REGULATORY INFORMATION DISTRIBUTION SYSTEM (RIDS)

ACCESSION NBR:8408130129 DOC.DATE: 84/08/08 NOTARIZED: NO DOCKET #
FACIL:50-387 Susquehanna Steam Electric Station, Unit 1, Pennsylva 05000387
50-388 Susquehanna Steam Electric Station, Unit 2, Pennsylva 05000388
AUTH.NAME AUTHOR AFFILIATION
CURTIS,N.W. Pennsylvania Power & Light Co.
RECIP.NAME RECIPIENT AFFILIATION
SCHWENCER,A. Licensing Branch 2

SUBJECT: Responds to 840602 SER re safety pasameter display sys,per Suppl 1 to NUREG-0737.Secondary displays may be called up temporarily,but display always returns to primary display automatically.

DISTRIBUTION CODE: A003S COPIES RECEIVED:LTR 1 ENCL 1 SIZE: 9
TITLE: OR/Licensing Submittal: Suppl 1 to NUREG-0737(Generic Ltr 82-33)

NOTES:1cy NMSS/FCAF/PM. LPDR 2cys Transcripts. 05000387
OL:07/17/82
1cy NMSS/FCAF/PM. LPDR 2cys Transcripts. 05000388
OL:03/23/84

	RECIPIENT ID CODE/NAME	COPIES LTTR	COPIES ENCL	RECIPIENT ID CODE/NAME	COPIES LTTR	COPIES ENCL
	NRR LB2 BC	7	7			
INTERNAL:	ADM-LFMB	1	0	IE/DEPER/EPB	3	3
	NRR PAULSON,W	1	1	NRR/DHFS/HFEB	5	5
	NRR/DHFS/PSRB	1	1	NRR/DL/ORAB	1	1
	NRR/DL/ORB5	5	5	NRR/DSI/CPB	1	1
	NRR/DSI/ICSB	1	1	NRR/DSI/METB	1	1
	NRR/DST/RAB	1	1	NRR/DSI/RSB	1	1
	REG FILE 5	1	1	RGN1	1	1
	RGN2/DRSS/EPRPB	1	1			
EXTERNAL:	LPDR	2	2	NRC PDR	1	1
	NSIC	1	1	NTIS	1	1
NOTES:		3	3			

TOTAL NUMBER OF COPIES REQUIRED: LTTR 40 ENCL 39

PP&L Pennsylvania Power & Light Company
Two North Ninth Street • Allentown, PA 18101 • 215 / 770-5151

Norman W. Curtis
Vice President-Engineering & Construction-Nuclear
215/770-7501

AUG 08 1984

Director of Nuclear Reactor Regulation
Attention: Mr. A. Schwencer, Chief
Licensing Branch No. 2
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, DC 20555

SUSQUEHANNA STEAM ELECTRIC STATION
SPDS SER INFORMATION REQUEST
ER 100450/100508 FILE 896 Docket Nos. 50-387
PLA-2258 50-388

Dear Mr. Schwencer:

This letter is in response to your Safety Evaluation Report for the Safety Parameter Display System at Susquehanna SES, Units 1 and 2 provided by your letter dated June 2, 1984. Enclosed are our responses to your staff's concerns with respect to our compliance with the requirements of Supplement 1 of NUREG 0737 and the information requested for the NRC confirmatory review for the Safety Parameter Display System.

NRC concerns with respect to compliance to Supplement 1 of NUREG 0737:

1. On page 15 of the SAR, the licensee states, "The primary display is meant to be continually displayed." The words "is meant to be" imply to the staff some uncertainty about whether the primary display will be continually displayed. Supplement 1 of NUREG-0737 requires that the licensee provide continuous display of the minimum parameter set necessary to assess plant status.

   Response:

   The words in the SPDS SAR were chosen poorly. The statement of concern in the SAR should have been worded, "The primary display is designed to be continually displayed." This would have left no uncertainty that the primary display satisfies the requirement of Supplement 1 of NUREG-0737 that a continuous display of the minimum parameter set necessary to assess plant status is provided. In normal operation two CRT displays are provided, one of which is dedicated to the primary display. In the event of primary CRT failure, there is provision for operator switchover of the primary display to the secondary CRT. In that case, secondary displays can be called up for a limited time on the display but the display always reverts to the primary display automatically.

