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MIDDLE SOUTH UTILITIES SYSTEM

February 14, 1986

George W. Knighton, Director
PWR Project Directorate No. 7
Division of PWR Licensing-B
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

W3P86-0021
A4.07
NQA

Subject: Waterford SES Unit 3
Docket No. 50-382
Safety Parameter Display System

Reference: Letter dated December 2, 1985 from G.W. Knighton (NRC) to R.S. Leddick (LP&L)

Dear Mr. Knighton:

By your referenced letter you transmitted the results of the September 25-27, 1985 audit of the Waterford 3 SPDS. In order to address the issues raised by your audit report LP&L appointed an internal task force charged with determining the future form and scope of the SPDS consistent with its safety significance. The task force results are herein presented.

Background

To place the LP&L audit report response in the proper context it is important to briefly review the LP&L and regulatory history of SPDS.

The computer hardware and SPDS display generation software was contracted for and received by LP&L well in advance of the issuance of NUREG 0737 Supplement 1. Upon issuance of Supplement 1 LP&L committed to the requirements of Supplement 1 and developed SPDS displays to address the needs of both the control room and TSC/EOF personnel. A broad base of SPDS critical parameters was defined to cover these needs with the intent of erring on the conservative side with respect to parameter selection - i.e. there was not an attempt to define an absolute minimum set of SPDS parameters. In this way, LP&L felt that it was implementing an SPDS which went beyond the minimum requirements of Supplement 1. The SPDS display design was complete by the Fall of 1983 and implemented on the plant computer during the startup test program.

On the regulatory side, the SPDS requirements were finalized upon issuance of Supplement 1 in December, 1982. Supplement 1 cautioned that the previous NUREGs on the subject, including NUREG 0737 itself, "shall not be misconstrued as requirements to be levied on licensees or as inflexible criteria to be used by NRC staff reviewers." In November, 1984, nearly two years following the issuance of Supplement 1, the NRC issued Section 18.2 of the Standard Review Plan (NUREG 0800) which defined the review guidelines for the SPDS.

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SPDS Audit Report

As noted in the SPDS audit report, "the audit was based upon the recommended criteria of NUREG 0800 Section 18.2." The deficiencies identified in the report are largely the result of application of NUREG 0800 "requirements" to the Waterford 3 SPDS. For instance, numerous deficiencies are identified in the Waterford 3 SPDS Verification and Validation (V&V) program. This is not surprising because, as the auditors were informed, there was no separate V&V program for the SPDS, nor is it a requirement of Supplement 1. Unlike many other plants, the SPDS at Waterford 3 is merely a software implementation on the pre-existing plant computer which received sufficient testing during the startup test program.

The cover letter to the audit report also states that "the staff recognizes that the fact that much of the system was designed and implemented in good faith when the requirements for SPDS were not fully defined could have contributed to some of the problem areas." It should be noted that the SPDS requirements were fully stated in Supplement 1 and have not been altered since. The SRP has expanded upon the original Supplement 1 requirements.

SPDS Enhancement Program

Based on the above, LP&L has concluded that the guidance of NUREG 0800 is an inappropriate vehicle for assessment of the Waterford 3 SPDS and that the majority of the audit report deficiencies are, therefore, invalid. Nonetheless, LP&L has reviewed the audit report and shares the NRC concern over operator useability of the SPDS.

In order to enhance the SPDS and make it more useable to the operators the LP&L task force has determined that the primary impediment is the large number of "critical" parameters originally defined for the SPDS (the audit report does not address this as a root concern). In defining these parameters in 1983, as previously noted, the intent was to provide for TSC/EOF needs as well as the control room. The current enhancement effort, however, has focused on limiting the parameter set to only those values needed by the operators to assess the status of the critical safety functions. An added advantage of the enhancement at this time is the integration of the SPDS with the emergency operating procedure safety functions which were unavailable during the initial preparation.

Attachment 1 describes the enhanced set of SPDS critical parameters while Attachment 2 depicts the tentative display design for the SPDS. By following this scheme the Waterford 3 SPDS will be defined as a one page display that will be continuously available in the control room, and continue to meet the requirements of Supplement 1.

The sub-displays currently available will be retained for use by TSC/EOF personnel as required by Supplement 1 but will no longer be defined as a portion of SPDS.

In summary:

- o The SPDS will be enhanced through redefinition of the critical parameter set as defined by Attachment 1.
- o The SPDS will consist of one display, tentatively shown in Attachment 2.
- o All enhancements to the SPDS will be implemented to conform with Supplement 1. NUREG 0800 will not be used as a basis for enhancements (e.g. V&V program).
- o The enhancements are estimated to require 10 months, however, LP&L does not intend to implement the enhancements until final resolution of the SPDS audit report and acceptance of the enhancements by the NRC.

