TECHNICAL EVALUATION REPORT

Pump and Valve Inservice Testing Prog:am
Farley Nuclear Power Plant, Units 1 :nd 2
Southern Nuclear Operating Com:an:

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ABSTRACT

This report presents the results of Brookhaven National Laboratory's evaluation of Joseph M. Farley Nuclear Plant Pump and Valve Inservice Testing Program relief requests.

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Pump and Valve Inservice Testing Program
Farley Nuclear Plant

1. INTRODUCTION

Contained herein is a technical evaluation of ASME Section XI pump and valve inservice testing (IST) program relief requests submitted by the Southern Nuclear Operating Company (formerly the Alabama Power Company) for its Joseph M. Farley Nuclear Plant, Units 1 and 2. The Farley Units are Westinghouse Pressurized Water Reactors (PWRs) that began commercial operation in 1977 and 1981.

Alabama Power Company (APCO) submitted revision 4 for Unit 1 and revision 2 for Unit 2 of the Pump and Valve Inservice Testing Program August 20, 1990. This program addresses the second interval, which ends December 1, 1997 for both units, and complies with the 1983 Edition through Summer 1983 Addenda of the ASME Section XI Code. The NRC reviewed this program and issued a Safety Evaluation (SE) May 23, 1991. The Safety Evaluation denied relief for testing the service water pumps, the diesel generator fuel oil transfer pumps, and the safety injection check valves, and granted provisional relief for many pumps and valves. APCO submitted revision 5 for Unit 1 and Revision 3 for Unit 2 on July 26 and 29, 1991, respectively, which incorporated commitments related to Generic Letter 90-06 and other technical and editorial changes. These revisions added two new relief requests to the program and revised a number of previously submitted requests. On December 3, 1991, APCO submitted their response to the SE and requested a meeting with the NRC to discuss the impracticality of the requirements discussed in the SE. As a result of the December 16, 1991 meeting with the NRC, the licensee submitted six revised relief requests for Unit 1 and 7 for Unit 2, one revised cold shutdown justification for each unit, and two previously submitted relief requests for each unit on December 30, 1991. The NRC performed a preliminary review of the July 26, 1991, July 29, 199 and December 30, 1991 submittals and granted interim relief in a letter dated February 14, 1992, until the NRC and their contractors could perform a final, in-depth evaluation. The NRC's February 14, 1992 letter also requested additional information concerning the service water pumps. The licensee provided this information on April 10, 1992 and also submitted a revised request concerning the instrument air system. This Technical Evaluation Report evaluates the relief requests and supporting information submitted July 26, July 29, December 3, and December 30, 1991, and April 10, 1992.

The Code of Federal Regulations, 10CFR50.55a(g) requires that inservice testing of ASME Code Class 1, 2, and 3 pumps and valves be performed in accordance with Section XI of the ASME Boiler and Pressure Vessel Code and applicable addenda, except where specific relief has been requested by the licensee and granted by the commission pursuant to 10CFR50.55a(a)(3)(i), (a)(3)(ii), or (g)(6)(i).

The Southern Nuclear Operating Company has requested relief from certain ASME Section XI testing requirements. This review was performed utilizing the Standard Review Plan, Section 3.9.6; Generic Letter No. 89-04, "Guidance on Developing Acceptable Inservice Testing Programs"; and the Minutes of the Public Meeting on Generic Letter 89-04, dated October 25,

1989. The IST Program requirements apply only to component testing (i.e., pumps and valves) and are not intended to provide a basis to change the licensee's current Technical Specifications for system test requirements.

Section 2 of this report presents one pump relief request and Brookhaven National Laboratory's (BNL) evaluation. Similar information is presented in Section 3 for the nine relief requests for the valve testing program. A review of the one valve cold shutdown justification was performed and details of this review are contained in Section 4.

Section 5 summarizes the actions required of the licensee resulting from the relief request evaluations. The licensee should resolve these items in accordance with the evaluations, conclusions, and guidelines presented in this report.

2. PUMP IST PROGRAM RELIEF REQUESTS

In accordance with 10CFR50.55a, the Southern Nuclear Operating Company has submitted a relief request for the service water pumps at the Farley Nuclear Plant which are subject to inservice testing under the requirements of ASME Section XI. This relief request has been reviewed to verify its technical basis and determine its acceptability. The relief request, along with the technical evaluation by the BNL reviewer, is summarized below.

2.1 Relief Request PR-10, Service Water Pumps

Relief Request: The licensee has requested relief from the individual pump tests quarterly in accordance with ASME Section XI, paragraphs IWP-3100,3110, and 3400, for service water pumps P001A-A, P001B-A, P001C-AB, P001D-B, and P001E-B. The request evaluated was submitted on Dec. 30, 1991.

Proposed Alternate Testing: The licensee proposes to perform quarterly combined flow, inlet pressure, differential pressure and vibration tests. These will be compared to reference values. Individual pump evaluations, consisting of performing three two-pump combination tests at a reference differential pressure, and solving analytical equations for individual flows, will be performed whenever combined flow measurements are not in the acceptable range, and three pumps are available to support the testing. Corrective action will be taken on the individual pumps as a result of the evaluation in accordance with IWP-3230.

