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July 27, 1989

Director of Nuclear Reactor Regulation
US Nuclear Regulatory Commission
Mail Station P1-137
Washington, DC 20555

Subject: Byron/Braidwood Simulator Facility
Response to Request for Additional Information
NRC Docket Nos. 50-454, 455, 456, and 457

Reference: May 26, 1989 letter from S.P. Sands to
T.J. Kovach

Gentlemen:

Our submittal of October 7, 1988 provided information pursuant to 10 CFR 55.45.b.5 in order to attain Certification of the Braidwood Simulation Facility. Your review of our submittal indicated the need for additional information in order to ensure the completeness of the documentation associated with the certification process. Your request for additional information was transmitted to us by the letter indicated in the above reference. Our response to your request is provided in the Attachment to this letter.

Each of the seventeen questions contained in your Enclosure was addressed by the Simulator Review Board. This Board is composed of members with responsibilities in the areas of Simulator Configuration Management Control and Simulator Fidelity. In addition, the Board included the Simulator Training Supervisor and Senior Reactor Operator representatives from both Byron and Braidwood Stations.

The responses to the questions in your request are supported by seventeen additional Attachments. One copy of these Attachments is being provided at this time. Please advise us if you require additional copies of this material.

Please forward any questions that you may have regarding this matter to this office.

Very truly yours,

Glenn E. Trzyna

G.E. Trzyna
Nuclear Licensing Administrator

/sci:0222T:1
Att.
cc: A.B. Davis-w/o Att.'s
S.P. Sands-w/o Att.'s

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BRAIDWOOD SIMULATOR CERTIFICATION

RESPONSE TO NRC QUESTIONS

ATTACHMENTS

1. Normal Operations Test Abstract (NO-1)
2. Real Time Test Abstract (RT-1)
3. Valve Stroke Time Test Abstract (ST-1)
4. Surveillance Test Abstract (SV-1)
5. Malfunction Tests Abstract/Initial Conditions
6. Simulator Testing Program Procedure
7. Byron Units 1/2 Control Room Layout
8. Braidwood Units 1/2 Control Room Layout
9. Simulator Control Room Layout
10. Revised Panels/Equipment Listing
11. Transient Tests Baseline Data
12. Rx Trip/SI Procedure - Braidwood Unit 1
13. Rx Trip/SI Procedure - Braidwood Unit 2
14. Rx Trip/SI Procedure - Byron Unit 1
15. Rx Trip/SI Procedure - Byron Unit 2
16. Braidwood Procedure Generation Package
17. Steady State Test (SS-1)

Question 1:

Your submittal included performance test abstracts only for steady state tests at 30%, 50%, 75%, and 100% power and the ten ANSI/ANS-3.5-1985, Appendix B transient tests. Regulatory Guide 1.149 explains that the performance testing to be performed is that described in ANSI/ANS-3.5-1985, Section 5.4, "Simulator Testing." This section states that the simulator's performance shall be compared to the requirements of Section 4, "Performance Criteria." Section 4 requires tests for the limiting cases of the evolutions in Sections 3.1.1, "Normal Plant Evolutions," and 3.1.2, "Plant Malfunctions." Tests demonstrating compliance with the criteria of Section 4.3, "Simulator Operating Limits," are also required. Please provide performance tests abstracts for these additional tests or provide justification for exception to the requirements for these tests.

Response 1:

Per your request, Attachments 1-5 are test abstracts for "Normal Plant Evolutions", "Plant Malfunctions", and "Simulator Operating Limits". Attachment 6 describes the administration of the simulator testing program.

Question 2:

Regarding DR #3 in Attachment A to Form 474; please explain why the simulator and station performed their tests at different core ages (i.e. why not initialize the simulator to the same core age as that for which the data exists)?

Response 2:

The Simulator Review Board has concluded that the steady state test and analysis are valid as performed. The simulator performed steady state testing using beginning-of-life (BOL) initial conditions. The simulator BOL initial conditions were not the same core age as the station when it performed its steady state testing. The simulator's boron concentration does not detract from training and it is not cost-effective to change the simulator's core model in order to change its core age (boron concentration).

Question 3:

Regarding DR #7 in Attachment A to Form 474; please provide justification for use of this valve stroke time criteria. Include in this justification an explanation of whether the criteria of ANSI/ANS-3.5-1985, Section 4.2, "Transient Operation," are met. Of particular concern are automatically actuated valves with stroke times of less than 20 seconds.

Response 3:

ANSI/ANS-3.5-1985, Section 4.2 criteria are met. Section 4.1 criteria has been modified for valve stroke times less than twenty seconds. The acceptance criteria for each valve's stroke time is ± 10% of the reference plant valve's stroke time. However, ± 10% of most valve's stroke time would yield a small tolerance which does not lend itself to enhanced operator training due to the fact that the operator is not directly affected by a difference in valve stroke time of a few seconds.