Conclusions

LP&L has reviewed the NRC SPDS audit report and, in response, concludes:

1. Application of an SRP to an operating plant after the license is granted is an unjustified regulatory action. In particular, use of Section 18.2 of the SRP to levy requirements on the Waterford 3 SPDS is invalid.
2. Enhancements to the SPDS could improve operator useability and provide a closer integration with the emergency operating procedures. However, implementation of such enhancements is not economically warranted with the Standard Review Plan as the requirements document. For instance, in preparing a value/impact analysis it would be difficult to ascribe much positive value related to core melt/dose averted for incremental changes to the non-safety related SPDS. The correct basis for SPDS requirements lies in LP&L's commitment to NUREG 0737 Supplement 1.
3. Further enhancements to the SPDS will be implemented upon documented agreement that the NRC accepts the enhanced system as meeting the requirements of Supplement 1.

LP&L would be happy to further discuss resolution of the SPDS audit report. Should you wish to arrange such a meeting, or require further information, please contact Tim Gaudet at (504) 595-2835.

Very truly yours,

K.W. Cook
Nuclear Support & Licensing Manager

KWC:MJM:sms

Enclosures

cc: R.D. Martin, NRC Region IV
J.H. Wilson, NRC-NRR
NRC Resident Inspectors Office
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ATTACHMENT 1

SPDS CRITICAL PARAMETERS

Reactivity Control

Reactor Power: Reactor core power, as measured by neutron flux, provides a direct determination of the success of reactivity control. Reactivity control is accomplished when core power is either less than the high reactor power trip setpoint or when power is continuously decreasing after a reactor trip signal has been generated.

RCS Inventory Control

Pressurizer Level: Pressurizer level is an indication of the amount of coolant inventory in the reactor coolant system. As long as there is water in the pressurizer, their is (under most conditions) sufficient inventory to cool the core. Control of pressurizer level indicates successful recovery from many accidents.

Subcooling: The margin to saturated conditions provides information on the possibility of voids existing in the RCS. For example, if saturated conditions (zero subcooling) exist in the reactor vessel upper head, a void is suspected to be present. Adequate subcooling in combination with pressurizer level provides assurance that RCS inventory is controlled.

Safety Injection Actuation Signal: For some events (large break LOCA) pressurizer level is never recovered. In this case, RCS inventory control is assured by safety injection flow as indicated by the presence of a safety injection actuation signal.

RCS Pressure Control

Pressurizer Pressure: RCS pressure must be controlled in order to prevent damage to RCS piping and components. Pressurizer pressure provides a direct determination of the success of RCS pressure control.

RCS and Core Heat Removal

Reactor Vessel Water Level: As long as the reactor core is entirely covered by water or a two-phase mixture, core heat removal is accomplished. The Heated Junction Thermocouple System measures water inventory above the core and provides an indication that the core is covered or could be uncovered.

Core Exit Temperature: When the reactor core is uncovered, steam at the top of the core increases its temperature due to heatup of the exposed fuel. Inadequate core heat removal is indicated by a high and increasing core exit temperature.

Steam Generator Level: The steam generators are the primary heat sinks for heat transfer from the RCS coolant. RCS heat removal can be accomplished if there is sufficient water on the secondary side.

Containment Isolation

Containment Isolation Actuation Signal: The generation of a containment isolation actuation signal indicates the need to close all containment isolation valves. The success of containment isolation can be verified by checking the status (closed/not closed) of those isolation valves available to the plant monitoring computer.

Steam Plant Activity: With the containment isolated the only path for escape of radioactivity from the RCS is through the steam generators. An indication of secondary side radioactivity is provided by the condenser air ejector radiation monitor.

Containment Temperature and Pressure Control

Containment Pressure: Containment integrity must be assured to prevent the uncontrolled release of radioactivity to the environment. Containment pressure is a direct indication of the potential for or actual failure of the containment. Containment temperature control is assured by control of containment pressure.

Containment Spray Actuation Signal: Some events require containment spray to control containment pressure. The containment spray actuation signal provides an indication that containment spray has been initiated.

Containment Combustible Gas Control

Hydrogen Concentration: The existence of combustible gas (hydrogen) within containment results in the potential for containment or equipment failure due to an explosion inside containment. The concentration of hydrogen is a direct indication of the success of combustible gas control.

Vital Auxiliaries

Safety Bus Voltage: Vital electric power must be maintained to continue to satisfy all safety functions. Voltage on each safety bus provides an indication that each bus is energized and available.

