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U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Attention: Document Control Desk

Subject: Request for Additional Information, Cooper Nuclear Station Safety Parameter Display System (SPDS) (TAC No. 51232)

Reference: Letter from W. O. Long to G. A. Trevors, dated April 22, 1988; same subject

Gentlemen:

In accordance with the request for further information regarding the Safety Parameter Display System (SPDS) contained within the referenced letter, the following attached responses are provided. For clarity in presentation, the specific information requests are noted and are followed by the District's responses.

Should you have any questions regarding this information please contact Mr. J. C. Murphy at our General Office.

Sincerely,

G. A. Trevors
Division Manager
Nuclear Support

GAT/gmc:dmr14/1(1C)

cc: U. S. Nuclear Regulatory Commission
Regional Office - Region IV
Arlington, Texas

NRC Resident Inspector
Cooper Nuclear Station

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Requested Information

1. Provide a discussion of Safety Parameter Display System (SPDS) response times. This discussion should include:

   The specified system response times and the basis for this specification.

   Actual data rates for each type of data including discrete, composed points, and calculated values.

   Screen up-date rate.

   Is the data rate different for information which changes rapidly under severe transients (e.g., neutron flux) than less volatile parameters?

   The time required for the SPDS to respond to an operator request. That is, how long does it take following a command for a new display for that display to be completely presented on the screen? Does this response time degrade under full system demand with all consoles operating?

Response

The response time originally specified for SPDS displays was three seconds or less. The basis for this specification was engineering judgment from past experience with real-time systems.

Actual data rates for SPDS points range from ten times per second to once per minute, with the majority of the points being monitored at a rate of once per second or faster. At this time, all SPDS data rates, including discrete, composed points and calculated values, are once per second or faster with the exception of the following points: Main steam safety valve and safety relief valve temperatures (every five seconds), Reactor Building differential pressure (every five seconds), suppression chamber air and water temperatures (every 15 seconds), area radiation monitors/gaseous effluent monitors and related flows (at least every 30 seconds), and Reactor Building basement water level (every 60 seconds).

The screen update rate for SPDS displays is three seconds on SPDS Trend displays and two seconds on all other SPDS displays (bar charts, mimics, etc.).

As noted above, the majority of SPDS points are monitored at a rate of once per second or faster. This includes the SPDS points which monitor neutron flux, which are monitored at a rate of once per second or faster.

SPDS responds to an operator request for a SPDS display in the Control Room within approximately two to five seconds when the operator is within the SPDS set of displays at the time a new display is requested. Although not actually measured with a clock, a site computer administrator has witnessed this same level of response during and immediately following a plant scram. Actual clocked response times during an on-site system load test are not available.

Additionally, it should be noted that if an operator requests a SPDS display, while viewing a non-SPDS display, response time to bring up the SPDS display is slower and may take from two to sixty seconds depending on system load. To insure quick access to SPDS displays, a SPDS display is present at all times on at least one of the five colorgraphic display terminals in the Control Room.

Requested Information

2. Describe the use of the SPDS keyboard in accessing displays.

Is the user assisted by overlays?

Do all keyboards work the same?

Response

The SPDS does not use keyboard overlays. Labeled special function keys are used to supplement ordinary keyboard operation.

There are several different ways to execute a SPDS function from the keyboard. These include:

° SPDS Command - Any SPDS display may be called up by entering the four to eight character SPDS display Turn-On-Code (TOC) and depressing the "RETURN" key.

° Main Menu - The main menu is a display which lists and allows display of various sub-menus. One of these sub-menus is the SPDS menu described below. By depressing the key marked "MAIN MENU", the main menu will be displayed. The main menu may also be called up by typing the command "MAINMENU", followed by depressing the "RETURN" key.

Once the main menu is displayed, the Operator may call up the SPDS menu by either depressing a single function key or by entering the number associated with the SPDS menu, followed by depressing the "RETURN" key. SPDS displays may be called up from the SPDS menu, as described below.

° SPDS Menu - The SPDS menu is a display which lists the SPDS display names and associated Turn-On-Codes. The SPDS menu may also be called up by typing the command "SPDSMENU", followed by depressing the "RETURN" key.

Once the SPDS menu is displayed, the Operator may call up any SPDS display by entering the item number associated with the SPDS menu item of choice, followed by depressing the return key, or by using one of the other methods described herein.