In response to the potential problem of changing most valve's stroke time to that of Braidwood, our tolerance was changed to ±10% or ±2 seconds, whichever is greater as long as Braidwood acceptance criteria is not violated. A biennial comparison of Braidwood Unit 1 valve stroke times to the simulator valve stroke times will be performed to ensure that the revised valve stroke time criteria will be maintained. See Attachment 3 for a copy of the valve stroke time test (ST-1). This minor change in the criteria will not detract from operator training.

Question 4:

Item 9, on page 10c/5 in the "Simulator Information" portion of your submittal states that the plant computer is not fully modeled. ANSI/ANS-3.5-1985, Section 3.2.2, "Controls on Panels," requires "...plant computer interface hardware and other components or displays that would function during normal, abnormal, and emergency evolutions shall be included in the simulator." Please confirm that this criteria is met even though the plant computer is not fully modeled or provide justification for exception.

Response 4:

The in-plant computer possesses sufficient modeling for the operators to review the necessary data for the normal, abnormal, and emergency evolutions required by ANSI/ANS-3.5-1985. Full modeling of the Braidwood in-plant computer will be completed after SUN Computer installation. Differences exist between the Byron computer hardware and the simulator computer hardware, however, these differences will not adversely impact training.

Question 5:

Regarding Section A.1.2.2, "Panels/Equipment," in the "Simulator Information" portion of your submittal; it is difficult to determine the scope of your panel and equipment simulation as compared to each of the units for which you are certifying the simulator. ANSI/ANS-3.5-1985, Section 3.2.1, "Degree of Panel Simulation," requires that the simulator contain sufficient operational panels to provide the controls, instrumentation, alarms, and other man-machine interfaces to conduct the normal plant evolutions of 3.1.1 and respond to the malfunctions of 3.1.2. Please confirm that the Braidwood Unit 1 simulator meets these criteria for Braidwood Units 1 & 2 and Byron Units 1 & 2. Floor plan sketches, including full panel names, of the simulator and each of the plant control rooms would be helpful. Any differences which preclude operations required by 3.1.1 or 3.1.2 of ANSI/ANS-3.5-1985 should be noted as exceptions and justifications should be provided.

Response 5:

The Braidwood Simulator contains sufficient operational panels to provide the controls, instrumentation, alarms, and other man-machine interfaces to conduct normal plant evolutions of 3.1.1 and respond to the malfunctions of 3.1.2 for each of the Braidwood and Byron Units to the extent identified in the Certification Report. Attachments 7-9 are control room layouts of Byron Units 1/2, Braidwood Units 1/2, and the simulator. Attachment 10 is a revised listing (page 10c/5 of the Certification Report) of the simulator's Panels/Equipment.

Question 6:

ANSI/ANS-3.5-1985, Section 3.3.1, "Systems Controlled from the Control Room," requires the inclusion of systems and the degree of simulation to be to the extent necessary to perform the normal plant evolutions in 3.1.1 and respond to the malfunctions in 3.1.2. Items 4,7,8,9 and 10 under A.1.2.2, "Panels/Equipment," and section A.1.2.3, "Systems," in the "Simulator Information" portion of your submittal, would appear to indicate that the criteria of 3.3.1 of ANSI/ANS-3.5-1985 may not be met in all cases. Any discrepancies which preclude operations required by 3.1.1 or 3.1.2 of ANSI/ANS-3.5-1985, for any of the four units, should be noted as exceptions and justification should be provided.

Response 6:

The minor differences in the Essential Service Water System, Circulating Water System, and Switchyard/Electrical Bus nomenclature between the Byron Units and the simulator do not detract from training. In addition, these differences do not impact on the ability to perform the normal plant evolutions in 3.1.1 or respond to the malfunctions in 3.1.2. Most of the tasks related to these differences are minor in nature and are handled administratively.

Response 6 (Con't):

The systems that are not modeled (Section A.1.2.3 of the Certification Report) do not detract from training. The tasks related to these systems are handled administratively to ensure procedural compliance is maintained. The Turbine-Generator Temperature Monitoring System, Fire Protection Detection System, and Radiation Monitors (RM-23's) are located outside the normal operating area. In addition, these non-modeled systems do not impact on the ability to perform the normal plant evolutions in 3.1.1 or respond to the malfunctions in 3.1.2. The Equipment Status Display (ESD) is located inside the normal operating area and is considered visually simulated hardware until SUN Computer installation.

Question 7:

Regarding item 6 under A.1.2.2, "Panels/Equipment," in the "Simulator Information" portion of your submittal; it appears that you are utilizing an operator aid in the simulator which does not exist in the plant. For examination purposes, operator aids which are not used in the plant should not be used in the simulator. Please describe your intentions in this regard.

