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Note:
Redistributed because the first distribution did not contain shts 2 thru 5 of the attachment.

UNION ELECTRIC

Donald F. Schnell
Senior Vice President
Nuclear

July 19, 1988

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Mail Stop P1-137
Washington, D.C. 20555

Gentlemen:

ULNRC - 1809

DOCKET NUMBER 50-483
CALLAWAY PLANT
SIMULATOR FACILITY CERTIFICATION

References: 1) ULNRC-1686 dated November 30, 1987
2) NRC Letter from T. W. Alexion to D. F. Schnell dated June 21, 1988

Reference 1 transmitted the certification of the Callaway Simulator in accordance with 10CFR55.45. Provided herewith are responses to NRC's request for additional data transmitted by Reference 2.

If there are any additional questions, please contact us.

Very truly yours,

Donald F. Schnell

Donald F. Schnell

SMH/keb

Attachments

M003
1/1

STATE OF MISSOURI)
) S S
CITY OF ST. LOUIS)

Donald F. Schnell, of lawful age, being first duly sworn upon oath says that he is Senior Vice President-Nuclear and an officer of Union Electric Company; that he has read the foregoing document and knows the content thereof; that he has executed the same for and on behalf of said company with full power and authority to do so; and that the facts therein stated are true and correct to the best of his knowledge, information and belief.

By Donald F. Schnell
Donald F. Schnell
Senior Vice President
Nuclear

SUBSCRIBED and sworn to before me this 19th day of July, 1988.

Barbara J. Pfaff
BARBARA J. PFAFF
NOTARY PUBLIC, STATE OF MISSOURI
MY COMMISSION EXPIRES APRIL 22, 1989
ST. LOUIS COUNTY

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July 12, 1988

Callaway Plant Simulator Certification

Response to NRC Questions

TABLE OF CONTENTS

ATTACHMENTS

July 12, 1988

Callaway Plant Simulator Certification

Response to NRC Questions

GENERAL QUESTIONS

1. No specific action is required other than to respond to questions 2, 3, and 4.

2. A list of the Malfunction performance tests conducted (attachment E) is provided for your information. Abstracts used for Malfunction performance tests were obtained from a 'Malfunction Description' document used by simulator instructors. Copies of specific malfunction descriptions tested are attached (attachment F) for review as requested.

3. A general statement in procedure APA-ZZ-00645, Simulator Configuration Management, indicated that items would continue to be tested on an ongoing basis. A specific schedule was not included to minimize the paper requirement of the certification submittal. A schedule for simulator certification testing during the next four years is provided as requested (attachment G).

4. No exceptions are being taken to the standard. Tests not applicable to the Callaway Plant are not being conducted. This is not an exception, but rather, a limitation due to plant configuration.

SIMULATOR CONFIGURATION MANAGEMENT PROCEDURE

Page 4, Section 4.0.

Controlled copies of procedures are used in the Callaway Plant Simulator.

Page 5, Section 4.1.1.7.

Section 3.1.1(7) of the standard refers to 'Normal Plant Evolutions'. Operation of the Callaway Plant at less than full flow, at power, is not a 'Normal Plant Evolution',but rather a situation in which Plant Technical Specifications require a reduction to Hot Standby within six hours. During those six hours, a plant shutdown is required. A special test procedure allowed the plant to be operated in natural circulation during the initial core startup. This was a special test and not part of 'Normal Plant Evolutions'. The Callaway Plant is not allowed to operate as a normal evolution at less than full flow (i.e. 3 loop operation) and therefore this item is not applicable for the Callaway Plant Simulator. The Natural Circulation statement will be removed because at no time would the plant be operated at power in natural circulation as a normal plant evolution.

Page 6, Section 4.1.2.

The procedure will be corrected to read: "shall be simulated" to correspond with the requirement of the standard.

Plant License Event Reports (LER's), Incident Reports (IR's), Significant Operating Event Reports (SOER's), etc. are evaluated for impact on simulator operations as part of the Course Deficiency review per TDP-ZZ-00009, Course Deficiences. Any items that have simulator impact are incorported on the simulator and tested as part of the configuration control process.

Page 8, Section 4.4.2.

New malfunctions based on plant operating experience are included as part of the configuration control process of the Course Deficiency review per TDP-ZZ-00009, Course Deficiences (attachment A), and TDP-ZZ-00013, Callaway Simulator Modifications (attachment B).

