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JUL 20 1984

Mr. A. Schwencer, Chief
Licensing Branch No. 2
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Docket Nos.: 50-352
50-353

Subject: Limerick Generating Station, Units 1 and 2
Request for Additional Information
Limerick SPDS Review

Reference: Letter, A. Schwencer to E. G. Bauer, Jr. dated May 31, 1984

File: GOVT 1-1 (NRC)

Dear Mr. Schwencer:

The reference letter requested additional information on Limerick's Safety Parameter Display System (SPDS). This information is provided in the attached draft FSAR pages that will be incorporated into the FSAR via Revision 35 which will be submitted in August, 1984.

The reference letter also requested information concerning plans between PECO and GE directed at ensuring sufficient progress on NEDE-30284-P, describing generic SPDS, to support the needs of Limerick. While PECO has no coordinated plans with GE, we understand that a NRC design verification audit of GE's generic SPDS effort has been scheduled for late July 1984 at GE's San Jose Facility. The agenda for this audit is expected to address several of the concerns expressed in the reference letter, and, as with NEDE-30284-P, the results of this audit will be generally applicable to the Limerick SPDS.

Sincerely,

John S. Kemper

DFC/gra/07168403

cc: See Attached Service List

A001
1/1

cc: Judge Lawrence Brenner (w/enclosure)
Judge Richard F. Cole (w/enclosure)
Troy B. Conner, Jr., Esq. (w/enclosure)
Ann P. Hodgdon, Esq. (w/enclosure)
Mr. Frank R. Romano (w/enclosure)
Mr. Robert L. Anthony (w/enclosure)
Charles W. Elliot, Esq. (w/enclosure)
Zori G. Ferkin, Esq. (w/enclosure)
Mr. Thomas Gerusky (w/enclosure)
Director, Penna. Emergency Management Agency (w/enclosure)
Angus R. Love, Esq. (w/enclosure)
David Wersan, Esq. (w/enclosure)
Robert J. Sugarman, Esq. (w/enclosure)
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Atomic Safety & Licensing Appeal Board (w/enclosure)
Atomic Safety & Licensing Board Panel (w/enclosure)
Docket & Service Section (w/enclosure)
Martha W. Bush, Esq. (w/enclosure)
Mr. James Wiggins (w/enclosure)
Mr. Timothy R. S. Campbell (w/enclosure)
Ms. Phyllis Zitzer (w/enclosure)
Judge Peter A. Morris (w/enclosure)

QUESTION 620.01

Provide a description of the means incorporated in the design to assure that the data displayed are valid.

RESPONSE

The validation method used in the Limerick SPDS is identical to the method common to all General Electric SPDSs. The following is a summary of the generic design.

All SPDS related control parameters (ERFDS) of the Limerick Emergency Response Facilities [redacted] Data System are validated parameters. The validation process generates a weighted average of control parameter signals consisting of either an average of all consistent signals or an average of all in-range signals if there are less than two consistent signals. The validation process generates a validation status which defines whether the average is validated (signals are consistent), non-validated (signals are in-range but not consistent), or Bad Data (signals cannot be measured). If the average cannot be determined, the validation process parameter is assigned "Bad Data" and the parameter value is replaced with asterisks. The signal average calculated is used to represent the instrument readings of the process variable unless additional compensation is performed on the signal average (e.g., reactor power), in which case the compensated value is used to represent the adjusted instrument reading. For those parameters which are not directly measured (e.g. RPV temperature and other bulk temperatures), calculations are performed to derive these variables from measured parameters.

QUESTION 620.02

DRAFT

Provide a description of the display, its human factored design, and the methods used and results from a human factors program to ensure that the displayed information can be readily perceived and comprehended so as not to mislead the operator.

RESPONSE

The SPDS portion of the Limerick Generating Station (LGS) Unit 1 Emergency Response Facilities Data System (ERFDS) meets the NRC requirements for an SPDS, in that, it provides aid to the operator in determining the safety status of the plant during abnormal or emergency conditions. The graphic displays available to the control room operator are based on the Emergency Procedure Guidelines (EPGs) Revision 2 and are formatted to give maximum assistance in following the Limerick Generating Station Emergency Operating Procedures (EOPs).

Human factors engineering has also been taken into account during development of the Limerick SPDS to maximize the operator's ability to readily determine plant status and to minimize errors by the operator during its use.

The SPDS portion of the LGS ERFDS displays is a subset of the generic General Electric Emergency Response Information System (ERIS) displays. As such, its displays use patterns and colors for conveying current parameter values, trends, limit indications, and validation status which are identical to those used in the generic GE ERIS displays.

The human factors reviews of the generic GE ERIS displays consisted of a static review by Human Factor Engineering (HFE) professionals and a dynamic review which emphasized operator integration under dynamic conditions. This dynamic review consisted of a HFE check using a checklist approach, the administration of 12 unique simulated transients, operator/system performance evaluations during the transients using the Perry Nuclear Power Plant EOPs and data collection for the measurement of the usefulness of the ERIS SPDS related displays.

In general the ERIS was perceived by the operators as a significant aid in plant control during emergencies and was judged as presenting an exceptional source of synthesized/centralized information with regards to plant performance.

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DISPLAY DESCRIPTION

The LGS SPDS control room displays present the fundamental information needed by nuclear power plant personnel to respond to an emergency. Using standard alphanumeric keys and function keys at the graphic display console (GDC), the user can manually select displays for viewing on the cathode ray tube (CRT).

The displays available at each GDC consist of:

		# of Displays
a.	Rector Pressure Vessel (RPV) Control display	1
b.	Containment Control display	1
c.	Critical plant variables	1
d.	Two-dimensional (2D) plots	9
e.	Trend plots, and	10
f.	Validation status displays	11

These displays provide real time data with emphasis on showing the current plant status and recent trend history. RPV Control and Containment Control displays are keyed to the appropriate LGS EOPs. The Critical plant variables display shows all of the LGS EOP entry conditions. Trend plot displays contain real-time digital information, but their overall emphasis is to show the most recent trends. 2D plots present the limits defined in the LGS EOPs which are curves showing the relationship between two parameters. Validation status displays supply an evaluation of plant control parameter signals.

Figures 620.02-1 through 620.02-6 are black and white copies of representative displays. Each display shows the color gun status, date and time, and the RPV/containment alarm indications. The status of the three color guns—red, blue, and green—are shown next to the plant name in the lower right-hand corner of each display. The current calendar date and time of day (expressed to the nearest second) are shown next to the color gun status indication.

The RPV and containment alarm status indications are shown next to the display title on upper left-hand and right-hand corners (respectively) of the critical plant variables, trend plots, 2D plot and validation status displays. The RPV Control display has only the containment alarm indication, and the Containment Control display has only the RPV alarm indication.