° Single Key Call Up - The following SPDS displays may be called up by depressing one of the reserved special function keys along the top of the keyboard:

- The SPDS Overview Display
- The SPDS level-two bar chart displays associated with the five SPDS Safety Function Indicator Boxes
- The first display in the series of SPDS level-three Emergency Operating Procedure (EOP) Support Displays

Each reserved special function key is appropriately labeled. By using these function keys, the associated SPDS display may be called up with a single keystroke from all other SPDS displays and most PMIS displays.

It should be noted that more than one keystroke is required to bring up an SPDS display from a few of the PMIS displays (for example, the cancel key must first be depressed before an SPDS display can be requested from the "point value" display regardless of the method used to request the SPDS display). Note: The cancel key must also be used before being able to call up an SPDS display by the methods described in the above bullets.

° SPDS Internal Menu - Once a SPDS display is called up, the SPDS internal menu may be called up by depressing a single function key. All SPDS displays will be listed by name in white, with the most recently displayed SPDS display highlighted in yellow. The list is arranged in hierarchical order. The Operator may call up the display highlighted in yellow at any time by depressing a function key. The Operator may use other function keys to move about in the list, and once the Operator has moved to the display of choice, the Operator may execute the display by depressing a single function key. The Operator may also execute any SPDS display by typing the Turn-On-Code of the display of choice and depressing the "RETURN" key.

° Arrow Keys - Once a SPDS display is called up, the Operator may use the arrow keys to move from one SPDS display to another. Use of the arrow keys follow the hierarchical arrangement depicted in the SPDS internal menu display.

All PMIS/SPDS color graphic display terminal keyboards located in the Control Room, Technical Support Center, and Emergency Off-site Facility are identical to one another and operate in the same manner.

Requested Information

3. Provide information regarding the location of the SPDS terminals within the Control Room.

Response

The location of the PMIS/SPDS terminals within the Control Room was determined by members of the CNS Operations Department and the Detailed Control Room Design Review Committee during the early phase of the PMIS project. As a result, Drawing SKE-3, Control Room Proposed Arrangement, was developed and is included as Attachment 2. Actual placement of the consoles is as shown on the attached drawing except for very minor adjustments that were made in locating conduit penetrations and final minor adjustments by plant operations.

Requested Information

4. Discuss how the SPDS and the plant Emergency Operating Procedures (EOPs) have been integrated.

   Are there references in the EOPs to the SPDS displays?

   How does the process for assessing the status of critical safety functions differ with and without the SPDS operable?

Response

The EOPs do contain references to SPDS displays. Each 2-D plot in the EOPs references the display number for the applicable level-three SPDS EOP display. In addition, the EOPs reference the SPDS displays relating to drywell temperature, suppression pool temperature, control rod position indication, and the RPV pressure/level block.

When SPDS is operable, it is used to augment existing Control Room plant status indications in assessing the status of critical safety functions.

When SPDS is inoperable, the status of critical safety functions are determined from Control Room plant status indicators. Subsequent to SPDS becoming inoperable an investigation begins into the cause of failure so that the problem can be resolved in a timely manner.

Requested Information

5. Describe the content of the Cooper Nuclear Station (CNS) operator SPDS training program.

   How often are the operators retrained?

   Are questions on the SPDS included in operator licensing examinations?

Response

Emergency Operating Procedure Training is typically required to be performed on an annual basis. To properly instruct EOP's, SPDS is integrated into these sessions. Initial SPDS training is presented to Reactor Operator Candidates during the PMIS presentation; a practical factor demonstration is typically required.

When SPDS/PMIS lectures are presented to the Licensed Operators during Requalification Training, they are examined on the SPDS/PMIS during that cycle of training. During the oral section of the annual operating examination, many operators utilize PMIS and SPDS displays to answer the posed questions.

Requested Information

6. Describe the provisions for assuring that the Control Room SPDS displays continuously present information from which the status of the critical safety functions can be determined.

   Do the Safety Function Indicator boxes show up on all Plant Management Information System (PMIS) displays or only on SPDS displays?

   If the status boxes are not part of all displays, how do you ensure that the SPDS is always displayed to the Control Room Operators?

Response

Five PMIS/SPDS color graphics terminals are located in the Control Room. Each of these terminals is capable of displaying any SPDS display. Each of these terminals displays the five SPDS safety function indicator boxes all the time, regardless of the type of SPDS or PMIS display being viewed at the time. A specific standardized section of the display screen layout is reserved solely for display of the safety function indicator boxes on all PMIS and SPDS displays. Therefore, regardless of the PMIS or SPDS display being viewed on a PMIS/SPDS color graphics terminal, the safety function indicator boxes will be displayed on the same screen, and in their standard location on the screen.