A003

2. The licensee states that the Technical Support Center and Emergency Operations Facility have SPDS function keyboards and terminals. The design should assure that actions taken on the TSC and EOF Keyboards will not affect SPDS displays in the control room without the knowledge and consent of the control room operator. Any simulation or test mode displays should be obviously indicated as such on the displays.

Response:

The SPDS function keyboards in the TSC and EOF control only their associated CRTs. The SPDS function keyboards in the TSC and EOF cannot be utilized to change any display or perform an acknowledgement on the Control Room CRTs. There are no simulation or test mode displays in the control room that can be activated from the TSC or EOF.

3. Based on the text and photographs in the SAR, it seems that the SPDS includes unconventional color-coding, i.e., yellow for "normal," red for "caution," and magenta for "danger." These colors should be in accordance with the accepted convention of green for "normal," yellow or amber for "caution," and red for "danger."

Response:

The color convention on the Susquehanna SPDS CRTs is designed to be consistent with the color convention of the Advanced Control Room CRTs. An intensive human factors review concluded that it was much more important for the color convention on SPDS to be consistent rather than "conventional". The color convention utilized is provided in Attachment I.

4. As currently designed, there is no indication of poor quality data on the primary SPDS display other than the ambiguous word "message" on the left side of the display. Data of questionable quality should be more directly indicated. Validity information should be near or embedded in the displayed output so that the operator immediately recognizes questionable data and is not misled by it. For example, question marks following the data, reverse field, or color coding could be used.

Response:

The discussion of the treatment of low confidence data in the Susquehanna SPDS was inadvertently omitted from the SAR. In accordance with the convention established for the ACR computer displays, which the operator is familiar with, valid data is displayed in yellow (normal range) or red/magenta (alarm ranges). For low confidence data the last valid value is displayed in white. Validity information for individual displays is shown as follows:

Type of Display	Indication of Low Confidence Data
Bar charts on primary display	The last valid value of parameter is depicted with a white bar. Accompanying digital values are also white.
Rate of change indication on primary display	The word "INDETERMINATE" appears in white.
Numerical values on all displays	The last valid value is displayed in white.
Plots on trend curves	Low confidence data is not plotted and valid data is plotted in white.
Cursor and tail on EPG curves	The cursor is eliminated and only valid data is plotted in white.

The following are in response to the NRC concerns with respect to suitable isolation from electrical and electronic interference with equipment and sensors used in safety systems:

1. The SPDS be suitably isolated from electrical and electronic interference with equipment and sensors used for safety systems.

   Response:

   Remote multiplexers directly connected to 1E circuits are 1E-qualified. The multiplexers were tested to satisfy the following criteria of the SPDS design specification (D-1000 Rev. 3):

   4.4.4.1 Isolation Tests

   All inputs and outputs of the SPDS data acquisition system shall be capable of being connected to a 250 VAC, 60 Hz or 250 VDC power line without damage to other parts of the system or impairment of system function. The faulted input or output may itself be destroyed, but damage shall not affect any other circuits.

2. The licensee shall provide the following information to the NRC for confirmatory review:

   a. For each type of device used to accomplish electrical isolation, describe the specific testing performed to demonstrate that the device is acceptable for its application(s). The description should include elementary diagrams when necessary to indicate the test configuration and how the maximum credible faults were applied to the devices.

b. Data to verify that the maximum credible faults applied during the test were the maximum voltage/current to which the device could be exposed, and define how the maximum voltage/current was determined.

c. Data to verify that the maximum credible fault was applied to the output of the device in the transverse mode (between signal and return) and other faults were considered (i.e., open and short circuits).

d. Define the pass/fail acceptance criteria for each type of device.

e. Provide a commitment that the isolation devices comply with the environmental qualifications (10CFR50.49) and the seismic qualifications which were the basis for plant licensing.

f. Provide a description of the measures taken to protect the safety systems from electrical interference (i.e., Electrostatic Coupling, EMI, Common Mode and Crosstalk) that may be generated by the SPDS.