Response 7:

Operator aids are not used in the simulator unless they are approved for use in the plant. Item 6 of A.1.2.2 did not intend to imply that meter sideplates were operator aids. However, since the submittal of the Certification Report, a Computer-Aided-Drafting System has been developed which can replicate the meter sideplates currently installed at the station. Work Requests have been written for changing the simulator's meter sideplates to match the plant's meter sideplates. Estimated completion date is January 1, 1990.

Question 8:

Regarding item 18 under A.1.2.2, "Panels/Equipment," in the "Simulator Information" portion of your submittal; please provide justification for the acceptability of the failure of the recorder paper drives to deenergize upon a loss of power to the chart recorders.

Response 8:

The Simulator Review Board has determined that negative training does not occur with the chart drive motors being continuously driven. The chart drive motors are continuously driven to minimize maintenance upkeep. If the chart drive motors are deenergized for a long period of time (i.e., weekend/loss of power), the recorder pens become dryed out/clogged due to a loss of capillary flow and extensive maintenance work would then be required to restore the recorder pens to operable status. Byron and Braidwood Stations are considering a change to felt-tip pens. If this change occurs, we will reevaluate our position on this matter.

Response 8 (Con't):

Static simulator exams on a frozen simulator can be successfully accomplished by deenergizing each chart recorder by its "on-off" switch.

Question 9:

ANSI/ANS-3.5-1985, Section 3.2.3, "Control Room Environment", requires communication systems that a control room operator would use to communicate with an auxiliary operator or other support activities to be operational to the extent that the simulator instructor, when performing these remote activities, shall be able to communicate over the appropriate communication system. Please provide justification for the lack of sound powered phone jacks and the lack of simulation of the plant's radio system.

Response 9:

The lack of sound-powered phone jacks does not detract from training since sound-powered phones are normally used for maintenance activities in the plant.

The lack of a simulated plant radio system does not detract from training since the page and telephone systems adequately address communications outside the control room.

Question 10:

It is not clear that simulator design data updating and simulator modifications will be performed in accordance with the time frames of ANSI/ANS-3.5-1985, Section 5.2, "Simulator Update Design Data," and 5.3 "Simulator Modifications." Please confirm that these criteria are met or provide justification for exception. Also, please provide a schedule for the planned corrections listed on page 10c/10 of A.1.2.2 of your submittal and for installation of the SUN computer.

Response 10:

The simulator update and modification program meets the requirements of ANSI/ANS-3.5-1985, Sections 5.2 and 5.3. See Attachment 6, Section 3.k.

The status of the items listed on page 10c/10 are listed below:

- Difference #2 (PI-403/405A meter scales), #12 (FW-9 valve operation), #13 (RCFC vibration monitors) and #17 (turbine audio block circuit) have already been corrected.

- Difference #14 (SPDS subcooling/low setpoints) will be corrected upon SUN computer installation. Estimated completion date for SUN Computer installation is November, 1990.

Question 11:

ANSI/ANS-3.5-1985, Section 3.4.1, "Initial Conditions," requires initial conditions to include various times in core life. The set of initial conditions provided with your certification does not include any end-of-life (EOL) conditions. Please provide justification for the lack of such initial conditions.

Response 11:

The list of initial conditions (IC's) incorrectly listed IC-26, 28-30 as beginning-of-life (BOL) initial conditions. IC-26, 28-30 are end-of-life (EOL) initial conditions. See Attachment 5 for the list of initial conditions.

Question 12:

10 CFR 55.45(b)(5)(vi) requires "...the conduct of approximately 25 percent of the performance tests per year for the subsequent four years" following any certification report. However, your "Proposed Simulator Malfunction Testing Schedule" indicates that you intend to perform 33 percent of the testing in the fourth year. It is recommended that you revise your schedule to more nearly perform 25 percent per year. Please provide a revised schedule or provide justification for not doing so.

Response 12:

A revised simulator testing schedule for the four years of post-certification malfunction testing is listed in Attachment B of Attachment 6. Please note that a new malfunction (AUX-17) has been added to the malfunction testing schedule. Each year of malfunction testing contains 25% ±2.5% of the total malfunctions required to be tested. Please note that Attachment C of Attachment 6 contains non-certified malfunctions that are currently used to enhance operator training.

Question 13:

NUREG-1258 states, "it is essential, for the conduct of a license examination, that the simulation facility permit a candidate to mitigate the consequences of an event using the reference plant's Emergency Operating Procedures (EOPs). It must also be possible for the candidate to employ the reference plant's normal and abnormal operating procedures as required." Regarding Attachment 1, "Reg. Guide 1.149 Requirements for Dual Plant Simulation Facility," to Form 474, pages 11c/119 and 11c/120; please provide justification for not using the Unit 2 training disc for abnormal operations or casualty training, and for not maintaining Unit 2 abnormal and emergency procedures for the simulator.