Requested Information

7. Discuss more fully the Verification and Validation (V&V) team concern with the linkage between the Level 1, 2, and 3 displays (Discrepancy 14). Also, discuss more completely the resolution of this concern. Address:

   The nature of the specific linkage problem.

   The discrepancies found and corrected.

   What sort of problems would a future review possibly uncover?

Response

As noted in the Technical Evaluation Report for the Safety Parameter Display Systems dated November 9, 1987, Lawrence Livermore National Laboratory (LLNL) personnel were unable to determine the V&V team's precise concern on the linkage question. NPPD and the system developers also had this same difficulty.

The original concept of a linkage was simply to provide the ability to incorporate a display into a hierarchial display structure. In this linkage, a top display (one or more) containing summary information on many systems could reference lower level displays that contain more detailed information on the systems which were part of the higher level display. The operator could then use arrow keys to move from display to display within the structure. This approach was used and implemented.

Display of the hierarchical listing is provided as part of the SPDS internal menu. Arrow keys may be used to move about in this structure as described in the response to Question 2 of this attachment. Use of the arrow keys or the linkage listing is intended as an aid to the operator and its use is optional. Neither the listing nor the arrow keys have any negative effect on the ability of the operator to call up an SPDS display of choice. In fact, the linkage is nothing more than a menu organized in a relational manner which also allows use of arrow keys to move about within this menu.

The V&V team had questions regarding the linkage which appear to have stemmed from V&V misunderstandings regarding the manner in which the linkage was intended to work and its operation. The V&V team questioned the manner in which the display names were arranged in relation to plant operation logic. The display names are arranged in the linkage in a logical relationship to one another. The V&V team also incorrectly concluded that a listing of the linkage names was not available to the operator and that use of the arrow keys could result in only being able to return to the menu. The V&V team misunderstood the operation of the arrow keys. The linkage listing display is available from any SPDS display.

It should be noted that use of the arrow keys does not in any way preclude calling up another SPDS display. All methods of accessing SPDS displays is outlined in the response to Question 2 of this attachment. The linkage was provided as an optional tool for access to displays.

In summary, the discrepancies found during the V&V team review were largely the result of a V&V team misunderstanding of the way the linkage worked, and an undefined and unclear difference of opinion regarding the arrangement of the displays within the linkage. NPPD feels the linkage and related functions as currently implemented are acceptable. It is anticipated that a future review of the linkage would also find the linkage to be acceptable.

Requested Information

8. Describe how the SPDS user verifies that the data displayed on the SPDS is current and is being updated.

Response

The system design provides a simple indicator to allow the Operator to readily verify system health. System time, which is displayed on all PMIS and SPDS displays and is updated each second, provides a readily available means of verifying general system health and operability. In addition to this readily available indicator, data quality and validation techniques are used for the SPDS and are reflected in the operation of the SPDS safety function indicator boxes and displays. The Operator also has the means readily available on any PMIS terminal to display the current value and quality of any point. In fact, the Operator has many methods available to verify that the data on the SPDS is current and is being updated, even down to the level of viewing the current millivolt reading of an analog input point from a PMIS display in the Control Room. In addition to the features available to the Operator, the computer system monitors its own health and takes appropriate actions (such as failover to the backup computer) if it finds its own health is in question.

While it may be noted that no single combined indicator of SPDS health is available, it is NPPD's position that implementation of such an indicator is neither feasible nor advisable. Such an indicator could not be relied upon to provide dependable, unambiguous indication of SPDS health. For example, such an indicator would have no choice but to indicate some sort of "SPDS Unhealthy" condition when either a single SPDS point failed or all SPDS points failed. There could be no clear differentiation between these conditions with a single indicator. NPPD has chosen to take an approach which provides a more precise indication of health, while at the same time, indicating health in a dependable, unambiguous manner.

SPDS is not one single point, nor a single group of points. Rather it is a complex group of important direct and derived parameters which, when combined, make up the "system." Loss of any single point, or group of points, does not make the "system" unhealthy. Therefore, the NPPD approach to indication of SPDS health is to inform the Operator of the health of points or groups of points, via the SPDS data quality and validation techniques. This, combined with the availability of the general system health indicators, such as system time, provides a clear and accurate indication of health to the Operator at all times, without misleading the Operator regarding the health of the system as a whole, or of individual sections of the system.

Requested Information

9. Provide documentation of the SPDS human factors review.

   Was the Human Factors Plan described to the NRC during the Preimplementation Audit actually implemented?