Each status is determined from applicable control parameter process limmit and event statuses.

1. RPV CONTROL DISPLAY

This display provides control room operators with the primary plant information required to execute the LGS EOPs developed from the RPV Control Guideline. This display is not intended to provide information to unlicensed personnel or personnel whose emergency response functions are not defined by the EOPs (e.g., engineers, supervisors, or management), although these personnel may certainly utilize this display for detailed plant status information. The RPV Control Display is shown in Figure 620.02-1.

1.1 Event Targets

There are four event targets on the RPV Control Display. They give the status of the following "events".

a. Group Isolation: Has a demand for isolation occurred and has the required isolation been successfully completed?

b. Safety Relief Valve (SRV): Is any SRV open?

c. Main Steam Isolation Valve (MSIV): Is a MSIV closure signal present and are the MSIVs open or shut?

d. Scram: Has a scram been initiated and have all control rods been fully inserted?

The event labels and color coding for border and text indicate event status of "inactive", "safe", "caution" and "alarm".

1.2 Control Parameter Trend Plots

Each control parameter, as defined by the EPG, is presented in a trend plot mini-display consisting of a time history data plot, bar graph, and digital readout. Control parameters for the RPV Control Display are RPV water level, pressure, reactor power, and RPV temperature.

The horizontal scale of the time history data plot for all control parameters is the most recent ten minutes.

The bar graph and digital readout are used to highlight and pinpoint the current value or the control parameter. The color of the bar graph and border around the digital readout reflects the control parameter validation status.

A trend line tracks the value of each control parameter, and its color coding is the same as that for the bar graph. Whenever the trend line goes off the vertical scale, it appears either at the top of the plot if above scale or at the bottom of the plot if below scale. The user can select the desired scale range to establish the vertical plot scales. Function keys allow the operator to rescale the plot.

1.3 Limit Tags

A control parameter may have up to five limit tags associated with it, each corresponding to a process limit identified by the LGS EOPs. Table 620.02-1 lists the limit tags which are associated with each of the trend plots on the RPV Control Display. The process limits are of two types: dynamic limits and control parameters and, therefore, may change with time. Static limits are limits which remain constant with time. In addition, each of the two types of process limits fall into two categories: upper limits and lower limits. Upper limits are limits which alert the system user when the limit is approached or exceeded from below; lower limits are limits which alert the system uers when the limit is approached or exceeded from above. The process limits further belong to two classes: alarm limits and permissive limits. An alarm limit informs the operator an operating limit has been exceeded, whereas a permissive limit lets the operator know when an action is capable of being performed (e.g., 100% Bypass Value).

The process limit status is indicated by the color of the limit tag border. For permissive limit tags, the border colors indicate "inactive", "active", or bad data/data not measured. Permissive limit tags are "active", when the control parameter equals or exceeds the process limit and "inactive" otherwise. For alarm limit tags, the border colors reflect "safe", "caution", "alarm", or "bad data/data not measured." Alarm limit tags are in the "alarm" state when the control parameter equals or exceeds the process limit, the "caution" state when the control parameter approaches the process limit, and the "safe" state if not in the "alarm" or "caution" state.

A line (tail) connects each limit tag to the bar graph at a point which corresponds to the value of the process limit. Limit lines are presented with trend lines to track the value of dynamic limits associated with the control parameters. Color coding for the limit line (tail) is the same as for the limit tags. Whenever data for a limit line is bad or not measured, the limit line is not plotted.

2. CONTAINMENT CONTROL DISPLAY

This top-level display provides control room operators with the primary plant information required to execute the LGS EOP developed from the Containment Control Guideline. The Containment Control display is shown in Figure 620.02-2.

2.1 Event Targets

There are event targets on the Containment Control Display. They give the status of the following "events".

a. Group Isolation (see para. 1.1).

b. Safety Relief Valve (SRV) (See para. 1.1).

c. Scram (see para. 1.1).

The event labels border and text are color coded to indicate event status of "inactive", "safe", "caution", and "alarm".

2.2 Control Parameter Trend Plots

Control parameters plotted for the Containment Control Display are containment level, drywell pressure, drywell temperatures, wet-well pressure, suppression pool temperature, and suppression pool water level. Except for the drywell temperatures, all containment control parameters are validated parameters. The trend plot description is the same as given in Paragraph 1.2.

2.3 Limit Tags

620.02-2

As on the RPV Control Display, limit tags are associated with each of the trend plots on the Containment Control Display. The limit tag description is the same as given in Paragraph 1.3. Table (2) lists the limit tags which are associated with each of the trend plots on the Containment Control display.

3. CRITICAL PLANT VARIABLES DISPLAY

This top level display provides the control room operators, shift supervisor, TSC supervisor, and emergency director with the the status of the critical plant variables, which are the variables controlled by the LGS EOPs.

620.02-3

The Critical Plant Variables Display (Figure (3)) is an image of the plant and presents two types of EOP information: control parameters and their limits, and event indications. For each control parameter, the current digital readout is shown with the upper limit above and/or the lower limit below. The label and color coding for each digital readout, limit tag, and event indication are identical to the corresponding digital readout, limit tag, or event indication in the RPV or Containment Control displays.

4. TREND PLOT DISPLAYS

620.02-4

Trend plot displays are available for all control parameters. A typical Limerick trend plot display is shown in Figure (4). Each trend plot consists of a time history data plot, a bar graph giving the current reading, and a digital readout. Limit tags and limit lines are also supplied. The bar graph, digital readout, limit tags, trend lines, and limit lines are as specified for the control parameter trend plots and limit tags in the RPV or Containment Control displays.

The horizontal plot scale for all inputs is the most recent thirty minutes. The plot displays include

Reactor Pressure Vessel (RPV) Water Level

Suppression Pool Level

Reactor Presssure Vessel (RPV) Pressure

Reactor Power

Reactor Pressure Vessel (RPV) Temperature

Containment Water Level

Drywell Pressure

Wetwell Pressure

Suppression Pool Temperature

Drywell Temperature

5. 2D PLOT DISPLAYS

These lower-level displays provide operators in the control room and plant engineers in the control room and TSC with plots of the two-dimensionsal limits defined in the EOPs. These limits are also presented as limit tags on the RPV and containment control displays.

