason exists that would require the classification of an Emergency Action Level (EAL). In using this method, we handle the major emergencies, followed by other types of emergencies which could become major emergencies.

The average SRO licensed individual should take approximately five minutes to go through the entire flowpath and determine that an Emergency Classification is or is not warranted. In the case of an Unusual Event, Alert, or Site Emergency condition, the time delay is acceptable. If conditions are quickly deteriorating, then a faster method of classification is needed.

Preface: (continued)

Because of this, the Site Emergency Coordinator is directed on the flowpath to declare a General Emergency as soon as it is determined to exist. If conditions warrant this declaration, notification should begin IMMEDIATELY! The required notifications due to a Site Emergency, Alert, or an Unusual Event are reduced sufficiently that it is worth the time necessary to finish the flowpath, to find out if a higher level classification exists, prior to the declaration of the event.

The flowpath is designed to look at the worst case event first, then the other events in descending order of importance. Some consideration was given to the layout of the path, so some of the potential events were moved to make the path flow better.

The EAL flowpath follows the same rules and conventions that the EOP (Emergency Operating Procedure) flowpath's follow. This is an aid to the user in that he does not have to learn two conventions, just follow the one on which he has been trained. In addition, items previously covered by attachments to the PEP-101 are now directly on the flowpath. This eases the use of the flowpath and ensures that the entire spectrum is covered every time the flowpath is entered.

General:

Each of the Barriers is analyzed to determine if it is breached or in jeopardy. The first indication of either event results in declaring the specific barrier to be either breached or jeopardized. From an EAL declaration standpoint, it does not matter whether the barrier is breached or in jeopardy. However, it is important to the actions executed by other plant documents; therefore, the breach indicators are examined before the jeopardy indicators.

When any single indicator shows any barrier to be breached or jeopardized, the FPB Status Board is marked to show the indication, and the rest of the indications are bypassed. If there is proof that a barrier is breached, there is no need to continue to examine that barrier.

General: (continued)

The EOP Network has many indications that would prove one or more of the Fission Product Barriers to be breached. The plant staff has analyzed the EOP Network in an effort to determine those points at which any one (or more) of the barriers indicates a breach. These points are identified in the EAL flowpath as entry points T, U, and V. If the Fuel indicates breached, in the EOP Network, the EOP Network orders the operators to enter the EAL flowpath at ENTRY POINT T. The same process is used for entry points U (RCS breached) and V (Containment breached).

These entry points serve two purposes: first, they force a reentry into the EAL flowpath in case the Emergency Action Level should be upgraded; and second, since the entry point, as determined by the EOP's, has already determined that one of the Fission Product Barriers is breached, it reduces the time necessary to arrive at the correct Emergency Classification. This aid is used throughout the Fission Product Barrier Analysis.

FISSION PRODUCT BARRIER STATUS

Fuel Fission Product Barrier:

Flowpath Coordinates A-2 through A-6

A-2 WAS ENTRY POINT AT T?

EXPLANATION:

If the entry point was at T, the Fuel Fission Product Barrier is indicating breached, based upon the EOP Network determination.

A-2 GFFD INCREASED >1 E^5CPM IN 30 MINUTES?

EXPLANATION:

This item complies with the NUREG-0654 recommendation for Alert level declaration. An increase of this magnitude indicates that the Fuel FPB is breached. The set point is below the NUREG-0654 "Alert" classification which is based on 1% failed fuel in 30 minutes or 5% failed fuel. Only two set points were provided by Westinghouse on the Gross Failed Fuel Detector (the lower set point was used for the Unusual Event Declaration).

A-3 ANY RAD MONITOR EAL TABLE 6 IN ALARM?

EXPLANATION:

If none of the Rad monitors are in alarm, Coordinates A-3 through A-5 can be bypassed which speeds up the time to go through the flowpath. The next valid question would be at Coordinate A-5.

A-3 PLANT VENT STACK #1 WIDE RANGE GAS MON EFFL CHNL >3.6 E5 uCi/sec?

EXPLANATION:

The stack effluent monitor would exceed this level if the Containment airborne concentration of radioactivity was due to a 50 gpm RCS leak with an RCS activity of 300 uCi/cc (I-131). This includes the dilution effects that are predicted to occur during the release through the Plant Vent Stack release path. This is an indication that all 3 FPBs are breached.

A-4 EITHER CNMT HI RANGE ACCIDENT MON >17.5 R/HR?

EXPLANATION:

The CNMT monitors would not indicate this level of radiation unless a fuel breach and an RCS breach had occurred. This radiation level is based upon 300 uCi/cc RCS activity (I-131) (Alert level) and 40 gpm leakage from the RCS to Containment in addition to the 10 gpm allowable by Technical Specifications.

A-5 ANY EAL TABLE 2 MONITOR >1000 TIMES NORMAL?

EXPLANATION

This value was taken directly from the NUREG-0654 recommendations.

A-5 RCS ACTIVITY (I-131 DOSE EQUIVALENT) >300 uCi/cc?

EXPLANATION

The value of 300 uCi/cc (I-131) was taken directly from NUREG-0654.

A-6 HEAT SINK CSF RED?

EXPLANATION

A Red CSF-2 would be due to either core temperatures above 1200°F or core temperatures above 730°F and RVLIS less than 39%. In either case, the fuel is in jeopardy.

REACTOR COOLANT SYSTEM FISSION PRODUCT BARRIER

Flowpath Coordinates A-7 through A-10:

A-7 WAS ENTRY AT POINT U?

EXPLANATION

If the entry point, into the EAL Network, was at entry point U, then the EOP Network has already determined that the RCS boundary is either breached or in jeopardy.

The determination is made and time is saved in going through the EAL Network.

A-7 ANY RAD MON IN EAL TABLE 6 IN ALARM?

EXPLANATION

If none of the Radiation Monitors is in alarm, the section of the RCS Barrier that asks if the Radiation Monitors have exceeded a specific level is bypassed. This reduces the time needed to go through the path, and is appropriate because all of the Radiation Monitors questioned have alarm points at or below the level used to determine the RCS breached.

A-7 CNMT LEAK DET RAD MON NOBLE GAS CHNL >8.0 E^{-3} uCi/cc?

EXPLANATION

With normal activity in the RCS, if the Containment Leak Detection Radiation Monitor noble gas channel increases to greater than 8.0 E^{-3} uCi/cc, the RCS is leaking at a rate greater than 40 gpm in addition to the Tech. Spec. limit of 10 gpm.

A-8 PLANT VENT STACK #1 WIDE RANGE GAS MON EFFL CHNL >9.4 E^2 uCi/sec.

EXPLANATION

This level of activity would indicate that a release from the Containment was occurring (CNMT FPB breached) concurrent with an RCS breach. This level would occur if the RCS was breached with Technical Specifications allowable activity levels in the system and the activity released was fully diluted by the Containment atmosphere and the plant vent stack. Note that this level is substantially below the level required for this monitor to indicate fuel breach; an indication of only an RCS and Containment breach.

A-9 EOP PATH-2 ENTERED?

EXPLANATION

This is an indication of an SG tube rupture with safety injection. The RCS is breached with an initial leak rate of >120 gpm.

A-10 RCS LEAKAGE >50 GPM?

EXPLANATION

This is an indication of an RCS breach, regardless of the activity level in the system. This was taken directly from NUREG-0654.

B-9 ANY MAIN STEAMLINE RAD MON >20 mR/HR?

EXPLANATION:

The limit of 20 mR/HR is based upon having 300 uCi/cc RCS activity (I-131) leaking at 40 gpm into a Steam Generator. This does not include the 10 gpm of leakage from the RCS to the Containment Atmosphere. If EOP PATH 2 has been entered, the SG radiation monitor levels are an indication that both the fuel and the RCS barriers are breached.

A-10 INTEGRITY CSF MAGENTA OR RED?

EXPLANATION

If the Integrity does not indicate green or yellow, the RCS FPB is in jeopardy. This ensures that a pressurized thermal shock event will be classified at least as an Alert.

CONTAINMENT FISSION PRODUCT BARRIER

A-11 ENTRY AT POINT V?

EXPLANATION

If the EOP Network has ready determined that the CNMT FPB has been breached, we do not need to ask Questions related to the CNMT barrier. We declare the breach and bypass the steps.

D-2 ALL SG SAFETY VALVES SHUT?

EXPLANATION

An open Steam Generator Safety Valve is one indication of a Main Steam break outside of Containment (Containment breach). If they are all shut, we can bypass E-2, which looks for a stuck open safety. If the answer is NO, we have to determine if the safety valve should be open, or is stuck.

E-2 SG AFFECTED PRESSURE >SAFETY VALVE SETPOINT?

EXPLANATION

If the answer is NO, we assume that the safety valve is functioning properly. If it is stuck and pressure is above the setpoint, we will catch it on our next pass through the flowpath. However, it is very rare that SG pressure gets above the safety setpoint, and when it does, it is only for a moment. So, if the safety were stuck open, it would be clearly evident because the pressure would be much less than the setpoint, and the safety would be open.

D-3 ALL SG PORVs SHUT?

EXPLANATION

This is normally the case, following a Reactor Trip. The PORV's may open momentarily, but quickly close as the energy is dissipated. By the time that the Shift Foreman gets to this point in the flowchart, all of the PORV's should be closed and this step can be bypassed. If one (or more) is open, then he must determine if it is stuck open. This is done by reviewing the next two steps.

E-3 ANY MAIN STEAM PORV STUCK OPEN?

EXPLANATION

If the PORV's are working correctly, the answer is NO and the rest of the indications of the Containment Barrier are examined. If the answer is YES, the next question is asked.

E-3 BLOCK VALVE FOR STUCK OPEN PORV CAN BE SHUT?

EXPLANATION

If the stuck PORV block valve can be shut, the Containment is not breached, and the path should be continued. If the block valve cannot be shut and the PORV is stuck open, the Containment FPB is breached. This is indicated on the FPB status board and the number of lost barriers is queried.

F-4 PRIMARY TO SECONDARY LEAKAGE TO AFFECTED SG TECH. SPECs?