Response 13:

Since Unit 1 and Unit 2 are almost identical, except for the steam generator model (the differences are listed on pages 11c/119-120 of the Certification Report), adequate Unit 2 training is conducted by concentrating on low-power operations (i.e., startups, shutdowns, abnormal and casualty operations up to 30%) by using the Unit 2 training disc. The Unit 1 disc correctly simulates plant response for both units above 30%. Since the submittal of the Certification Report, abnormal operations and casualty training have been conducted on the Unit 2 training disc.

Unit 2 abnormal and emergency procedures are not maintained in the simulator since the Unit 1 abnormal and emergency procedures are utilized for Unit 2 abnormal operations and casualty training. The Unit 2 abnormal and emergency procedures are developed from Unit 1 abnormal and emergency procedures and are almost identical as shown by the "Rx Trip/SI Procedure" in Attachments 12-15 for each of the four units (Units 1/2 for Byron and Braidwood). Byron and Braidwood emergency procedures are validated on the simulator. Attachment 16, page 3 of 50 states that commonality between Byron and Braidwood Stations allow the reference validation method to provide validation of the other three units emergency procedures. In addition, page 4 of 9 (section 6.3) discusses the step-by-step review of the individual Braidwood and Byron emergency procedure revisions to ensure consistency of information between each of the four units. Attachment 16 also contains setpoint documentation sheets that are utilized for Units 1/2 emergency procedure setpoints. The only setpoint deviations between Units 1/2 are on pages 62, 65 and 67 for the no-load S/G level and the HI-2 S/G level setpoints.

The NRC has successfully completed Unit 2 examinations on the simulator for both stations. The Braidwood exam was September, 1987 and the Byron exam was September, 1986.

Question 14:

Regarding Attachment 2, "Annual Steady/Transient Test Results," Test Number SS-1, Objectives 2 and 3; the 2% and 10% criteria for critical and non-critical parameters, respectively, do not necessarily determine whether something detracts from training. The criterion, "shall not detract from training," is an additional, more strict, performance criterion. Please confirm that the differences were determined not to detract from training in addition to meeting the 2% and 10% criteria or provide justification for exception to this requirement.

Response 14:

Steady state test (SS-1) has been revised to ensure that the ±2%/±10% criteria and the "does not detract from training" criteria are separate requirements. Steady state test results for 1988 and 1989 have been verified to meet the above criteria. See Attachment 17 for the revised steady state test (SS-1).

Question 15:

Regarding the transient tests included in Attachment 2 to Form 474; please provide the baseline graphs against which the simulator graphs may be compared. If such graphs are not available please provide a description of the baseline data used to determine fidelity to the reference plant. If the baseline data used was the judgement of a panel of experts, then documentation of their review, sufficient for a third party to evaluate the adequacy of the tests and results, should be included. This documentation should include such items as the makeup and qualifications of the panel and any differing professional opinions as to the outcome of the tests.

Response 15:

The baseline data was developed using either plant data, where available, or the judgement of a Transient Test Baseline Data Review Board. Attachment 11 includes the makeup and qualifications of the review board and the results of each test review.

Question 16:

ANSI/ANS-3.5-1985, Appendix B, B.2.2(7) requires a transient performance test of a maximum rate power ramp from approximately 100% down to approximately 75% and back up to 100%, a 25% power change in each direction. However, in Test Number TR-7, "Maximum Rate Power Ramp" you only performed a 10% load swing from 98% to approximately 88%. Please provide justification for performing this test other than as described in ANSI/ANS-3.5-1985.

Response 16:

ANSI/ANS-3.5-1985, Section 5.4.2, Simulator Operability Testing, (footnote 3) recommends substitution of Appendix B transient tests if these tests provide a more representative comparison to actual or predicted reference plant performance. In accordance with this recommendation, Braidwood Startup Test (BwSU NR-36), 10% Turbine Load Change, was substituted for the Appendix B, Section B.2.2(7) maximum rate power ramp test.

Question 17:

In Examination Reports dated May 20, 1987 and June 17, 1987 it was noted that the simulator instrumentation drifted while in freeze. This may have an impact on future examinations in which candidates are asked questions related to a "frozen" simulator. Please indicate whether you have corrected this problem. If not, please provide a schedule for correcting it or justification for not correcting it.

Response 17:

Th simulator instrumentation drift problem has been corrected. Fluctuating power supplies were responsible for the drifting instrumentation noted during the May, 1987 and June, 1987 examinations. After the power supplies were replaced, numerous "frozen" simulator exams have been administered including an April, 1989 NRC "frozen/static" simulator examination. No recurring problems were noted.