Parameter: Reactor Power (Log Power)

Display Type: Bar Chart

Display Limits: 10^{-6} - 200 (% Power)

Alarm Setpoint: Hi - 110%

Tentative Source of Data: Safety Channel excore neutron flux detectors through the QSPDS

Logic Notes:

For Low Power:

1. After trip, bar chart alarms when $Power_t < Power_{t+1}$ (i.e. when power is increasing)

2. Alarm clears when:

   a. $Power_{t+1} \leq Power_t$

   b. Reactor trip clears (i.e. breakers close)

3. Upon reactor trip (breakers open) the message "REACTOR TRIP" is displayed. The message clears when breakers are closed.

Parameter: Pressurizer Level

Display Type: Bar Chart

Display Limits: 0 - 100%

Alarm Setpoint: < 7%

Tentative Source of Data: Wide range IE inputs averaged (3 + 1 from QSPDS)

Logic Notes: N/A

Parameter: Subcooling

Display Type: Bar Chart

Display Limits: -50 to 200°F

Alarm Setpoint: < 28°F

Tentative Source of Data: Minimum of QSPDS inputs

Logic Notes: N/A

Parameter: Safety Injection Signal

Display Type: Text

Display Limits: N/A

Alarm Setpoint: N/A

Tentative Source of Data: ESFAS

Logic Notes:

1. The message "SAFETY INJ SIG ACTUATED: appears upon receipt of an SIAS

2. At any time following (1), when an SIAS is no longer present (i.e., reset), the message changes to "SAFETY INJ SIG RESET"

3. "SAFETY INJ SIG RESET" remains on until reactor trip clears (i.e. breakers close) - see Reactor Power

Parameter: Pressurizer Pressure

Display Type: Bar Chart

Display Limits: 0 - 3000 psia

Alarm Setpoint: > 2300 psia

Tentative Source of Data: Maximum of two QSPDS values

Logic Notes: N/A

Parameter: CET Temperature

Display Type: Bar Chart

Display Limits: 0 - 2300°F

Alarm Setpoint: > 700°

Tentative Source of Data: Maximum representative CET temperature from the 2 QSPDS channels

Logic Notes: N/A

Parameter: SG Level

Display Type: Two Bar Charts - one for each SG

Display Limits: 0 - 100%

Alarm Setpoint: < 50% wide range

Tentative Source of Data: Average of 4 wide range channel signals and 1 wide range signal from QSPDS

Logic Notes: N/A

Parameter: Reactor Vessel Level

Display Type: Text

Display Limits: N/A

Alarm Setpoint: N/A

Tentative Source of Data: 2 channels from QSPDS

Logic Notes: The message "CORE COVERED" appears normally unless:

1. The bottom 2 HJTCS on each channel are uncovered at which time the message "CORE UNCOVERED" is displayed.

2. The "CORE COVERED" message is used if:

   a. The bottom HJTC on each channel is covered, or

   b. The 2nd from the bottom HJTC on each channel is covered, or

   c. Any combination of (a) and (b) - i.e. the bottom HJTC on Channel A and the 2nd from bottom HJTC on Channel B

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Parameter: Containment Isolation

Display Type: Text

Display Limits: N/A

Alarm Setpoints: N/A

Tentative Source of Data: All digital points associated with CIAS actuation devices

Logic Notes: Given a CIAS:

1. The message "CIAS ACTD" appears upon receipt of a CIAS

2. Given a CIAS, the message "INCOMPLETE" appears if at least one of the isolation devices associated with CIAS (and available on the PMC) fails to isolate; otherwise the message "COMPLETE" is displayed.

3. (1) and (2) are cleared when CIAS is cleared.

Parameter: Radiation (Condenser Off-Gas)

Display Type: Text

Display Limits: N/A

Alarm Setpoint: .254 μCi/cc

Tentative Source of Data: 2 signals from Radiation Monitoring System (RMS)

Logic Notes: The message "CONDENSER OFF-GAS ACTIVITY HIGH" appears upon either of the two RMS signals exceeding the setpoint, and is removed when both signals are below the setpoint.

Parameter: Containment Pressure

Display Type: Bar Chart

Display Limits: 0 - 40 psia

Alarm Setpoint: > 17.7 psia

Tentative Source of Data: Containment pressure instrumentation covers three overlapping ranges. Evaluate instrument accuracy and qualification to determine the appropriate signal inputs for this parameter.

Logic Notes: Implement logic needed to combine varying sensor ranges, if necessary.

Parameter: Containment Spray Actuation

Display Type: Text

Display Limits: N/A

Alarm Setpoint: N/A

Tentative Source of Data: CSAS

Logic Notes: The message "CSAS ACTUATED" appears upon a CSAS and is removed when CSAS is reset.