Licensee's Basis for Requesting Relief: The licensee states: "The Service Water System is designed so that during normal operation there are two pumps in each of the two trains operating, with a standby pump available to swing to either train. Each pump has pressure gages, however flow instrumentation is installed only to measure the flow from each of the two trains.

Since flow instrumentation was not provided during construction for each pump, the only viable means of individually testing these pumps is by removal of one pump from service and measuring flow through the train with only one pump aligned. However, a flow of 32,186 gpm, which requires four pumps (or both trains operable) is required for normal operation per the FSAR. A condition where only one pump is aligned at a time to a train would result in degraded cooling water flow to essential or safety related equipment and is therefore an unacceptable method of operation. Furthermore, removal of one pump from the service water train could lead to an isolation of the turbine building service water supply lines causing a plant trip.

Since hydraulic performance of a degraded pump may be masked by the other pump when service water pumps are tested in pairs, FNP has developed analytical methods which can be used to determine individual pump flow rate. These analytical methods involve solving three equations involving dual pump flows for three individual pump flow rates. These analytical methods have proven reliable in determining individual pump degradation when the other pump in combination is compensating for the degraded pump."

Evaluation: A request for relief for these service water pumps was previously evaluated in the May 23, 1991 SE. Provisional relief was granted allowing the licensee to evaluate differential pressure and flow rate using pump curves, but relief permitting testing the pumps in pairs was denied. The licensee responded to the SE on Dec. 3, 1991, and stated the provisions were impractical, and proposed alternate testing and interim actions pending resolution of this issue. The licensee proposed testing the Service Water pumps in parallel quarterly, with individual pump tests conducted during refueling outages when plant conditions permit single pump operation. If the quarterly testing results exceeded the Acceptable Range, analytical evaluations would be performed to determine individual pump performance and to determine corrective action. Based on agreements and resolutions reached at a meeting between the NRC and the licensee, this relief request was revised and resubmitted on Dec. 30, 1991. This revised relief request does not include individual pump testing during refueling outages.

To facilitate the review of the revised relief request, the NRC requested the following additional information from the licensee on Feb. 14, 1992:

1. Provide justification for not individually flow testing the service water pumps during cold shutdowns and refueling outages, when plant conditions permit operation of a single pump.

2. Address the feasibility of using a non-intrusive diagnostic method of flow measurement for each service water pump when plant conditions do not permit operation of a single pump.

3. Quantify the extent to which the hydraulic performance of a degraded pump may be masked by the other pump when the service water pumps are tested in pairs. Take into consideration the effects of the accuracy of the flow instrument used to measure the combined flow and where the pumps are operating relative to the pump curves.

The licensee responded to these items on April 10, 1992, and provided the following information:

1. "Cold shutdowns are normally of insufficient duration to perform individual testing of the service water pumps. Testing of the pumps at refueling is possible; however, the data provided would not be meaningful in trending degradation of the pumps. The individual pump flow reference value required by the ASME Code could only be set during refueling. Subsequently, only like tests performed

every 18 months at refueling could be compared to this reference value to detect degradation. At present, service water pumps are overhauled every five years due to service conditions. This overhaul necessitates the setting of a new baseline in accordance with IWP-3111. Since this overhaul occurs every five years, the maximum number of tests that could be compared to this baseline would be three tests before another overhaul took place. Since three points are required as a minimum to determine a statistical trend, by the time degradation is noted by this test, corrective action will already be required due to pump maintenance schedules."

2. "Nonintrusive diagnostic flow measuring devices require that the transducers be mounted in areas where the flow profile is well developed. In general this requires a straight run of pipe at least 4 or 5 pipe diameters from the nearest flow restricting device. Since the discharge pipe on the service water pumps is 20 in. in diameter, a straight run of at least 6 ft. past the discharge butterfly valve is required to install the measuring device correctly. On the discharge of a service water pump, the following components are in series: an expansion joint, two inches of pipe, a discharge check valve, and a butterfly valve. After the butterfly valve there is only about 3 feet of straight run pipe where a flow measuring device could be installed. Therefore it is not feasible to install a nonintrusive diagnostic flow measuring device that could measure flow accurately."

3. "Flow reference values are set taking into account instrument accuracies as specified by Table IWP-4110-1, and the requirement that all reference values be set when the equipment is operating acceptably. All reference values shall also insure that the pump is capable of performing its safety related function. The safety related function of a service water pump is defined in the FSAR in terms of two pumps in operation per train. The reference points are set based on empirical data, at values sufficiently above those required for accident flow such that instrument accuracies are bounded.

   In order to prevent masking of a pump which has been in service for a period of time by a recently overhauled pump, a new baseline is set for the overhauled pump. After overhaul on a particular pump, a flow test is performed to determine the new baseline. This new baseline is based on actual test data as required by IWP-3110, and therefore increased pump performance is included in the new baseline. Degradation is then trended from that point.

