UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SAFETY EVALUATION

HOPE CREEK GENERATING STATION

POWER ASCENSION TEST PROGRAM ACCELERATION

This safety evaluation describes the staff's review of a number of Hope Creek Generating Station - Power Ascension Program (PAP) test modifications proposed by Public Service Electric and Gas Company (PSE&G). These proposed test modifications were submitted for staff review as part of a program to accelerate power ascension testing for Hope Creek. Hope Creek is also the lead plant for generic changes for acceleration of the traditional General Electric Boiling Water Reactor power ascension test program.

The proposed test modifications discussed in this safety evaluation were submitted by letters dated August 21, October 4 and 17, November 6 and December 9, 1985. This safety evaluation discusses the following tests:

1. Test No. 24 - Relief Valves
2. Test No. 28E - Recirculation System Cavitation
3. Test No. 31 - Drywell Piping Vibration
4. Test No. 25 - Turbine Trip and Generator Load Rejection
5. Test No. 28D - Recirculation Pump Runback Test
6. Test No. 3 - Elimination of Fuel Chambers During Fuel Loading
7. Test No. 11 - Process Computer Test Simplification
8. Test No. 16 - TIP Uncertainty
9. Test No. 1 - Chemical Radiochemical Test Simplification
10. Test No. 32 - Reactor Water Cleanup System
11. Test No. 28B - Two Pump Recirculation Pump Trip Test

Discussion of the above tests follows:

1. TEST NO. 24 - RELIEF VALVES

The purpose of Test number 24 - Relief Valves, is to demonstrate the operability of the relief valves, i.e., that they can be opened and closed manually, that they reseat properly, and that there are no blockages in the relief valve piping. This testing is currently planned to be performed at low (250-500 psig) pressure during heatup and at rated reactor pressure between Test Conditions 2 and 3. By letter dated October 17, 1985, the applicant proposed to delete the operability test at low pressure and between Test Conditions 2 and 3. Alternatively, the applicant proposed verifying operability between 10% and 20% power at Test Condition 1.

The Hope Creek Safety Relief Valves (SRVs) are manufactured by Target Rock Corporation. Actuation of the relief valves at low pressure has been identified as a contributor to valve seat damage caused by the valves' reseating against abnormally low pressure. Therefore, operation of the valves at low pressure should be avoided whenever possible. Furthermore, from an operational point of view, conducting the test at a steam flow greater than the capacity of a

relief valve (typically 5-7%) will significantly enhance plant pressure control during the transient. Finally, protection from the effects of overpressure transients which may occur prior to relief valve operability testing will be assured through compliance with Technical Specification 4.5.1.d which requires that all automatic depressurization system (ADS) valves be manually opened within twelve hours of reaching a steam dome pressure of 100 psig. The ADS valves by themselves provide sufficient relief capacity to mitigate the relatively mild overpressure transients which could occur at less than 20% power. For the reasons stated above, the proposed change to test the SRVs at Test Condition 1 is acceptable.

2. TEST NO. 28E - RECIRCULATION SYSTEM CAVITATION

Test Number 28E, Recirculation System Cavitation, verifies that no recirculation system cavitation will occur in the operable region of the power-flow map. Currently, this test is planned to be performed at Test Condition 3 by lowering power at high recirculation flow until a recirculation pump runback occurs, or the plant is at approximately 18% power and no runback has occurred, or there is indication of cavitation. By letter dated October 17, 1985, the applicant proposed that the testing be simplified by temporarily bypassing the cavitation interlock to prevent runback of the recirculation pumps.

Acceptable response of the system near the cavitation region is determined by analyzing test data and comparing to acceptance criteria which define the required system performance. For the recirculation system cavitation test, the recirculation runback logic is required to be demonstrated to have settings adequate to prevent operation in areas of potential cavitation. This may be demonstrated without requiring that recirculation runback occur by temporarily bypassing the runback logic during the test. Power can then be reduced by inserting control rods when cavitation is indicated. The cavitation interlock logic can be monitored to ensure that it is actuated at the correct setpoint.

With appropriate placement of the jumper on the cavitation interlock, no other recirculation pump runback logic feature will be affected. In addition, should a feedwater transient occur during the performance of this test, the operators can manually run back recirculation pump speed as necessary to prevent cavitation.

Cavitation interlock setpoints are designed to allow maximum operation in the power-flow map but are conservatively set to assure that no recirculation system cavitation occurs. The proposed simplified testing will verify that cavitation does not occur at or above the cavitation interlock setpoint while eliminating unnecessary core flow reductions during the test. Similar testing simplification was used at Limerick and Susquehanna. The proposed change to the Recirculation System Cavitation test is acceptable.

