UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
101 MARIETTA STREET, N.W., SUITE 2900
ATLANTA, GEORGIA 30323-0199

Report No.: 50-302/95-22

Licensee: Florida Power Corporation
3201 34th Street South
St. Petersburg, Fl 33733

Docket No.: 50-302 License No.: DPR-72

Facility Name: Crystal River Nuclear Plant Unit 3

Inspection Conducted: December 11-15, 1995

Inspector: _____ 1/31/96
Paul J. Kellogg, Team Leader Date Signed

Accompanying Inspectors: C. Rapp, Reactor Inspector
R. Schin, Reactor Inspector

Approved by: _____ 1/31/96
Harold O. Christensen, Chief Date Signed
Maintenance Branch
Division of Reactor Safety

SUMMARY

Scope:

An inspection was conducted to determine if management provided adequate guidance, training, procedures, and other support necessary to meet management's expectations for operation of the Make-up Tank System. The inspection reviewed Make-up Tank data to determine if the system was operated in accordance with approved procedures and if appropriate actions were taken for out of specification conditions.

Results:

Four apparent violations were identified:

Apparent violation 50-302/95-22-01: Nine examples of operation of the makeup tank outside the acceptable operating region while adding hydrogen.

Apparent violation 50-302/95-22-02: Two examples of conducting an unauthorized test or experiment without a written safety evaluation containing the bases for the determination that an unreviewed safety question did not exist.

Apparent violation 50-302/95-22-03: Three examples of inadequate corrective action concerning inadequate revisions to Curve 8, Maximum Make-up Tank Overpressure; inadequate review of Problem Report 94-149; and inadequate corrective action for required tank volumes.

Apparent violation 50-302/95-22-04: Four examples of inadequate design control concerning the incorrect design information contained in Curve 8 which allowed the plant to be operated outside of its design basis, incorrect swapover point for the borated water storage tank, inadequate net positive suction head for the low pressure safety injection pumps during swapover to the Reactor Building sump, and minimum volume requirement for the fire water storage tank not being met.

Weaknesses were identified in the human factors aspects of information provided to operators for control of makeup tank level and pressure, lack of tracking out of calibration data, the failure to place the makeup tank level/pressure alarm in a routine calibration program, ineffective communications between operations and engineering and within both departments, vague guidance provided to operators in procedures for when procedures are adequate for evolutions being performed, for alarm response times, and for determining when evolutions constitute a test or experiment.

REPORT DETAILS

1. Persons Contacted

Licensee Personnel

*K. Baker, Manager Nuclear Configuration Control
G. Becker, Nuclear Plant Operations Evaluator
*G. Bolt, Vice president Nuclear Production
*R. Bright, Nuclear Principle Licensing Engineer
J. Campbell, Manager Nuclear Power Technical Support
*R. Davis, Maintenance Manager
*D. deMonfort, Nuclear Operations Instructor
*M. Donovan, Supervisor Nuclear Power Technical Support
*R. Enfinger, Senior Licensing Engineer
P. Flemming, Senior Nuclear Licensing Engineer
*A. Friend, Nuclear Principle Licensing Engineer
*B. Gutherman, Nuclear Licensing Manager
*G. Halnon, Manager Nuclear Plant Operations
V. Hernandez, Senior Nuclear Employee Concern Specialist
*B. Hinkle, Director, Nuclear Power Operations
*L. Kelly, Director, Nuclear Operations Site Support
*W. Kisner,Jr., Senior Nuclear Schedule Coordinator
*K. Lancaster, Nuclear Projects Manager
*J. Lind, Manager Nuclear Operations Training
*G. Longhouser, Manager Nuclear Security
*J. Maseda, Manager Nuclear Engineering Design
*R. McLaughlin, Nuclear Regulatory Specialist
B. Moore, Manager Work Controls
*S. Robinson, Manager Nuclear Quality Assurance
J. Smith, Supervisor Operator Training
*D. Stenger, Attorney
*P. Tanguay, Director Nuclear Engineering and Projects
*S. Weinberg, Attorney
R. Widell, Nuclear Operations Training

Other licensee employees contacted included engineers, technicians, operators and office personnel.

NRC Personnel

*R. Butcher, Senior Resident Inspector
*T. Cooper, Resident Inspector
*P. Kellogg, Senior Project Manager, Division of Reactor Safety, Region II
*K. Landis, Branch Chief, Division of Reactor Projects, Region II
*C. Rapp, Reactor Inspector
*R. Schin, Reactor Inspector

* Attended Exit Interview.

2. Operation of the Makeup Tank

The inspection documented in NRC Inspection Report (IR) 50-302/95-13 reviewed the circumstances surrounding the September 5, 1994 event involving pressure control of the reactor coolant system makeup tank. Details of the review of the September 5, 1994 event are documented in paragraph 2 of IR 50-302/95-13. Apparent violation 50-302/95-13-01 was identified as a result of that review. After further review, the NRC has concluded that, on two occasions on September 4 and 5, 1994, not only did operators fail to follow procedures, but 10 CFR 50.59 was also violated in that the manipulations were not required by plant conditions and no approved procedure existed for the conduct of the tests. This apparent violation is discussed in detail in Section 2.1 of this report and identified as apparent violation 50-302/95-22-02. Apparent violation 50-302/95-13-01 is administratively closed and the failure to follow procedures on September 5, 1994 identified in 50-302/95-13-01 is incorporated into example 2 of apparent violation 50-302/95-22-02.

Paragraph 3 of IR 50-302/95-13 documents the NRC review of the design basis of MUT operating limits. During this review, it was determined that the MUT pressure limit curve constitutes a design basis limit. Apparent violation 50-302/95-22-01 described in detail below therefore represents examples not only of a failure to follow procedures, but also examples of the failure to operate within the design basis limit.

2.1 Makeup Tank Data

The inspectors reviewed make-up tank data for the time period June 1, 1994, through September 7, 1994, to determine the number of times Curve 8 limits on make-up tank pressure and level had been exceeded. The inspectors also observed the make-up tank pressure and level instrumentation in the control room, reviewed drawings and calibration records for that instrumentation, reviewed the design calculation that supported Curve 8, reviewed operator logs, and discussed the instrumentation design and operation with engineers and operators.

Instrumentation in the control room for make-up tank level and pressure included a high pressure alarm, computer points, and a chart recorder. During the time period June 1, 1994, through September 7, 1994, the alarm was driven by the computer such that whenever the computer value for make-up tank pressure exceeded the Curve 8 limit for the existing make-up tank level, the alarm would be activated. When the pressure was equal to or below Curve 8, the alarm would be de-activated (there was no programmed dead band). Operators could display the computer points for make-up tank level and pressure on video screens above the main control board or on the right side of the control board. The computer data was saved by the plant computer every minute and was available for the inspector to review. The chart recorder was located on the vertical section of the main control board and

displayed make-up tank level and pressure on one strip chart. The chart records were saved by the licensee and copies were available for the inspector to review.

Plant computer records of make-up tank pressure and level indicated that Curve 8 limits had been exceeded, and the related control room alarm had been validly activated, on numerous different occasions during the time period in question. The inspectors selected the eleven most significant occasions for further review, when the alarm had been in continuously for more than 30 minutes and Curve 8 had been exceeded by more than 0.5 psig. Those occasions were:

	Date	Time	Duration (minutes)	Maximum pressure over Curve 8 (psig)
1)	7/23/94	12:13-14:14	122	1.08
2)	7/25/94	10:27-11:14	48	0.68
3)	7/27/94	14:44-16:01	78	0.68
4)	7/28/94	14:26-17:29	184	2.10
5)	7/30/94	09:28-12:38	190	0.73
6)	8/6/94	09:55-12:15	141	0.82
7)	8/8/94	10:08-11:14	67	1.54
8)	8/24/94	13:24-14:50	87	0.51
9)	9/4/94	04:24-05:06	43	2.36
10)	9/4/94	15:21-16:46	86	2.07
11)	9/5/94	04:45-05:21	37	1.71

On the first occasion (7/23/94), the computer data indicated that operators reduced make-up tank level to about 53 inches (below the 55 inch low level limit), added hydrogen to increase pressure from about 11 psig to about 14 psig (above the Curve 8 limit), then increased level to about 82.5 inches. As level was increased, make-up tank pressure increased to about 29 psig. The computer data indicated that the Curve 8 alarm would have been activated during the hydrogen addition, remained in through the level increase, and then stayed in for about another 95 minutes as pressure gradually decreased to below the alarm point. Chart recorder data indicated approximately 1.0 inch higher level (54 inches and 83.5 inches) and approximately 0.5 to 1.5 psig lower pressure (11.5 psig and 27.5 psig) than the computer data. Calibration and accuracy of these instruments are addressed later

in this report. When plotted on Curve 8, chart recorder data indicated that make-up tank pressure exceeded Curve 8 during the hydrogen addition, crossed to the acceptable region of Curve 8 during the level increase, and then remained in the acceptable region. Operator logs included bleeding 585 gallons from the RCS to the "C" RCBT, then feeding 935 gallons from the "C" RCBT to the RCS. There were no other log entries concerning this evolution. An assessment of operator logkeeping is addressed later in this report.