   To take into consideration where the pumps are operating relative to the pump curves, FNP sets all flow reference values while maintaining the individual pumps at the same differential pressure. The tolerance on this differential pressure is ± 1 psig (or about 1.2%). Since all the service water pumps are held at the same differential pressure, all the pumps are maintained at the same point on their centrifugal pump curves. By maintaining all differential pressures at the same point, an individual pump flow analysis may be performed. Since all pumps are tested at the same differential pressure, this individual analysis will detect any masking that may be occurring."

The purpose of pump testing per Section XI, is to allow for the performance of corrective maintenance before a individual pump degrades, and is unable to perform its safety function. However, as described above, it is not possible to monitor individual pump flow during normal plant operations due to system design and operating restrictions.

The proposed alternate plan consists of monitoring quarterly combined flow, inlet pressure, differential pressure,and vibration, and comparing them to reference values in accordance with IWP-3110. In the event the combined flow measurements are not in the acceptable range, the licensee proposes to perform individual pump evaluations. This consists of performing three two-pump combination tests at a reference differential pressure, and solving analytical equations for individual flows when three pumps are available to support the testing. The proposed analytical methods will not provide individual pump data if a third pump is unavailable. The licensee should address the corrective actions which will be required in the event of this occurrence. Reference values for all possible pump combinations should be established in accordance with IWP-3110, and reconfirmed following any pump overhaul or replacement in accordance with IWP-3111. This proposed plan will provide reasonable assurance of the pump combinations' ability to perform their design function provided each of the five pumps is tested in at least one combination quarterly.

The licensee has not provided adequate justification for not also performing individual pump surveillance during refueling outages and those cold shutdowns which are long enough to permit single pump operation. Monitoring individual pump performance attributes during refueling outages and cold shutdowns, in accordance with IWP-3110, and comparing them to reference values established under single pump operating conditions, is the most accurate way to obtain individual pump data given the system design limitations. Individual pump flow measurements are necessary to adequately assess the hydraulic condition of the service water pumps, even though they are normally operating. Without these measurements, degrading conditions of individual pumps could remain undetected, even when total system flow is monitored. Statistical data trending is not required by the Code to determine pump operational readiness. One value in the required action range is sufficient to indicate a problem requiring the licensee to take corrective action. Individual pump tests at cold shutdowns and refueling outages will provide adequate data for determining impaired operational readiness. Additionally, NRC Generic Letter 89-04, Position 9, indicates that pumps which do not have flow instrumentation installed in a minimum flow test recirculation line should be tested quarterly, monitoring at least differential pressure and vibration and with a test performed during plant shutdown which includes measurement of pump flow. Though the service water pumps are not tested using minimum flow test recirculation line, individual pump flow rates cannot be assessed during normal operation, making this situation similar to that addressed by Position 9. The licensee should therefore individually test the service water pumps, including flow, in accordance with IWP-3100, each refueling outage and cold shutdowns which are of sufficient duration to permit single pump operation. Reference values for dual and single pump operation should be established in accordance with IWP-3110, reconfirmed following repair or routine servicing in accordance with IWP-3111, compared to the reference values in accordance with IWP 3200, and corrective action taken in accordance with IWP-3230, if required.

Based upon the impracticality of performing individual quarterly pump testing during plant operation, the burden of imposing the Code requirement, which would require major system modifications to reroute large bore piping and install individual pump flow instrumentation, and that the licensee's proposed quarterly surveillance of combinations of two pumps in each train provides reasonable assurance of operational capability, it is recommended that provisional relief from quarterly, individual pump testing be granted in accordance with the provisions of 10CFR50.55a(g)(6)(i), provided the licensee tests each of the five pumps in at least one combination quarterly and monitors individual pump operation each refueling outage and cold shutdowns when conditions permit single pump operation. Reference values should be established, and revalidated as required by Code, for dual and single pump operation. The licensee should also address corrective actions to be taken in the event of degraded flow from a pump combination, and the third pump is unavailable to support additional testing necessary to analytically determine individual pump flow rates.

3. VALVE IST PROGRAM RELIEF REQUESTS

In accordance with 10CFR50.55a, the Southern Nuclear Operating Company has submitted relief requests for specific valves at the Farley Nuclear Plant that are subject to inservice testing under the requirements of ASME Section XI. These relief requests have been reviewed to verify their technical basis and determine their acceptability. Each relief request is summarized below, along with the technical evaluation by BNL.

3.1 Relief Request Q1(2)B13-RV-1, Reactor Head Vent Valves

Relief Request: The licensee has requested relief from exercising the reactor head vent valves, HV-1, 2, 3, and 4, quarterly or during each cold shutdown in accordance with ASME Section XI, paragraphs IWV-3411, 3412, 3413 and 3415.

Proposed Alternate Testing: The licensee proposes to full-stroke exercise, measure the stroke time, and fail-safe test the valves at refueling outages or at least every 18 months and at cold shutdowns if the RCS pressure is less than 100 psig.

Licensee's Basis for Requesting Relief: The licensee states: "The head vent valves can not be exercised during normal operation with adequate assurance that an uncontrolled release of reactor coolant and a rapid RCS depressurization would not occur. To exercise the valves open in any order could result in a potential pressure shock to the closed valve and a potential "BURP" reaction. The consequences of this reaction are too severe to warrant testing during normal operation.