EXPLANATION

The Containment is not considered breached by stuck open SG safeties or PORVs unless there is a release pathway caused by primary to secondary leakage in the affected SG. This is in accordance with NUREG-0654.

D-4 ALL CNMT PENETRATIONS ISOLABLE PER TECH. SPECs?

EXPLANATION

If all Containment penetrations are isolable, then related steps can be bypassed. This is because the related questions further confirm that an event is in progress where the Containment barrier is needed.

D-4 CNMT PHASE A ISOLATION ACTUATED?

EXPLANATION

If a Phase A Isolation has been received and any of the Containment penetrations are not isolable (per T.S.), then the Containment FPB may be breached when needed during an event and is so indicated on the FPB status board.

D-5 CNMT VENT ISOL ACTUATION?

EXPLANATION

If a Containment Ventilation Isolation Actuation has occurred, the Containment FPB may be breached because radiation levels have increased inside Containment. The unisolable penetration MAY permit a release.

D-5 FUEL AND RCS INTACT ON FPB STATUS BOARD?

EXPLANATION

If either the Fuel or RCS Fission Product Barriers is in jeopardy or breached and one or more Containment penetrations is not isolable, then the Containment may be breached in an event when it is needed to protect the public.

E-5 PATHWAY FOR FISSION PRODUCTS TO ESCAPE CNMT EXISTS?

EXPLANATION

This question prevents escalating on the basis of an isolation failure in a closed system or a failure of one of two redundant isolation valves.

D-6 UNISOLABLE STEAM AND/OR FEED BREAK OUTSIDE CNMT?

EXPLANATION

A unisolable steam and/or feed break outside of the containment is a breach of the containment FPB if a release pathway via primary to secondary leakage exists.

D-7 PRIMARY TO SECONDARY LEAKAGE TO AFFECTED SGs EXCEEDS 10 GPM?

EXPLANATION

The Containment is not considered breached due to an unisolable secondary break unless primary to secondary leakage in the affected Steam Generator exceeds NUREG-0654 limits.

D-7 SG PRESS <1230 PSIG?

EXPLANATION

If SG pressure is below 1230 PSIG, then the SG's are acting as a normal heat sink. Following a Reactor trip, the SG pressure rapidly increases but remains below 1100 PSIG. If it increases above this, the PORV's and Safeties lift to restore the pressure. If the pressure cannot be maintained below 1230 PSIG, an SG tube rupture has occurred. The RCS will already be considered breached because EOP PATH-2 will be entered. If the SG cannot be controlled to prevent filling up, the PORV and safeties are about to lift, and Containment is in jeopardy.

E-8 SG LEVEL <82.4%?

EXPLANATION

If SG pressure is greater than 1230 PSIG and the affected Steam Generator does not have a tube rupture, then the SG level will be less than 82.4%. This is a final check to see if the SG has ruptured or the operator is just trying to control Tavg.

D-8 CNMT CSF MAGENTA OR RED

EXPLANATION

If the Containment CSF is not Yellow or Green, the Containment is in jeopardy of being breached.

EXAMPLE INITIATING CONDITIONS: NOTIFICATIONS OF UNUSUAL EVENT

Unusual Events are declared when conditions warrant and a higher level declaration is not needed. Once the flowpath is completed, if a declaration of an Alert, Site Emergency, or General Emergency is not needed, the Site Emergency Coordinator is directed to evaluate against the Unusual Event Matrix. This Matrix is located at the bottom of the flowpath.

If a higher level classification is in effect, the Unusual Event Matrix is not examined in order to expedite initiation of the actions required by the higher level declaration.

NOUE = Notification of Unusual Event as defined in NUREG-0654.

SHNPP Flowpath Coordinate J-15	Side 2	NUREG-0654 EAL NOUE	ITEM 1
J-15 UNPLANNED ECCS DISCHARGE TO VESSEL		Emergency Core Cooling System (ECCS) initiated and discharge to vessel.	

EXPLANATION

Technical Specification Surveillance Requirements demand periodic testing of the ECCS which include flowing to the vessel in order to test the pumps and valves (ASME Boiler and Pressure Vessel Code, Section XI). If a planned initiation occurs, it should not result in an Unusual Event declaration. Therefore, we added "Unplanned" for clarity and to avoid unnecessary declarations.

SHNPP Flowpath Coordinate A-15 Side 2	NUREG-0654 EAL NOUE ITEM 2
A-15 VALID HIGH ALARM OCCURS ON ANY OF THE MONITORS IN EAL TABLE 5 AND THE RELEASE HAS NOT BEEN TERMINATED.	Radiological effluent technical specification limits exceeded.

EXPLANATION

Table 5 lists the plant effluent monitors. The alarm setpoints for these monitors are set below the T.S. effluent limit. If the alarm setpoint is exceeded, a T.S. Limit is being approached and an Unusual Event is declared if automatic isolation does not occur.

SHNPP Flowpath Step NONE	NUREG-0654 EAL NOUE ITEM 3a
	Fuel damage indication. Examples: a. High off gas at BWR air ejector monitor (greater than 500,555 uCi/sec; corresponding to 16 isotopes decayed to 30 minutes; or an increase of 100,000 uCi/sec within a 30 minute timer period).

EXPLANATION

SHNPP is a PWR.

SHNPP Flowpath Coordinate B-15 Side 2	NUREG-0654 EAL NOUE ITEM 3b
B-15 RCS SPECIFIC ACTIVITY EXCEEDS TECHNICAL SPECIFICATION 3.4.8	Fuel damage indication. Examples: b. High coolant activity sample (e.g., exceeding coolant technical specifications for iodine spike)

EXPLANATION

This item complies with the NUREG without further explanation.

SHNPP Flowpath Coordinate B-15 Side 2	NUREG-0654 EAL NOUE ITEM 3c
B-15 GROSS FAILED FUEL DETECTOR INDICATES AN INCREASE GREATER THAN 2 E_4 CPM WITHIN 30 MINUTES.	Fuel damage indication. Examples: c. Failed fuel monitor (PWR) indicates increase greater than 0.1% equivalent fuel failures within 30 minutes.

EXPLANATION

An increase of 2×10^4 CPM within thirty minutes in the reading of the Gross Failed Fuel Detector is indication that fuel is starting to fail. Westinghouse provided this set point along with a higher set point which is used for the Alert Classification.

SHNPP Flowpath Coordinate J-15 Side 2	NUREG-0654 EAL NOUE ITEM 4
J-15 INITIATION OF ANY SHUTDOWN REQUIRED BY TECHNICAL SPECIFICATIONS	Abnormal coolant temperature and/or pressure or abnormal fuel temperatures outside of technical specification limits.

EXPLANATION

Abnormal coolant temperature and/or pressure or abnormal fuel temperature would require a plant shutdown due to Tech. Specs.

SHNPP Flowpath Coordinate D-15 Side 2	NUREG-0654 EAL NOUE ITEM 5
D-15 LOSS OF REACTOR COOLANT OR PRIMARY TO SECONDARY SYSTEM LEAKAGE IN EXCESS OF TECHNICAL SPECIFICATION 3.4.6.2.	Exceeding either primary/secondary leak rate technical specification or primary system leak rate technical specification.

EXPLANATION

Technical Specification 3.4.6.2 addresses both Unidentified RCS leakage and RCS identified leakage that is going into the steam generator(s). If this Specification is exceeded, then an Unusual Event is declared.

SHNPP Flowpath Coordinates C-15, D-15 Side 2	NUREG-0654 EAL NOUE ITEM 6
C-15 FAILURE OF AN SG SAFETY OR PORV TO RESET AFTER OPERATION. D-15 FAILURE OF A PRESSURIZER SAFETY OR RELIEF VALVE TO CLOSE FOLLOWING REDUCTION OF APPLICABLE PRESSURE.	Failure of a safety or relief valve in a safety related system to close following reduction of applicable pressure.

EXPLANATION

At SHNPP, the valves of concern are the Safety and Relief valves on the Steam Generator or Pressurizer. Any other relief valve that could malfunction is easily isolable and discharges to a closed system. However, the above listed valves could result in a challenge to the plant safety systems and require notification of an Unusual Event.

SHNPP Flowpath Coordinate E-15 Side 2	NUREG-0654 EAL NOUE ITEM 7
E-15 LOSS OF ALL OFFSITE POWER, OR E-15 LOSS OF BOTH EMERGENCY DIESEL GENERATORS.	Loss of offsite power or loss of onsite AC power capability.

EXPLANATION

The loss of offsite power capability is straight forward. The loss of normal onsite power (Main Generator) is covered under item J-16, if it was unplanned. The loss of both Emergency Diesel Generators, is the onsite power of concern. Loss of only one Diesel Generator is covered by the Tech. Spec. Action statement. Therefore, if both Diesel Generators are lost, an Unusual Event is declared regardless of the status of the Main Generator.

SHNPP Flowpath Coordinate J-15 Side 2	NUREG-0654 EAL NOUE ITEM 8
J-15 INITIATION OF ANY SHUTDOWN REQUIRED BY TECHNICAL SPECIFICATIONS.	Loss of containment integrity requiring shutdown by Technical Specifications.

EXPLANATION

This complies with the NUREG item. It also covers any other Tech. Spec. shutdown requirements.

SHNPP Flowpath Coordinate J-15 Side 2	NUREG-0654 EAL NOUE ITEM 9
J-15 INITIATION OF ANY SHUTDOWN REQUIRED BY TECHNICAL SPECIFICATIONS.	Loss of engineered safety feature or fire protection system function requiring shutdown by Technical Specifications (e.g., because of malfunction, personnel error, or procedural inadequacy).

EXPLANATION

This Step requires the declaration of an Unusual Event for any plant shutdown that is required by Technical Specifications. This includes loss of an ECCS component or any other safety related component or system, regardless of the reason for the loss.

SHNPP Flowpath Coordinate F-15 Side 2	NUREG-0654 EAL NOUE ITEM 10
F-15 FIRE LASTING MORE THAN 10 MINUTES WITHIN THE PROTECTED AREA.	Fire within the plant lasting more than 10 minutes.