Response

The SPDS Human Factors Plan which was described to the NRC during the Preimplementation Review consisted of the following areas: 1) SPDS User Definition, 2) SPDS Integration with Normal and Emergency Operation Procedures, 3) SPDS/Control Room Interface Requirements, 4) SPDS Man-Machine Interfaces, 5) SPDS Training Considerations, and 6) Functional Validation of SPDS. Attachment 3 is SAIC Report 86/1797, titled "Summary of Human Factors Activities Related to Cooper Nuclear Station CNS Plant Management Information System (PMIS) and Safety Parameter Display System (SPDS)." This report provides a summary of the human factors activities and references the many supporting documents that address these activities for the areas identified above.

As can be determined from review of the Human Factors Summary Report, all areas identified in the Human Factors Plan were addressed. The supporting documentation for these areas are referred to in the text of the Summary Report and can be made available to the NRC if desired. It is the District's opinion that the human factors plan as described to the NRC during the Preimplementation Meeting was implemented.

Requested Information

10. Provide a description of the operator responses and comments resulting from the man-in-the-loop testing and a discussion of the resolution of any negative comments received.

Response

A total of 61 responses or comments were received as a result of man-in-the-loop testing. These were reviewed by the developer and the station Operations Department. The changes described below have been implemented to address 41 of the items. Other changes needed to resolve one item remains to be implemented. The determination was made that 19 of the items required no further action. The numbered comments below are written as they were obtained from man-in-the-loop testing and have not been edited. The bullets after each numbered comment provide our discussion of the resolution of the negative comments received.

Generic Comments (Level 1 and 2 Displays)

1) Rate of display data update is too fast.

   ° Trend displays were modified to update every three seconds. Other displays were modified to update every two seconds.

2) Add SPDS turn-on codes (TOCs) to the EOP status indicator blocks to assist operators in quickly identifying appropriate EOP display.

   ° The related SPDS display number was added to status indicator blocks.

3) Color codes are sometimes difficult to keep straight. Suggest including one word definitions in boxes.

   ° This item was not implemented. It was determined that training and experience would address this item.

4) Place "tick" marks (and numbers) on right-hand side of graphs (Y axis).

   ° "Tick" marks were added to the right of all graphs. It was decided that numbers would not be necessary.

5) Place tick marks on graphs identifying color change (alarm or warning) points.

   ° Tick marks were added, identifying alarm and warning points.

SPDS #10 Plant Overview

6) APRMs should be flow-biased on color change (also SPDS 20/21).

   ° The method for setting the APRM warning and alarm limits was modified to account for flow.

7) Change tick mark from 1.45 to 0.6 on drywell pressure.

   ° This tick mark and indicated value was changed.

8) Rate of change is too sensitive.

   ° Rate of change was revised to address this comment.

9) Why is the RPV saturation limit block in this display (also, SPDS 22)?

° This item will be useful to operators when determining confidence in RPV water level.

10) RPV saturation doesn't turn red until 400°F; however, EOPs require emergency depressurization if drywell temperature cannot be maintained at <285°F.

° Drywell temperature points initially had no warning or alarm limits. These points now generate warning and alarm indications on SPDS.

11) Reactor scram box should be red when full scram signal in and APRM 2.5%. Inside box in letters should tell the operator when a full scram signal is present. Suggest the word "full". One-half A or B could be put in box when half-scram signal is present. Example: 1/2 A for Channel A half-scram; 1/2 B for Channel B half-scram; FULL for full scram signal (also SPDS 20/21).

° Indication of scram status for each channel and full scram was provided.

SPDS #20 Reactivity Control - Bar

12) Make "SRM Position" and "All-Rods-In" blocks mode switch dependent.

° The data base for these points was modified to reflect an alarm condition based on mode.

13) Change the "Any APRM Bypassed" and "Any SRM Bypassed" blocks to orange instead of red background when bypassed.

° Implemented, using yellow rather than orange.

14) Instead of having blocks for bypassed and inoperable APRMs and SRMs, state which APRMs and SRMs are operable.

° This information was not deemed necessary for SPDS. It is readily available elsewhere in the Control Room. No change was made.

15) When does the SRM bar change color?

° The bar does not change color.

16) APRM display does not show the 2.5% downscale trip setpoint.

° A tick mark at 2.5% only served to clutter the display. It was not added.

SPDS #21 Reactivity Control - Trend

17) Segregate APRM and SRM boxes with white lines.