The RPV head vent valves are Target Rock solenoid operated valves. The valve stem is completely enclosed within the operator and thus visual position verification is impossible. Position indicators (reed switches) are located within the operator and provide position indication for the pilot valve assembly. In order to verify that the valves exercise open and re-close and agree with remote indication, it is necessary to establish flow through the vent lines. Flow cannot be established through the vent lines except at refueling or cold shutdown when the plant conditions for testing can be established. To insure that a stuck open valve would not cause an uncontrollable loss of reactor coolant and rapid depressurization it is preferable that RCS pressure be less than 100 psig."

Evaluation: The May 23, 1991 SE had previously evaluated the licensee's request for relief from exercising the reactor head vents quarterly and interim relief was granted. The SE stated that the licensee's proposal of full-stroke exercising the valves and verifying that the valve changes position by observation of indirect evidence, i.e., flow from the reactor vessel vents, does not provide a means to monitor valve condition and detect degradation and is therefore unacceptable on a long term basis. The SE recommended that the licensee evaluate non-intrusive diagnostic techniques to measure the full-stroke time of these valves. The licensee responded December 3, 1991 to the SE and stated that the "solenoid-operated valves have no means of verifying valve stem position. Furthermore, Westinghouse has no approved alternative design to replace or modify these valves to accommodate valve stem movement verification."

The revised relief requests submitted December 30, 1991 clarified that valve stroke times will be measured, however, they only indicate the solenoid pilot valve's position and not the position of the valve's main disc. Although the pilot disc is not attached to the main disc, when the pilot valve's disc is stroked open, the pressure differential across the main disc opens the valve. Therefore, measurement of the pilot disc's stroke time will provide a means of detecting some modes of valve degradation and together with position indication verification should provide reasonable assurance of the valve's operational readiness.

The licensee has requested testing the valves at refueling outages or at least once every 18 months and at cold shutdowns, if the RCS pressure is less than 100 psig. This is a revision to the relief reviewed in the May 23, 1991 SE, which requested testing at cold shutdowns if the RCS pressure is less than 50 psig, due to the use of flexible test lines. Based on the potential for the valves to spuriously open due to fast pressure transients resulting in a release of reactor coolant and a potential for RCS leakage if the valves fail to reseat which would require a plant shutdown, testing at operation is impractical. Spurious opening of Target Rock pilot-operated solenoid valves is discussed in NUREG-1275, Volume 6, Appendix B. In accordance with the Farley Technical Specifications 4.4.12, each valve in the vent system is operated from the control room through one cycle of full travel at least once per 18 months during cold shutdowns or refueling outages. Additionally, verification of flow through the reactor vessel head vent systems by venting is verified at least once per 18 months during cold shutdowns or refueling outages. The Technical Specifications do not, however, contain any RCS pressure restrictions on testing during cold shutdowns. The licensee's basis for not testing during cold shutdowns (i.e., RCS average temperature ≤200F) with RCS pressures greater than 100 psig is that a stuck open valve could cause an uncontrolled loss of reactor coolant and rapid depressurization. The FSAR, Section 5.5.15.3, states that at Unit 1 the inadvertent opening of both isolation valves for the expected short-term operation of the vent system will result in a discharge to the pressurizer relief tank and no damage to safe shutdown equipment will result. This is assuming operation at RCS system design pressure and temperature. Although Revision 8 of the FSAR states that the Unit 2 vent system discharges into the reactor cavity, the licensee in their July 29, 1991 letter states that a design change has rerouted the vent system to the pressurizer relief tank (PCNB88-2-5245). The FSAR should be revised to reflect the current system configuration at Unit 2. Additionally, there are two fail-closed solenoid valves in series, a 3/4 inch manual valve, and the 3/4 inch vent line contains 3/8 inch flow-limiting orifices. Therefore, the probability and the consequences of an uncontrolled loss of coolant and rapid depressurization during cold shutdowns is sufficiently low such that it is not impractical to test during any cold shutdown. Therefore, it is recommended that relief be denied. Based on the impracticality of testing the valves during operation, the valves should be tested at all cold shutdowns in accordance with the Code.

3.2 Relief Request Q2E13-RV-1, Containment Spray Check Valves

Relief Request: The licensee has requested relief from full-stroke exercising the containment spray header and RWST suction check valves, QV002A and B and QV014, quarterly or during cold shutdowns in accordance with ASME Section XI, paragraphs IWV-3521 and 3522.

Proposed Alternate Testing: The licensee proposes a future modification to the system to allow full-flow system testing during refueling outages, by installing spool pieces that can be connected to the refueling cavity, and partial-flow testing the pump suction check valve, QV014, during the quarterly pump test. In the interim, the licensee has proposed a disassembly and inspection program for the header check valves, QV002A and B, which includes a partial-stroke test with air following valve reassembly. The licensee's December 30, 1991 submittal does not address testing the pump suction check valve, QV014, in the interim.

Licensee's Basis for Requesting Relief: The licensee states: "The only way to verify forward-flow operability during normal operation or cold shutdown would be by using the pumps and injecting a large quantity of water into the containment. Spraying the containment would result in extensive damage to safety-related equipment located inside the containment."