The inspectors assessed whether operator actions during the 7/23/94 evolution were in accordance with operating procedures. Procedure OP-402, Makeup and Purification System, Rev. 75, step 4.4.3, directed operators to stop reducing make-up tank level "when MUT decreases to low level alarm". Since the procedure directed operators to stop reducing level after getting the 55-inch low level alarm and the data indicated that the make-up tank level was increased, within approximately 11 minutes, to above 55 inches, the inspectors concluded that operators did not violate the procedure when they decreased make-up tank level below 55 inches. However, the inspectors noted that engineering calculation I90-0024, from which Curve 8 was derived, assumed that the make-up tank would always be operated at an indicated level of greater than or equal to 55 inches. The inspectors concluded that the operating procedure and low level alarm setpoint (at 55 inches) were weak in supporting the engineering calculation. The inspectors also concluded that operators violated procedures during subsequent parts of this evolution. Operators did not follow OP-402 instructions for adding hydrogen. The applicable step in OP-402 specifically stated "refer to Curve 8 of OP-103B for maximum MUT overpressure". However, operators exceeded Curve 8 during hydrogen addition. Operators also exceeded the administrative limits of OP-103B, Curve 8, Maximum Makeup Tank Overpressure, for an extended period of time (about 122 minutes). Engineering calculation I90-0024 assumed that the make-up tank would always be operated at an indicated pressure of less than or equal to Curve 8. In addition, procedure AR-403, Annunciator Response, required that, for a valid alarm, operators take action to reduce pressure to within the limits of OP-103B, Curve 8. However, during this evolution, operators did not take timely action in response to the "MAKEUP TANK PRESS HIGH" annunciator. Operators stated that venting the make-up tank to reduce pressure would take approximately ten minutes because of the required auxiliary operator actions. The auxiliary operator actions included selecting a waste gas decay tank, donning anti-contamination clothing and entering a contaminated area, closing one manual valve and opening another, exiting the contaminated area, and starting a waste gas compressor. During this evolution, instead of reducing pressure in response to the alarm, operators increased level (and pressure) in the makeup tank and then left the alarm in for approximately an additional 95 minutes without taking action to reduce pressure. While the computer/alarm and

chart recorder data differed, all instruments were operational and indications from all should have been considered valid. Operation with a valid pressure indication outside of values allowed by procedures, as indicated by the alarm, constituted a violation of the procedures. To rely on the chart recorder indication and disregard the alarm and computer data, without having the alarm/computer indication checked by maintenance personnel and proven to be invalid, would be considered nonconservative and unacceptable. As discussed later, in this instance the chart recorder indication was apparently inaccurate and nonconservative. The failure of operators to follow procedures by violating the limits of OP-402 while adding hydrogen on 7/23/94 is identified as an example of apparent violation 50-302/95-22-01.

On the second occasion (7/25/94), computer data indicated that operators reduced make-up tank level to approximately 58.5 inches (pressure went to about 15 psig), then increased level to approximately 83 inches while pressure increased to approximately 29 psig. The data indicated the Curve 8 alarm would have been activated when level was decreased to 58.5 inches, remained in through most of the level increase, and then deactivated as level increased above 79 inches. Chart recorder data indicated that pressure went from a low of approximately 15.5 psig to a high of approximately 28 psig while level went from a low of about 59 inches to a high of about 84 inches. When plotted on Curve 8, the chart recorder data indicated that make-up tank pressure was on or below Curve 8 throughout this evolution. Operator logs included bleeding 400 gallons to the "C" RCBT, then feeding 650 gallons from the "C" RCBT and 100 gallons from the "A" RCBT to raise hydrogen pressure to 27 psig. There were no other log entries for this evolution. The inspectors concluded that operators violated procedures during this evolution. Operators exceeded the administrative limits of OP-103B, Curve 8, Maximum Makeup Tank Overpressure, for an extended period of time (about 48 minutes). In addition, operators did not take timely action in response to the "MAKEUP TANK PRESS HIGH" annunciator. Instead of reducing pressure in response to the alarm as required by the annunciator response procedure, operators increased level (and pressure) in the makeup tank. This is an example of apparent violation 50-302/95-22-01.

On the third occasion (7/27/94), computer data indicated that operators started at a make-up tank level of approximately 72 inches and a pressure of approximately 19.5 psig, added hydrogen to increase pressure to about 21.5 psig, then increased level to about 77.5 inches (pressure went to about 25 psig). The data indicated that the Curve 8 alarm would have activated during the hydrogen addition, remained in during the level increase, then stayed in for about another 70 minutes as pressure gradually decreased to below the alarm point. Chart recorder data indicated that initial make-up tank level was about 73 inches and initial pressure was about 19 psig, pressure was increased to about 21

psig, then level was increased to about 78 inches (pressure went to about 24 psig). When plotted on Curve 8, the chart recorder data indicated that make-up tank pressure was below Curve 8 throughout this evolution. Operator logs included feeding 150 gallons from the "C" RCBT and 30 gallons of demineralized water to the make-up tank. There were no other log entries for this event. The inspectors concluded that operators violated procedures during this evolution. Operators did not follow OP-402 instructions for adding hydrogen by manually bypassing the 15 psig hydrogen regulator. The applicable step in OP-402 specifically stated "Determine maximum MUT overpressure using Curve 8 of OP-103B. Add desired amount of hydrogen while ensuring MUT pressure limit is not exceeded." However, operators exceeded Curve 8 during hydrogen addition. Operators also exceeded the administrative limits of OP-103B, Curve 8, for an extended period of time (about 78 minutes). In addition, during this evolution, operators did not take timely action in response to the "MAKEUP TANK PRESS HIGH" annunciator. Instead of reducing pressure in response to the alarm as required, operators increased level (and pressure) in the makeup tank and then left the alarm in for about an additional 70 minutes without taking action to reduce pressure. This is an example of apparent violation 50-302/95-22-01.

On the fourth occasion (7/28/94), computer data indicated that operators started with a make-up tank level of about 73.5 inches and a pressure of about 16.5 psig, added hydrogen to increase pressure to about 24 psig, then increased level to about 83 inches (pressure went to about 30.5 psig). The data indicated that the Curve 8 alarm would have activated when the hydrogen was added, remained in through the level increase, then stayed in for about 180 minutes longer as pressure gradually decreased to below the alarm point. Chart recorder data indicated that the initial make-up tank level was about 74 inches and pressure was about 16 psig, pressure was increased to about 23 psig, then level was increased to about 84 inches (pressure went to about 29 psig). When plotted on Curve 8, the chart recorder data indicated that make-up tank pressure was on or below Curve 8 throughout this evolution. Operator logs included adding hydrogen to the make-up tank to the maximum for the curve, feeding 47 gallons from the "A" RCBT and 253 gallons from the "B" RCBT, then adding 60 gallons of demineralized water to the make-up tank. There were no other log entries for this evolution. The inspectors concluded that operators violated procedures during this evolution. Operators did not follow OP-402 instructions for adding hydrogen by manually bypassing the 15 psig hydrogen regulator. The applicable step in OP-402 specifically required "ensuring MUT pressure limit is not exceeded." However, operators exceeded the Curve 8 MUT pressure limit during hydrogen addition. Operators also exceeded the administrative limits of OP-103B, Curve 8, for an extended period of time (about 184 minutes). In addition, during this evolution, operators did not take timely action in response to the "MAKEUP TANK PRESS HIGH" annunciator. Instead of reducing pressure in

response to the alarm as required, operators increased level (and pressure) in the makeup tank and then left the alarm in for about an additional 180 minutes without taking action to reduce pressure. This is an example of apparent violation 50-302/95-22-01.