Page 10, Section 5.2.3.

Section 5.2.3 of procedure APA-ZZ-00645 will be revised as follows to comply with section 4.1(3) of the standard:

"...shall agree within +/-2% of the Callaway Plant parameters and shall not detract from training..."

Page 10, Section 5.3.1.

Section 5.3.1 of procedure APA-ZZ-00645 will be revised replacing the term "trip" with "automatic action" to comply with section 4.2.1(c) of the standard.

Automatic actions associated with valves and bistables are controlled by "logic statements" within the valve handlers and bistable handlers. Setpoints are validated by comparison agiainst the plant setpoint document referred to as the "JU8000". These logic tests and setpoint tests are conducted as part of the configuration control process at the time that changes are made to the various handlers. Automatic actions during the evolutions are validated by monitoring control board indications and alarms.

Page 11, Section 5.3.3.

The safety parameter display system has been previously engineered to monitor the parameters that are necessary during the use of the emergency procedures and are considered to include the critical parameters. If any additional parameters are required for a specific minor malfunction, they can be easily added to the monitor file.

Page 11, Section 5.4.

The message area for the simulator and the plant SPDS is normally displayed and available to the operators in the control room. This is not unique to the simulator. The message is visible to both the operator and the simulator instructor.

Only the critical parameters used by SPDS are checked against upper and lower limits for message generation. For groups of redundant parameters, two or more must exceed limits to generate the offscale message. This prevents a failure of a single channel from providing an off-scale indication to the operator. Since the parameters included in the SPDS are required for safe shutdown of the unit it includes an all inclusive list of critical parameters.

Page 11, Section 5.5.

Parametric and time resolution requirements are not delineated in section 4.4 of the standard. Our monitoring capabilities however, do meet the requirement of 0.5 seconds or less used in appendix B of the standard. Plots done from collected data were generated at a lessor frequency of 1.0 second because it took less time to generate graphs with no perceptable differences over plots generated at higher frequencies.

Page 14, Section 6.4.3.

10CFR55.45 requires that 25% of the tests be performed each year. Since some sort of records are required to document conduct of the tests, it is our intent to update the annual report and locate the records in one document. If discrepancies are found they must be reported. By treating the annual report as a living document, the reporting requirement can be easily met.

Page 15, Section 7.4.

The final revision of NUREG-1258 has been received and will be referenced in future revisions to the procedure. This final revision was issued after the completion of the initial certification testing and was therefore not referenced.

ANNUAL REPORT

Page 4, Section 2.9, Paragraph 1.

Data was recorded every 0.25 seconds to meet the requirements of the standard, but it was determined by a trial and error that plotting on a one second time interval provided adequate visual presentation of the data.

Page 4, Section 2.10.

Baseline data from the plant is only available for the reactor trip transient. The plant has not experienced any of the other nine transients in the Appendix B. A table top review of all transients was conducted by the simulator certification review group with members from engineering, operations, training and simulator groups. All curves were reviewed for trend and negative impact on training prior to accepting the transient graphs. During the course of training, the emergency procedures can be followed by the operators adding credibility to the simulation fidelity. During the Appendix B transients, however, no operator action is taken for a majority of the transients.

Page 1, Items 1.6 and 1.7

Two sets of photographs were taken and compared to determine differences between the Callaway Plant Control Room and the Callaway Plant Simulator Control Room. A second comparison has been done and additional minor differences have been discovered and documented. Actions to resolve these differences are expected to be completed by November of 1988.

CHECKLIST

Page 1, Item 1.2.

No additional information is available on two SPDS panels that cannot be obtained on a single SPDS panel. To limit cost with no reduction in training value, it was decided not to purchase and simulate the KC008, SP010, RRIS, and second SPDS panels.

The major users of Training in the above areas, with the exception of SPDS, is presently addressed in the On-The-Job Training fo operators and over the past few years has been shown to be adequate.

Page 1, Item 1.3.

Simulator control room lighting levels do not prevent the operators from viewing the indications available and therefore have no negative impact on training. Lighting levels vary in intensity to simulate normal and emergency lighting conditions and to provide the operators with the feel of associated changes in lighting levels. The need to perform a formal study of lighting level changes between normal and emergency conditions has been identified and documented. It is our intent to perform a review and submit the results to the certification review board at their next meeting.