EXPLANATION

This complies with the NUREG item without further explanation.

SHNPP Flowpath Coordinates E-15, E-16 Side 2	NUREG-0654 EAL NOUE ITEM 11
E-15 LOSS OF ALL REPRESENTATIVE METEOROLOGICAL DATA. E-15 INABILITY OF ERFIS TO PERFORM ITS INTENDED FUNCTION FOR A CONTINUOUS PERIOD OF 4 HOURS WHILE IN MODES 1, 2, 3, OR 4 AS DEFINED BY: A. FAILURE OF BOTH CPU's. B. FAILURE OF BOTH DATA CONCENTRATORS. C. FAILURE OF BOTH DATA DISCS. D. INABILITY TO DISPLAY SPDS IN THE CONTROL ROOM. E. INABILITY TO UPDATE CURRENT DATA DISPLAYS IN THE CONTROL ROOM. (THIS IS NOT TO BE CONSTRUED AS A FAILURE OF A SINGLE VARIABLE OR SMALL SUBSET OF DATA). E-16 FAILURE OF BOTH SITE TELEPHONE AND EMERGENCY TELEPHONE SWITCHES.	Indications or alarms on process or effluent parameters not functional in Control Room to an extent requiring plant shutdown or other significant loss of assessment or communication capability (e.g., plant computer, Safety Parameter Display System, all meteorological instrumentation).

EXPLANATION

The loss of Process or Effluent parameters that are important to safety are listed in the Tech. Spec. 3.3. Loss of these items would require the declaration of an Unusual Event due to Coordinate J-15. All of the other items addressed by the NUREG item, are listed above.

SHNPP Flowpath Coordinates G-15 Side 2	NUREG-0654 EAL NOUE ITEM 12
G-15 A SECURITY ALERT HAS BEEN DECLARED AS DEFINED IN THE SECURITY PLAN.	Security threat or attempted entry or attempted sabotage.

EXPLANATION

The Security Plan for the plant addresses the security alert condition. This complies with the NUREG item.

SHNPP Flowpath Coordinate H-15, H-16 Side 2	NUREG-0654 EAL NOUE ITEM 13
H-15 INDICATION OF ANY TWO SEISMIC SYMPTOMS LISTED IN EAL TABLE 4. H-15 HURRICANE OR TORNADO CROSSING EAB. H-16 WATER LEVELS IN THE MAIN AND AUXILIARY RESERVOIRS: MAIN >240.2 FT. <240.7 FT. AUXILIARY >257.7 FT. <250 FT.	Natural phenomenon being experienced or projected beyond usual levels a. Any earthquake felt in-plant or detected on station seismic instrumentation. b. 50 year flood or low water, tsunami, hurricane surge, seiche. c. Any tornado on site. d. Any hurricane.

EXPLANATION

Symptoms of any earthquake occurring are listed on EAL Table 3. Indication of tornado or hurricane is addressed. The low water levels are the levels that would require a plant shutdown. Tsunami, hurricane surge, and seiche are not applicable to the site beyond the extent addressed in the FSAR. The FSAR states that the lake levels for Safe Shutdown will bound the probability of damage to the plant from these type of events. The levels used, in the FSAR, ensure a safe shutdown margin. The levels used in the EAL Network are the same, or more conservative, than those used in the FSAR.

SHNPP Flowpath Coordinates H-15, H-16 Side 2	NUREG-0654 EAL NOUE ITEM 14
H-15 AIRCRAFT CRASH WITHIN EAB OR UNUSUAL AIRCRAFT ACTIVITY OVER FACILITY H-15 TRAIN DERAILMENT WITHIN EAB H-15 UNPLANNED EXPLOSION WITHIN EAB H-15 UNPLANNED TOXIC OR FLAMMABLE GAS RELEASE GREATER THAN 10 POUNDS WITHIN EAB H-16 TURBINE ROTATING COMPONENT FAILURE RESULTING IN A REACTOR TRIP	Other hazards being experienced or projected: a. Aircraft crash on-site or unusual aircraft activity over facility. b. Train derailment on-site. c. Near or onsite explosion. d. Near or onsite toxic or flammable gas release. e. Turbine rotating component failure causing rapid plant shutdown.

EXPLANATION

The plant-specific step was modified to include the word "Unplanned." This was done because periodically planned explosions occur which would result in an Unusual Event declaration when one was not warranted (Ex. Plugging SG tubes with explosive plugs).

At times, planned releases of toxic or flammable gases occur. These are controlled releases and must be done to continue safe and efficient plant operations. SHNPP does not consider that this type of release should require an Unusual Event declaration because it is done on purpose and in a controlled manner.

The ten pound threshold on the release of toxic or flammable gas is determined based upon the requirements to report to the local authorities. Release levels less than ten pounds do not require notification.

Events occurring outside of the Exclusion Area Boundary do not require Notification of an Unusual Event if they are not part of the site, as defined in the FSAR, and do not directly affect plant operations. This is the reason that the above statements include the qualification that the event must have occurred inside of the EAB (Exclusion Area Boundary).

SHNPP Flowpath Coordinates I-15, J-16 Side 2	NUREG-0654 EAL NOUE ITEM 15
I-15 OTHER PLANT CONDITIONS EXIST THAT WARRANT INCREASED AWARENESS ON THE PART OF THE PLANT OPERATING STAFF CHATHAM, HARNETT, LEE, AND WAKE COUNTIES AND THE STATE OF NORTH CAROLINA. J-16 OTHER PLANT CONDITIONS EXIST THAT INVOLVE OTHER THAN A NORMAL CONTROLLED SHUTDOWN (E.G., COOLDOWN RATE EXCEEDING TECHNICAL SPECIFICATION LIMITS, PIPE CRACKING FOUND DURING OPERATION).	Other plant conditions exist that warrant increased awareness on the part of a plant operating staff or state and/or local offsite authorities or require plant shutdown under technical specification requirements or involve other than normal controlled shutdown (e.g., cooldown rate exceeding Technical Specification limits, pipe cracking found during operation).

EXPLANATION

The above items comply with the NUREG requirements.

SHNPP Flowpath Coordinate J-16 Side 2	NUREG-0654 EAL NOUE ITEM 16
J-16 CONTAMINATED OR POTENTIALLY CONTAMINATED INJURED INDIVIDUAL REQUIRING OFFSITE MEDICAL TREATMENT.	Transportation of contaminated injured individual from site to offsite hospital.

EXPLANATION

This item complies with the required NUREG item and includes consideration of individuals who are, or may be, contaminated.

SHNPP Flowpath Coordinate C-15 Side 2	NUREG-0654 EAL NOUE ITEM 17
C-15 RAPID DEPRESSURIZATION OF SECONDARY SIDE. C-15 MAIN STEAM OR FEEDWATER BREAK. C-15 SG BLOWDOWN LINE BREAK (MODES 1, 2, & 3).	Rapid depressurization of PWR secondary side.

EXPLANATION

This item complies with the NUREG. SHNPP added the rupture of a blowdown line as a specific method of secondary plant depressurization that would not result in an Alert, but would require notification of an Unusual Event.

ALERT
CLASSIFICATION

EXAMPLE INITIATING CONDITIONS: ALERT

SHNPP Flowpath Step NONE	NUREG-0654 EAL ALERT ITEM 1a
	Severe loss of fuel cladding. a. High off gas at BWR air ejector monitor (greater than 5 Ci/sec; corresponding to 16 isotopes decayed 30 minutes).

EXPLANATION

SHNPP is a PWR.

SHNPP Flowpath Coordinate D-10 Side 1	NUREG-0654 EAL ALERT ITEM 1b
D-10 1 FPB BREACHED/JEOPARDIZED?	Severe loss of fuel cladding b. Very high coolant activity sample (e.g., 300 uCi/cc equivalent of I-131).

EXPLANATION

Refer to the Fission Product Barrier Analysis, especially SHNPP Coordinate A-7, Side 1. This step asks if RCS dose equivalent I-131 activity is less than 300 uCi/cc. If the answer is NO, then one Fission Product Barrier is declared to be breached. In addition, the radiation monitors addressed in the Fuel Barrier steps assume that this activity level exists in the RCS.

SHNPP Flowpath Coordinate D-10 Side 1	NUREG-0654 EAL ALERT ITEM 1c
D-10 ! FPB BREACHED/JEOPARDIZED?	Severe loss of fuel cladding c. Failed fuel monitor (PWR) indicates greater than 1% fuel failures within 30 minutes or 5% total fuel failures.

EXPLANATION

Refer to the Fission Product Barrier Analysis. The Gross Failed Fuel Detector in Coordinate A-2, Side 1, is used to determine if the integrity of the fuel is in jeopardy. The low set point is used for the Unusual Event declaration and the other is used for determination that the fuel FPB is in jeopardy or breached. The values used were supplied by Westinghouse.

SHNPP Flowpath Coordinate D-10 Side 1	NUREG-0654 EAL ALERT ITEM 2
D-10 1 FPB BREACHED/JEOPARDIZED?	Rapid gross failure of one steam generator tube with loss of offsite power.

EXPLANATION

Refer to the Fission Product Barrier Analysis. Several of the RCS Fission Product Barrier questions would result in declaration of the RCS breached if a Steam Generator tube leak occurred. This would happen with a leak rate much less than the design leakage associated with the failure of one tube. A leak rate in excess of 50 gpm (Coordinate A-12, Side 1) or entering EOP PATH-2 (Coordinate A-14, Side 1) would result in the declaration of an Alert condition. This is done whether or not offsite power is available.

SHNPP Flowpath Coordinate D-10	Side 1	NUREG-0654 EAL ALERT	ITEM 3
D-10 1 FPB BREACHED/JEOPARDIZED?		Rapid failure of steam generator tubes (e.g., several hundred gpm primary to secondary leak rate)	

EXPLANATION

Refer to the Fission Product Barrier Analysis. Several of the RCS Fission Product Barrier questions would result in declaration of the RCS breached if a Steam Generator tube leak occurred. This would happen with a leak rate much less than the design leakage associated with the failure of one tube. A leak rate in excess of 50 gpm (Coordinate A-12, Side 1) or entering ECP PATH-2 (Coordinate A-14, Side 1) would result in the declaration of an Alert condition.