Evaluation: As discussed in the May 23, 1991 Safety Evaluation, it would be impractical to full-stroke exercise these three valves quarterly because that would result in spraying the containment, causing potential electrical and lagging damage. If the Code requirements were imposed, the licensee would be required to install a full-flow test loop which would require the installation of large motor operated valves and containment penetrations for the RWST return lines. This modification would be significantly more extensive than the modification proposed and would be burdensome. The future modification proposed by licensee would allow full-stroke testing without spraying the containment. However, spool pieces inside containment would be required to be manually installed. This is impractical to perform quarterly, since containment entry during operation is restricted and a quarterly plant shutdown would then be required. Installing the spool pieces during cold shutdowns is also impractical because the time required to install the spool pieces, perform the test, remove the spool pieces, and leak test the flanges could delay plant startup. The RWST suction check valves will be partial stroke tested quarterly. For the interim, the licensee has proposed partial stroke exercising the header check valves following reassembly using air flow. Partial stroke exercising quarterly is not possible because containment entry would be required. The licensee has not, however, addressed the possibility of partial stroke exercising the valves during cold shutdowns. If possible, partial stroke exercising should be performed during cold shutdowns, for the interim and long term.

Therefore, based on the impracticality of full-stroke exercising these valves quarterly and during cold shutdowns, the burden on the licensee if the Code requirements were imposed, and considering that the proposed future modification and alternate testing should provide reasonable assurance of operational readiness, it is recommended that long term relief be granted as requested in accordance with 10CFR50.55a(g)(6)(i), provided the licensee performs partial stroke exercising of the header check valves at cold shutdowns, if possible.

In the interim, the licensee has proposed a valve disassembly and inspection program for the header check valves. It is assumed that the RWST to containment spray pumps' suction valve (QV-014) will also be disassembled and inspected in the interim as discussed in the May 23, 1991 Safety Evaluation. Relief is granted for the interim in accordance with Generic Letter 89-04, provided all the criteria contained in Position 2 of the Generic Letter are met for the three valves. This includes partial valve stroking quarterly, if possible, or during cold shutdowns, and after valve reassembly.

3.3 Relief Request Q1(2)E21-RV-1, RWST to Charging Pump Suction Check Valve

Relief Request: The licensee has requested relief from full-stroke exercising the RWST to Charging pump suction check valve, QV026, quarterly or during cold shutdowns in accordance with ASME Section XI, paragraphs IWV-3521 and 3522.

Proposed Alternate Testing: The licensee proposes to full flow test the valve each refueling outage.

Licensee's Basis for Requesting Relief: The licensee states: "The only possible method of full flow testing this valve is by aligning the RWST to the charging pump suction and injecting full design flow into the RCS. Full flow testing during normal operation is impossible because the charging pumps cannot develop full rated flow against RCS pressure.

Partial flow testing cannot be performed during normal operation because water from the RWST is highly borated and injection into the RCS could adversely affect reactivity.

Full or partial flow testing at cold shutdown could only be performed with a steam bubble in the pressurizer to prevent overpressure transients. However, normal plant practice is to collapse the bubble early in the shutdown procedure and cool the plant down in the solid condition. Therefore, to full or partial flow test at cold shutdown would require maintaining the pressurizer bubble for a longer period of time which would postpone other related shutdown activities."

Evaluation: In the May 23, 1991 Safety Evaluation, the NRC granted interim relief from the Code requirements to allow the licensee a period of time to develop a partial stroke test method and procedures. The revised relief request's Basis provides an explanation of the burden of partial stroke testing the valve and the request states that testing will only be performed at refueling outages.

Due to the lack of a recirculation test loop, partial stroke exercising the valve during power operation would require borated water from the RWST to be injected into the reactor coolant system. This testing could cause reactivity excursions and power transients, which could cause an unnecessary plant shutdown. Therefore, testing during operation is impractical. The licensee's basis for not testing the valve at cold shutdowns is that the testing would postpone other related shutdown activities. The licensee has not provided an adequate technical justification as to why a partial stroke test can not be performed while changing modes from power operation to cold shutdown. The licensee will be increasing the boron concentration in the reactor coolant system to ensure available shutdown margin while shutting down the plant. With a charging pump in operation, the suction of the charging pump could be shifted to the

RWST for a few minutes permitting a partial stroke exercise of this valve. It does not appear that the partial stroke test would significantly affect shutdown activities.

As discussed in the May 23, 1991 SE, full stroke testing the valve during operation is impractical because the only full flow path is into the RCS and the charging pumps cannot develop full rated flow against normal RCS operating pressure. This valve cannot be full-stroke exercised during cold shutdowns because the RCS does not contain sufficient expansion volume to accommodate the flow required and a low temperature overpressure condition could result. Therefore, based on the impracticality of full or partial stroke testing the valve during operation and full stroke exercising the valve at cold shutdowns, the burden on the licensee if the Code requirements were imposed, which would require a plant shutdown, cooldown, and reactor head removal quarterly to test the valve, and the licensee's proposal to full stroke exercise the valve during refueling outages, it is recommended that relief be granted in accordance with 10CFR50.55a(g)(6)(i), provided that the licensee partial stroke exercise the valve when shutting down to cold shutdown.