Page 2, Item 1.4.

No formal evaluation of noise levels associated with the VHF system has been done. We feel that the VHF system does not impact communications in the control room. The channels are normally muted to a very low background level during normal plant operations.

Page 4 and 5, Items 1.9 and 1.10.

Section 3.2.2 of the ANSI/ANS-3.5-1985 standard does not require the entire plant computer system displays to be simulated.

Plant computer displays available in the plant that are not currently simulated include:

Point Display
Point Summary
Bar Chart Display
Alarm CRT
Alarm Printer

Other than the Alarm CRT and Alarm Printer, these displays perform no automatic initiations during normal, abnormal, or emergency conditions, and do not affect the safe operation of the plant. The video trend feature of the plant computer and the SPDS system in addition to the main control board trend recorders provide the most frequently used means to trend important plant parameters.

The Alarm CRT is a documented deficiency identified through our existing student feedback process. The Alarm Printer and CRT are expected to be available for training use by August 1988.

Page 6, Item 1.11.

Providing trending capability on the plant computer is in excess of what is required during normal, abnormal, and emergency evolutions. Providing trending capability on only one of the available CRT's is adequate to meet or exceed the requirements of section 3.2.2 on the ANSI/ANS-3.5-1985 standard.

Page 6, Item 1.12.

The computer Alarm CRT display is currently implemented on the simulator development system and should be transferred into the training load in August of 1988. The Alarm Printer software is completed. As soon as the hardware is ready to support moving a printer into the simulator control room the Alarm Printer will also be added to the simulator.

Page 6, Item 1.13.

The following items were treated as special features since they were added to the simulator after the initial installation of the simulator at the training facility:

RM11 Radiation Monitoring Console
SPDS Safety Parameter Display System
Emergency Telephone System
Merge Capability on the PA System

The RM11 Console is not required for normal, abnormal, and emergency evolutions. The panel provides an alternate method for the operator to obtain radiological information about the plant. This information is also available from other plant indications. Simulation of this panel exceeds the requirements of the standard and is therefore identified as a special feature. Training on this panel could be performed in the control room RM11 panel. Simulation training on this panel is considered an enhancement.

The SPDS is not required for normal, abnormal, and emergency evolutions. The panel provides an alternate method for the operator to obtain information about the plant condition that is already available on other control room indications. Simulation of this panel exceeds the requirements of the standard and is therefore identified as a special feature. Training on this panel could be performed in the control room or at the Technical Support Facility. Simulation training on this panel is considered an enhancement.

The Emergency Telephone system is a special feature since the student can actually call the county and state personnel using the emergency phone line. The phone system is only used to support Radiological Emergency Response Plan (RERP) drill training.

The PA system in general is a requirement for communication between the students and the simulator instructor. The merge capability is a special feature since the student can actually communicate with the plant. The merge position is only used to support Radiological Emergency Response Plan (RERP) drill training.

In general, it is our interpretation of the standard that not all panels in the control room are required to be functionally simulated as implied by the question. The full scope simulator includes the operating consoles (the main control boards) and control panels required for manual safety actions, equipment surveillance, and to monitor plant conditions under normal and accident conditions. Some of these panels may contain visually simulated hardware if no dynamic interface is required. The extent of simulation is based on required operator actions to conduct normal plant evolutions and respond to malfunctions.

Page 6, Item 2.1.

With a computer cycle time of approximately 50%, a simple test of monitoring a perceived difference between real time and simulation time was considered to be more than adequate. A stop watch was used to measure the real time while the simulator console displayed the simulation time. No perceived difference could be detected, thus meeting the requirements of real time operation. Graphs of the transients also verified no perceived difference in time. A complex test was not considered to be desired or appropriate with a computer cycle time of 50% percent.

A more elaborate time measurement could be developed but may not be more reliable or effective at measuring real time. A more accurate method may be necessary if computer cycle time is increased closer to 100%.

Page 9, Item 7.1

The Loss of Instrument and DC buses malfunctions are scheduled to be added in January of 1989 and November of 1988 respectively.