On the fifth occasion (7/30/94), computer data indicated that operators started at a make-up tank level of about 74.5 inches and a pressure of about 19.0 psig, added hydrogen to increase pressure to about 23.5 psig (when the alarm activated), then about 190 minutes later increased level to about 82.5 inches (pressure went to about 28 psig). The data indicated that the Curve 8 alarm would have activated when hydrogen was added and remained in until it cleared when level was subsequently raised. Chart recorder data indicated that the initial make-up tank level was about 76 inches and pressure was about 18.5 psig, pressure was increased to about 23 psig, then level was increased to about 84 inches (pressure went to about 26.5 psig). When plotted on Curve 8, the chart recorder data indicated that make-up tank pressure remained below Curve 8 throughout this evolution. Operator logs included feeding 45 gallons from the "A" RCBT and 255 gallons from the "B" RCBT to the make-up tank. There were no other log entries for this evolution. The inspectors concluded that operators violated procedures during this evolution. Operators did not follow OP-402 instructions for adding hydrogen by manually bypassing the 15 psig hydrogen regulator. The applicable step in OP-402 specifically required "ensuring MUT pressure limit is not exceeded." However, operators exceeded the Curve 8 MUT pressure limit during hydrogen addition. Operators also exceeded the administrative limits of OP-103B, Curve 8, for an extended period of time (about 190 minutes). In addition, during this evolution, operators did not take timely action in response to the "MAKEUP TANK PRESS HIGH" annunciator. Instead of reducing pressure in response to the alarm as required, operators took no action for about 190 minutes, then increased level (and pressure) in the makeup tank to clear the alarm. This is an example of apparent violation 50-302/95-22-01.

On the sixth occasion (8/6/94), computer data indicated that operators increased make-up tank level to about 81 inches (pressure went to about 22 psig), then added hydrogen to increase pressure to about 27.5 psig. The data indicated that the Curve 8 alarm would have activated when the hydrogen was added, then stayed in for about 141 minutes as pressure gradually decreased to below the alarm point. Chart recorder data indicated that the maximum pressure was about 26.5 psig at about 82 inches. When plotted on Curve 8, the chart recorder data indicated that make-up tank pressure remained below Curve 8 throughout this evolution. Operator logs included adding 150 gallons from the "C" RCBT to the make-up tank. There were no other log entries for this evolution. The inspectors concluded that operators violated procedures during this evolution. Operators did not follow OP-402 instructions for

adding hydrogen by manually bypassing the 15 psig hydrogen regulator. The applicable step in OP-402 specifically required "ensuring MUT pressure limit is not exceeded." However, operators exceeded the Curve 8 MUT pressure limit during hydrogen addition. Operators also exceeded the administrative limits of OP-103B, Curve 8, for an extended period of time (about 141 minutes). In addition, during this evolution, operators did not take timely action in response to the "MAKEUP TANK PRESS HIGH" annunciator. Instead of reducing pressure in response to the alarm as required, operators left the alarm in for about 141 minutes. This is an example of apparent violation 50-302/95-22-01.

On the seventh occasion (8/8/94), computer data indicated that operators started with a make-up tank level of about 79 inches and a pressure of about 20 psig, then added hydrogen to increase pressure to about 27.5 psig. The data indicated that the Curve 8 alarm would have been activated when the hydrogen was added, then stayed in for about 67 minutes as pressure gradually decreased to below the alarm point. Chart recorder data indicated that the maximum pressure was about 26 psig at a level of about 80 inches. When plotted on Curve 8, the chart recorder data indicated that make-up tank pressure remained on or below Curve 8 throughout this evolution. There were no operator log entries for this evolution. The inspectors concluded that operators violated procedures during this evolution. Operators did not follow OP-402 instructions for adding hydrogen by manually bypassing the 15 psig hydrogen regulator. The applicable step in OP-402 specifically required "ensuring MUT pressure limit is not exceeded." However, operators exceeded the Curve 8 MUT pressure limit during hydrogen addition. Operators also exceeded the administrative limits of OP-103B, Curve 8, for an extended period of time (about 67 minutes). In addition, during this evolution, operators did not take timely action in response to the "MAKEUP TANK PRESS HIGH" annunciator. Instead of reducing pressure in response to the alarm as required, operators left the alarm in for about 67 minutes. This is an example of apparent violation 50-302/95-22-01.

On the eighth occasion (8/24/94), computer data indicated that operators started at a make-up tank level of about 77 inches and a pressure of about 18 psig, increased level to about 81.5 inches (pressure went to about 21 psig), then added hydrogen to increase pressure to about 28 psig. The data indicated that the Curve 8 alarm would have been activated when hydrogen was added, then stayed in for about 87 minutes as pressure gradually decreased to below the alarm point. Chart recorder data indicated that the maximum pressure was about 27 psig at about 82.5 inches. When plotted on Curve 8, the chart recorder data indicated that make-up tank pressure remained below Curve 8 throughout this evolution. There were no operator log entries for this evolution. The inspectors concluded that operators violated procedures during this evolution. Operators did not follow OP-402 instructions for adding hydrogen by manually bypassing the 15 psig hydrogen

regulator. The applicable step in OP-402 specifically required "ensuring MUT pressure limit is not exceeded." However, operators exceeded the Curve 8 MUT pressure limit during hydrogen addition. Operators also exceeded the administrative limits of OP-103B, Curve 8, for an extended period of time (about 87 minutes). In addition, during this evolution, operators did not take timely action in response to the "MAKEUP TANK PRESS HIGH" annunciator. Instead of reducing pressure in response to the alarm as required, operators left the alarm in for about 87 minutes. This is an example of apparent violation 50-302/95-22-01.

On the ninth occasion (9/4/94), computer data indicated that operators started at about 80 inches and 23 psig in the make-up tank, increased level to about 85 inches (pressure went to about 26 psig), added hydrogen to increase pressure to about 31 psig (when the alarm activated), reduced level to about 52.5 inches (pressure went to about 14.5 psig), increased level to about 79 inches (pressure went to about 26 psig), then vented the make-up tank to about 20 psig. The data indicated that the 55 inch minimum level was exceeded during the evolution. Also, the Curve 8 alarm would have been activated from the time that hydrogen was added at the beginning of the evolution until the make-up tank was vented at the end of the evolution. The data also indicated that, as level was reduced from about 85 inches to about 52.5 inches, pressure exceeded Curve 8 by an increasing amount. Chart recorder data indicated that pressure went from a high of about 29.5 psig at a level of about 85 inches, to a low of about 14.5 psig at a level of about 52 inches, then to a high of about 25 psig at a level of about 80 inches. When plotted on Curve 8, the chart recorder data indicated that make-up tank pressure went above Curve 8 as level was being decreased below about 80 inches, remained above Curve 8 during the level decrease, then returned below Curve 8 during the level increase. Operator logs included feeding 125 gallons from the "B" RCBT; adding hydrogen; bleeding 924 gallons to the "B" RCBT; and feeding 120 gallons from the "A" RCBT, 380 gallons from the "C" RCBT, and 350 gallons from the "C" RCBT. There were no other log entries for this evolution. The inspectors concluded that operators violated procedures during this evolution. Operators did not follow OP-402 instructions for adding hydrogen by manually bypassing the 15 psig hydrogen regulator. The applicable step in OP-402 specifically required "ensuring MUT pressure limit is not exceeded." However, operators exceeded the Curve 8 MUT pressure limit during hydrogen addition. Operators also exceeded the administrative limits of OP-103B, Curve 8, for an extended period of time (about 43 minutes). In addition, during this evolution, operators did not take timely action in response to the "MAKEUP TANK PRESS HIGH" annunciator. Instead of reducing pressure to clear the alarm as required, operators reduced level (and pressure) which caused the Curve 8 limits to be exceeded by an increasing amount. Operators left the alarm in for about 43 minutes before venting the make-up tank to

clear the alarm. Evolutions, not required by plant conditions, conducted to collect data constitute a test or experiment. 10 CFR 50.59 requires in part that tests or experiments that are conducted must contain a written safety evaluation that provides the bases for why an unreviewed safety question does not exist. The evolution conducted on 9/4/94 without a written safety evaluation is identified as example 1 of apparent violation 50-302/95-22-02.