3.4 Relief Request Q1(2)E21-RV-4, Safety Injection to RCS Check Valves

Relief Request: The licensee has requested relief from full-stroke exercising the Safety Injection to RCS check valves, QV062A, B, C; 66A, B, C; 78A, B, C; and 79A, B, C, quarterly or during cold shutdowns in accordance with ASME Section XI, paragraphs IWV-3521 and 3522.

Proposed Alternate Testing: In lieu of full-stroke exercising the valves, the licensee proposes a disassembly and inspection program. Additionally, the valves will be partial stroke exercised with flow after reassembly.

Licensee's Basis for Requesting Relief: The licensee states: "It is impractical to full- or part-stroke any of these check valves with flow during normal operation because all of the associated flow paths bypass the regenerative heat exchanger and establishing flow through these valves would result in relatively cold water being injected into the RCS. The normal stresses produced by injecting cold water could greatly reduce the service life of the injection nozzles. These valves cannot be full-stroke exercised during cold shutdowns because the RCS may not contain sufficient expansion volume to accommodate the flow required and a low temperature overpressurization condition could occur.

It is also impractical to confirm a part-stroke exercise of these valves during cold shutdowns because permanent flow instrumentation is not installed for the individual flow orifices on the system. The test connections at the orifices have been capped and seal welded. Use of these flow orifices would require a design change to the system."

Evaluation: As discussed in the May 23, 1991 Safety Evaluation, it is impractical to full or partial stroke exercise these check valves with flow during power operation because of the potential damage to the injection nozzles caused by the relatively cold water being injected into the RCS. Additionally, it is impractical to full stroke exercise the check valves during cold shutdowns due to the potential of a low pressure overpressurization event. Full stroke exercising could only be performed during refueling outages, with the reactor head removed to preclude a low temperature overpressurization event. The SE granted relief from the Code test frequency requirements provided the licensee verifies the full stroke capability using temporary flow instrumentation each refueling outage. The licensee revised the request to clarify that there is no permanently installed flow instrumentation to measure the individual flows through each valve. Although there are flow orifices and test connections currently installed on the individual lines, the test connections have been capped and seal welded and "full flow testing is not possible."

The licensee states in the Basis that it is impractical to confirm a partial stroke exercise during cold shutdowns because permanent flow instrumentation is not installed. The licensee states in the Alternate Test section, however, that the valves will be partial stroke exercised with flow following reassembly at refueling outages using installed header instrumentation, pressure changes, level changes, or through the use of ultrasonic flow measuring devices. Based on the revised Alternate Testing, it appears that a full stroke exercise can be performed at refueling outages as well as a partial stroke exercise during cold shutdowns.

The Supplement to the Minutes of the Public Meeting on Generic Letter 89-04, state that the use of disassembly and inspection to verify the full-stroke capability of check valves is an option only where full-stroke exercising cannot **practically** be performed by flow or by other positive means. The Staff does not generally consider the addition of instrumentation to be impractical. The licensee has not established the burden of removing the seal welds and installing flow instrumentation for the purpose of testing. Based on the existence of the flow elements and test connections, it does not appear that the burden would be excessive considering the safety importance of these valves. Therefore, the proposed alternative of disassembly and inspection is not acceptable. Additionally, the licensee has stated in the revised request that the flow during the partial stroke test could be indicated by the use of ultrasonic flow measuring devices. Therefore, the licensee should verify the full stroke capability of each of these valves using installed or ultrasonic flow instrumentation during each refueling outage and verify the partial stroke capability at cold shutdowns. Relief from the Code required test frequency is recommended in accordance with 10CFR50.55a(g)(6)(i), provided that the licensee performs this testing with flow as discussed in Generic Letter 89-04, position 1.

3.5 Relief Request Q1(2)N23-RV-1, CST to Auxiliary Feedwater Pump Suction Check Valves

Relief Request: The licensee has requested relief from full-stroke exercising the CST to Auxiliary Feedwater Pump Suction check valves , QV006, QV007A and B, in the closed direction quarterly or during cold shutdowns in accordance with ASME Section XI, paragraphs IWV-3521 and 3522.

Proposed Alternate Testing: The licensee proposes to verify check valve closure capability by performing a leak test during each refueling outage.

Licensee's Basis for Requesting Relief: "There are no system design provisions for verification of reverse flow closure. The only possible test method would involve isolating the condensate storage tank, draining a large section of piping, and injecting service water into the auxiliary feedwater system. The service water is of poor quality and would contaminate the auxiliary feedwater piping. It cannot be guaranteed that flushing would remove all contamination after testing. Any contaminants which remain in the piping may be injected into the steam generators which could adversely affect secondary water chemistry and contribute to steam generator degradation."