° This change was accomplished by tighter grouping of related boxes and adding headings.

18) Can "downscale" be written by APRM trend graph?

° The decision was made not to use a downscale indicator on our trends. The current value is always present and the downward trend will be displayed. No change was made.

SPDS #22 Core Cooling - Bar

19) Eliminate the tick mark and label at "14" on the FZ (fuel zone) Yarways (also SPDS #23).

° This mark corresponds to the bottom of the adjacent wide range scale. It was recommended this mark be left. No change was made.

20) Why is "NPSH Limit" block in this display?

° NPSH curve can indicate impending loss of pumping capacity for coolant make-up pumps drawing a suction on the suppression pool.

21) Re-arrange IN/MIN on GEMAC side (narrow range level instruments) to be consistent with wide range readings.

° This display was re-arranged and made more uniform.

22) Align readings in inches with respective level indicator.

° This display was re-arranged and made more uniform.

23) Dislike the use of magenta to indicate disagreement of two good points in the logic, as too many things turn display magenta (suggest yellow) (also SPDS #24).

° While this comment had validity, there was no acceptable alternative with only eight colors to choose from. No change was made.

24) Should trend both FZ and WR in different colors.

° This change was implemented.

SPDS #23 Core Cooling - Trend

26) Have indications available on this display that would show the operability of the ECC pumps because these have a direct effect on core cooling trend (also SPDS #25, #28).

° A new display (SPDS2D) was created to address these items.

SPDS #24 Coolant System Integrity - Bar

27) Isolations would be more understandable if they turned red when the isolation was in.

° The SPDS was revised to accommodate this comment.

28) Would like to see a point ID number for bar (also SPDS #29).

° A decision was made early in the PMIS project not to add ID numbers to displays. They would only serve to clutter the displays. No change was made.

29) Would prefer drywell mimic to replace this display.

° The main advantage of mimics is to display spatially-dependent parameters, which are not involved here. No change was made.

30) Add a wide range -150 to +60 inch water level indication.

° This information is available on other displays. It would only serve to clutter this display. No change was made.

31) Drywell pressure not in PSIG (not consistent with EOPs).

° The SPDS displays were changed to be consistent with other plant indicators, the EOPs, etc.

<u>SPDS #25 Coolant System Integrity - Trend</u>

32) Need more containment information.

° The Secondary Containment Display (SPDS2C) was developed.

33) Drywell pressure is a very wide range over a short span.

° This item is unavoidable due to space limitations. No change was made.

34) Suggest including drywell humidity, temperature, sump flow rate.

° Much of this data is available elsewhere within SPDS. The usefulness of humidity was questionable. No change was made.

<u>SPDS #26 Containment Integrity - Bar</u>

35) Drywell spray limit will be violated during normal operation. Need to change box so it is not red all the time.

° The point was changed to eliminate this problem.

<u>SPDS #27 Containment Integrity - Trend</u>

36) Should define suppression pool temperature points of 95°F and 110°F.

° These are Technical Specification limits. This was determined to be a training issue. No change was made.

<u>SPDS #28 Suppression Chamber Mimic</u>

37) Can anything be done to better denote the SVs?

° The display was modified to provide better demarcation of SVs.

38) "V"s in SVB and SVC resemble "U"s.

- The shape of the "V" is a function of the CRT's font and is not changeable. No change was made.

39) Add definition lines around suppression pool temperature and RPV pressure to make them stand out better.

- The display was re-arranged to address this item.

40) Add RHR/SDC entry points, and if injecting in SDC, lineup for "on".

- This display was intended to show only steam blowdown points that could cause local temperature changes in the torus water. It was determined that no change would be made.

SPDS #29 Radioactive Release - Bar

41) Split to high range bar and low range bar (also SPDS #2A and B).

- This change has yet to be implemented. The change is in progress and should be completed in the near future.

42) Add: isolation indications, SGT system operation, wind speed and direction, RX building ventilation (also SPDS #2A and 2B).

- This information is available on other displays. It was determined that no change was needed.

SPDS #2A/2B Radioactive Release - Trend

43) Poor use of scientific notation.

- The format for all scientific notation was modified to use a more standard format.

Generic Recommendations (Level 3 Displays)

44) Provide EOP graph or page under headings.

- The graph name has been added as part of the heading.

45) Add words in blue zone indicating that this is undesirable status.

- A message to this affect has been added, in white, just above the affected graphs.

46) Make cursor different color so it can be seen in blue zone.