STEADY STATE TESTS

At present, the reference plant data is only compared to the simulator at one condition, either BOL, MOL, or EOL. The condition used for comparison is dependent upon the amount of change in core configuration as well as the receipt and incorporation of new reload data into the simulator core model. 100% steady state data for the remaining conditions is then extrapolated or calculated using the existing Stable 100% Initial Condition. It is anticipated that once we reach cycle 5 (assuming no significant core load changes), the changes from one reload to another will be minimal and BOL 100% steady state data will become the benchmark for comparison of the reference plant to the simulator for MOL and EOL conditions.

The basis for determining a difference between the plant and the simulator assumes a perception by the control room operator. The operator can only determine a change by monitoring available indications. A small indication change will remain undetected. A movement of greater than 2% for critical parameters is assumed to be detectable. All differences must be based on the indications available to the operator in the control room.

Calculations of percent difference is based on indicator scales of the actual plant control room indications. The top of the scale is considered to be 100% and the bottom of the scale is considered to be 0%. To meet the 2% and 10% deviation requirement between the plant and the simulator a deviation of less than this indicator movement was allowable. Some scales had values from 0 to 100. The calculation for these indications is merely a straight difference. Other scales had values such as 1700 to 2500 or 100 to 700. Scales were normalized to the 0% to 100% positions, then the difference was determined. The consistancy in the calculations is based on the scale of the indication.

Exceptions were boron concentration and switch positions which do not readily allow a percent calculation. For these items the mismatch was merely noted.

For the 50%, 80%, and 100% tests the containment temperature difference does not exceed the criteria in the standard. Differences are as follows:

50%	6.2%, 4.3%, 3.4%, and 2.9%
80%	6.1%, 4.6%, 3.7%, and 3.2%
100%	5.5%, 4.5%, 4.1%, and 4.4%

The mismatch was calculated as follows:

Determining meter scales by observation on control board

GN TI-61 meter scale.....0-400 degrees F
GN TI-63 meter sclae.....0-400 degrees F
GN TI-60 meter scale.....0-400 degrees F
GN TI-62 meter scale.....0-400 degrees F

Determining 1% of meter scale

0 = 0%, 400 = 100%..... implies 4 degrees F per %

Determining allowed deviation

Non critical parameter is allowed 10% deviation

Determining actual deviation

(example: simulator value = 81.2, plant value = 103)

103 - 81.2 = 21.8
21.8 / 4 = 5.5%

Thot and Tcold are not recorded or compared to plant information since these data values are not reported as part of OSP-ZZ-00001, Control Room Shift And Daily Log Readings And Channel Checks (attachment C), which are used as the basis for determining simulator fidelity during steady state operation.

TRANSIENTS

TRIP OF A SINGLE RC PUMP.

Reactor coolant pump D was the pump tripped.

POWER RAMP.

Power ramp is the maximum allowed by the operating procedure based on restrictions placed on the plant.

"The maximum rate of power increase above 20% of Full Power should be limited to 3% per hour as an administrative limit. This may be waived at the discretion of the Shift Supervisor provided (1) existing Westinghouse maneuvering guidelines would not be violated and (2) a maximum rate of increase of 10% per hour would continue to be observed."

Reference: Plant Procedure OTG-ZZ-00004, Power Operation (attachment D).

The hump in the steam generator narrow range level graph is a combination effect of changing primary temperature, power (steam flow and feed flow), and main feedwater regulating valve (FRV) controller response time. The transient is conducted by taking standby control of the turbine and changing turbine load at the maximum allowed rate. If the steam flow and feed flow graphs are overlaid it can be seen that a slightly higher feed flow exists at the beginning of the transient bringing the steam generator level up. The FRV controller then senses the transient and returns water level to normal. At the end of the transient the feed flow is slightly lower than steam flow which also results in a change in steam generator level (level goes down). The FRV controller again senses the transient and restores water level to normal.

RC SYSTEM RUPTURE

The particular malfunction used had a maximum size leak which was used to conduct the test. The ANSI/ANS-3.5-1985 Standard does not specifically indicate that a DBA must be used, only a maximum size break. Rather than change the malfunction, it was used as provided. The intent was to test the simulator to see if it would run a break transient that would quickly drain the pressurizer, providing indications of increasing containment humidity, pressure and temperature. A system rupture can be run on the simulator as indicated by the graphs provided.

SLOW DEPRESSURIZATION

Flows cycle at the end due to loss of net positive suction head causing pump cavitation. This is not an indication that the model limits have been exceeded.