Evaluation: Section XI, IWV-3522, requires check valves that perform a safety function in the closed direction to be tested in a manner that proves that the disk travels to the seat promptly on cessation or reversal of flow. Verification that a valve is in the closed position can be done by visual observation, by an electrical signal initiated by a position indicating device, by observation of appropriate pressure indication in the system, by leak testing, or by other positive means. This verification is required by the Code to be performed quarterly, or at cold shutdowns if testing quarterly is not practical. This relief request was revised to propose leak testing as an alternate test in lieu of valve disassembly and inspection. The request's Basis, however, was not revised and no longer appears relevant. Additionally, the request does not provide any basis for extending the test frequency to refueling outages. Therefore, it is recommended that relief from the Code required frequency be denied. The licensee should perform the leakage tests in accordance with the Code requirements or provide justification for testing the valves only at refueling outages.

3.6 Relief Request Q1(2)P17-RV-3, Component Cooling Water to RCP Thermal Barrier Check Valves

Relief Request: The licensee has requested relief from full-stroke exercising the Component Cooling Water to RCP Thermal Barrier check valves , QV087A, B, C, quarterly or during cold shutdowns in accordance with ASME Section XI, paragraphs IWV-3521 and 3522.

Proposed Alternate Testing: The licensee proposes to verify check valve closure capability by measuring back flow leakage during each refueling outage.

Licensee's Basis for Requesting Relief: "The only way to verify reverse flow closure of these valves requires isolating component cooling water flow to the Reactor Coolant Pumps, entering the containment and locally measuring backflow leakage. Plant procedures strictly regulate entry into the containment during normal operation and at cold shutdown."

Evaluation: As discussed in the May 23, 1991 Safety Evaluation, it is impractical to exercise the valves closed during power operation because they have no position indication and are located inside containment and are, therefore, inaccessible. Containment entry is not allowed during power operation due to personnel safety and radiation exposure considerations. The licensee also states that entry into the containment is strictly regulated at cold shutdowns. Additionally, testing these valves during every cold shutdown is impractical because the testing would require stopping the associated reactor coolant pump to avoid potential pump damage as a result of isolating cooling water. Although the RCP can be operated for a short period of time without component cooling water flow, all RCP seal cooling is then dependent on seal injection from the charging pumps. RCP seal damage will occur rapidly if charging flow is disrupted. It would be burdensome to require the licensee to perform a plant shutdown and cool down quarterly in order to establish plant conditions that allow stopping the reactor coolant pumps. Additionally, establishing plant conditions to allow the pump to be stopped and testing these valves each cold shutdown could delay reactor startup. The licensee's proposal to perform a reverse flow closure verification test during refueling outages, when sufficient time is available to establish the proper plant conditions and connect the necessary test equipment, is an acceptable test method and should provide an acceptable level of quality and safety. OMa-1988, Part 10, which has been accepted by the NRC, permits testing during refueling outages when it is not practicable during operation or cold shutdowns.

Therefore, based on the impracticality of exercising these valves quarterly and during cold shutdowns, the burden on the licensee if the Code requirements were imposed, and considering the proposed alternate testing provides reasonable assurance of the valves' operation readiness, it is recommended that relief be granted in accordance with 10CFR50.55a(g)(6)(i).

3.7 Relief Request Q1(2)P19-RV-2, Backup Nitrogen Supply to PORV Check Valves

Relief Request: The licensee has requested relief from full-stroke exercising the Backup Nitrogen Supply to the PORV check valve , QV004, quarterly or during cold shutdowns in accordance with ASME Section XI, paragraphs IWV-3521 and 3522.

Proposed Alternate Testing: The licensee proposes to verify check valve forward flow capability each refueling outage.

Licensee's Basis for Requesting Relief: "There are no system design provisions for verification of forward flow operability and testing will require isolation and venting of the instrument air header. Instrument air supplies a number of components inside containment which are necessary for normal operation. Testing during normal operation or at cold shutdown would deprive these components of their normal air supply, and since the system has no reserve air capacity, could result in operating transients or component failures. Loss of instrument air during normal operation could result in a forced plant shutdown."

Evaluation: This check valve permits flow from the nitrogen accumulators and auxiliary building instrument air system to the PORVs and closes to provide containment isolation. The PORVs are required to limit pressurizer pressure to a value below the high pressure reactor trip setpoint for a loss of load. The licensee as stated in the relief request that forward flow testing this valve requires isolating and venting the instrument air header. Based on a review of the P&IDs, it appears that a forward flow test could be performed using currently installed test connections, after isolating the instrument air system. This test would not require venting the instrument air header or isolating components, other than the PORVs, from the instrument air system.

The valve is located inside containment and is inaccessible during power operation, making quarterly testing impractical. However, the licensee has not provided sufficient justification for not testing the valve at cold shutdowns in accordance with the Code. Therefore, it is recommended that relief from the Code requirements be denied. The licensee should perform testing at cold shutdowns.

3.8 Relief Request Q1(2)P19-RV-3, Backup Nitrogen Supply to PORV Check Valves

Relief Request: The licensee has requested relief from reverse flow exercising the "Backup Nitrogen Supply to pressurizer PORVs" check valves , NV135, NV137A and B (Unit 1) and NV243 and NV236A and B (Unit 2), quarterly or during cold shutdowns in accordance with ASME Section XI, paragraphs IWV-3521 and 3522.

Proposed Alternate Testing: The licensee proposes to verify check valve closure capability using a disassembly and inspection program. Additionally, the valves will be partial stroke exercised with flow after reassembly. Flow indication will be through installed instrumentation, observed pressure changes, level changes or through the use of ultrasonic or similar flow measuring devices.