- The cyan cursor was made slightly larger. As it offers the best possible contrast, based on the colors available, it was not changed.

47) Add applicable EOP steps to display.

- This item was not implemented. Although SPDS and EOPs are integrated, there is not always a one-to-one relationship between SPDS and EOP procedural steps. Some SPDS EOP limit curves are a decision point in more than one part of the EOP. The EOPs contain references to SPDS displays, as outlined in the response to NRC Question 4. No change was made.

48) Update curves to EOPs.

- This was accomplished and these curves continue to be updated as necessary.

<u>SPDS #30 Heat Capacity Temperature Limit</u>

49) Assign a function key to this display (also SPDS #39).

- A spare function key was assigned to SPDS30. It was decided not to use one for SPDS39.

<u>SPDS #33 Containment Pressure Limit</u>

50) Y axis of curve should be in PSIG (as in EOPs).

- See Item 31.

51) X axis points need calibration.

- This point was calibrated.

<u>SPDS #34 Drywell Spray Initiation Pressure Limit</u>

52) Y axis should be in air space temperature.

- This change was made.

53) X axis drywell pressure should be in PSIG.

- See Item 31.

54) During normal operation, this display will be in the shaded area. This will cause the E to be on and the containment integrity block to be red.

- This display was modified to no longer affect the E in the upper right-hand corner of the IDT. It never was an input to the Safety Function Indicators, therefore, it never did turn the box red.

<u>SPDS #37 RPV Saturation Temperature Limit</u>

55) Y axis should be average of 505 TE, not maximum.

- This change was made.

56) EOP has expanded curve from 0-200 PSIG RPV pressure (need another graph).

° A new display (SPDS3C) was developed.

SPDS #38 Maximum Core Uncovery Time Limit

57) Include a box for scram time.

° This information is not necessary for SPDS. It is available on PMIS and is recorded on the alarm typer. No change was made.

58) Would prefer a dynamic display instead.

° This display was modified. It is now dynamic. It shows the user how much time has elapsed since shutdown.

SPDS #3A Core Spray Pump NPSH Limits

59) Drywell pressure should be in PSIG (also 3B).

° See Item 31.

SPDS #3B RHR Pump NPSH Limits

60) Set up curve for two pump operation, also with pump status logic.

° A note has been added to this display instructing the user on the method to use for two pump operation.

61) Flow does not correspond to flow in the Control Room.

° This item was corrected.

Requested Information

11. Submit additional justification for not performing an as-installed system load test.

In the absence of such a test, how did NPPD verify that SPDS response time will not unacceptably degrade during accident conditions when the PMIS is expected to be heavily utilized?

Response

During the Factory Acceptance Testing (FAT), a load test of the PMIS was performed to determine its capability to respond under heavy load conditions. A significant part of that load test was a test of the Data Acquisition System (DAS) to verify that it could successfully follow changes of a large number of analog and digital input points occurring in a relatively short time frame. This was accomplished by wiring up a small number of analogs and digitals to sine wave generators (analog) and on/off voltage sources (digitals) and varying the input signals in a cyclic manner. These signals were propagated throughout the rest of the analog and digital points by changing the software scan addresses for the remainder of the analogs and digitals so that they pointed to the scan addresses of those analogs and digitals actually wired to the test signal generators. This caused a majority of the analog and digital points to change values and go into and out of an alarm condition. This is a much heavier load test of the DAS than can be conducted as-installed in the plant with the DAS actually connected to sensors throughout the plant. Concurrently with the test of the DAS, various programs were demanded at a frequency that exceeded their in plant use (e.g. core monitoring program P-1 was demanded repetitively as soon as it had completed execution), displays (including SPDS) were demanded at all terminals, etc. This load test of the DAS successfully demonstrated that the PMIS can track changes in a large number of plant input points while at the same time updating values at the normal update rates on the SPDS (and other) displays once they are active on the CRT terminals. Therefore, it is still NPPD's position that no controlled load test can realistically be performed on the as-installed system with the DAS actually connected to sensors throughout the operating plant that can be more severe than the above test conducted at FAT. Since installation, the plant has experienced a number of scrams during which the PMIS has demonstrated its ability to capture transient plant data during conditions where many points change value.