On the tenth occasion (9/4/94), computer data indicated that operators started with a make-up tank level of about 82.5 inches and pressure about 20.5 psig, added hydrogen to increase pressure to about 30 psig, then about 85 minutes later a different shift of operators vented the make-up tank to reduce pressure to about 19 psig. The data indicated that the Curve 8 alarm would have been activated from the time that hydrogen was added until the time that the make-up tank was vented. Chart recorder data indicated a maximum pressure of about 28.5 psig at a level of about 83 inches. When plotted on Curve 8, the chart recorder data indicated that make-up tank pressure remained on or below Curve 8 during this evolution. Operator logs included venting the make-up tank at the end of this evolution. There were no other log entries for this evolution. The inspectors concluded that operators violated procedures during this evolution. Operators did not follow OP-402 instructions for adding hydrogen by manually bypassing the 15 psig hydrogen regulator. The applicable step in OP-402 specifically required "ensuring MUT pressure limit is not exceeded." However, operators exceeded the Curve 8 MUT pressure limit during hydrogen addition. Operators also exceeded the administrative limits of OP-103B, Curve 8, for an extended period of time (about 86 minutes). In addition, during this evolution, operators did not take timely action in response to the "MAKEUP TANK PRESS HIGH" annunciator. Operators left the alarm in for about 86 minutes before they vented the make-up tank to reduce pressure. This is an example of apparent violation 50-302/95-22-01.

On the eleventh occasion (9/5/94), computer data indicated that operators started with a make-up tank level of about 84 inches and a pressure of about 24 psig, added hydrogen to increase pressure to about 30 psig (when the alarm activated), increased level to about 86.5 inches (when the alarm cleared at a pressure of about 32 psig), decreased level to about 53.5 inches (pressure went to about 14 psig), then increased level to about 81 inches (pressure went to about 27 psig). The data indicated that the Curve 8 alarm would have been activated for about 25 minutes from the time hydrogen was added until the level was increased to about 86.5 inches and the alarm cleared. Then the alarm would have been activated for about 37 minutes from the time the level decrease was begun until the alarm cleared during the subsequent level increase. The data also indicated that, as level was decreased following the alarm, pressure exceeded Curve 8 by an increasing amount. Chart recorder data indicated a maximum pressure of about

30 psig at a level of about 86 inches and a minimum pressure of about 14 psig at a level of about 54 inches. When plotted on Curve 8, the chart recorder data indicated that make-up tank pressure went above Curve 8 about midway during the level decrease and returned to on or below Curve 8 during the subsequent level increase. Operator logs included feeding 185 gallons from the "B" RCBT; adding hydrogen; bleeding 955 gallons to the "B" RCBT; then feeding 120 gallons from the "A" RCBT; 380 gallons from the "C" RCBT; and 360 gallons from the "B" RCBT. There were no other log entries for this evolution. The inspectors concluded that operators violated procedures during this evolution. Operators did not follow OP-402 instructions for adding hydrogen by manually bypassing the 15 psig hydrogen regulator. The applicable step in OP-402 specifically required "ensuring MUT pressure limit is not exceeded." However, operators exceeded the Curve 8 MUT pressure limit during hydrogen addition. Operators also exceeded the administrative limits of OP-103B, Curve 8, for an extended period of time (about 37 minutes during the level decrease and subsequent level increase). In addition, during this evolution, operators did not take timely action in response to the "MAKEUP TANK PRESS HIGH" annunciator. Instead of reducing pressure to clear the alarm as required, operators cleared the first alarm by increasing level (and pressure). When the alarm came in while operators were reducing level (and pressure), operators continued to reduce level which caused the Curve 8 limits to be exceeded by an increasing amount. Operators subsequently cleared the alarm after 37 minutes by increasing level (and pressure) in the make-up tank. Evolutions, not required by plant conditions, conducted to collect data constitute a test or experiment. 10 CFR 50.59 requires in part that tests or experiments that are conducted must contain a written safety evaluation that provides the bases for why an unreviewed safety question does not exist. This evolution was conducted without a written safety evaluation and is identified as example 2 of apparent violation 50-302/95-22-02.

Of the 11 occasions reviewed, the inspectors noted that two of them, the ninth and eleventh occasions, differed in some material respects from the other nine. On nine of the occasions, operators were taking actions to increase make-up tank hydrogen pressure (as recommended for RCS chemistry control) when they exceeded Curve 8 limits. However, on two of the occasions (9/4/94 a.m. and 9/5/94 a.m.), operators exceeded Curve 8 limits while reducing make-up tank level (and pressure) and while performing an evolution that was not required to support RCS chemistry control. On nine of the occasions, operators took delayed action (or no action) following the alarm to reduce the amount by which make-up tank pressure exceeded the allowable region of Curve 8. However, on two of the occasions (9/4/94 a.m. and 9/5/94 a.m.) operators took nonconservative actions following the alarm to further increase the amount by which make-up tank pressure exceeded the allowable region of Curve 8. Also, the licensee stated that on two of the occasions (9/4/94 a.m. and 9/5/94 a.m.) operators planned the

evolutions to challenge the accuracy of Curve 8 and took data during the evolutions. In addition, on 9/5/94 a.m. operators stationed an auxiliary operator by the make-up tank vent to take action if a plant event occurred while the make-up tank pressure exceeded Curve 8. The inspectors concluded that while operators violated procedures, and the design basis limits established by the MUT pressure limit curve, on each of the 11 occasions reviewed, available information indicated that the intent of the operators during the two occasions (9/4/94 and 9/5/94) differed from the other nine occasions. These unauthorized manipulations of the plant on 9/4/94 and 9/5/95 in addition to violating the procedures OP-402, OP-103B, and AR-403 while adding hydrogen, also violated 10 CFR 50.59 in that the manipulations were not required by plant conditions and no approved procedure existed for the conduct of the tests. As described previously, these two unauthorized tests are identified as examples 1 and 2 of apparent violation 50-302/95-22-02.

While reviewing the computer and chart recorder data, the inspectors noted that many substantial changes in make-up tank level had been made where Curve 8 was not exceeded. The licensee's analysis of this issue found that, during the time period June 1 through September 30, 1994, there were 669 manipulations of make-up tank level or pressure; including 610 level reductions or level increases, 49 hydrogen additions, and 10 vents of the tank. The licensee further stated that 21 of those manipulations (only 3.1%) resulted in the computer-generated annunciator for make-up tank pressure being in the alarm condition. This indicated that, on most make-up tank level or pressure manipulations, operators did not exceed the pressure limits of Curve 8.

In summary, the inspectors concluded that operators exceeded Curve 8 limits and violated operating procedures on at least 11 occasions during the time period June 1, 1994, through September 7, 1994. Two of these occasions were unauthorized tests or experiments not required by plant conditions.

2.2 Human factors and Control Room Instrumentation

The inspector assessed the human factors aspects of the control room instruments for make-up tank pressure and level. The computer data for pressure and level were clearly displayed digitally. Pressure was displayed to the nearest one-hundredth of a psig and level was displayed to the nearest one-hundredth of an inch. The chart recorder was much more difficult to read. Pressure could be read to approximately the nearest one-half psig and level could be read to approximately the nearest inch. Since the Curve 8 calculation (I90-0024) provided only two feet of water (about 0.8 psig) as protection for the HPI pump, the inspector considered that the readability of the chart recorder was not sufficient to support operating the make-up tank on or near

Curve 8. Operation on or near Curve 8 was allowed by procedures and was encouraged by licensee management to maximize the hydrogen concentration in the reactor coolant system. Also, there was no display in the control room for proximity to Curve 8. To make a determination of proximity to the limit of Curve 8, operators would have to manually plot make-up tank pressure and level on a copy of Curve 8. The lack of such a display, which could have been provided by the computer, made it very difficult for operators to increase make-up tank pressure close to Curve 8 without exceeding Curve 8. The inspectors concluded that the human factors aspects of the MUT information displayed in the control room were weak in supporting operation near Curve 8.