SHNPP Flowpath Coordinate D-10 Side 1	NUREG-0654 EAL ALERT ITEM 4
D-10 1 FPB BREACHED/JEOPARDIZED?	Steam line break with significant (e.g., greater than 10 gpm primary to secondary leak rate (PWR) or MSIV malfunction causing leakage (BWR).

EXPLANATION

Refer to the Fission Product Barrier Analysis. When judging the integrity of each Fission Product Barrier, we look for steam and feedline breaks, (Coordinate D-6, Side 1) and primary to secondary leakage (Coordinate D-7, Side 1). This condition would result in the declaration of an Alert condition.

SHNPP Flowpath Coordinate D-10	Side 1	NUREG-0654 EAL ALERT	ITEM 5
D-10 1 FPB BREACHED/JEOPARDIZED?		Primary coolant leak rate greater than 50 gpm.	

EXPLANATION

Refer to the Fission Product Barrier Analysis. The RCS barrier specifically asks if the RCS unidentified leakage is greater than 50 gpm (Coordinate A-12, Side 1). It also refers to other plant indications that would indicate a breach of the RCS barrier. If any indicator shows that the RCS is breached or in jeopardy, an Alert is declared unless a higher level declaration is warranted.

The 50 gpm leak rate is based on the requirements of NUREG-0654.

SHNPP Flowpath Coordinates D-10, G-6 Side 1&2	NUREG-0654 EAL ALERT ITEM 6
D-10 1 FPB BREACHED/JEOPARDIZED? G-6 AIRBORNE RAD LEVELS INDICATE SEVERE DEGRADATION IN RADIOACTIVE MATERIAL CONTROL?	Radiation levels or airborne contamination which indicate a severe degradation in the control of radioactive materials (e.g., increase of factor of 1000 in direct radiation readings within facility).

EXPLANATION

Refer to the Fission Product Barrier Analysis. Coordinate A-6, Side 1 covers radiation monitors in the vicinity of RCS fluids. Coordinate G-6, Side 2 covers all other cases.

SHNPP Flowpath Coordinates D-15, G-2, G-3, G-4 Sido 1	NUREG-0654 EAL ALERT ITEM 7
D-15 LOSS OF POWER? G-2 1A-SA OR 1B-SB ENERGIZED? G-3 >222.5 KPPH FEED FLOW AVAILABLE? G-3 FULL RANGE RVLIS LEVEL >62%? G-4 1A-SA AND 1B-SB LOST FOR >15 MINS?	Loss of offsite power and loss of all onsite AC power (see Site Area Emergency for extended loss).

EXPLANATION

If the first question can be answered, or the next question is YES, then the remaining questions are bypassed. If the first question is answered YES and the next question is answered NO, then the question on feed flow is asked. If insufficient feed flow exists and RVLIS is below 62%, then a General Emergency is declared due to a loss of heat sink and imminent core uncovering. If sufficient feed flow exists or the core is covered, then the amount of time that AC power has been lost is used to determine whether to declare an Alert or a Site Emergency. The last question determines which declaration is appropriate. If the power is lost for less than 15 minutes, a continuing action "clock" begins and the user is directed to return to the flowpath at entry point C.

SHNPP Flowpath Coordinate H-5 Side 1	NUREG-0654 EAL ALERT ITEM 8
H-5 LOSS OF ALL ON-SITE ESF DC BUSSES (125VDC 1ASA AND 1BSB) H-5 ALL ON-SITE ESF DC LOST FOR >15 MINS?	Loss of all onsite DC power (see Site Area Emergency for extended loss).

EXPLANATION

ESF DC power is the vital DC power supply. If it is lost, then an Alert is declared. If the loss extends for greater than 15 minutes, the Alert is upgraded to a Site Emergency via entry point "C" (if the second question is answered NO, an ALERT is declared; if answered YES, then a Site Emergency is declared).

SHNPP Flowpath Coordinate D-10	Side 1	NUREG-0654 EAL ALERT	ITEM 9
D-10 ONE FPB BREACHED/JEOPARDIZED?		Coolant pump seizure leading to fuel failure.	

EXPLANATION

A coolant pump seizure is one possible way to incur core damage. But so are other methods of loss of flow, loss of coolant and core power excursions, just to name a few examples. The point of this item is to declare an Alert condition if a fuel failure has occurred or is imminent. The Fission Product Barrier analysis looks at the integrity of the fuel instead of trying to list all possible events that could lead to fuel failure.

SHNPP Flowpath Coordinates G-7, G-8 Side 1	NUREG-0654 EAL ALERT ITEM 10
G-7 COMPLETE LOSS OF ANY FUNCTION LISTED ON EAL TABLE 1? G-8 FUNCTION LOSS DUE TO UNAVAILABILITY OF ALL AC OR ALL DC POWER G-8 LOST FUNCTION REQUIRED FOR MODE 3? G-8 LOST FUNCTION REQUIRED FOR MODE 4 OR 5?	Complete loss of any function needed for plant cold shutdown.

EXPLANATION

If the answer to the first question is YES, then the user must determine if the function is lost due to loss of power (which is covered separately in the flowpath). If the loss is due to loss of power, this portion of the flowpath is bypassed. Otherwise, the only item left to determine is whether to declare a Site Emergency or an Alert. If the next question is answered YES, a Site Emergency is declared, otherwise an Alert is declared.

SHNPP Flowpath Coordinate D-11 Side 1	NUREG-0654 EAL ALERT ITEM 11
D-11 DID YOU HAVE AN ATWS EVENT? D-11 MCB MANUAL REACTOR TRIP SUCCESSFUL.	Failure of the reactor protection system to initiate and complete a scram which brings the reactor subcritical.

EXPLANATION

If an ATWS event has occurred and the manual reactor trip from the Main Control Board was successful, an Alert is declared. If the manual reactor trip was not successful, the event is upgraded to a Site or General Emergency depending on the status of the Fuel Fission Product Barrier.

SHNPP Flowpath Coordinates G-11, G-12, G-14, G-15 Side 1	NUREG-0654 EAL ALERT ITEM 12
G-11 ANY SPENT FUEL POOL AREA RAD MON >100 mR/HR? G-12 ANY SPENT FUEL POOL AREA RAD MON >700 mR/HR? G-14 PLANT IS IN MODE 6? G-14 VALID CNMT VENT ISOL ACTUATION? G-15 ALL CNMT HI RANGE ACCIDENT MON >6.5 R/HR?	Fuel damage accident with release of radioactivity to containment or fuel handling building.

EXPLANATION

If the first question is answered YES and the next is answered NO, then an Alert is declared due to suspected fuel damage in the spent fuel pool. If both questions are answered YES, then the condition is upgraded to a Site Emergency.

The 100 mR/HR set point is based on dropping one spent fuel assembly and is used to actuate the FHB emergency ventilation system. The 700 mR/HR limit is based on the expected dose rate from dropping two spent fuel assemblies. These readings are projected to exist at the Radiation Monitor closest to the dropped assemblies. The remaining questions examine the possibility of fuel damage inside of the Containment. This could only occur during Mode 6 (Refueling), so the sequence is bypassed if the plant is not in Mode 6. If fuel was damaged during refueling, a minor release would result in a Containment Ventilation Isolation and evacuation of Containment. If the damage was severe enough to warrant an Alert, the Containment Hi Range Monitors would increase to greater than 6.5 R/HR.

The Containment Ventilation Actuation signal is established based on the activity release that would occur if one spent fuel assembly was dropped after removal from the core. The 6.5 R/HR reading is based on the expected reading from the radiation monitors due to dropping two spent fuel assemblies that have just been removed from the core.

SHNPP Flowpath Coordinates D-14, D-15 Side 1	NUREG-0654 EAL ALERT ITEM 13
D-14 FIRE? D-14 FIRE MAY AFFECT SAFETY RELATED (ESF) EQUIPMENT? D-15 COMPLETE LOSS OF ANY SAFETY RELATED (ESF) FUNCTION DUE TO FIRE?	Fire potentially affecting safety systems.

EXPLANATION

If a fire has not occurred, then this sequence is bypassed. If one has occurred but it has not caused a loss of any safety related equipment, but has the potential to do so, an Alert condition is declared. A Site Emergency would be declared if the fire has caused the loss of any safety related function (ESF) to the point that a complete loss has occurred.

SHNPP Flowpath Coordinate G-6 Side 1	NUREG-0654 EAL ALERT ITEM 14
G-6 LOSS OF >50% OF MCB ANNUNCIATOR's (ALB's)? G-6 ANNUNCIATORS LOST FOR >10 MINUTES? G-6 EOP PATH 1 HAS BEEN ENTERED?	Most or all alarms (annunciators) lost.

EXPLANATION

Entry into EOP Path 1 is indication that a Plant Transient has been initiated or is in progress. If this is not the case, then the loss of greater than fifty percent of the Main Control Board (MCB) annunciators will result in an Alert classification. If Path 1 has been entered, the classification is upgraded to a Site Emergency. An Alert is not declared unless the annunciators are lost for at least 10 minutes.

SHNPP Flowpath Coordinate B-13 Side 2	NUREG-0654 EAL ALERT ITEM 15
B-13 MONITOR IN EAL TABLE 5 READING >10 TIMES THE HIGH ALARM SETPOINT?	Radiological effluents greater than 10 times technical specification instantaneous limits (an instantaneous rate which, if continued over 1 hour, would result in about 1 MR at the site boundary under average meteorological conditions).

EXPLANATION

EAL Table 5 lists the plant effluent radiation montiors. The setpoints for these monitors is less than the Tech Spec instantaneous limits. An Alert is declared if any of these monitors exceeds its alarm setpoints by a factor of ten, which is below the level required by Item 15.