Under heavily loaded conditions, there is some degradation in the time it takes to initially access a SPDS display (but not in updating values on a display once active) on a terminal that does not already have another SPDS display active on it. Investigation is continuing on ways to improve the response when initially accessing a SPDS display. Actions that have already been taken include expanding the computer main memory from six (6) to sixteen (16) megabytes, making the SPDS displays resident in main memory, adjusting program priorities to assure that the SPDS functions have the highest priority after the VMS Operating System and the DAS function, and administratively setting up one control room terminal so it will always have a SPDS display on it. Another action being considered includes making the display access program resident in main memory. Once a SPDS display is active on a terminal, it takes two to five seconds to bring another SPDS display up on that terminal following a demand even under heavily loaded conditions.

In conclusion, as discussed in our response to Question 6 of this submittal, part of the SPDS is always available on <u>all</u> displays (including PMIS displays). That part of the SPDS is the five (5) safety function indicator boxes for reactivity, core cooling, coolant system integrity, containment integrity, and radioactive release. It is the District's opinion that having the safety function indicator boxes available at all times by being part of all PMIS displays is the most important action that we have taken to verify that basic high level information is always available and will not degrade under heavily loaded conditions.

<u>Requested Information</u>

12. Describe the mechanism for preventing unauthorized changes to SPDS data and software.

<u>Response</u>

Password protection is the primary mechanism employed on the PMIS/SPDS system to prevent unauthorized changes to SPDS data and software. In order to access system features which allow changes to SPDS data and software, knowledge of the proper password is required. These passwords are changed on a periodic basis. Access to these system features is controlled by the System Manager in accordance with station procedures.

Access to system features which allow changes to SPDS related software is typically limited to computer support personnel within the Cooper Nuclear Station Engineering Department. Access is also given to consultants, as required, to support system operation and maintenance. Maintaining SPDS software integrity is also a function of the software configuration management program administered by the CNS computer support personnel.

The capability to perform database changes is limited to computer support personnel. Station procedures specify associated review and documentation requirements for SPDS database point changes. The ability to delete/enable point processing, substitute a value, delete/enable point alarming, etc, is available to operations personnel and computer support personnel. It should be noted that the quality code assigned to the point value reflects the processing status of the point (e.g., a substituted value has a quality code of "sub" and a quality color of blue).

Additional security measures in effect include control of dial-in access to the computer system and control of physical access to the Computer Room.

Requested Information

13. Discuss the availability of SPDS maintenance and operations manuals to the Control Room Operators.

Response

SPDS operations manuals are available to the Control Room Operators. Two vendor supplied manuals are located in the Control Room. These are the "Plant Management Information System Operator's Manual" and the "Detailed Descriptions of the Displays for the Cooper Nuclear Station Safety Parameter Display System." These manuals are controlled via the Cooper Nuclear Station Vendor Manual Control System. In addition to these two manuals, controlled copies of related station procedures are located in the Control Room. These controlled manuals and procedures describe the SPDS and its operation, as well as recovery procedures. The Control Room Operators do not perform SPDS maintenance. Maintenance activities are performed by on-site support groups, such as Engineering, and Instrument and Control.

Requested Information

14. Describe the process for ensuring that proper and adequate spares are maintained for the SPDS. Include a discussion of the process for factoring the system maintenance history into the requirements for spare parts inventory.

Response

The spare parts supplied by the original contracts were added to the CNS equipment spare parts per CNS Procedure 1.11, Equipment Spare Parts Inventory (ESPI) Program. Equipment maintenance history is introduced into the spare parts inventory by requirements in the procedure to factor in maintenance history and to change the spare parts inventory based upon equipment usage.

Requested Information

15. Provide justification for not indicating the Core Cooling Critical Safety Function (CSF) status indication and the Reactor Pressure Vessel (RPV) water level indication are invalid or suspect when the RPV saturation caution or alarm limits are exceeded.

How does the operator connect the fact that a magenta or red RPV Saturation Limit for the EOP Status Indicator (EOPSI) indicates invalid or suspect RPV water level?

How does the operator determine that the Core Cooling CSF status indication is suspect or invalid when the RPV Saturation Limit EOPSI is not on the selected display?

RESPONSE

The Core Cooling safety function indicator box and RPV Water Level Indication do not indicate invalid or suspect when the RPV saturation caution or alarm limits are exceeded because:

- It is NPPD's position that setting a point to suspect quality color and forcing the operator to question its validity solely based on the fact that the saturation temperature has been reached is a poor practice and could potentially mislead the operator. The operator should follow the same practice here as is outlined in the Emergency Operating Procedures (EOPs).

  The EOPs instruct the Operations staff to observe the various level instruments and determine if the various indicated values are in agreement. If they are reasonably close in value and the readings are not erratic, the operator is to assume the values are accurate. This same practice is followed with the level indicators on SPDS. If a point has not failed its redundant point check and it is stable, or at least tracking along with the other level detectors, its validity is not questioned.