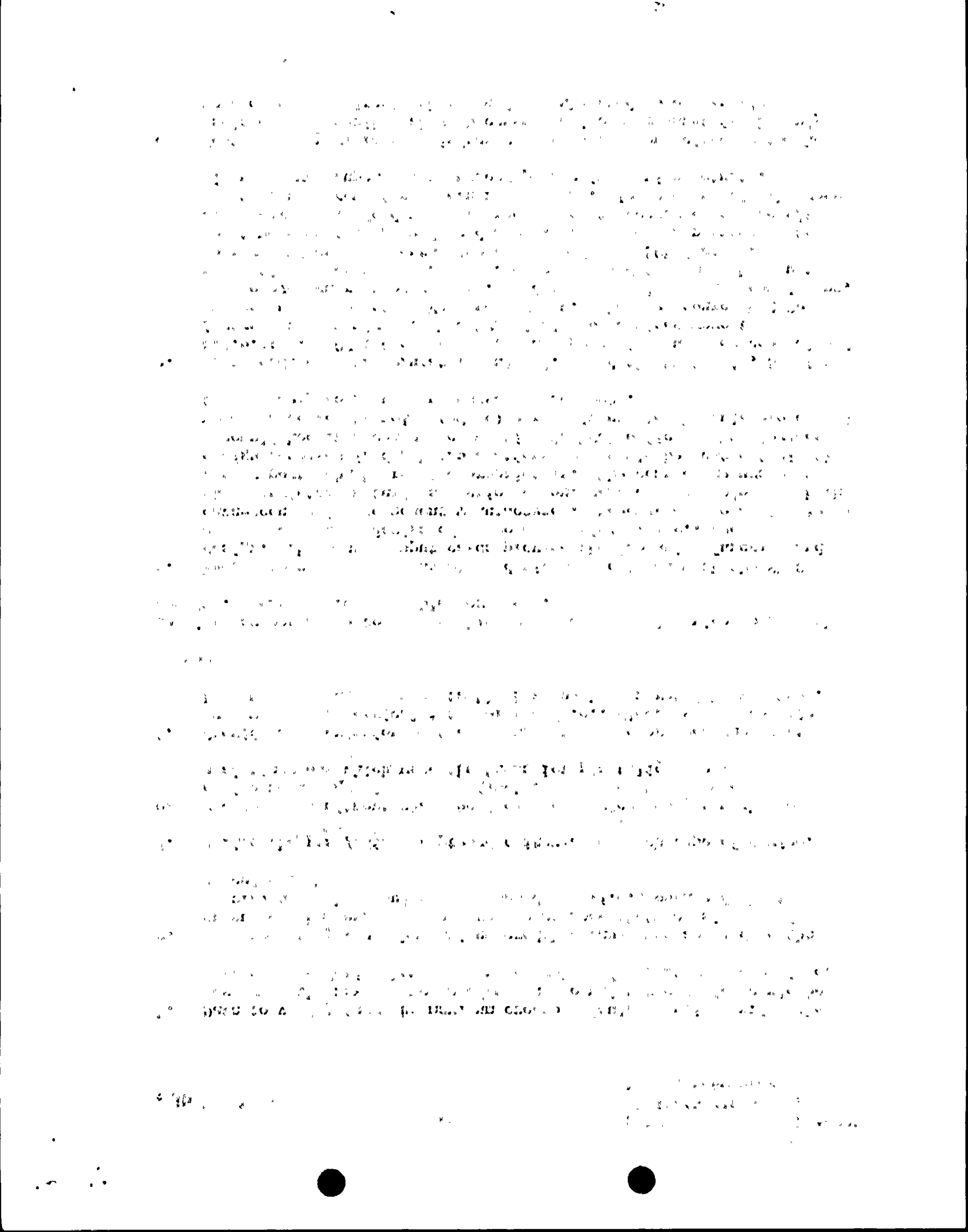
Response:

Testing was performed to verify this isolation and all devices passed the testing. Results are available for audit.

a. There are no separate isolation devices associated with the SPDS design. The system input cards provide the isolation function and are a proprietary design of Simmonds Precision, Inc., the data-acquisition component manufacturer. Schematics are available in the proprietary materials section of our central file, along with the test reports which are also proprietary. The complex nature of the design requires in depth explanations that would be most efficiently accomplished in a conference meeting in PP&L offices. The devices were tested to 250 volts (AC/DC) across inputs to the multiplexer and transversely to ground and passed those tests.

b. In accordance with Regulatory Guide 1.75 and the SSES FSAR, Section 8.1.6.1(n), 250V (AC or DC) is the design basis fault for control and instrumentation wiring. The SPDS isolation devices were tested successfully against 250VAC and 250 VDC. The test source had 20 ampere over current protection. Under line to line fault conditions, protective circuit elements on the card opened to limit the fault energy. Circuit elements also opened under a 250V fault from pointive signal to ground, and again, no damage was propogated to other circuits. No damage to other circuits occurred as a result of a 250V fault from signal return to ground. In no event did the test circuit power supply over current protective device actuate.

