SAFETY EVALUATION REPORT
OVERPRESSURE MITIGATING SYSTEM
CRYSTAL RIVER UNIT 3

1.0 INTRODUCTION

By letter dated December 2, 1976, (Reference 1) Florida Power Corporation (FPC) submitted to the NRC a plant-specific analysis in support of the reactor vessel overpressure mitigating system (OMS) for Crystal River Unit 3 Nuclear Power Station (CR-3). The analysis was supplemented by letter dated February 17, 1979 (Reference 2) and other documentation submitted by FPC (References 3, 4, 5). FPC has installed the equipment and incorporated the procedures described in this report.

Our review of the information submitted by FPC in support of the proposed overpressure mitigating system is complete and has found that the system provides adequate protection from overpressure transients. A safety evaluation follows.

2.0 EVALUATION

The enclosed Technical Evaluation Report was prepared for us by EG&G, Idaho, Inc., as part of our DOR technical assistance program.

3.0 SYSTEM DESCRIPTION

The OMS consists of both active and passive subsystems. The active subsystem is simply the modification of the actuation circuitry of the existing electrical pilot actuated relief valve (PARV) to provide dual setpoints, a normal operation setpoint of 2255 psig and a low pressure setpoint of 550 psig. The low pressure setpoint is employed when the reactor coolant system is below 280°F. This system is manually enabled. An alarm will function should the operator fail to enable the system when the temperature drops below 280°F. An alarm has also been installed to monitor the position of the pressurizer relief block valve, RC-V2. This alarm indicates over-pressurization mitigating system not enabled. The passive subsystem consists of the introduction of a nitrogen blanket in the pressurizer. The reactor is operated during heatup and cooldown with a steam or nitrogen bubble. The bubble functions as a pressure damperer. This subsystem is actually the original B&W design. In addition to the existing design and the above design features, we recommend that the licensee implement the changes described in Section 5 of this evaluation.

4.0 PROCEDURES

A number of provisions for prevention of pressure transients are incorporated in the plant operating procedures. These are discussed in the RSB safety evaluation report. However, those procedures that affect the instrument and power systems are described below:

(a) The OMS is to be manually enabled when the reactor coolant system temperature is less than 280°F. An alarm will sound if the operator fails to enable the system at this temperature. This requirement is to be incorporated in the plant Technical Specifi cations. An alarm will also be actuated if the operator fails to open or close the PARV isolation valve and the RCS temperature is below 280°F.

(b) The plant is to be operated with a steam or nitrogen blanket in the pressurizer during plant cooldowns and heatups. The initial pressurizer water level is to be less than or equal to the high level alarm at system pressures above 100 psig and less than the high level alarm for pressures less than or equal to 100 psig. At least two channels of level instrumentation will be required to be operable when overpressure protection is required.

(c) The makeup tank water level is to be less than the high level alarm. Level instrumentation as required for (b) above.

(d) A Core Flood Tank is provided. Discharge valves are to be closed and circuit breakers for the motor operators "racked out" during plant cooldown prior to reaching 280°F system temperature. Power to these valves is also alarmed.

(e) Testing of HPI pumps during shutdown will only be performed with the vessel head removed.

Each of the items, (a) through (e) above, where operator dependence upon instrumentation and alarm indications to assure the overpressurization analysis assumptions have been complied with will be tested and calibrated in accordance with the requirements of the technical specification.

We find that the procedural and administrative controls described are acceptable.

5.0 CONCLUSIONS

The Florida Power Corporation's proposal for a low temperature overpressure mitigation system for Crystal River Unit 3 does not fully meet all of our criteria in the areas of electrical, instrumentation, and controls. It fails to meet the criteria on the basis that (a) operator action will be required within ten minutes after detection of one specific transient (HP safety injection), (b) the system does not have redundant channels and may be susceptable to a single failure, and (c) the system does not satisfy the IEEE Std-279 and seismic requirements.

Although the CR-3 plant does not comply with all of our overpressure criteria, there are other factors which we considered to be compensatory. The criteria for an OMS were originated for PWR's that may be operated with the RCS in a water solid condition during cooldown and startup. The B&W designed plant never operates with a water solid condition. A steam or nitrogen bubble is maintained in the reactor pressurizer at all times.

Of the 44 overpressure transients to date, there has been only one low temperature overpressure transient at B&W designed plants.

In order that the OMS be found acceptable in the areas of EI&C, it is recommended that the following additional changes be made by the licensees at the next refueling outage.

1. Pressure alarms should be installed to give the operator direct indication that a low temperature pressure transient is in progress and that the RCS pressure is on a trend to exceeding the 550 psig relief setpoint.

2. The RCS pressure and temperature should be continuously recorded to provide a permanent record of all low temperature pressure transients. The recorder should have the capability to record 100 psig per second overpressure transients.

Based on the above, we find the Crystal River Unit 3 overpressure mitigating system acceptable in the EI&C area as a long term solution to the problem of overpressure transients.

6.0 REFERENCES

1. J. T. Rodgers "Interim Response to Overpressurization at Shutdown Conditions," December 2, 1976, FPC letter.

2. J. T. Rodgers, "Response to NRC Request for Additional Information," February 17, 1977, FPC letter.

3. J. T. Rodgers, Status report to John Stolz, NRC, June 3, 1977, FPC letter.

4. W. P. Stuart, "Response to NRC Request for Additional Information," January 5, 1978, FPC letter.

5. W. P. Stuart, "Technical Specification Change Request No. 17," January 23, 1978, FPC letter.

6. "Staff Discussion of Fifteen Technical Issues Listed in Attachment G, November 3, 1976 Memorandum from Director NRR to NRR Staff, NUREG-0138, November 1976.

7. J. F. Stolz, "Verification for Compliance with Appendix G Pressure-Temperature Limits During Startup and Shutdown," NRC letter, October 1, 1976.

8. J. F. Stolz, NRC letter to FPC in regard to overpressure protection system, NRC letter, November 19, 1976.

9. J. F. Stolz, "Verification for Compliance with Appendix G Pressure-Temperature Limits During Startup and Shutdown" (Crystal River Unit 3 Nuclear Generating Plant), NRC letter, January 7, 1977.

10. R. W. Reid, NRC letter to FPC in regard to overpressure protection system, November 11, 1977.

11. J. G. Herbein, "Overpressure Protection System," January 13, 1978, Met-Ed letter GQL 0048.