SHNPP Flowpath Coordinates G-9, G-10 Side 1	NUREG-0654 EAL ALERT ITEM 16
G-9 SECURITY EMERGENCY AS DEFINED BY THE SECURITY PLAN? G-9 LOSS OF PHYSICAL CONTROL OF THE PLANT? G-10 SUCCESSFUL PENETRATION OF VITAL AREAS? G-10 ACTUAL OR IMMINENT POTENTIAL FOR OFFSITE RAD RELEASE?	Ongoing security compromise.

EXPLANATION

If the answer to the first question is YES, then an Alert will be declared unless a higher level declaration is warranted. If the next question is answered YES, then a General Emergency is declared and if the last two questions are answered YES, then a Site Emergency is declared.

SHNPP Flowpath Coordinates A-14, E-3 Side 2	NUREG-0654 EAL ALERT ITEM 17a
A-14 ANY TWO INDICATIONS OF A SEISMIC EVENT LISTED ON EAL TABLE 4? E-3 ANY YELLOW LIGHT ON TRIAXIAL RESPONSE SPECTRUM ANNNUNCIATOR LIT? E-3 ANY RED LIGHT ON TRIAXIAL RESPONSE SPECTRUM ANNUNCIATOR LIT?	Severe natural phenomena being experienced or projected. a. Earthquake greater than OBE levels.

EXPLANATION

EAL Table 4 lists all available plant indications of a seismic event including indication of tremors or vibration. If any two of these indications are positive the operators determine if an OBE or SSE has occurred. A yellow light on the Triaxial Response Spectrum Annunciator indicates that the event has exceeded 70% of the OBE level, a Red annunciator indicates that the event has exceeded the OBE level. If a Yellow annunciator is lit, but not a Red one, then an Alert is declared. If a Red annunciator is lit, then the OBE level has been reached or exceeded and we must assume that an SSE has occurred. This is conservative, but appropriate, based on the current indications available at SHNPP.

SHNPP Flowpath Coordinates E-4, E-5 Side 2	NUREG-0654 EAL ALERT ITEM 17c & d
E-4 ADVERSE WEATHER? E-5 TORNADO HAS HIT THE POWER BLOCK? E-5 WIND SPEEDS AT 10 METERS LESS THAN 90 MPH? E-5 WIND SPEEDS AT 10 METERS LESS THAN 100 MPH?	c. Any tornado striking facility. d. Hurricane winds near design basis level.

EXPLANATION

If Adverse weather occurs and wind speeds exceed 90 MPH, but not 100 MPH (Site Emergency level), then an Alert is declared. The 90 MPH windspeed is based on the 100 year reoccurrence described in the FSAR. The 100 MPH wind speed is based on the maximum design of the annemometer used at the metrological tower. A tornado could conceivably strike the power block without registering wind speeds of greater than 90 MPH, at the Met. Tower, so a specific question is asked concerning the chance of tornado.

SHNPP Flowpath Coordinates E-7, E-8 Side 2	NUREG-0654 EAL ALERT ITEM 18a, b, c
E-7 AIRCRAFT CRASH, MISSILE IMPACT OR UNPLANNED EXPLOSION INSIDE POWER BLOCK? E-7 PLANT IN COLD SHUTDOWN? E-8 SAFETY RELATED EQUIP. OR STRUCTURE AFFECTED?	Other hazards being experienced or projected a. Aircraft crash on facility b. Missile impacts from whatever source on facility c. Known explosion damage to facility affecting plant operation.

EXPLANATION

If the first question is answered YES, then an Alert condition is declared unless a Site Emergency is required. The remaining questions determine whether the declaration should be an Alert or a Site Emergency based upon plant condition and whether safety systems are affected.

SHNPP Flowpath Coordinates E-8, E-9 Side 2	NUREG-0654 EAL ALERT ITEM 18d
E-8 UNCONTROLLED OR UNPLANNED RELEASE OF TOXIC OR FLAMMABLE GAS INTO POWER BLOCK? E-9 RELEASE ENDANGERING PERSONNEL OR OPERABILITY OF ESF EQUIP? E-9 PLANT IN COLD SHUTDOWN?	Other hazards being experienced or projected d. Entry into facility environs of uncontrolled toxic or flammable gases

EXPLANATION

If the first question is answered YES, an Alert is declared unless the answer to the remaining questions determine that a Site Emergency should be declared instead.

SHNPP Flowpath Coordinate E-10 Side 2	NUREG-0654 EAL ALERT ITEM 18e
E-10 TURBINE FAILURE RESULTING IN CASING PENETRATION?	Other hazards being experienced or projected e. Turbine failure causing casing penetration.

EXPLANATION

If the answer to the question is YES, then an Alert is declared.

SHNPP Flowpath Coordinates G-2, G-3, H-3, G-6 Side 2	NUREG-0654 EAL ALERT ITEM 19
G-2 MALFUNCTION RESULTING IN UNCONTROLLABLE BORON DILUTION? G-3 PLANT IN MODE 6? H-3 DILUTION EVENT LASTING >15 MINS? G-3 DILUTION EVENT LASTING >35 MINS? G-6 AIRBORNE RAD LEVELS INDICATE SEVERE DEGRADATION IN RADIOACTIVE MATERIAL CONTROL? G-6 ANY PLANT CONDITION EXISTS THAT IN THE JUDGEMENT OF THE SHIFT FOREMAN OR SITE EMERGENCY COORDINATOR, WARRANTS AN ALERT DECLARATION?	Other plant conditions exist that warrant precautionary activation of Technical Support Center and placing near-site Emergency Operations Facility and other key emergency personnel on standby.

EXPLANATION

Boron dilution accident in Modes 1 thru 5 will cause the declaration of an Alert if it lasts for greater than fifteen minutes. The dilution in Mode 6 will require a Site Emergency Declaration if it lasts at least 35 minutes. This was added by SHNPP because it is early indication of the potential loss of plant shutdown margin which could result in an unplanned criticality, as described in the FSAR Chapter 15.4.6.

Previous Alert items address specific radiation levels for which an Alert should be declared. The step at Coordinate G-6 was added to give the Site Emergency Coordinator the discretion to declare an Alert for airborne radiation levels even if specific levels have not been exceeded.

The judgement step allows the Site Emergency Coordinator to declare an Alert when, in his judgment, conditions exist that justify the Alert declaration. A judgement step is necessary because all possible types of events that should lead to an Alert classification cannot be addressed.

SHNPP Flowpath Coordinates E-11, E-12, F-12 Side 2	NUREG-0654 EAL ALERT ITEM 20
E-11 CONTROL ROOM EVAC REQUIRED OR ANTICIPATED? E-12 AUX CONTROL PANEL (ACP) OPERATIONAL? F-12 CONTROL ROOM EVACUATED FOR >15 MINS?	Evacuation of Control Room anticipated or required with control of shutdown systems established from local stations.

EXPLANATION

If a Control Room evacuation is required or anticipated, an Alert is declared unless a Site Emergency is necessary. If the first question is answered YES and the next is answered YES, or the last question is answered YES, then an Alert is declared. If the evacuation is required (or anticipated) and the Auxiliary Shutdown Panel is not operational within 15 minutes, the Alert is upgraded to a Site Emergency.

SITE EMERGENCY
CLASSIFICATION

EXAMPLE INITIATING CONDITIONS: SITE AREA EMERGENCY

NUREG-0654 APPENDIX 1

SHNPP Flowpath Coordinate D-9 Side 1	NUREG-0654 EAL SITE EMERGENCY ITEM 1
D-9 2 FPB's BREACHED/JEOPARDIZED?	Known loss of coolant accident greater than makeup pump capacity.

EXPLANATION

If a loss of coolant accident (LOCA) occurs, that exceeds the makeup capability of the CSIP's, the RCS would indicate BREACHED/JEOPARDIZED and the Containment would indicate a potential loss of integrity, because Containment pressure would rapidly increase to greater than three psig. This would result in two FPB's BREACHED/JEOPARDIZED. The result would be a declaration of a Site Emergency.

SHNPP Flowpath Coordinate D-9 Side 1	NUREG-0654 EAL SITE EMERGENCY ITEM 2
D-9 2 FPB's BREACHED/JEOPARDIZED?	Degraded core with possible loss of coolable geometry (indicators should include instrumentation to detect inadequate core cooling, coolant activity and/or containment radioactivity levels).

EXPLANATION

The Fission Product Barrier Analysis shows that each fission product barrier is analyzed to determine if it is breached or in jeopardy. This includes examining proper instrumentation to detect inadequate core cooling, increasing coolant and/or containment radioactivity levels, as well as other symptoms of core degradation.

SHNPP Flowpath Coordinate D-9	Side 1	NUREG-0654 EAL SITE EMERGENCY	ITEM 3
D-9 2 FPB's BREACHED/JEOPARDIZED?		Rapid failure of steam generator tubes (several hundred gpm leakage) with loss of offsite power.	

EXPLANATION

RCS unidentified leakage in excess of 50 gpm would require that the RCS be declared to be breached. In addition, if the SG tube leak was "several hundred gpm", the Containment would indicate breached due to the high SG press (1230 PSIG) coupled with the high SG level (82.4%). This would show two FPB's breached and warrant a Site Emergency declaration.

SHNPP Flowpath Coordinate G-4	Side 1	NUREG-0654 EAL SITE EMERGENCY	ITEM 6
G-4 1A-SA AND 1B-SB LOST FOR >15 MIN?		Loss of offsite power and loss of onsite AC power for more than 15 minutes.	

EXPLANATION

The 6.9 KV Emergency Busses, 1A-SA and 1B-SB are normally powered by the Main Generator or by off-site power. If normal power is lost, these busses are powered directly by the Emergency Diesel Generators. Therefore, if 1A-SA and 1B-SB are lost, all on-site and offsite AC power has been lost.

SHNPP Flowpath Coordinate G-5 Side 1	NUREG-0654 EAL SITE EMERGENCY ITEM 7
G-5 LOSS OF ALL ON-SITE ESF DC BUSSES (125VDC 1ASA AND 1BSB) G-5 ON-SITE ESF DC LOST FOR >15 MINS?	Loss of all vital onsite DC power for more than 15 minutes.