620.02-5

There are eight dynamic and one static 2D plot displays. A typical LGS 2D plot is shown in Figure 9. Each 2D display consists of an x-y plot with a forbidden region and a historical track, and digital readings of the current values of the dependent and independent parameters. Color coding for digital readings of control parameters is as specified for the RPV and containment control displays. The forbidden region appears on each plot as cross hatch, and the historical track is the curve which continuously tracks the values of the two parameters. The cursor at one end of the historical track represents the current plant status and is color coded the same as the limit status. The 2D plot displays include:

Suppression Pool Load Limit (dynamic)

Heat Capacity Level Limit (dynamic)

Heat Capacity Temperature Limmit (dynamic)

Primary Containment Pressure Limit (dynamic)

Primary Containment Design Pressure (dynamic)

Pressure Suppression Pressure (dynamic)

Maximum Core Uncovery Time Limit (static)

RPV Saturation Temperature (dynamic)

Drywell Spray Initiation Pressure Limit (dynamic)

6. VALIDATION STATUS DISPLAYS

These lower level displays provide operators in the control room and plant engineers in the control room and TSC with an evaluation of the signals for all the control parameters plus core flow. The displays list each instrument that supplies a control parameter signal; indicate if the instrument raw data value is within its calibrated range; compensate individual signals if appropriate; present the compensated value; indicate if these values are consistent with each other; and average these values for a final value, with weighting factors if appropriate.

The upper right field of the display presents the final averaged value, plus indication if that value is compensated and/or validated. The color coding of the read-outs are consistent with the control parameter trend plots in paragraph 1.2 typical LGS SPDS validation display is shown in Figure (5). The validation displays include

620.02-6

Reactor Pressure Vessel Level

Reactor Pressure Vessel Pressure

Reactor Power

Reactor Pressure Vessel Temperature

Drywell Pressure

Drywell Temperatures

Pool Level

Pool Temperature

Reactor Core Flow

Containment Level

Wetwell Pressure

TABLE 620.02 - 1

TREND PLOT LIMIT TAGS FOR RPV CONTROL DISPLAY

CONTROL PARAMETER	STATIC LIMIT	DYNAMIC LIMITS
RPV Water Level	Trip Hi, Scram Lo, TAF	None
RPV Pressure	SRV Lift, 100% BPR*	Pool LD, Heat Cap
Reactor Power	APRM DNSCL	None
RPV Temperature	None	None

*Indicates a permissive limit

TABLE 620.02-2

CONTAINMENT CONTROL DISPLAY TREND PLOT LIMITS

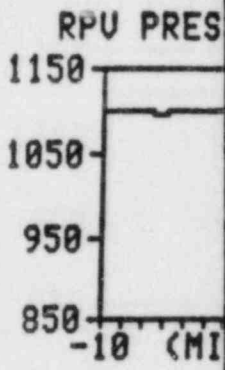
CONTROL PARAMETER	STATIC LIMIT	DYNAMIC LIMITS
Containment Level	Design	None
DW Pressure	Oper Hi	None
Wetwell Pressure	None	Maximum, Design, Pressure Suppresion, Spray
DW Temperature	Design, Oper Hi	RPV Sat
Suppression Pool Temp.	SCRM Temp, Oper Hi	Heat Cap
Supp. Pool Level	Oper Hi, Oper Lo	Pool LD, Heat Cap