c. Testing was performed satisfactorily only on input circuits to the isolator as described above because the isolator input is the only portion of the circuit that could be subjected to externally



initiated faults. The output circuits for SPDS isolation are housed totally within the SPDS system and as such are not subject to high voltage line faults.

d. The devices were tested against 250V (AC/DC) without propagation of damage to other circuits or impairment of system function. This constituted acceptable performance. Records of the testing are available for audit.

e. In accordance with Section 4.4.3 of the SPDS design specification for Environmental Qualification of Class 1E Equipment, isolation devices were qualified in accordance with IEEE Standard 323-1974 in accordance with NUREG-0588 Category I including dynamic qualification in accordance with IEEE Standard 344-1975 and Regulatory Guide 1.100.

f. Electromagnetic Compatibility Tests were conducted on SPDS components to MIL-STD-462 tests, CS01, CS02, CS06, RS02 and RS03, and no adverse impact was observed. In addition, the Class 1E portions of SPDS equipment is located in the upper and lower relay rooms where radio use is administratively prohibited. The data from these tests is available for audit.

This completes our response. Should you have any questions regarding this submittal, please contact Mr. W. W. Williams at (215) 770-7856.

Very truly yours,

N. W. Curtis
Vice President-Engineering & Construction-Nuclear

Enclosure

cc: R. L. Perch NRC

COLOR CONVENTION FOR SPDS DISPLAYS

Color	General Meaning	Use
Red	Abnormal, Alert, Out	Applied to all displayed process variables including bar graphs, trend curves, digital displays, or other dynamic display elements when the variable has exceeded process limits.
Yellow	Dynamic, Reliable Data, In Limit	Applied to all displayed variables including bar graphs, trend curves, digital displays, or other dynamic display elements when the variable is within process limits.
White	Neutral, Reference Only, Low Confidence Data	Applied as a supportive hue on bar graphs or other scales to indicate non-dynamic process limits.
Green	Neutral, Reference Only, Non-Dynamic	Applied to all non-dynamic display elements that represent system components, plant hardware, or format background information including prose descriptions and nomenclature.
Cyan (Light Blue)	Neutral	Applied to all scale markings, format titles, alphanumeric identification, and other supporting display elements.
Dark Blue	--	Water, borders.

COLOR CONVENTION FOR SPDS DISPLAYS

Color	General Meeting	Use
Magenta	Danger	Applied to all displayed process variables including bar graphs, trend curves, digital displays, or other dynamic display elements when the variables have entered danger status.
Black	Neutral	Background.
Orange	--	Applied as a supportive hue for non-dynamic display elements to draw attention to the display element.

General Guidelines for Display Colors

- Common Displays

Background	--	Black
Tiles, Units	--	Cyan
Scale Delimiters	--	White
Variable Data:		
o Good Data	--	Yellow
o Alarm Data	--	Magenta
o Low Confidence Data	--	White
o Cautionary Data	--	Red
Mimic, Non-Dynamic Digital Values Parameter Names	--	Green

COLOR CONVENTION FOR SPDS DISPLAYS

General Guidelines for Display Colors (continued)

o Graphs and Bar Graphs

A. Single Graphs:

Border	--	Cyan
Coordinate & Scales	--	Cyan
Background	--	Black
Axis Parameter Names	--	Green
Curves:		
o Abnormal & Danger	--	Magenta
o Caution	--	Red
o Normal & Safe	--	Yellow
Bars:		
o Abnormal & Danger	--	Magenta
o Caution	--	Red
o Normal & Safe	--	Yellow
Limit Lines	--	White

B. Multiple Graphs:

Curves	--	Use different plotting characters to indicate different variables.
Coordinate & Scale	--	Indicate plotting character associated with variable.

COLOR CONVENTION FOR SPDS DISPLAYS

General Guidelines for Display Colors (continued)

o **Tables**

Border, Title, Headings Units	--	Cyan
Variable Data:		
o Good Data	--	Yellow
o Alarm Data	--	Magenta
o Low Confidence Data	--	White
o Cautionary Data	--	Red
Parameter Names	--	Green