EXPLANATION

ESF (Engineered Safety Features) DC is the plant-specific name for vital on-site DC power. If this DC power supply is lost for greater than fifteen minutes, a Site Emergency is declared.

SHNPP Flowpath Coordinates G-7, G-8 Side 1	NUREG-0654 EAL SITE EMERGENCY ITEM 8
G-7 COMPLETE LOSS OF ANY FUNCTION LISTED ON EAL TABLE 1? G-8 LOST FUNCTION REQUIRED FOR MODE 3?	Complete loss of any function needed for plant hot shutdown.

EXPLANATION

EAL Table 1 is a listing of the plant functions required for hot or cold shutdown. Mode 3 is "Hot Standby" which is the plant condition where RCS temperature is greater than 350°F and the Reactor is subcritical. This equates to the NUREG term "HOT SHUTDOWN." Mode 4 (Hot Shutdown) or Mode 5 (Cold Shutdown) are the plant conditions where the RCS is below 350°F and less than 400 PSIG which equates to the NUREG recommendation concerning Cold Shutdown. These events result in an Alert classification as the same equipment is affected resulting in the same concerns.

SHNPP Flowpath Coordinates D-11, D-12 Side 1	NUREG-0654 EAL SITE EMERGENCY ITEM 9
D-11 DID YOU HAVE AN ATWS EVENT? D-11 MCB MANUAL REACTOR TRIP SUCCESSFUL? D-12 FUEL FPB BREACHED?	Transient requiring operation of shutdown systems with failure to scram (continued power generation but no core damage immediately evident).

EXPLANATION

If the ATWS question is answered YES, the next question is MCB "Manual Reactor Trip Successful?" If the answer to this question is YES, an Alert is declared. If the answer is NO, then a Site Emergency is declared unless the Fuel FPB is breached which requires a General Emergency. The note following the declaration explains that the Site Emergency exists only as long as the rods remain out of the core (i.e., until the Reactor Trip is successfully executed, or the rods are fully inserted by other means).

SHNPP Flowpath Coordinates G-11, G-12, G-14, G-15 Side 1	NUREG-0654 EAL SITE EMERGENCY ITEM 10
G-11 ANY SPENT FUEL POOL AREA RAD MON >100 MR/HR? G-12 ANY SPENT FUEL POOL AREA RAD MON >700 MR/HR? G-12 SPENT FUEL POOL LEVEL LESS THAN 1 FT ABOVE TOP OF FUEL? G-14 PLANT IS IN MODE 6? G-14 VALID CNMT VENT ISOL ACTUATION? G-15 ALL CNMT HI RANGE ACCIDENT MON >6.5 R/HR?	Major damage to spent fuel in containment or fuel handling building (e.g., large objects damages fuel or water loss below fuel level).

EXPLANATION

If the spent fuel pool area rad monitors are all below 100 MR/HR, then you skip the next step (the setpoint is based on the SFP ventilation actuation signal which is based on dropping one spent fuel assembly). This helps to expedite getting through the flowpath. If the rad. levels are less than 100 MR/HR, then they are obviously less than 700 MR/HR.

If the first question is answered YES, then if the next question is answered NO, a Site Emergency is declared. If the Radiation levels in the spent fuel pool exceed 700 MR/HR, then two assemblies in the spent fuel pool have been damaged, for some reason. When declaring this emergency, the cause of the damage (large objects, dropped assembly, etc.) is not an immediate concern. Declaring the emergency and getting the necessary assistance is the immediate concern because the damage is done.

After questions about dropped spent fuel have been addressed (or bypassed) the flowpath looks at spent fuel pool level. If the level is less than one foot above the spent fuel assemblies, the spent fuel is about to become uncovered.

The last three questions address fuel handling accidents inside Containment. If the plant is not in the refueling mode, then damage to spent fuel inside of the containment is not possible. All spent fuel is stored in the spent fuel pool. If the plant is in Mode 6, then a question on Containment ventilation isolation is asked.

(CONTINUED ON NEXT PAGE)

SHNPP Flowpath Coordinates G-11, G-12, G-14, G-15 Side 1	NUREG-0654 EAL SITE EMERGENCY ITEM 10

(continued)

If a valid containment ventilation isolation signal has not been received, then a spent fuel assembly has not been dropped (or was dropped and was not damaged) in containment. The containment ventilation isolation setpoints are sufficiently low that the signal will actuate with minor damage to the spent fuel.

If Containment ventilation isolation has occured, then the radiation level inside Containment is assessed. If the Accident monitors are reading greater than 6.5 R/HR, we have indication of damage to two spent fuel assemblies, inside of the containment and declare a Site Emergency. If not, then we continue on through the flowpath after declaring an Alert condition.

SHNPP Flowpath Coordinates D-14, D-15 Side 1	NUREG-0654 EAL SITE EMERGENCY ITEM 11
D-14 FIRE? D-14 FIRE MAY AFFECT SAFETY RELATED (ESF) EQUIPMENT? D-15 COMPLETE LOSS OF ANY SAFETY RELATED (ESF) FUNCTION DUE TO FIRE?	Fire compromising the functions of safety systems.

EXPLANATION

If the answer to the above questions is YES, then a Site Emergency is declared. ESF is an abbreviation for "Engineered Safety Features."

SHNPP Flowpath Coordinate G-6 Side 1	NUREG-0654 EAL SITE EMERGENCY ITEM 12
G-6 LOSS OF >50% OF MCB ANNUNCIATORS (ALBs)? G-6 ANNUNCIATORS LOST FOR >10 MINUTES? G-6 EOP PATH 1 HAS BEEN ENTERED?	Most or all alarms (annunciators) lost and plant transient initiated or in progress.

EXPLANATION

The Main Control Board (MCB) annunciators are referred to as ALB's (Annunciator Light Boxes). If greater than fifty percent of these are lost, the question becomes "Has PATH-1 been entered?" Path 1 is entered any time that a Reactor Trip has been received or should be received. This is a simple method used to determine if a plant transient has been initiated or is in progress. A Site Emergency is not declared unless the annunciators are lost for at least 10 minutes.

SHNPP Flowpath Coordinates B-6, B-7, B-8 Side 2	NUREG-0654 EAL SITE EMERGENCY ITEM 13a
B-6 PROJECTED DOSE RATE >50 mrem/HR (WB) AT EAB. B-6 PROJECTED DOSE RATE >250 mrem/HR (THYROID) AT EAB. B-7 ESTIMATED DURATION OF RELEASE >30 MINS? B-7 PROJECTED DOSE RATE >250 mrem/HR (WB) AT EAB. B-8 PROJECTED DOSE RATE >2.5 REM/HR (THYROID) AT EB AB. B-8 ESTIMATED DURATION OF RELEASE >2 MINS?	Effluent monitors detect levels corresponding to greater than 50 MR/HR for 1/2 hour or greater than 500 MR/HR W.B. for two minutes (or five times these levels to the thyroid) at the site boundary for adverse meteorology.

EXPLANATION

The statement just prior to the sequence of these questions tells the Site Emergency Coordinator to "USE ADVERSE MET ASSUMPTION (CHI/Q = .000617 SEC/M^3) FOR DETERMINING PROJECTED DOSE RATES." From a Human Factor standpoint, as well as a spacing standpoint, this is preferable to repeating the same statement four times in order to answer four successive questions.

If the answer to either of the first two questions is YES, then the question on release duration is asked. If the release duration is >30 minutes, a Site Emergency is declared. If the release duration is less than 30 minutes, then the process is repeated for the next three questions. All of the Action values agree with the NUREG recommendation except for the WB dose rate value of 250 mrem/HR. This value is fifty percent of the recommended value. The Projected Dose Rates are Dose Rate projections at the Exclusion Area Boundary.

SHNPP Flowpath Coordinates B-11, B-12, C-11, C-13 Side 2	NUREG-0654 EAL SITE EMERGENCY ITEM 13b
B-11 MEASURED WHOLE BODY DOSE RATE >50 mr/HR AT EAB? B-12 MEASURED I-131 EQUIVALENT CONCENTRATION >7.31 E-8 uCi/cc AT EAB? C-11 MEASURED LEVEL HAS EXISTED FOR >30 MINS? B-12 MEASURED WHOLE BODY DOSE RATE >500 mr/HR AT EAB? B-12 MEASURED I-131 EQUIVALENT CONCENTRATION >7.31 E-7 uCi/cc AT EAB? C-13 MEASURED LEVEL HAS EXISTED FOR >2 MINS?	These dose rates (listed in 13a) are projected on other plant parameters (e.g., radiation level in containment with leak rate appropriate for existing containment pressure) or are measured in the environs.

EXPLANATION

If the first two questions are answered YES, then the question or release duration is asked. If the release duration exceeds 30 minutes, then a Site Emergency is declared. If the release duration is <30 minutes, then the process is repeated for the remaining questions. The measured values are consistent with the recommendations stated in the NUREG. The Thyroid dose limits are listed in Equivalent I-131 concentration in order to speed up the reporting process which will speed up the evaluation and declaration process.

SHNPP Flowpath Coordinate B-5 Side 2	NUREG-0654 EAL SITE EMERGENCY ITEM 13c
B-5 PROJECTED DOSE >1 REM (WB) AT EAB? B-5 PROJECTED DOSE >5 REM (THYROID) AT EAB?	EPA Protective Action Guidelines are projected to be exceeded outside the side boundary.

EXPLANATION

If either of the projected integrated dose levels are exceeded, a Site Emergency is declared.

SHNPP Flowpath Coordinates G-9, G-10 Side 1	NUREG-0654 EAL SITE EMERGENCY ITEM 14
G-9 SECURITY EMERGENCY AS DEFINED BY THE SECURITY PLAN? G-9 LOSS OF PHYSICAL CONTROL OF THE PLANT? G-10 SUCCESSFUL PENETRATION OF VITAL AREAS? G-10 ACTUAL OR IMMINENT POTENTIAL FOR OFFSITE RAD RELEASE?	Imminent loss of physical control of the plant.