2.3 Calibration and Accuracy of Makeup Tank Instruments

The inspector assessed the calibration and accuracy of the instruments. Make-up tank pressure inputs to the computer and chart recorder were from the same pressure transmitter and electrical buffer. Maintenance procedure MP 103-A calibration records from October 27, 1994, indicated that the chart recorder pressure string read about 0.7 psig low (at 25 psig). (The make-up tank pressure was normally controlled between approximately 15 and 30 psig.) The inspectors found that the 0.7 psig error was within the 1.12 psig maximum instrument error assumed by Calculation I90-0024, dated August 28, 1992, from which Curve 8 was derived. The inspectors noted that the chart recorder read low (by about 1.0 to 4.0 psig) and out of tolerance, at pressures above 25 psig (i.e., at 50, 75, and 100 psig), on two consecutive calibrations, November 27, 1992 and October 27, 1994. On each occasion, it had been recalibrated and left reading accurately. However, the licensee had no trending program to identify (and initiate corrective action) when an instrument, that was calibrated by a maintenance procedure and possibly important to safety, was repeatedly found to indicate inaccurately outside of the allowed tolerance. From the as-found calibration data, the inspector could not determine whether the chart recorder pressure would have read within the 1.12 psig assumed maximum instrument error, at a make-up tank pressure of 29 or 30 psig, during the period July through September, 1994. When informed of these chart recorder errors, the licensee promptly checked the calibration of the chart recorder for make-up tank pressure and found it to be within the allowable tolerance. The inspectors identified the lack of instrument out of calibration tracking (and corrective action) as a weakness in the licensee's maintenance program.

The inspectors noted that the computer make-up tank pressure and the Curve 8 alarm were not checked by calibration procedures. By comparison of the computer data with the chart recorder data, the inspectors found that the computer generally indicated higher pressure than the chart recorder by about 0.5 to 1.5 psig at about 29 psig and by about 0.2 psig at about 17 psig. The inspectors found that action taken to complete MAR 93-06-06-01A, dated

July 12, 1993, which had installed the computer pressure point and Curve 8 alarm, had failed to revise procedures to assure that the instruments would be calibrated in the future. The MAR functional test had tested the Curve 8 alarm setpoints in July 1993. The inspectors noted that calibration procedures would have required the instruments to be calibrated every two years, and that less than two years had transpired since the instruments were installed. Therefore, the safety significance of the missed procedure revisions was minor. The inspectors identified this failure of the implementation of MAR 93-06-06-01A to appropriately revise procedures as a weakness in the licensee's modification process.

Level inputs to the computer and chart recorder were from two different level transmitters and electrical buffers. Through a selector switch on the vertical section of the main control board, control room operators could select either transmitter to the chart recorder. The non-selected transmitter would then supply the computer. There were no records of the switch position, there was no indicated preferred switch position, and operators stated that they occasionally had changed the switch position. Calibration of level transmitter LT2 on December 8, 1994, per surveillance procedure SP-169E, Enclosure 2, found that the chart recorder level string indicated about 1.0 inches high at 60 and 90 inches of level. (The make-up tank level was normally controlled between about 55 and 80 inches.) The computer point was not checked at that time. Calibration of level transmitter LT1 on March 18, 1994, per SP-169E, Enclosure 1, found that the chart recorder level string indicated about 1.5 inches high at 60 inches of level and about 1.0 inches high at 90 inches of level. That calibration also checked the computer point and found that it indicated about 1.0 inches high at 60 and 90 inches of level. On both dates, the as-found conditions were generally within allowable tolerances, and the instruments were recalibrated and left with approximately zero error. By review of the make-up tank level calibration data, strip charts, and computer data, the inspectors determined that chart recorder normally read higher than the computer by about 0.0 to 1.0 inches. The inspectors concluded that the 1.0 and 1.5 inch errors found during calibration were within the 2.7 inches maximum instrument error assumed by Calculation I90-0024, which derived Curve 8.

In summary, the inspectors identified two licensee weaknesses related to make-up tank instrument calibration: one weakness in the licensee's maintenance program in that out of calibration tracking and corrective action was lacking for instruments that were relied upon to support a safety-related calculation, and one weakness in the licensee's modification process in that a MAR that installed instruments did not revise procedures to require

periodic calibration of those instruments. The inspectors concluded that overall, the make-up tank instrumentation (alarm, computer, and chart recorder) was sufficient to support operation of the make-up tank within the authorized region of Curve 8.

2.4 Operators Logs

In reviewing operator logs, the inspectors found that the information in the logs did not thoroughly or consistently document the evolutions. However, the inspectors concluded that the state of the logs did not violate licensee requirements for logkeeping, as the licensee's requirements were vague. The inspectors also noted that operators on shift during all or part of the eleven evolutions included 30 different licensed operators, approximately 100% of all licensed operators on shift at Crystal River 3. (The operators were on a six-shift rotation, and each shift included five licensed operators, two SROs and three ROs.) Also, the inspectors noted that there were shift turnovers, during three of the eleven occasions, when the make-up tank high pressure alarm would have been in. The shift managers were supposed to attend the shift turnovers, and then would have had the opportunity to become aware that the make-up tank high pressure alarm was in.

The inspectors concluded that most of the licensed operators at Crystal River 3 were involved in the nine examples of apparent violation 50-302/95-22-01. Also, licensee management had ample opportunity to identify the apparent violation.

2.5 Reportability

The inspectors reviewed the timeliness of the licensee's reporting of the operation of the make-up tank outside the design basis, with excessive hydrogen overpressure. The operator evolutions that challenged the accuracy of Curve 8 occurred on September 4 and 5, 1994. Problem Report PR 94-0267, MUT Pressure Curve Technical Basis Inadequate, was dated September 7, 1994. Licensee documents and statements indicated that engineering determined on November 16, 1994 that Curve 8 was nonconservative and outside the design basis. The licensee further determined that operation on or above Curve 8 would potentially allow make-up tank hydrogen to enter and damage a make-up (HPI) pump during a certain event, a core flood line break coincident with a failure of one emergency diesel generator. The licensee made the required one-hour 10 CFR 50.72 report at 17:55 on November 16, 1994, and submitted the required LER on December 19, 1994. The inspector concluded that the licensee made the one-hour report promptly after discovering the outside of design basis condition. The LER was submitted late, and was previously identified as VIO 50-302/94-27-02.

3. Engineering Support

The inspectors assessed engineering support to operations. They reviewed problem reports and engineering department correspondence related to the Curve 8 problems; reviewed the engineering calculation from which Curve 8 was derived; and discussed the issues with system engineers, design engineers, and operators to assess the adequacy of engineering support for this issue.

3.1 Accuracy of Curve 8, Maximum Makeup Tank Overpressure Curve

The operators stated that the purpose of the evolutions on September 4, 1994 and on September 5, 1994, was to confirm their perception that Curve 8 was incorrect. The inspectors reviewed engineering support to operations during June - September 1994; specifically, the issue regarding the accuracy of Curve 8. The inspectors reviewed Problem Reports PR 93-0010, Potentially Inadequate Make-up Pump NPSH, dated January 20, 1993; PR 94-0149, MUV-60 Stuck Open, dated May 10, 1994; and PR 94-0267, MUT Pressure Curve Technical Basis Inadequate, dated September 7, 1994. The inspectors also reviewed related REA 940747, concerning air being drawn into the make-up pumps during the performance of SP-630 (MUP Full Flow Testing), dated June 7, 1994; and REA 941308, concerning operator burden in ensuring make-up pump operability during accident scenarios, dated December 1, 1994. In addition, the inspectors reviewed engineering Calculation I90-0024, dated August 28, 1992, from which Curve 8 was derived; MAR 93-06-06-01A, Setpoint Changes to MUT Overpressure, Low BWST Level, and MUV-491; and a related safety evaluation dated July 15, 1993. The inspectors also reviewed copies of various related internal engineering memoranda and computer mail messages and discussed the issue regarding the accuracy of Curve 8 with system engineers and design engineers.