322

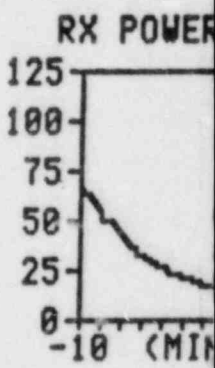
SRV SHUT

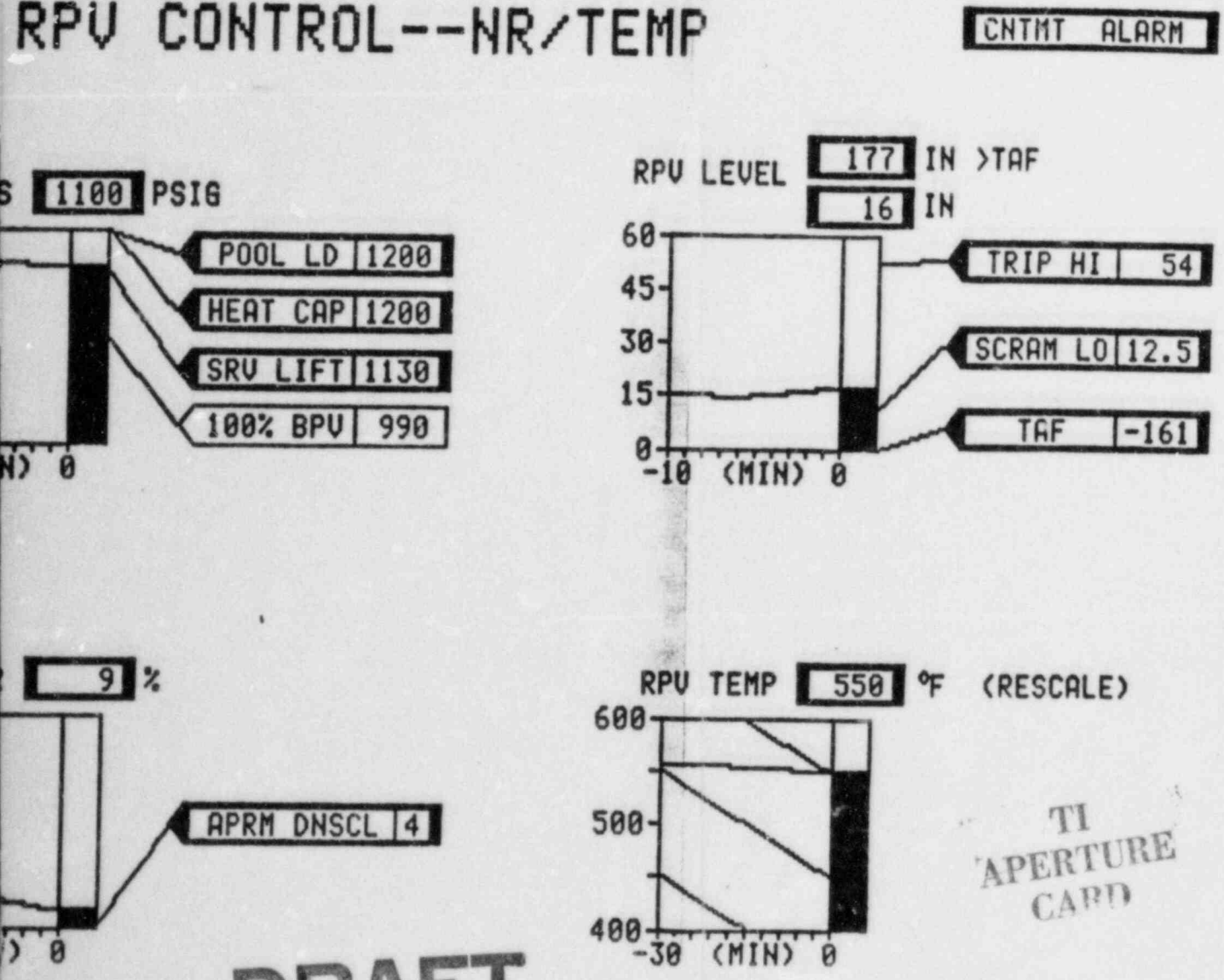
MSIV CMD

GROUP NO ISLN



SCRAM RODS IN





620.02-1

FIGURE 6: RPV CONTROL DISPLAY

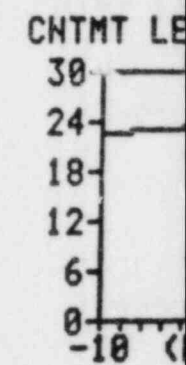
328

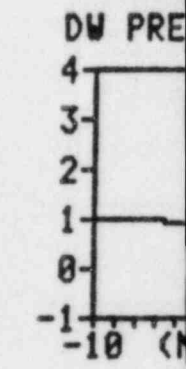
RPV NORMAL

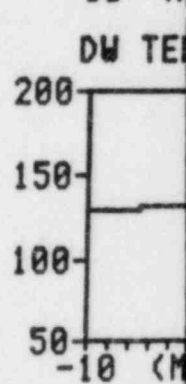
SRV OPEN

GROUP ISOL

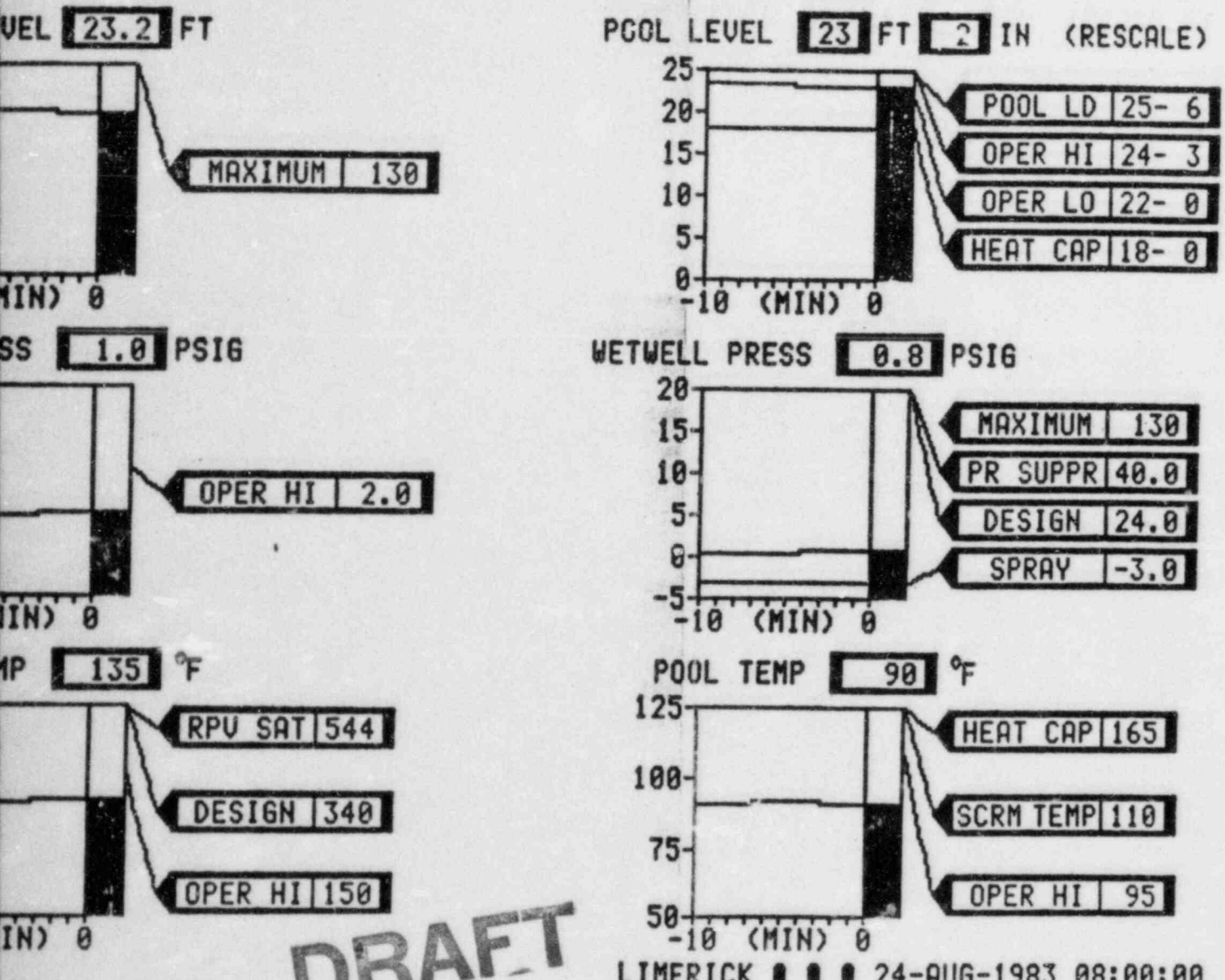
SCRAM NONE