Parameter: Hydrogen Concentration

Display Type: Bar Chart

Display Limits: 0 - 20%

Alarm Setpoint: > .5%

Tentative Source of Data: QSPDS

Logic Notes: N/A

Parameter: Safety Bus Voltage

Display Type: Text

Display Limits: N/A

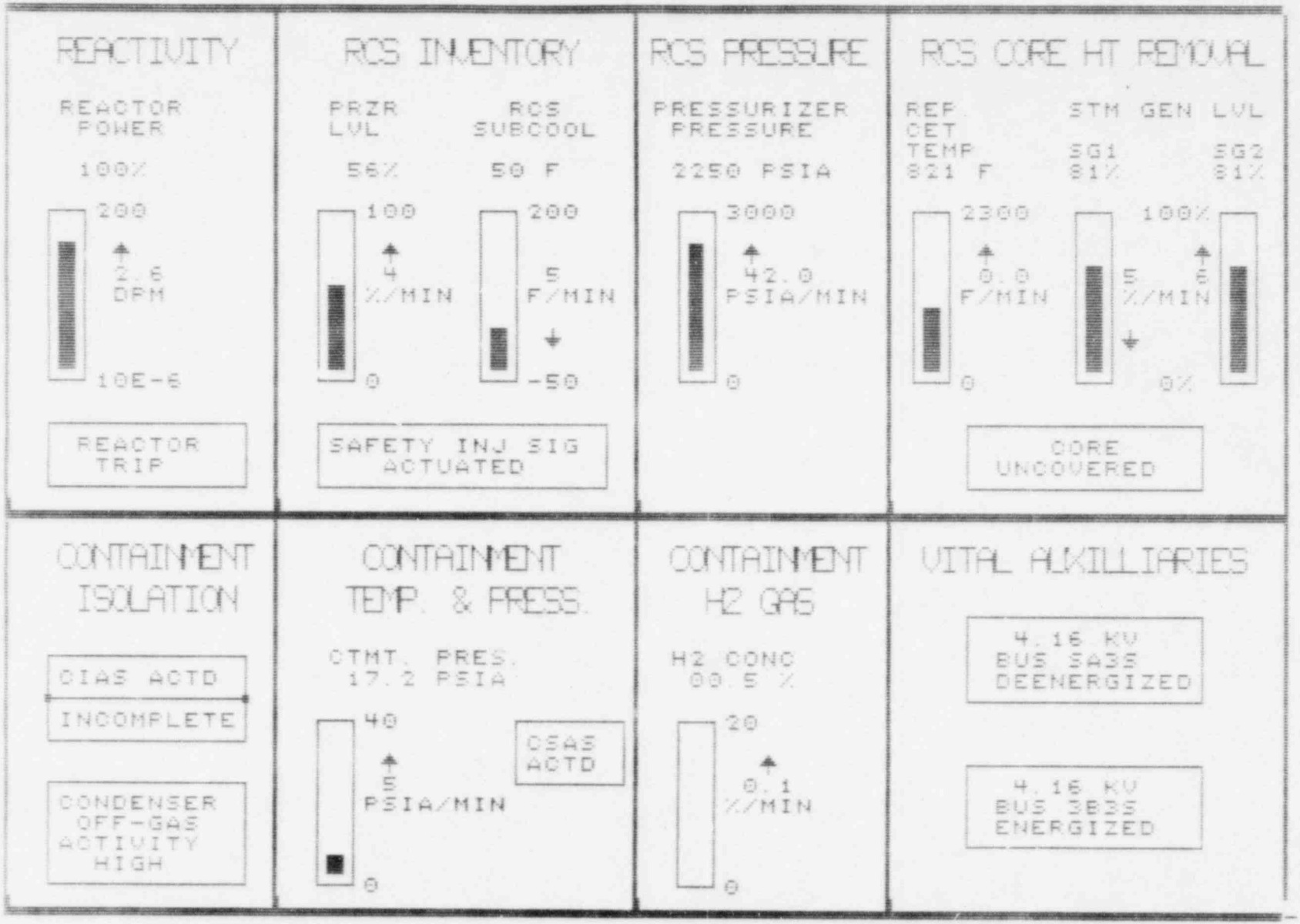
Alarm Setpoint: N/A

Tentative Source of Data: 3A3S, 3B3S bus inputs

Logic Notes: For either bus the message "DEENERGIZED" appears when voltage drops below [80%] of 4160V. The message(s) are reset to "ENERGIZED" when bus voltage exceeds this value.

ATTACHMENT 2

TENTATIVE SPDS DISPLAY



10:24:45 05FEB86

ALARM CONDITION