Based on this review, the inspectors concluded that the operators' concern with the accuracy of Curve 8 was identified as a contributing factor in Problem Report PR 94-0149, dated May 10, 1994, and was also identified more clearly in PR 94-0267 (after the September 4 and 5 evolutions). A June 14, 1994, written engineering evaluation of a stated concern regarding the accuracy of Curve 8, which had been reported in PR 94-0149, concluded that the data supplied did not indicate an error in Curve 8. The engineering evaluation identified no errors in calculation I90-0024, that derived Curve 8. Subsequent licensee review of Curve 8, after September 5, 1994, identified several errors related to the calculation of Curve 8. These errors included the omission of the effects of gas absorption, temperature changes, and the partial pressure of water vapor. Internal memoranda, electronic messages, and statements by engineers indicated that PR 94-0149 corrective action (and Curve 8) were discussed several times between engineers and operators, including at meetings on July 19, 1994, and on August 5, 1994. In addition, engineers were

aware that at least one operator was not satisfied with the responses from engineering and made attempts to get the operator's concerns more clearly documented. Engineering managers (and operations managers) did not get proactively involved in the problems with resolving operator's concerns with the accuracy of Curve 8. The inspectors concluded that the failure of the engineering evaluation in response to PR 94-0149 to identify errors in Calculation I90-0024 with respect to the slope of Curve 8 constituted inadequate corrective action. This inadequate corrective action is identified as example 1 of apparent violation 50-302/95-22-03. Additional examples of failure to take adequate corrective actions were identified as apparent violations in IR 50-302/95-13. As described in Section 7 of this report, these examples are incorporated into examples 2 and 3 of apparent violation 50-302/95-22-03.

Internal licensee documents also indicated that engineers and operators discussed the method utilized by operators to maintain adequate hydrogen overpressure in the MUT to achieve 25 cc/kg of dissolved hydrogen in the RCS. Also, a memorandum from a system engineer on August 8, 1994, to one SRO and one RO (apparently in response to questions from them) advised the operators to use the computer points for make-up tank pressure and level when making hydrogen additions, since they would give more accurate indication than the chart recorder. The memo further stated that the alarm took precedence over the recorder indications. This informal response to a question was not disseminated to other operators by engineering or by operations. The inspectors noted that the response also was not consistent with a conservative operating practice that any valid indications (i.e. alarm, computer, and recorder) be kept out of the unacceptable operating regions. This was another indication of a weakness in communications between operations and engineering and also within operations.

Records available to the inspectors indicated that the calibration/accuracy of the make-up tank pressure and level instruments (alarm, computer, chart recorder) were not challenged by operators or engineers. Maintenance records revealed that the make-up tank pressure indicators had not been calibrated between November 1992 and October 1994 and then in October 1994 the chart recorder pressure indication was found to be erroneous and nonconservative. (The instruments were scheduled for routine calibration every two years). No corrective action was taken to preclude recurrence of this problem.

The inspectors concluded that engineering responded to problems or questions that were clearly stated in PRs and REAs. However, the quality and timeliness of these responses varied. While the above responses were incomplete and untimely, others appeared to be thorough. In one example, engineers identified the cause of make-up pump cavitation identified in PR 94-0149 to be air pockets left after maintenance in certain sections of piping - they then

initiated modifications and procedure changes to assure that the sections of piping were vented after maintenance. In another example, REA 941308, engineers performed a detailed Kepner-Tregoe decision making analysis of various potential corrective actions to reduce or eliminate operator burden in ensuring make-up pump operability during an accident. An example of another issue where operators were dissatisfied with corrective action involved the emergency feedwater control system, where operators had to routinely place the EFW pumps in manual control and reduce the flowrates during transients. This action was required in the EOPs and successfully practiced on the simulator, but was considered by operators to be an unnecessary burden. This operator burden was on the licensee's list of "operator workarounds" for which corrective actions were being appropriately pursued by plant management.

While reviewing Calculation I90-0024, dated August 28, 1992, from which Curve 8 was derived, the inspectors noted a discrepancy between a calculation assumption and licensee procedures. The calculation assumed that, during a LOCA, the switchover of ECCS pumps' suction from the BWST to the reactor building sump would occur by procedure at an RB sump level that would equate to a BWST level of about 14 ft. The calculation assumption stated that the value for BWST switchover level would be valid through refuel 8, which had occurred in 1993. However, licensee emergency operating procedures in effect during June - September 1994 required operators to begin the switchover at a BWST level of 5 ft. The inspectors found that a MAR to raise the level of certain instruments in the reactor building (for flood plane concerns) had been installed in 1993. The MAR indicated that the emergency operating procedures were to be changed but did not indicate that Calculation I90-0024 was affected. Following the MAR, the emergency operating procedures had been changed to require the switchover at a BWST level of 5 ft. The licensee showed the inspectors an internal engineering memorandum dated March 24, 1993, with an evaluation showing that the 5 ft switchover level was appropriate. While the 14 ft level was based on two running HPI (make-up) pumps in one train, the 5 ft level was based on only one running HPI pump per train and thus less flow and less pressure loss from the BWST to the HPI pumps. The inspector reviewed the evaluation in the memorandum and concluded that it was a logical and reasonable extension of Calculation I90-0024 with respect to ensuring the make-up tank hydrogen was kept out of the HPI pumps. However, it overlooked potential vortexing in the BWST and introduction of air into all ECCS pumps. Also, it overlooked the fact that the EOP started switchover at 5 ft in the BWST and that there would be time (and BWST level decrease) involved during the switchover. Further, both the memo and calculation I90-0024 overlooked the fact that, with make-up tank level allowed to go below zero, operators would have no indication of adequate make-up pump NPSH and as a result could decide to stop the affected pump. The inspector verified that the emergency

operating procedures included a requirement for operators to ensure that no more than one HPI pump per train was running when BWST level decreased below 25 ft. The internal engineering memorandum was signed by a senior nuclear engineer and a nuclear engineering supervisor. However, no formal change was made to the official calculation. The formal change to the calculation, a quality record, might have identified the discrepancies with the calculation and would have required independent verification by a second qualified engineer in addition to the supervisors approval. The inspectors noted that problem report PR 94-0149, dated May 10, 1994, had identified the need for a formal calculation to support the 5 ft BWST swapover point. The engineering schedule for completion of that analysis was September 30, 1994. Also, problem report PR 94-0267, dated September 7, 1994, identified the need to update calculation I90-0024.

The inspectors concluded that the licensee's failure to generate a new official calculation or revise the calculation I90-0024 in March 1993 was an apparent violation of 10 CFR 50, Appendix B, Criterion III requirements for design control including independent verification of design calculations. This inadequate design control will be included in example 2 of apparent violation 50-302/95-22-04. Apparent violation 95-13-03, example 1, paragraph 5 of IR 50-302/95-13, described an apparent violation of 10 CFR 50, Appendix B, Criterion III, Design Control, for inadequate design assumptions for borated water storage tank swapover level. This apparent violation is administratively closed and incorporated into apparent violation 50-302/95-22-04, example 2.

Additional examples of inadequate design control were identified as apparent violations in IR 50-302/95-13. As described in Section 7 of this report, these examples are incorporated into examples 1, 3 and 4 of apparent violation 50-302/95-22-03.

3.2. Review of Operability Concern Resolution Evaluation Report

As part of the review of the licensees' new operability evaluation process, the inspectors reviewed the operability evaluation concerning an unsecured section of RB sump grating installed over the ECCS pump suction pit. While installed mainly for personnel protection, this grating was credited in the FSAR for preventing objects larger than 1.5 inches from entering the ECCS pump suction pit.