CONTAINMENT CONTROL--NR



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620.02-2

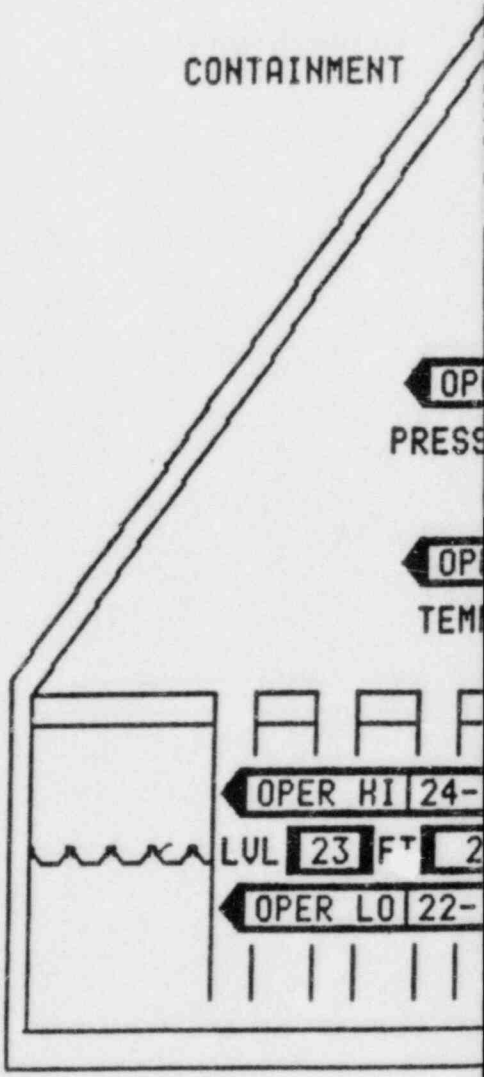
FIGURE 2. CONTAINMENT CONTROL DISPLAY

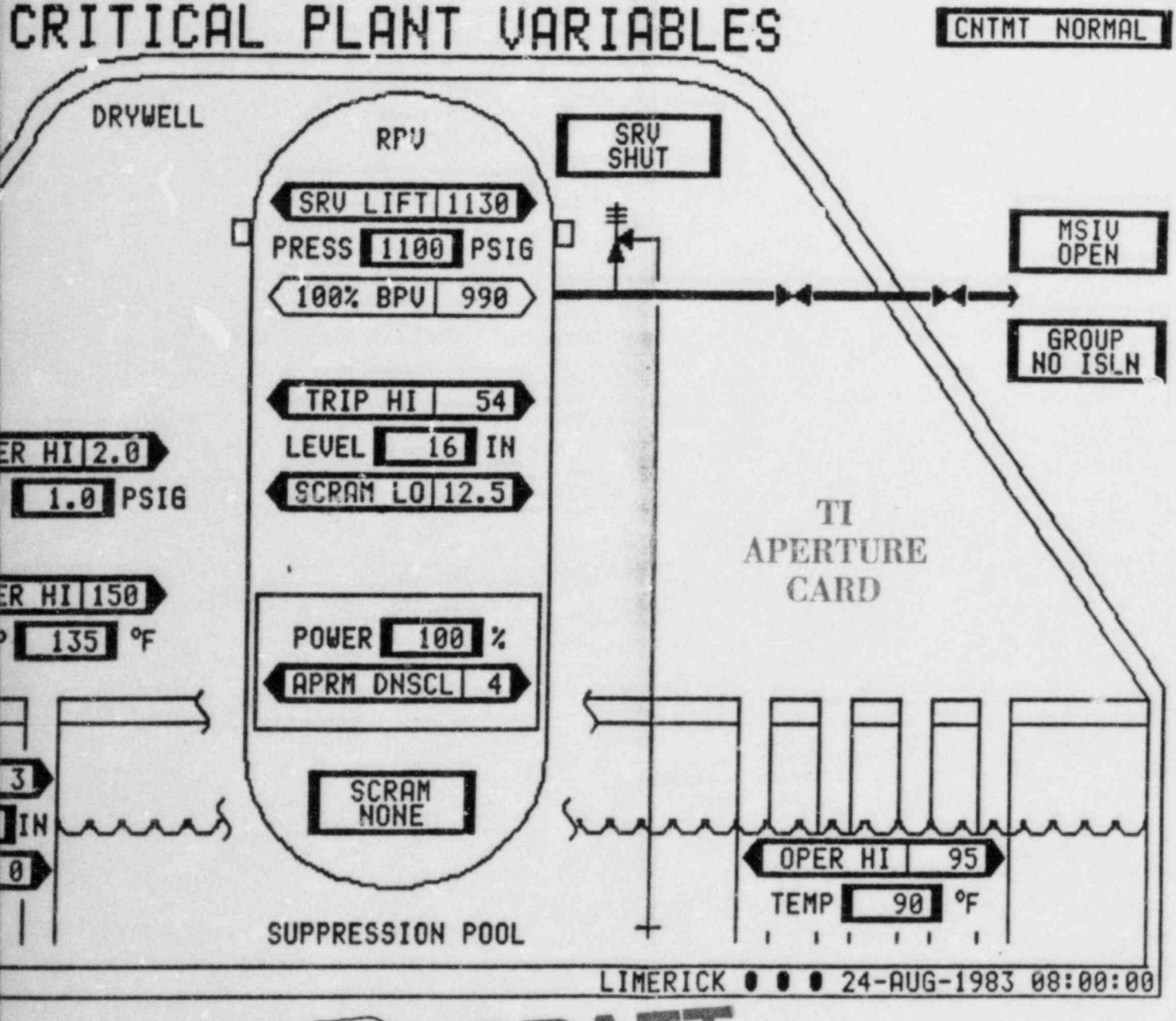
Also Available On
Aperture Card

8407260208-02

312 RPV CAUTION

FIGURE 20.1.4-1





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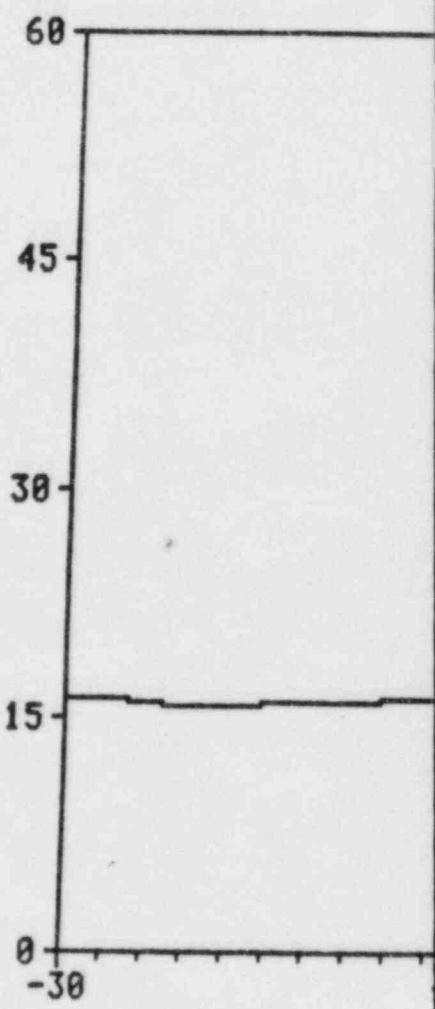
620.02-3