3. TEST NO. 31 - DRYWELL PIPING VIBRATION

Test Number 31 was intended to evaluate the dynamic response of the main steam and recirculation piping to various transients in terms of vibrational characteristics and dynamic deflection. By letter dated October 17, 1985, the applicant proposed eliminating two of these transients from this test series. These transients are the recirculation pump trips and restarts. The applicant's justification for eliminating these tests is that previous startup results on similar plants indicate that vibration and deflection measurements of recirculation piping during recirculation pump trips and restarts are always well below the prescribed limits. As part of this justification, the applicant submitted a quantitative comparison of recirculation piping system parameters on Hope Creek and Susquehanna Unit 1. Table 2 in the applicant's October 17, 1985, letter shows that these parameters are almost identical. In addition, Table 1 of the applicant's letter shows that measured vibrations for the recirculation pump trip/restart transients on Susquehanna Unit 1 were well below the allowable.

The basic objective of all piping preoperational testing is to confirm the as-built condition of piping systems in each plant. Although the design of such systems may be identical from plant to plant, fabrication, installation, inspection and quality assurance of the piping and the pump could introduce differences or defects which may affect the dynamic characteristics of the piping systems. Therefore, the staff's position is that all of the preoperational piping tests which the applicant, in the FSAR, agreed to conduct shall be completed and that the proposed modifications to these tests are not acceptable.

4. TEST NO. 25 - TURBINE TRIP AND GENERATOR LOAD REJECTION

By letter dated August 21, 1985, the applicant proposed a) changing the generator load rejection test at Test Condition 2 to a turbine trip test and b) deleting the turbine trip test at Test Condition 3.

The staff finds these proposed changes acceptable. Regarding changing the generator load rejection test at Test Condition 2 to a turbine trip test at Test Condition 2, the staff notes that the purpose of this test segment, namely to test turbine bypass system performance, can be accomplished by either a turbine trip test or a generator load rejection test. Accordingly, this modification is acceptable. Regarding deleting the turbine trip test at Test Condition 3, the applicant indicates that performing the already planned turbine generator full load rejection test at 100% power required by Regulatory Guide 1.68 is more bounding with respect to severity than the turbine trip test at Test Condition 3. The applicant provided comparative date for these two tests for five boiling water reactors to support that position.

The staff has reviewed the evaluation and supporting data and agrees with the applicant that the regulatory guidance outlined in Regulatory Guide 1.68, Revision 2, related to plant testing involving the turbine generator is satisfied by performing a full load rejection/turbine trip test at Test Condition 6 (100% power). Therefore, the staff finds it acceptable to delete the turbine trip test at Test Condition 3.

5. TEST NO. 28D - RECIRCULATION PUMP RUNBACK TEST

By letter dated October 4, 1985, the applicant requested that the recirculation pump runback test, currently planned as a separate test at Test Condition 3, be combined with the feedwater pump trip test at Test Condition 6.

The staff finds this change acceptable for the following reasons. The recirculation pump runback feature is included in the design to avoid unnecessary scrams due to low water level when a feedwater pump inadvertently trips. When performed at Test Condition 3, the runback is initiated by a simulated feedwater pump trip signal. If performed at Test Condition 6 as part of the feedwater pump trip test, demonstration of the runback circuit would be obtained as an actual integrated test. Therefore, some testing advantage is obtained without compromising any safety objectives.

6. TEST NO. 3 - ELIMINATION OF FUEL LOADING CHAMBERS DURING FUEL LOADING

By letter dated December 9, 1985, the applicant proposed simplifying the fuel loading procedure by replacing the fuel loading chambers (FLCs) with source range monitor (SRM) instrumentation. Additionally, the startup sources will be positioned in their alternate locations (to be closer to the SRMs) and the fuel loading sequence will be modified such that initial fuel loading will begin between an SRM detector and a neutron source. Fuel will be loaded in a spiral pattern around the SRM until the core is fully loaded.

Test No. 3 is conducted in the fuel loading phase of initial operations. It has usually been necessary in past fuel loadings to use FLCs in addition to SRM detectors to achieve Technical Specification required count rates with fuel in the core. A number of utilities have, in the past, requested and been granted reload fuel loading operations in which a small number of fuel assemblies are loaded before the usual required count rate on SRMs or FLCs are achieved. This initial loading is sufficient to provide the needed count rate. Additionally, the permitted (small) number of assemblies can not become critical, even with all control rods removed.