To determine if the unsecured RB sump grating could affect the operability of the ECCS pumps, the licensee calculated the pressure on the grating created by the worst case flowrate out of the suction pit and into the RB sump and compared that to the force necessary to lift the grating. Based on this calculation, the licensee concluded the worst case flowrate caused insufficient force to lift the grating. The licensee also considered the force

on the grating resulting from opening the DH drop line with the reactor at pressure. This action was directed by procedure to protect the DH pumps from failure in the event the DH pumps had been operated at low flow for an extended period of time. The licensee dismissed this as a potential cause using "engineering judgement" based on the calculated flow rate necessary to exert a force sufficient to lift the grating. Using the same methodology for calculating the force from suction pit outflow, the licensee calculated that greater than 3,000,000 gpm would be required to lift the grating. However, independent calculations by the inspectors, using the licensee's methodology, found that only 138,000 gpm was required to lift the grating. Because of the significant difference between the two values, the inspectors questioned how the value of 3,000,000 gpm was calculated. The licensee stated the value was calculated by structural engineering and not by mechanical engineering. Structural engineering failed to recognize that flow varied as a function of the square root of the differential pressure and had performed an inappropriate extrapolation. Furthermore, structural engineering did not communicate this value to mechanical engineering for review. The licensee said the value was questioned by mechanical engineering after the operability resolution was issued, but no mechanism existed to amend the value.

The inspectors questioned the effect of steam/water impingement on the grating due to opening the DH drop line with the reactor at pressure. The inspectors reviewed the procedural guidance provided by the licensee. Prior to direction to open the DH drop line, actions were taken to reduce RCS temperature to less than 200°F. Furthermore, the DH drop line was required to be opened only if DH pump operation at low flowrate would exceed ten hours. Based on the procedural actions to reduce RCS temperature below 200°F and the extended time period before this action would be required, the inspectors concluded there was no potential for steam/water impingement on the grating.

The inspectors concluded that, while there was no immediate operability concern, the operability concern resolution process lacked adequate reviews to ensure that conservative operability determinations were made. Furthermore, the fact that plant management had accepted the resolution indicates that insufficient management attention was given to this particular resolution and a willingness by management to accept, without review, engineering evaluations that resulted in continued plant operation. The failure of the structural engineering group to communicate the value to the mechanical engineering group for review is another example of weak communications between plant organizations.

In summary, the inspectors identified two apparent violations and two weaknesses in the area of engineering support to operations. The failure of the engineering evaluation in response to PR 94-0014 to identify errors in Calculation I90-0024 with respect to the accuracy of

Curve 8 constituted inadequate corrective action. The failure to generate a new or revised official calculation for Curve 8 in March 1993, to support the revised operating procedure lowering BWST switchover level to 5 ft, constituted inadequate design control including a lack of independent verification. The informal communications between engineering and operations regarding operator use of make-up tank instruments and lack of such communications within operations indicated a weakness in intra and interdepartmental communications. Also, the incorrect calculation and lack of communications within the engineering department, with respect to an evaluation of an unsecured section of RB sump grating, indicated a weakness in the licensee's operability evaluation process.

4. Procedures

The inspectors reviewed the procedures that were in effect during the period June 1 to September 5, 1994. Particular emphasis was placed on the adequacy of guidance available to operators for the conduct of plant evolutions, responding to plant alarms, and determining when an evolution was covered by existing plant procedures.

AI-500, Conduct of Operations, revision 75, provided general guidance on operator responsibilities and procedure usage. AI-500 section 3.3.2.15 stated that operators were responsible for taking timely and proper actions to ensure safe operation of the plant. Furthermore, AI-500 section 4.3.2.2.4 stated that annunciator response procedures shall be used to diagnose alarms not directly related to intentional manipulation of plant controls and for any alarm the operators were not explicitly familiar with. No further guidance on timeliness in responding to alarms or implementing alarm response operator actions was provided in AI-500. AI-500 section 4.2.35.1 stated that it was the duty of every member of the Crystal River Unit 3 workforce to strictly adhere to written policies and to comply with procedures written for Crystal River Unit 3. However, AI-500 section 4.3.2.3.2.a stated that when the adequacy of existing procedures was questioned, shift supervision would make the determination as to which procedural requirements were applicable.

NOD-12, Implementation of Technical Specification, revision 3 provided a mechanistic process to determine when procedures were required for conducting activities covered by Technical Specification 5.6.1.1. This process did not provide guidance for determining when procedures were potentially inadequate or when an activity was not covered by existing procedures. Procedure NOD-12 was an upper-tier procedure and was implemented by AI-400A, Description and General Administration of Plant Procedures. Procedure AI-400A, revision 8, gave direction on the generation process for new procedures including any reviews that were required. However, no guidance on when new procedures should be generated was present.

Procedure AI-400E, Performance and Transmittal of Procedures, provided a checklist to assist in determining if a procedure constituted a test or infrequent evolution. However, this checklist only would be used if a new procedure had been generated and not to determine if an evolution being conducted using existing procedures was a test or an infrequent evolution. No guidance was present to assist in determining if an evolution being conducted was a test or infrequent evolution. Furthermore, the licensee did not define what activities constituted a test or experiment.

The inspectors discussed with the licensee the issues concerning when new procedures would be developed. The licensee said there was no specific guidance and it would have been the shift supervisors' judgement to determine if new or additional procedural guidance was required. The inspectors asked if the shift supervisors received any training that would assist them in making this determination. The licensee stated they relied on the shift supervisors' experience and licensed operator training.

Procedure AI-402B, Procedure Writing (Except for EOP/AP/VP), provided direction for the content and format of plant procedures. Specifically, the guidance for operating procedures stated that parameters that may jeopardize equipment safety if exceeded should be included in the limits and precautions section of the procedure. Procedure OP-103B Curve 8 was a limit established for the purpose of protecting the high pressure injection pumps from hydrogen gas intrusion. Contrary to the guidance of AI-402B, no reference to Curve 8 was present in the limits and precautions section of procedure OP-402, Makeup and Purification System, revision 75. AI-402B did not provide guidance on use of plant curves referenced within procedures.

Procedure OP-402, revision 75, gave instructions for normal operation of the makeup and purification system including MUT hydrogen gas addition and water level changes. This procedure was presented in a sectional format to allow for operator flexibility by implementing only the applicable section or sections. However, a precaution or limitation given in one section did not apply to other sections of the procedure. The only precautions and limitations that were applicable throughout the entire procedure were those given in the precautions and limitations section. The precaution or limitation for MUT pressure was presented only in the section for hydrogen gas addition. No further guidance for MUT pressure limit was given in procedure OP-402 including lowering and raising MUT water level.

Procedure AR-403, PSA H Annunciator Response, revision 21, provided guidance for operator response to a MUT high pressure alarm. The alarm was driven by a comparison of MUT level and pressure to a computer algorithm that approximated the MUT pressure limit (Curve 8). The guidance for a valid alarm was to ensure MUV-141 and MUV-143 were closed and to reduce pressure within the MUT pressure limit (Curve 8). No guidance for timeliness to initiate operator actions or the method for reducing MUT pressure was given.

Procedure OP-103B, Plant Operating Curves, provided the administrative operating limits for normal plant operations. This procedure did not provide guidance on normal plant operations or on the applicability of administrative operating limits. In fact, procedure OP-103B was used only to provide revision/control when administrative operating limits were revised.

Procedural guidance was not provided to assist the shift supervisor in determining when existing procedures were adequate or if new procedures were necessary. Furthermore, the inspectors concluded that procedure OP-402 did not provide sufficient emphasis on maintaining MUT pressure within the limits of procedure OP-103B Curve 8. Additionally, no specific guidance for timeliness of response to plant alarms was present.

The inspectors concluded that operating procedures, as written, were adequate for operations within the authorized region of Curve 8. All nine of the examples of apparent violation 95-22-01 involved hydrogen addition, for which procedures were clear in invoking Curve 8 limits. However, there were weaknesses in written directions to operators regarding applicability and use of procedures.

5. Training

The inspectors reviewed the licensed operator initial and requalification training programs to determine if adequate training existed.

The licensed operator requalification program was presented over a two-year period. However, not all procedures or systems were covered within that two-year period. The inspectors determined that the AI-400 series procedures were last covered in 1991 and the Makeup and Purification operating procedure was last covered in 1990. Procedure AI-500 was covered during the licensed operator requalification cycle prior to September 5, 1994.

The licensee supplemented the licensed operator requalification program with the licensed operator required reading program. This program was used to keep operators aware of procedural changes. Guidance for the licensed operator required reading program consisted of a process for developing the required reading list and processing of sign-off sheets. However, no formal direction on the intent of the required reading program was present. Furthermore, procedures that the operators used routinely were not always included as required reading.