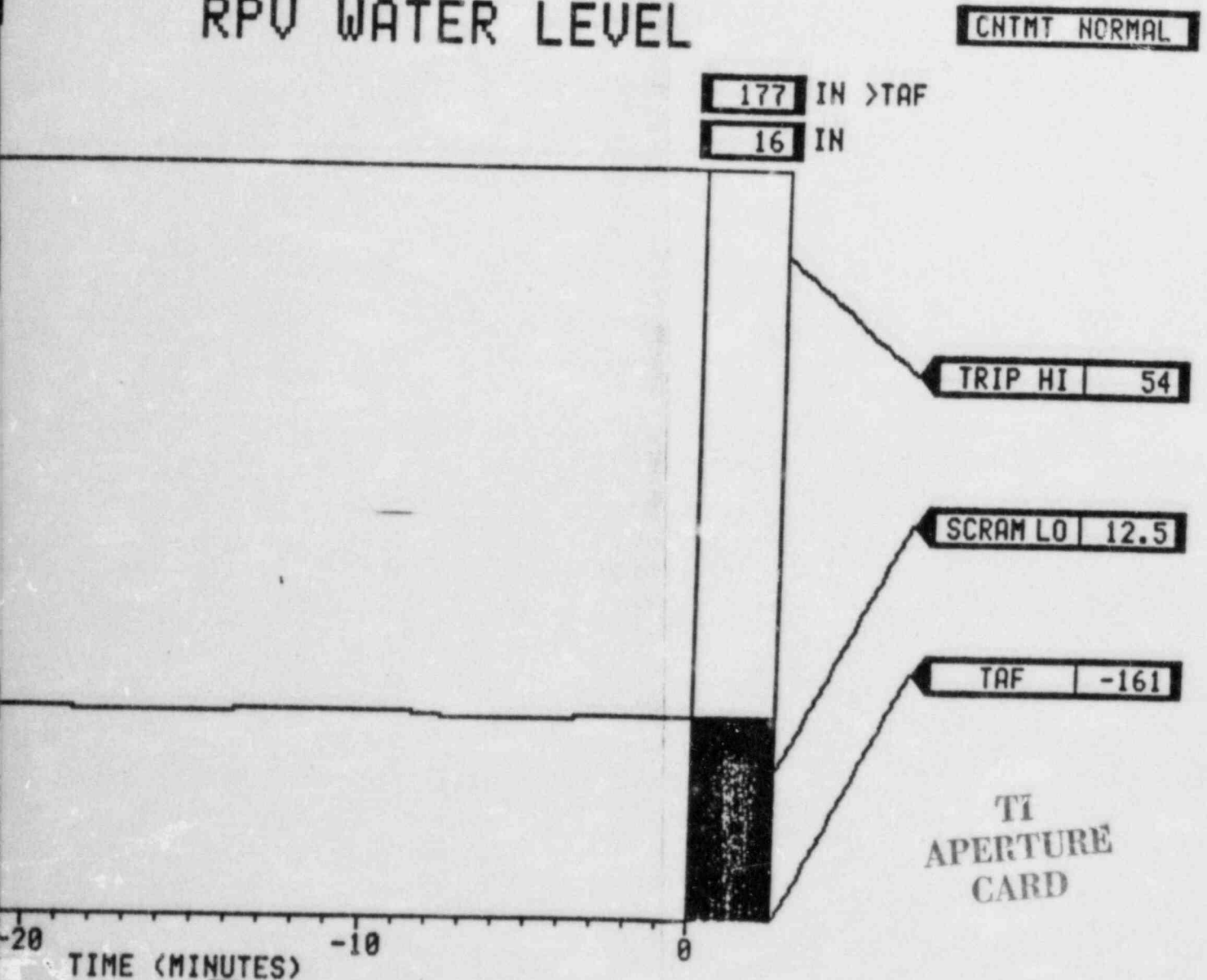
FIGURE 3.: CRITICAL PLANTS VARIABLES DISPLAY

Also Available On
Aperture Card

8407260208 -03

362 RPV NORMAL





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620.02-4

FIGURE 1 TREND PLOT DISPLAY

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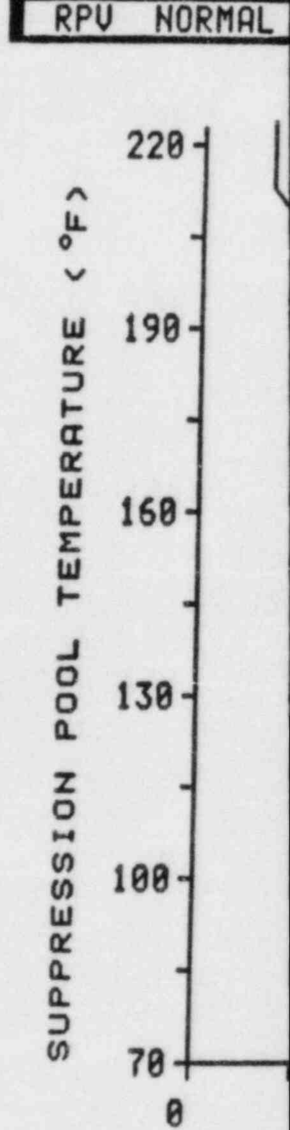
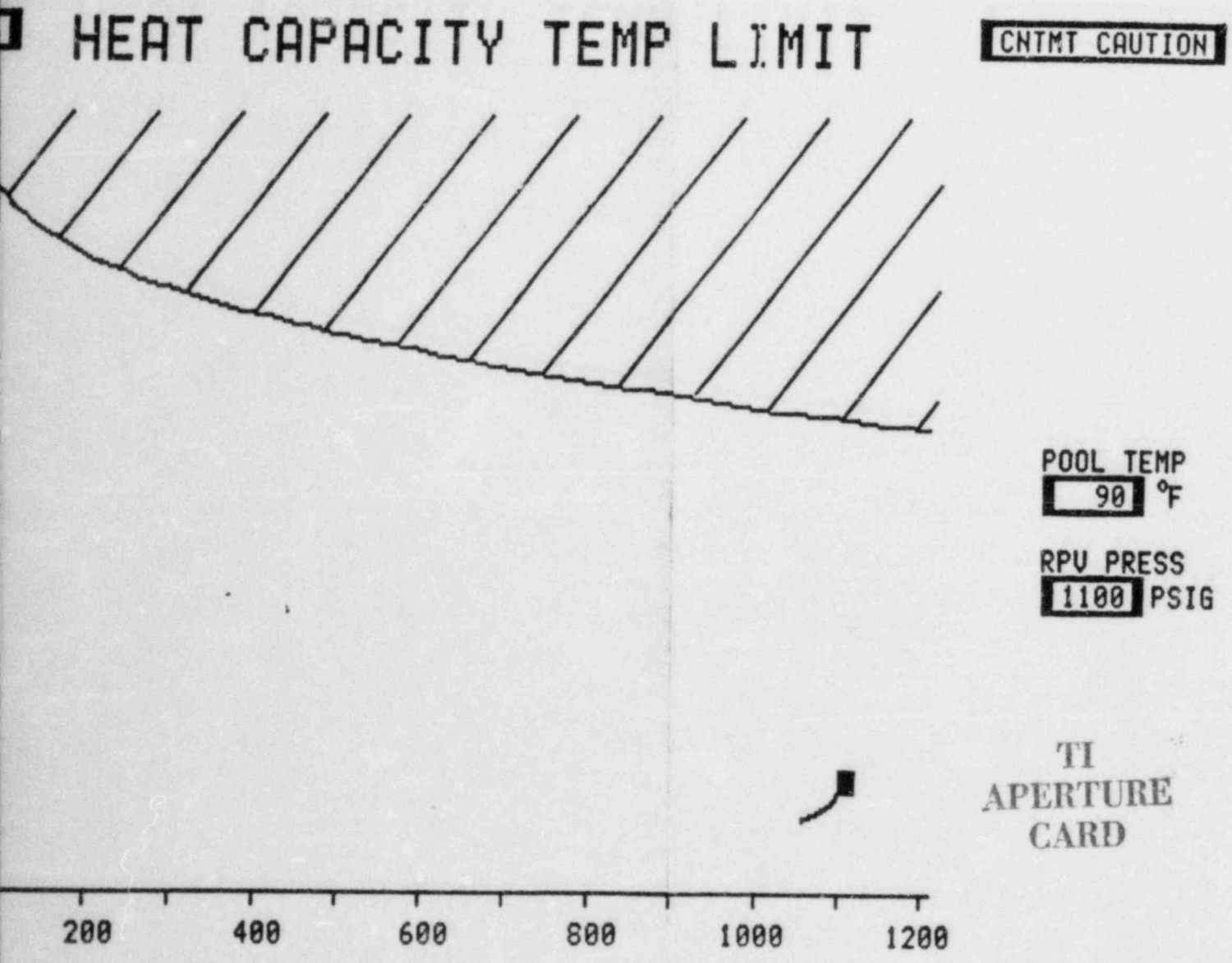