The proposed modifications to Hope Creek Test No. 3 are to permit the loading of 16 assemblies without (necessarily) meeting the usual required 0.7 counts/sec for the SRMs or FLCs. This is based on analysis (by General Electric) which shows that this array would not be critical (with rods out) and would provide the necessary count rate. This change would make it unnecessary to use FLCs, which interfere with operations, and would permit the use of the standard SRMs alone. The procedure places the sources in alternate locations, close to an SRM and uses a spiral loading pattern around the initial source-SRM and 16 assembly locations rather than around the core center.

These procedures are compatible with a number of previously approved reload procedures. The criticality calculations are done with standard methodology. They are consistent with other analyses reviewed in this area. Tests on other reactor startups indicate that required count rates should be achieved. The Technical Specifications will require (after loading 16 assemblies) the usual count rate on at least one SRM (the SRM near the initial loading). The other SRMs will be checked with a source, as has been approved for other reactors, until they reach a suitable count rate.

The staff notes that the Technical Specifications should be revised to specify that one of the operable SRMs must be in an area that has fuel loaded around it on one side. Specifically, we require that two SRMs be operable and continuously indicating in the control room. One of the SRMs will be in the quadrant where fuel is being loaded and the other will be in an adjacent quadrant. One of these two SRMs will be in an area in which fuel has been loaded. The minimum count rate must be met for at least one of the SRMs. With this additional requirement, the applicant's proposal is acceptable.

7. TEST NO. 11 - PROCESS COMPUTER TEST SIMPLIFICATION

By letter dated November 6, 1985, the applicant proposed simplifying Test No. 11. Test No. 11 involves the testing of the Process Computer and its programs. OD-11 is one of these programs and deals with the area of fuel pellet-clad interaction monitoring (Preconditioning Interim Operating Management Recommendations, (PCIOMR)). The program assists in implementing PCIOMR to prevent this type of fuel failure mechanism during operation. However, with barrier fuel (as used at Hope Creek), General Electric Company (GE) (the fuel facricator) has removed the PCIOMR procedures from the operation plans since they are no longer needed. Accordingly, the applicant has proposed the removal of the OD-11 test from the startup program. Our review has indicated that there is no need for PCIOMR monitoring for this fuel. The removal of OD-11 monitoring is acceptable.

8. TEST NO. 16 - TIP UNCERTAINTY

By letter dated November 6, 1985, the applicant proposed deleting Test No. 16 from the power ascension program. Test No. 16 measures the Traversing Incore Probe (TIP) uncertainty. The uncertainty is composed of geometry effects and random noise. These are determined by comparing symmetric pairs of TIP readings and repeated traverses of common TIP tubes. The criterion for first cycle TIP uncertainty tests is that uncertainty should be less than 6 percent. This is the value which, if used in the uncertainty analyses for GETAB (rather than the 2.6 percent value normally used in first cycle), would increase the power density value sufficiently to increase the safety limit minimum critical power ratio (MCPR) by 0.01. Previous tests in other reactors (including LaSalle 1 and Susquehanna 1) have always provided a TIP uncertainty well below 6 percent. Furthermore, the uncertainty is lower when using the recently introduced TIP gamma detector rather than the usual neutron detector since the gamma system is less sensitive to geometry errors. For these reasons, the applicant has proposed deleting this test.

TIP operability is determined in preoperational testing and during power ascension power distribution measurements and tests of the Process Computer. Previous tests in other reactors have indicated no problem in the TIP uncertainty area, and the gamma detectors to be used have lower uncertainty parameters. The Hope Creek system should be well below the criteria. The safe operation of the plant will not be affected by deleting this test. Accordingly, the proposed deletion of Test No. 16 is acceptable.

9. TEST NO. 1 - CHEMICAL RADIOCHEMICAL TEST SIMPLIFICATION

By letter dated December 9, 1985, the applicant proposed to substitute plant surveillance procedures for the chemistry and radiochemistry monitoring requirements. Additionally, the applicant proposed deleting the integrated performance testing of the reactor water cleanup system (RWCU) and condensate demineralizer system at Test Condition 3.

The purpose of Test No. 1 is to demonstrate that the plant water chemistry and radiochemistry are within limits during the power ascension test program and also to demonstrate the design capability of the plant chemistry system. It is proposed by the applicant to substitute the plant surveillance procedure CH-TI.ZZ-012(Q), Chemistry Sampling and Surveillance Procedure, for the chemistry and radiochemistry monitoring requirements of Test No. 1. This surveillance procedure, based on BWR Water Chemistry Guidelines (BWR Owners Group/EPRI report dated April 1, 1984), is used to ensure that plant water chemistry meets fuel warranty limits. The improved water chemistry can enhance fuel performance and minimize radiation field buildup on out-of-core surfaces. The surveillance procedure insures that plant water chemistry meets the limits specified by Technical Specification 3.4.4 and the General Electric fuel warranty. The surveillance procedure limits are at least as restrictive as those of Test No. 1. Since the surveillance procedure will be used during normal operation it would be prudent to also use this procedure during power ascension testing. It is therefore acceptable to substitute the plant surveillance procedure CH-TI-ZZ012(Q) for Test No. 1, Chemical and Radiochemical, for monitoring plant water chemistry and radiochemistry during power ascension testing. Although this substitution is acceptable, we encourage the applicant to review the results of the surveillance with the same management attention which would have been given the review of the startup test.