EXPLANATION

If a Security Emergency has been declared and has resulted in a loss of physical control of the plant, then a General Emergency is declared. If loss of physical control of the plant has not occurred, then the next two questions are asked. If the answer to either of these questions is NO, a Site Emergency is not warranted and an Alert is declared. If Vital Areas have been penetrated and this could result in an offsite radiation release, then a Site Emergency declaration is in order. This sequence of events meets the intent of the NUREG item.

SHNPP Flowpath Coordinates A-14, E-3 Side 2	NUREG-0654 EAL SITE EMERGENCY ITEM 15a
A-14 ANY TWO INDICATIONS OF A SEISMIC EVENT LISTED ON EAL TABLE 4? E-3 ANY YELLOW LIGHT ON TRIAXIAL RESPONSE SPECTRUM ANNUNCIATOR LIT? E-3 ANY RED LIGHT ON TRIAXIAL RESPONSE SPECTRUM ANNUNCIATOR GREATER THAN LIT?	Severe natural phenomena being experienced or projected with plant not in cold shutdown. a. Earthquake greater than SSE levels.

EXPLANATION

If the answer to the first question is NO, a Seismic event has not occurred and the other two questions are unnecessary nad therefore bypassed. The EAL table lists the possible alarms which would alert the staff to a Seismic event and also lists "noticeable tremors or vibration." A yellow annunciator indicates that the plant has experienced 70% of an OBE and a red annunciator indicates that the design OBE has been exceeded. An SSE cannot be readily evaluated, based on current plant instrumentation, so the maximum reliable instrumentation reading (equal to an OBE) was used to declare an SSE.

If any indication has been received, then the Site Emergency Coordinator must determine if the event was of sufficient magnitude to warrant an Alert or Site Emergency declaration. If a yellow light is not lit, then a declaration is not warranted. If a yellow light is lit, but no red light is lit, an Alert is declared. If a red light is lit, a Site Emergency is declared.

SHNPP Flowpath Step NONE	NUREG-0654 EAL SITE EMERGENCY ITEM 15b
	Severe natural phenomena being experienced or projected with the plant not in cold shutdown. b. Flood, low water, tsunami, hurricane surge, seiche greater than design levels, or failure of protection of vital equipment at lower levels.

EXPLANATION

The location of SHNPP makes the possibility of these events essentially zero except for a Seiche which could occur during an earthquake. This item is covered in response to item 15a. The other items are potential hazards to a facility that is located on the ocean. All of these items are analyzed in the SHNPP FSAR.

SHNPP Flowpath Coordinates E-4, E-5 Side 2	NUREG-0654 EAL SITE EMERGENCY ITEM 15c
E-4 ADVERSE WEATHER? E-5 TORNADO HAS HIT THE POWER BLOCK? E-5 WIND SPEEDS AT 10 METERS LESS THAN 90 MPH? E-5 WIND SPEEDS AT 10 METERS LESS THAN 100 MPH?	Severe natural phenomena being experienced or projected with plant not in cold shutdown. c. Sustained winds or tornadoes in excess of design levels.

EXPLANATION

During adverse weather, sustained wind speeds of greater than 100 MPH warrant declaration of a Site Emergency. If the levels are less than 100 MPH but greater than 90 MPH, an Alert is declared. The plant has been designed to withstand 90 and 100 MPH winds, but, an Alert is declared at 90 MPH based upon the 100 year reoccurence described in the FSAR. A Site Emergency declaration at wind speeds in excess 100 MPH is conservative and is based on the maximum reliable reading from the Annemometer located at the plant meteorologicial station. The tornado query is to determine if an Alert condition should be declared because a tornado could hit without being sustained winds in excess of 90 MPH.

SHNPP Flowpath Coordinates E-7, E-8 Side 2	NUREG-0654 EAL SITE EMERGENCY ITEM 16a, 16b
E-7 AIRCRAFT CRASH, MISSILE IMPACT OR UNPLANNED EXPLOSION INSIDE POWER BLOCK? E-7 PLANT IN COLD SHUTDOWN? E-8 SAFETY RELATED EQUIP OR STRUCTURE AFFECTED?	Other hazards being experienced or projected with plant not in cold shutdown. a. Aircraft crash affecting vital structures by impact or fire. b. Severe damage to safe shutdown equipment from missiles or explosion.

EXPLANATION

If an aircraft crash, missile impact or an unplanned explosion inside of the Protected Area (PA) occurs which affects safety related equipment, and the plant is not in cold shutdown, a Site Emergency is declared. This is done regardless of how the safety related equipment is affected (fire, explosion, etc.). This is in keeping with the intent of the NUREG items being addressed.

SHNPP Flowpath Coordinates E-8, E-9 Side 2	NUREG-0654 EAL SITE EMERGENCY ITEM 16c
E-8 UNCONTROLLED OR UNPLANNED RELEASE OF TOXIC OR FLAMMABLE GAS INTO POWER BLOCK? E-9 RELEASE ENDANGERING PERSONNEL OR OPERABILITY OF ESF EQUIP? E-9 PLANT IN COLD SHUTDOWN?	Other hazards being experienced or projected with plant not in cold shutdown. c. Entry of uncontrolled flammable gases into vital areas. Entry of uncontrolled toxic gases into vital areas where lack of access to the area constitutes a safety problem.

EXPLANATION

If any flammable or toxic gas is released into the Protected Area which would endanger personnel (this would inhibit operation of the facility in a controlled manner) or which would affect any safety related equipment, then a Site Emergency is declared if the plant is NOT in cold shutdown.

SHNPP Flowpath Coordinates G-2, G-3, H-5 Side 2	NUREG-0654 EAL SITE EMERGENCY ITEM 17
G-2 MALFUNCTION RESULTING IN UNCONTROLLABLE BORON DILUTION? G-3 PLANT IN MODE 6? G-3 DILUTION EVENT LASTING >35 MINS? H-5 ANY PLANT CONDITION THAT IN THE JUDGEMENT OF THE SHIFT FOREMAN OR SITE EMERGENCY COORDINATOR WARRANTS A SITE EMERGENCY DECLARATION.	Other plant conditions exist that warrant activation of emergency centers and monitoring teams or a precautionary notification to the public near the site.

EXPLANATION

SHNPP has determined, by reviewing the FSAR, that a malfunction which results in boron dilution during refueling and lasts for greater than 35 minutes could result in an unplanned and uncontrolled criticality. This was added to the EAL Network in addition to the major damage to fuel. This event could result in fuel damage, with the Reactor Vessel head removed, resulting radioactive release in the long term and warrants an early declaration of a Site Emergency.

The last question allows the Site Emergency Coordinator to declare a Site Emergency when he feels that it is warranted, based on his judgment. This is done because every conceivable set of circumstances, that would warrant a Site Emergency, cannot be predicted.

SHNPP Flowpath Coordinate E-11, E-12, F-12 Side 2	NUREG-0654 EAL SITE EMERGENCY ITEM 18
E-11 CONTROL ROOM EVAC REQUIRED OR ANTICIPATED? E-12 AUX CONTROL PANEL (ACP) OPERATIONAL? F-12 CONTROL ROOM EVACUATED FOR LESS THAN 15 MINUTES?	Evacuation of Control Room and control of shutdown systems not established from local stations in 15 minutes.

EXPLANATION

If the Control Room must be evacuated, control is shifted to the Auxiliary Control panel (ACP) which contains all of the controls needed to maintain the plant in Hot Shutdown or to conduct a controlled cooldown to Cold Shutdown. If the Control Room is evacuated and the Auxiliary Control panel is not in operation within 15 minutes, a Site Emergency is declared.

GENERAL EMERGENCY
CLASSIFICATION

EXAMPLE INITIATING CONDITIONS: GENERAL EMERGENCY

NUREG 0654 APPENDIX 1

SHNPP Flowpath Coordinates B-9, B-10 Side 2	NUREG-0654 EAL GENERAL EMERGENCY ITEM 1a
B-9 MEASURED WHOLE BODY DOSE RATE >1 R/HR AT EAB (EXCLUSION AREA BOUNDARY). B-10 I-131 EQUIV CONC >1.46 E-6 uCi/cc AT EAB.	Effluent monitors detect levels corresponding to 1 rem/HR W.B. or 5 rem/HR thyroid at the site boundary under actual metrological conditions.

EXPLANATION

If either of the above levels are exceeded, a General Emergency is declared.

A measurement of 1.46 E-6 uCi/cc at the Exclusion Area Boundary is the equivalent of a dose rate, to the thyroid of 5 rem/HR. The information is provided in this manner because it does not require conversion and can quickly be reported to the Site Emergency Coordinator, in this form.

SHNPP Flowpath Coordinates B-3, B-4 Side 2	NUREG-0654 EAL GENERAL EMERGENCY ITEM 1b
B-3 PROJECTED DOSE RATE >1 REM/HR (WB) AT EAB? B-4 PROJECTED DOSE RATE >5 REM/HR (THYROID) AT EAB?	These dose rates are projected based on other plant parameters (e.g., radiation levels in containment with leak rate appropriate for existing containment pressure with some confirmation from effluent monitors) or are measured in the environs.

EXPLANATION

Projected Dose Calculations are performed in accordance with PEP-343 or PEP-341. If the levels of 1 REM/HR (WB) or 5 REM/HR (Thyroid) are exceeded, a General Emergency is declared.

SHNPP Flowpath Coordinate D-9 Side 1	NUREG-0654 EAL GENERAL EMERGENCY ITEM 2
D-9 3 FPB's (FISSION PRODUCT BARRIERS) BREACHED/JEOPARDIZED?	Loss of 2 of 3 fission product barriers with a potential loss of 3rd barrier (e.g., loss of primary coolant boundary, clad failure, and high potential for loss of containment).

EXPLANATION

Refer to the analysis of the Fission Product Barriers for a detailed analysis of each barrier. the NUREG requires that if two barriers are breached and a potential exists for a loss of the third fission product barrier, a General Emergency should be declared. The plant has taken the position that if all three barriers are intact, but the potential exists for all of them to breach, a General Emergency Classification is warranted. Therefore, SHNPP considers a jeopardized (not yet breached) barrier as being in the same category as a breached barrier for emergency classification purposes. At the other end of the spectrum, if all barriers are breached, a General Emergency classification is obviously warranted.