- The RPV saturation limits provide the operator with additional information on which to make a judgement regarding the validity of the level indication. However, the SPDS should not cause the level indication to read as suspect or invalid as if the instrument was out-of-range or failing a redundant check because, in this case, the fact that the RPV temperature saturation limit has been exceeded provides indication of the possibility of level indication problems, not evidence that a problem with level indication is currently being seen. Additionally, during the 1988 Outage, Cooper added a Core Spray Reference Leg Fill system for its level instrumentation. This system will further serve to reduce the possibility of reference leg flashing. Due to the presence of this system, indicating a suspect/invalid level or safety function indicator box because of reaching the RPV temperature saturation limit could be even more misleading as well as confusing to the operator.

The judgement regarding the effect of the RPV temperature saturation limit on the level indicators for a particular plant condition should not be made by the SPDS, rather, SPDS should provide the information to the operator on which to base the judgement. This is especially true with the reference leg fill system installed. It should also be noted that if the reference legs do flash, the associated RPV water level indicators are expected to read out-of-range high and cause the level bar, the associated value, and the CFI to be displayed in the quality color representative of a bad reading.

° The system alarm area "E" indicator will be displayed whenever any data point which drives selected EOPSIs has a current value which corresponds to a warning or alarm state, or a not-healthy quality. One of the selected EOPSIs which drives the "E" indicator is RPV temperature saturation limit. This indicator provides a link between the level-one/two and the level-three displays. This indicator is available on all PMIS/SPDS colorgraphics terminals in the Control Room.

° The RPV saturation limit EOPSI is displayed on SPDS displays that deal with RPV water level. This EOPSI is provided on these displays to keep the operator appraised of the status of RPV temperature saturation.

In addition, every level bar used within SPDS for RPV level has a magenta downscale indicator, plus the ability to turn the bar and the analog readout to magenta should the point become suspect for various reasons. This includes failing a redundant point check, being driven out of range high or low, etc. The uses of magenta are standard within SPDS. To use magenta in a non-standard manner on SPDS for an individual indication would tend to confuse the issue, rather than provide helpful information.

The operator connects the fact that a magenta or red RPV saturation limit for the EOPSI indicates invalid or suspect water level through knowledge of plant operation and training. Operators are trained that reference leg flashing may occur due to a combination of drywell high temperature and pressure.

The operator determines that core cooling safety function indicator box may be suspect or invalid when the RPV saturation limit EOPSI is not on the selected display in the manner described above.

Requested Information

16. Provide the test plan and procedure for the SPDS/control board comparison study, the results of the test, and the disposition of discrepant items.

Response

The document entitled "Final Verification and Validation Report for Nebraska Public Power District, Plant Management Information System" document number SAIC-86/1097&264&0, was submitted to the NRC on June 13, 1986 via NPPD transmittal letter NLS8600212. Page 5-2, Section 6.0, of this report entitled, "Deficiencies Identified/Resolved", states that the V&V team concluded that the field installation verification generated no discrepancies.

This conclusion was based upon receipt of additional test information and NPPD informal test results which allowed resolution of the outstanding V&V team data acquisition system discrepancy report.

The NPPD informal test results referred to by the V&V team were the results of the review which they had earlier referred to in the same report (Page 5-1, Section 5.2, Summary of Results) as the "SPDS Control Board Comparison Study". As noted, the review was informal. As such, no test plan or procedures were developed nor were formal records of the review maintained. The approach was to perform a comparison of the values indicated on the PMIS/SPDS system against the values indicated on the Control Room boards or the original plant process computer (which was wired in parallel with the PMIS) and to process discrepancies in the normal manner. This is how the review was performed. Checks were performed for the SPDS points when they were at both high and low indications when feasible. The review was performed by the station as a general check of proper indication of the point values and no formal records were kept. It was performed to further ensure accuracy in the field installation.

Specific formal testing of this nature was considered unwarranted by the project due to the extensive testing performed on the system as part of the factory testing, site testing, loop testing, and the design of the system. The loop testing verified each individual PMIS input from its transducer through the data acquisition multiplexer via the hardware address of each point. This testing verified that both the I/O termination point and the value being read was correct. Factory and site testing demonstrated proper operation of signal processing in various ways. These efforts are believed to have satisfactorily tested the SPDS points. Performance of the informal test is additional evidence of NPPD's commitment to quality.

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