Training on plant curves and administrative limits was presented during initial license training. Routine plant operations, such as MUT hydrogen addition or water level changes, were not specifically included during licensed operator requalification training. The licensee explained that covering routine plant operations was not considered an effective use of training resources because the operators were familiar with such operations. Requalification training instead emphasized using

the abnormal and emergency plant procedures to respond to plant transients. Evaluations of operator performance were conducted during observed real-time simulator training. The licensee was using NUREG 1021, Operator Licensing Examiner Standards, as the evaluative standard for acceptable operator performance. NUREG 1021 was used by NRC examiners to determine if an individual demonstrated sufficient knowledge and abilities to receive or maintain an operator's license. NUREG 1021 evaluated operator performance in a variety of areas including procedure use and adherence, alarm response, and compliance with administrative limits.

The inspectors concluded the licensed training program was adequate.

6. Employee Concern Program

The inspector reviewed the ECP to determine the adequacy of the program. The inspector reviewed NOD Manual Procedure NOD-36, Revision 5, dated 12/21/94 to determine the content and purpose of the program. The purpose of the program is to call attention to the CFR requirements which prohibit discrimination by FPC, its contractors, or sub-contractors against an employee for engaging in certain protected activities. This includes providing the NRC information about possible violations of requirements imposed by the Atomic Energy Act or the Energy Reorganization Act. It assures that employees have a process to express concerns or make suggestions without fear of retribution or discrimination. The program establishes a process for documenting, investigating, and resolving the concerns. Additionally, the program assures that exiting employees have an opportunity to identify concerns.

The program contains a confidentiality provision to protect the identity of the individual providing the concern. This protection is not absolute in that there are some circumstances under which the identity could be revealed. These include an order of the court, hearing board or similar legal entity. Also, an individual is considered to have waived the right to confidentiality if he/she acts in a manner reasonably expected to disclose his/her identity.

The program requires notification of the individual of the resolution of his/her concern. The program also allows the individual the right to appeal the resolution of the concern to the Director, Nuclear Operations Site Support for review of the concern and resolution to determine if further investigative action is necessary or desired.

The inspector discussed the program with the ECR and reviewed the records of the program including several concerns that were completed and others that were still active. This review indicated that in the past year, the program received 30 to 40 concerns. In 1995, the number had dropped to three to four concerns per year. The inspector discussed this decrease in activity with plant management and the ECR and concluded that the reason for this decrease was the implementation of the precursor card system. This system was implemented to allow the licensee to identify concerns prior to their rising to the level where a

problem report was required to be generated. The precursor cards are reviewed at the daily plan of the day meeting and are assigned to individuals for action. The cards are then tracked to closure. Both the licensee and the inspector concluded that this program was an enhancement of their corrective action program and that its widespread implementation should have reduced the number of employee concerns. The inspector concluded that the closed concerns had received proper attention and that the open concerns were still active with long term corrective actions in progress.

The inspector reviewed audits of the ECP conducted in December 1993 and July 1994. The audit results indicated that training of personnel on the ECP was effective. Seventy five percent of the individuals surveyed indicated the expected degree of familiarity with the program. Eighty percent of the individuals surveyed indicated an adequate understanding of management's expectation as to when an ECP form should be submitted. In general, the survey indicated that employees generally were pleased with the program and management's commitment to the program. The inspector randomly interviewed personnel while on site and arrived at essentially the same conclusions as the audit reports.

7. Disposition of Apparent Violations Identified in NRC Inspection Report 50-302/95-13

The inspection documented in NRC IR 50-302/95-13 identified apparent violations involving the adequacy of design control and corrective actions.

Apparent violation 50-302/95-13-02, example 1, described in paragraph 3 of IR 50-302/95-13, involved the failure to translate the design basis to ensure proper operation of the Makeup and Purification System, such that the system is automatically switched from its normal operating mode to the emergency operating mode (High Pressure Injection) and is capable of delivering water from the BWST into the reactor vessel, as an apparent violation of 10 CFR 50, Appendix B, Criterion III. This apparent violation is administratively closed and incorporated into apparent violation 50-302/95-22-04, example 1.

Apparent violation 95-13-02, examples 2 and 3, described in paragraph 4 of IR 50-302/95-13, involved the failure to meet the requirements of 10 CFR 50, Appendix B, Criterion III and XVI for the interim curves and the curves issued in Revision 13 to OP-103B. This apparent violation is administratively closed and incorporated into apparent violation 50-302/95-22-03, example 2.

Apparent violation 95-13-03, example 1, described in paragraph 5 of IR 50-302/95-13, involved the manual swapover from the BWST to the RB sump at a level of five feet or less in the BWST, which is insufficient to assure that all of the ECCS pumps would not be damaged by vortexing. This is an apparent violation of 10 CFR 50, Appendix B, Criterion III, Design Control for inadequate design assumptions for borated water

storage tank swapover level. This apparent violation is administratively closed and incorporated into apparent violation 50-302/95-22-04, example 2.

Apparent violation 95-13-03, example 2, described in paragraph 6 of IR 50-302/95-13, involved the failure to implement timely corrective action to review potential significant conditions adverse to quality involving safety related tanks, including the BWST and FST, which is a violation of the requirements of 10 CFR 50, Appendix B, Criterion XVI. This apparent violation is administratively closed and incorporated into apparent violation 50-302/95-22-03, example 3.

Apparent violation 95-13-03, example 3, described in paragraph 6 of IR 50-302/95-13, involved the failure to translate the design basis requirements of the FST into operating procedures which is a violation of 10 CFR 50, Appendix B, Criterion III. This apparent violation is administratively closed and incorporated into apparent violation 50-302/95-22-04, example 4.

Apparent violation, 95-13-04, described in paragraph 7 of IR 50-302/95-13, involved inadequate design control to ensure adequate inventory in the RB sump to provide adequate NPSH to a LPI pump, with the HPI pump suction crosstie valve open, supplying two operating HPI pumps. This lineup could result in the loss of the only operable LPI pump. This was identified as an apparent violation of 10 CFR 50, Appendix B, Criterion III, Design Control. This apparent violation is administratively closed and incorporated into apparent violation 50-302/95-22-04, example 3.

8. Exit Interview

The inspection scope and findings were summarized on December 15, 1995, with those persons indicated in paragraph 1. The inspectors described the areas inspected and discussed in detail the inspection results listed below. Proprietary information is not contained in this report.

Type	Item Number	Status	Description and Reference
EEI	95-22-01	Open	Nine examples of operation of the makeup tank outside of acceptable operating region. (paragraph 2.1)
EEI	95-22-02	Open	Two examples of unauthorized tests / experiments during which the plant was operated in a nonconservative manner outside the acceptable operating region without a safety evaluation. (paragraph 2.1)

EEI	95-22-03	Open	Three examples of inadequate corrective action concerning inadequate revision to curve 8, inadequate reviews, inadequate tank volumes. (paragraph 3.1)
EEI	95-22-04	Open	Four examples of inadequate design control concerning Curve 8, various setpoints, and tank volumes. (paragraph 3.1)
EEI	95-13-01	Closed	Item closed by incorporating the example into 95-22-02.
EEI	95-13-02	Closed	Item closed by incorporating the examples into 95-22-03 and 04.
EEI	95-13-03	Closed	Item closed by incorporating the examples into 95-22-03 and 04.
EEI	95-13-04	Closed	Item closed by incorporating the example into 95-22-04.

8. Acronyms and Initialisms

BWST	Borated Water Storage Tank
DH	Decay Heat
ECCS	Emergency Core Cooling System
ECP	Employee Concern Program
ECR	Employee Concern Representative
EFW	Emergency Feedwater
EOP	Emergency Operating Procedure
FPC	Florida Power Corporation
FSAR	Final Safety Analysis Report
HPI	High Pressure Injection
LOCA	Loss Of Coolant Accident
MAR	Modification Action Request
MUP	Make Up Pump
MUT	Make Up Tank
NOD	Nuclear Operations Department
NPSH	Net Positive Suction Head
PR	Problem Report
RB	Reactor Building
RCBT	Reactor Coolant Bleed Tank
RCS	Reactor Coolant System
REA	Request for Engineering Assistance
RO	Reactor Operator
SRO	Senior Reactor Operator