In Test No. 1, the RWCU and condensate demineralizer systems are performance tested to demonstrate that they meet design specifications at Test Conditions 3 (low power) and 6 (rated power/flow). Performance testing the RWCU and condensate demineralizer systems at full power and flow, Test Condition 6, will demonstrate the ability of these systems to adequately control coolant chemistry at the most demanding plant operating condition. Performance testing at a lower power, Test Condition 3, can verify procedures and provide preliminary data, but is not required to demonstrate meeting design specifications. Therefore, it is acceptable to delete the RWCU and condensate demineralizer systems integrated performance testing requirement of Test No. 1 at Test Condition 3 as proposed by the applicant.

10. TEST NO. 32 - REACTOR WATER CLEANUP SYSTEM

By letter dated, October 17, 1985, the applicant proposed modifying Test No. 32 - Reactor Water Cleanup System. The purpose of Test No. 32, is to demonstrate the operability of reactor coolant system purification and cleanup systems during low power testing. It is proposed by the applicant to a) delete the RWCU non-regenerative heat exchanger (NRHX) flow test in the blowdown mode, b) delete the bottom head flow rate calibration from the power ascension test program, c) perform the reactor water cleanup system (RWCU) pump net positive

suction head (NPSH) test under cold conditions during preoperational testing, and d) perform the non-regenerative heat exchanger (NRHX) flow test in the normal mode during Test Condition 1 instead of during Test Condition Heatup. The RWCU system temperature and flow measurements will be obtained during the normal operating mode to demonstrate the heat exchange capability of the NRHX. However, during the blowdown mode, the regenerative heat exchanger capacity is decreased as a result of partially bypassing a portion of the reactor coolant system return flow to the main condenser or radwaste system. This could automatically isolate the RWCU system on NRHX high outlet temperature. RWCU isolation is not desirable during heatup when water chemistry is critical and when excess reactor coolant needs to be discharged. Therefore, the RWCU NRHX flow test in the blowdown mode should remain in Test No. 32.

The applicant proposed that the bottom head flow rate calibration be performed after completion of power ascension testing. This test is not critical to demonstrating the performance of the RWCU system. Therefore, it is acceptable to delete the bottom head flow calibration from Test No. 32 and postpone it until after completion of power ascension testing.

The applicant proposed to determine RWCU pump NPSH during preoperational testing under cold conditions. Calculations can be performed to extrapolate NPSH from preoperational cold conditions to operational conditions to demonstrate compliance with acceptance criteria. Therefore, it is acceptable to determine RWCU pump NPSH during preoperational testing.

The applicant proposed to perform the RWCU flow test for the NRHX at Test Condition 1 instead of at Test Condition Heatup. RWCU operation in the blowdown mode is important during heatup since during this phase, part of the reactor coolant will be bypassed to the main condenser or radwaste system. Therefore, the RWCU flow test for the NRHX should remain in Test Condition Heatup in Test No. 32. The applicant's proposal is not acceptable.

11. <u>TEST NO. 28B - TWO PUMP RECIRCULATION PUMP TRIP TEST</u>

By letter dated October 4, 1985, the applicant requested deleting the two pump trip and flow coastdown at Test Condition 3 and using the data obtained on the integrated systems Generator Load Rejection Test at Test Condition 6 to obtain the two pump trip and flow coastdown data to satisfy Regulatory Guide 1.68, Revision 2. The staff found this change to be unacceptable for the following reason. By letter dated August 21, 1985, the applicant requested to delete the turbine trip test at Test Condition 3 (see Test No. 25 - Turbine Trip and Generator Load Rejection, Item 4 in this safety evaluation). The turbine trip test deletion at Test Condition 3 was found acceptable based, in part, on the implicit condition that safety and accident mitigation features were tested before full power was attained. Explicitly, this conclusion was based, in part, on the fact that the two recirculation pump trip and flow coastdown would be performed at Test Condition 3 prior to the load rejection test at full power. Therefore, the two pump trip and flow coastdown should be performed at Test Condition 3 to test this accident mitigation feature before full power is attained.