SHNPP Flowpath Coordinate G-9 Side 1	NUREG-0654 EAL GENERAL EMERGENCY ITEM 3
G-9 SECURITY EMERGENCY AS DEFINED BY THE SECURITY PLAN? G-9 LOSS OF PHYSICAL CONTROL OF THE PLANT?	Loss of physical control of the facility.

EXPLANATION

Complies with NUREG 0654.
If the answer to the first question is YES, then proceed to the next question. If the answer is NO, you skip to the next event. If physical control of the plant is lost, then declare a General Emergency. If not, then Question 68 is evaluated for declaration of Alert or Site Emergency.

SHNPP Flowpath Step NONE	NUREG-0654 EAL GENERAL EMERGENCY ITEM 4

Other plant conditions exist, from whatever source, that make release of large amounts of radioactivity in a short period possible, e.g., any core melt situation. See the specific PWR and BWR sequences below. [PWR sequences, only, apply to SHNPP].

NOTES: a. For core melt sequences where significant releases from containment are not yet taking place and large amounts of fission products are not yet in the containment atmosphere, consider 2 mile precautionary evacuation. Consider 5 mile downwind evacuation (45° to 90° sector) if large amounts of fission products (greater than gap activity) are in the containment atmosphere. Recommend sheltering in other parts of the plume exposure Emergency Planning Zone under this circumstance.

b. For core melt sequences where significant releases from containment are not yet taking place and containment failure leading to a direct atmospheric release is likely in the sequence but not imminent and large amounts of fission products in addition to noble gases are in the containment atmosphere, consider precautionary evacuation to 5 miles and 10 mile downwind evacuation (45° to 90° sector).

c. For core melt sequences where large amounts of fission products other than noble gases are in the containment atmosphere and containment failure is judged imminent, recommend shelter for those areas where evacuation cannot be completed before transport of activity to that location.

SHNPP Flowpath Step NONE	NUREG-0654 EAL GENERAL EMERGENCY ITEM 4
(continued)	d. As release information becomes available, adjust these actions in accordance with dose projections, time available to evacuate and estimated evacuation times given current conditions.

EXPLANATION

Notes a, b, and c refer to core melt situations (Generic). Note d is general information and applies to any classification.

The notes are addressed by the Analysis of Fission Product Barriers. If a core melt situation exists, it will be addressed by the Fission Product Barrier analysis, at the beginning of the Flow Chart (Steps 1 thru 47).

In the Emergency Action Level Network, a potential loss of any of the fission product barriers (jeopardized) is treated the same as a breached fission product barrier. for the purposes of Emergency Classification, this is an appropriate and conservative treatment of fission product barrier breaches.

SHNPP Flowpath Coordinate D-9 Side 1	NUREG-0654 EAL GENERAL EMERGENCY ITEM 5a
D-9 3 FPB's BREACHED/JEOPARDIZED?	Example PWR Sequences: a. Small and large LOCA's with failure of ECCS to perform leading to severe core degradation or melt in from minutes to hours. Ultimate failure of containment likely for melt sequences. (Several hours likely to be available to complete protective actions unless containment is not isolated).

EXPLANATION

The Fission Product Barrier Analysis explains the reasoning used to determine if a loss of one or more barriers. This would be the case if a LOCA occurred with the RCS activity at 300 uCi/cc which would indicate fuel damage, or the CSFST's indicated a fuel breach/jeopardy event. Containment would indicate breach/jeopardy event. Containment would indicate breach/jeopardy if the pressure reached 3 PSIG which would occur if the LOCA exceeded the capacity of the CSIP's. Therefore, early into the event, all three FPB's would indicate breached/jeopardy.

SHNPP Flowpath Coordinates D-15, G-2, G-3 Side 1	NUREG-0654 EAL GENERAL EMERGENCY ITEM 5b
D-15 LOSS OF POWER? G-2 1A-SA OR 1B-SB ENERGIZED? G-3 >222.5 KPPH FEED FLOW AVAILABLE? G-3 FULL RANGE RVLIS LEVEL >62%?	Example PWR Sequences: b. Transient initiated by loss of feedwater and condensate systems (principal heat removal system) followed by failure of emergency feedwater system for extended period. Core melting possible in several hours. Ultimate failure of containment likely if core melts.

EXPLANATION

The Fission Product Barrier portion of the flow paths looks at a loss of Heat Sink which would result in a core melt situation. To incorporate the specific event of a complete and sustained loss of feedwater supply to the Steam Generators, the above steps were added.

Under normal and Tech. Spec. LCO conditions, the only way to incur a complete and sustained loss of all available feedwater flow, to the Steam Generators, is to lose the Steam Driven AFW pump and lose electrical power at the same time. This series of decision blocks checks to see if AC power is available. If AC power is not available, (1A-SA and 1B-SB Emergency Busses are deenergized) then the possibility of a total loss of feedwater exists. The question then becomes "IS A TOTAL OF 222.5 KPPH OF FEED FLOW AVAILABLE?" If the answer is YES, then a total loss of feed flow has not occurred because the EOP Setpoint Study has calculated (under the guidance of the Westinghouse Owners Group) that this is sufficient flow to ensure that a heat sink exists.

If this flow does not exist, then a General Emergency is declared as soon as RVLIS indicates that the Fuel FPB is in jeopardy. In a situation where a total loss of AC power is coupled with a total loss of feedwater flow, this will happen quickly and can only be mitigated by a restoration of feedwater flow and AC power.

SHNPP Flowpath Coordinates D-11, D-12 Side 1	NUREG-0654 EAL GENERAL EMERGENCY ITEM 5c
D-11 DID YOU HAVE AN ATWS EVENT? D-11 MCB MANUAL REACTOR TRIP SUCCESSFUL? D-12 FUEL FPB BREACHED?	c. Transient requiring operation of shutdown systems with failure to scram which results in core damage or additional failure of core cooling and makeup systems (which could lead to core melt).

EXPLANATION

If an ATWS occurs and a Manual Reactor Trip from the Control Board is unsuccessful, then the question becomes whether or not the core has been damaged. This is handled by asking if the Fuel FPB has been breached. If the answer is YES, then a General Emergency is declared.

SHNPP Flowpath Coordinate D-15, G-2, G-3	NUREG-0654 EAL GENERAL EMERGENCY ITEM 5d
D-15 LOSS OF POWER? G-2 1A-SA OR 1B-SB ENERGIZED? G-3 >222.5 KPPH FEED FLOW AVAILABLE? G-3 FULL RANGE RVLIS LEVEL >62%?	Example PWR Sequences: c. Failure of offsite and onsite power along with total loss of emergency feedwater makeup capability for several hours. Would lead to eventual core melt and likely failure of containment.

EXPLANATION

The Fission Product Barrier portion of the flow paths looks at a loss of Heat Sink which would result in a core melt situation. To incorporate the specific event of a complete and sustained loss of all electrical power along with loss of feedwater, the above steps were added.

Under normal and Tech. Spec. LCO conditions, the only way to incur a complete and sustained loss of all available feedwater flow to the Steam Generators, is to lose the Steam Driven AFW pump and lose electrical power at the same time. This series of decision blocks checks to see if AC power is available. If AC power is not available (1A-SA and 1B-SB Emergency Busses are deenergized) then the possibility of a total loss of feedwater exists.

The Question then becomes "IS A TOTAL OF 222.5 KPPH OF FEED FLOW AVAILABLE?" If the answer is YES, then a total loss of feed flow has not occurred because the EOP Setpoint Study has calculated (under the guidance of the Westinghouse Owners Group) that this is sufficient flow to ensure that a heat sink exists.

If this flow does not exist and RVLIS indicates the start of core uncovery, then a General Emergency is declared. The amount of time that all feed flow is lost is not specifically addressed, because, in the plants opinion the event of a total loss of feedwater warrants a General Emergency declaration as soon as RCS inventory is depleted to the point that core uncovery is imminent.

SHNPP Flowpath Coordinates A-2, A-9, A-16 Side 1	NUREG-0654 EAL GENERAL EMERGENCY ITEM 5e
A-2 WAS ENTRY POINT AT T? A-9 WAS ENTRY POINT AT U? A-16 WAS ENTRY POINT AT V?	Example PWR Sequences: e. Small LOCA and initially successful ECCS. Subsequent failure of containment heat removal systems over several hours could lead to core melt and likely failure of containment.

EXPLANATION

Entry Points T, U, and V are EOP Network entry points. If plant conditions degrade during an off-normal event, the EOP Network directs entry into the EAL Network to reevaluate the current Emergency Classification. This is done regardless of the initiating event or the initial performance of ECCS.

Therefore, an initially successful ECCS performance and subsequent loss of control of the event would cause a reevaluation of the Fission Product Barrier status as well as the rest of the EAL Network.

The EOP's direct an entry into the EAL Network any time that a loss of: 1) the FUEL FPB; 2) the RCS FPB; or 3) the containment FPB is anticipated. By integrating the EOP's in this fashion, a slow degradation of the Fission Product Barriers can be anticipated resulting in a new evaluation of the Emergency Action Level.

SHNPP Flowpath Coordinate G-4	Side 2	NUREG-0654 EAL GENERAL EMERGENCY	ITEM NONE
G-4 ANY CONDITION WARRANTING RECOMMENDATION TO EVACUATE OR SHELTER THE PUBLIC?			

EXPLANATION

If all else fails, the Site Emergency Coordinator can declare a General Emergency if he feels that it is warranted. This option is added because no one can predict all possible sequence of events that would call for a General Emergency Declaration. The Site Emergency Coordinator must have the flexibility to make this declaration, if he feels that it is warranted. It is always better to be safe than sorry. This statement gives him the necessary flexibility.

The Emergency Plan is not being sent to you in its entirety. Only the pages that are affected will be changed out, similar to the advance change. Please go by the LEP (List of Effective Pages) and exchange the correct pages. Figures 4.1-1 and 4.1-2 have been revised, but Annex H is still the same Revision 9.

Thank you
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