RPV NORMAL
SUPPRESSION POOL TEMPERATURE (°F)
220
190
160
130
100
70
0



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620.02-5

FIGURE 1. 2D PLOT DISPLAY

380 RPV NORMAL

RPV PRESS VALIDATED

INSTR RANGE	INSTR NO.	
NARROW	C32-N004A	
	C32-N004B	*
	C32-N004C	
WIDE	B21-N091A	-
	B21-N091B	
FUEL	B21-N085A	
	B21-N085B	
UPSET	C32-N017	
SHUTDOWN	B21-N027	**

RPV LEVEL VALIDATION

CNTMT NORMAL

*VALIDATED , RPV LEVEL 194 INCHES >TAF
30 INCHES

INSTR VALUE	DATA GOOD	ZERO ADJ	FLOW COMP	ADJ VALUE	TEMP COMP	REF LEG BOILING	COMP VALUE	COMP VALUE CONSISTENT
30 IN	YES	----	----	----	YES	NO	30 IN	YES
*** IN	NO	----	----	----	NO	NO	**** IN	NO
30 IN	YES	----	----	----	YES	NO	30 IN	YES
00 IN	YES	----	YES	-100 IN	YES	NO	-100 IN	NO
40 IN	YES	----	YES	40 IN	YES	NO	40 IN	NO
30 IN	YES	YES	----	30 IN	YES	NO	30 IN	NO
50 IN	YES	YES	----	50 IN	YES	NO	50 IN	NO
30 IN	YES	----	----	----	YES	NO	30 IN	NO
** IN	NO	----	----	----	NO	NO	**** IN	NO

DRAFT

LIMERICK ● ● ● 03-MAR-1984 08:00:00

620.02-6

FIGURE 8. VALIDATION DISPLAY

Also Available On
Aperture Card

QUESTION 620.03

Define and discuss the Verification and Validation Program Plan used in the development of the SPDS.

DRAFT

RESPONSE

The Verification and Validation Program used in the development of the Limerick SPDS is identical to the Program generically used for all GE supplied SPDSs.

The methods employed in the Verification and Validation (V&V) procedures ensure that the Limerick SPDS will have the functions and characteristics that it is required to provide and that the functions perform correctly. The review and testing processes are designed to identify problems or weaknesses in the design requirements, the design, and the implementation of the design, and to correct those problems and weaknesses.

The specific V&V plan identifies quality audit points (QAPs) along the Limerick SPDS development path. These QAPs range from performing specification reviews to code walkthroughs to several levels of software and system testing. Heavy emphasis is placed on achieving independent V&V, that is, employing reviewers and testers who have not been directly involved in the design.

Major V&V milestones consist basically of preparation and review of design specifications, coding and review of coding, development of test plans and procedures, conductance of tests and review of test results. This V&V procedure is not only sequential but also iterative. Results which identify areas requiring correction are used to modify the design or further define requirements in order to resolve concerns.

The review of specifications is accomplished by the reviewers documenting comments on a controlled issued document during the development of these specifications. Each comment must be resolved by the responsible engineer to the satisfaction of the reviewers prior to the issue of any document. The testing phases produce test reports which show any discrepancies between expected and actual test results, these discrepancies must be resolved by the responsible engineer of the design group and the test repeated.

By performing the V&V procedures a systematic and structured method is implemented to insure that the correct functions are provided and that the functions provided are correct.

QUESTION 620.04

Describe the SPDS design and provide data for each of the SPDS requirements listed in NUREG-0737, Supplement 1.

RESPONSE

THE SPDS portion of the L&S Emergency Response Facilities Data System (ERFDS) meets the requirements of NUREG-0737 Supplement 1.

The ERFDS is a centralized, integrated system which performs the process monitoring and calculations defined as being necessary for the effective evaluation of normal and emergency power plant operation. The ERFDS acquires and records process data including temperatures, pressure flows, and status indicators. This data is then processed to produce meaningful displays, logs, and plots of current or historical plant performance and presented to plant personnel in the plant main control room or other user definable locations.

The ERFDS can be functionally divided into major functional groupings which perform definable functions. These functional groupings are:

a. Main Processing Functions - performs functions entailing basic data manipulations and preprocessing.

b. Man Machine Interface - performs the function of interfacing the human with the ERFDS.

c. Data Acquisition Functions - performs data acquisition and plant process instrumentation interface.

d. Transient Recording and Analysis Functions - performs analysis, logging, plotting and recording functions.

e. Real-Time Analysis and Display Functions - performs all functions required to produce displays including display building and dynamic display processing functions.

SPDS Requirements

The following summarizes the requirements given in Section 4.1 of NUREG-0737, Supplement 1 and generic design implementation characteristics which are fully applicable to Limerick.

a. "Displays shall be available..."

- Reliability has been designed into the ERFDS by providing
  - . redundant and validated signals
  - . on-line failure diagnostics
  - . processor backup
  - . use of quality components

"Provide concise displays of critical plant variables..."

- This requirement is met by all top level displays discussed in the response to question 620.02 (Figures 620.02-1, 620.02-2, and 620.02-3).

b. "Continuous display of SPDS parameters shall be located conveniently to the control room operator..."

The installed ERFDS configuration assures that this requirement will be met.

Two ERFDS graphic display consoles are located in the Limerick Control Room. These consoles provide continuous display of SPDS parameters. One ERFDS console is located adjacent to the process computer CRT console and is convenient for use by the Reactor Operator. The second ERFDS console is in a central location and is convenient for use by the Senior Reactor Operator.

c. "The SPDS shall be suitably isolated from...safety systems."

- This concern is addressed in the response to question 620.07.

d. "Prompt Implementation of SPDS...Information."

- The schedule for implementation of the Limerick SPDS is provided in the response to question 620.06. The

selection of parameters includes the ERFDS was based upon the guidance provided in NUREG-0696.

e. "The SPDS shall be designed to incorporate accepted human factors principles..."

- This concern is addressed in the response to question 620.02.

f. "The minimum information to be provided shall be sufficient to provide information to plant operators about:"

"(i) Reactivity Control" DRAFT

- Reactor power is one of the EPG control parameters. Its control is addressed by the RPV Control Display which includes the reactor power trend plot and the SCRAM event target. Expanded trend information is also given by the full page reactor power trend plot.

"(ii) Reactor core cooling and heat removal from the primary system"

- Core cooling and heat removal are evidenced by EPG control parameters of RPV water level and pressure. The RPV Control Display provides trend and value information for these parameters as well as for RPV temperature when the reactor is shutdown. It also provides event targets (e.g., SRV, MSIV). Expanded trend information is also given by the full page trend plot displays.

"(iii) Reactor coolant system integrity"

- A breach of the reactor coolant boundary would be evident by the reactor and containment response (the latter for breaches in the primary containment). The initial alert would be evident on the Critical Plant Variables Display and/or the RPV Control and Containment Control Displays. Sufficient information to mitigate the consequences of a reactor coolant system breach in accordance with the LGS EOPs is given on the RPV Control and Containment Control Displays through indication of RPV water level, RPV pressure, SRV positions, drywell temperature, and drywell pressure.

"(iv) Radioactivity Control" DRAFT

- This concern is addressed in the response to question 640.03.

"(v) Containment conditions"

- Trends and values of containment control parameters and event indications that affect containment conditions (e.g., SRV open, isolation valve closure), are given on the Containment Control Display. Key top level information is given on the Critical Variables Display and expanded trend information on the full page Trend Plot Displays.

QUESTION 620.05

Define conclusions regarding unreviewed safety questions or changes to tech specs.

RESPONSE

The implementation of the Limerick SPDS does not involve an unreviewed safety question or require a change in the Limerick Technical specifications.

QUESTION 620.06

Provide a schedule for full implementation of the SPDS including hardware, software, training, procedures/operator manuals, etc.

RESPONSE

DRAFT

The schedule for full implementation of the Limerick Emergency Response Facilities Data System (ERFDS) is provided below.

	Activity	Completion Date
1.	Hardware installed and powered	September 15, 1984
2.	Static SPDS displays available in Control Room, TSC and EOF	September 15, 1984
3.	Control Room Operator Training	September 15, 1984
4.	Software debugging, Validation Testing and Acceptance Testing	February 15, 1985
5.	SPDS Displays Functional	March 1, 1985
6.	Reg. Guide 1.97 Parameter Displays Functional	April 1, 1985

QUESTION 620.07

DRAFT

Provide the following information for isolation devices between the SPDS and safety systems:

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). This description should include elementary diagrams where necessary to indicate the test configuation 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 (10 CFR 50.49) 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

DRAFT

Isolation for Class 1E SPDS signals connected to the Limerick ERFDS is provided by analog and digital input modules designed with optical circuit isolation. The Limerick input modules are identical to those used in other SPDSs supplied by General Electric. The input modules have been tested generically for electrical isolation, environmental qualification, and seismic qualification.

Parts a, d and f of Question 620.07 are scheduled to be addressed directly in the generic review of General Electric's ERIS. Parts b, c and e are addressed below.

DRAFT

b. Fiber optic couplers are used to isolate the inputs to ERFDS, which is non Class 1E, from the Class 1E instrument loops which provide the input signals. These fiber optic couplers are part of the ERFDS input modules, which are Class 1E. They are mounted in panels that contain cables and input modules of only one division. The output cable from the input module is a fiber optic cable which connects to a multiplexer in a seperate panel which, in turn, is connected via fiber optic cable to the computer system in the Technical Support Center. No failure of the ERFDS can be reflected back into the safety systems through the fiber optic cable because the cable, which is at least several feet long and usually much longer, has a typical dielectric breakdown value of 1.4×10^6 volts per inch. There is no credible voltage or current which can be generated either in the non Class 1E multiplexers or the computer main frames which can breakdown the fiber optic cable and cause failure of the input modules.

c. There is no maximum credible transverse mode fault which requires specific testing. This is because the output of the input module is fiber optic, and the non Class 1E device is located in a seperate enclosure seperated by several feet. This configuration also renders open and short circuit testing on the multiplexer output meaningless.

e. The Class 1E EREDS input modules are all located in a mild environment at Limerick. Therefore, as per 10 CFR 50.49, they do not require environmental qualification. However, General Electric has performed an environmental qualification program on the input modules and their power supplies. The results of that program are available at General Electric's San Jose facilities.

The multiplexers, power supplies and their enclosures have undergone seismic/hydrodynamic qualification and fully satisfy all criteria outlined in Section 3.10.

QUESTION 640.01

Define the operability status of the Safety Parameter Display System (SPDS) during all Technical Specification modes of reactor operation.

RESPONSE **DRAFT**

The SPDS will be operational during all modes of reactor operation defined in Table 1.2 of the Limerick Technical Specifications. However, operability of the SPDS does not constitute a Limiting Condition for Operation (LCO) because hardwired Class 1E instrumentation is available in the Control Room for the operator should the SPDS become inoperable.

QUESTION 640.02

Reactor Pressure Vessel (RPV) pressure is an entry condition for the BWR Emergency Procedure Guidelines. This parameter should be included in your SPDS under Reactor Pressure Vessel Control. If this process variable is not included in the final SPDS design, provide a justification for not including it.

RESPONSE

RPV pressure is included in the RPV control display (Figure 620.02-1).

QUESTION 640.03

NUREG-0737, Supplement 1 includes Radioactivity Control as a Safety function for which information should be available to assess the safety status of the plant. Expand your safety analysis report to include a discussion of the provisions made for Limerick 1 and 2 to monitor radioactivity control.

DRAFT

RESPONSE

The Limerick ERFDS monitors selected process and area radiation monitors in the plant. However, the computer based system with primary responsibility for providing the process, area, and stack effluent radiation data required for Radioactivity Control is the Radiation Meteorological Monitoring System (RMMS). An RMMS color graphic CRT with Keyboard is located in close proximity (within ~6 feet) of the ERFDS CRT in the Control Room. This provides Control Room personnel concise displays of radioactivity control data in close proximity to the SPDS displays provided by the ERFDS. A detailed discription of the RMMS is provided in Section 11.5.6.