Licensee's Basis for Requesting Relief: "There are no system design provisions for verification of reverse flow closure and testing will require isolation and venting of the instrument air header. Instrument air supplies a number of components inside containment which are necessary for normal operation. Testing during normal operation or at cold shutdown would deprive these components of their normal air supply, and since the system has no reserve air capacity, could result in operating transients or component failures. Loss of instrument air during normal operation could result in a forced plant shutdown."

Evaluation: These simple check valves isolate the PORV nitrogen accumulators from the normal instrument air system. In accordance with the FSAR, the PORVs are required to limit pressurizer pressure to a value below the high pressure reactor trip setpoint for a loss of load. The licensee has stated in Reference 22 that the PORVs are not utilized for low temperature overpressure protection. The nitrogen check valves have been classified by the licensee as Code Category C. However, leakage past these valves could compromise operation of the PORVs. The licensee should verify the valves' function and Code category.

The check valves are not provided with position indicating devices. Additionally, valves NV137 A and B (Unit 1) and NV236A and B(Unit 2) are located inside containment and are not accessible during power operation. In accordance with ASME Section XI, IWV-3522, closure verification may be accomplished by visual observation, by an electrical signal initiated by a position indicating device, by observation of appropriate system pressure indication, by leak testing, or by other positive means. If reverse flow testing is not possible, and other positive means, such as acoustic monitoring or radiography, are not available, valve disassembly and inspection may be used to verify valve closure upon cessation or reversal of flow, provided the valves are stroked after reassembly. Although a disassembly and inspection program may be acceptable for verifying valve closure (Reference Generic Letter 89-04, Position 2), the NRC Staff considers it a maintenance procedure with inherent risks and only limited information on the valves ability to seat promptly upon flow reversal or cessation is gained. Additionally, if the licensee has determined that the valves are Code Category AC, disassembly and inspection is not acceptable for demonstration of leak-tight integrity. The licensee should therefore investigate the use of non-intrusive testing techniques and should implement them if they can provide information on closure capability, valve degradation, and incipient failure. It appears, based on a review of the P&IDs, that a pressure decay test could be performed without venting the instrument air header. This test would demonstrate the closure capability of Unit 1 valves NV135 and 137A or B and Unit 2 valves NV243 and 236A or B. There are no drain, vent, or test connections installed between valves NV137A and B or NV236A and B. Verification of the closure of each valve is required in accordance with Section XI, unless the safety analysis does not require both check valves to isolate the instrument system. Therefore, long term relief cannot be granted as requested. An interim period should be allowed to provide time to investigate other test methods. Immediate imposition would be impractical because it would require testing with methods that have not been developed and procedures that have not yet been prepared. This may necessitate a plant shutdown.

Based on the determination that the licensee's proposed disassembly and inspection provides reasonable assurance of operational readiness in the interim, and considering the impracticality of immediately imposing the Code requirements which would require testing the valves with procedures that have not yet been prepared, it is recommended that interim relief be granted for one year or until the next refueling outage, whichever comes later, in accordance with 10CFR50.55a(g)(6)(i). In the interim the licensee should evaluate the function and Code category of the valves, and testing the valves with non-intrusive methods.

3.9 Relief Request Q1(2)E21-RV-15, CVCS Seal Injection to Reactor Coolant Pumps Check Valves

Relief Request: The licensee has requested relief from full-stroke exercising the CVCS Seal Injection to Reactor Coolant Pumps check valves, QV115A, B and C, quarterly or during cold shutdowns in accordance with ASME Section XI, paragraphs IWV-3521 and 3522.

Proposed Alternate Testing: The licensee proposes to verify check valve closure capability by performing a leak test each refueling outage.

Licensee's Basis for Requesting Relief: "The only method available to verify reverse flow closure is by leak testing of the valve at refueling."

Evaluation: The basis for relief provided by the licensee is weak; however, based on a review of the P&IDs, these valves are simple check valves which are located inside containment and are not equipped with position indication. They provide reactor coolant pump (RCP) seal water injection from the charging pumps. The RCPs employ a controlled leakage seal assembly to restrict leakage along the pump shaft and minimize the leakage of reactor coolant into the containment atmosphere. The only practical method available to verify closure of these valves is to perform a leak test. The test connections are located inside containment, which would require a containment entry in order to verify valve closure. Routine containment entries are not made during power operations due to high radiation levels and a potentially harsh environment. It would be impractical to require the licensee to make a containment entry quarterly during power operation in order to verify closure of these valves.

Performing this testing during cold shutdowns would subject plant personnel to increased radiation doses and could possibly delay plant startup due to the time required to set up and perform the valve leak tests. Additionally, testing would require interrupting seal injection flow to the reactor coolant pumps. Although the pumps can operate with short term interruptions of seal injection flow (generally up to 24 hours as recommended by the pump vendor), the increased potential of seal damage and pump bearing damage due to overheating and the introduction of crud from the RCS into the seals, which can result in seal wear and subsequent failure, makes it impractical to test the valves during pump operation even during cold shutdowns. Establishing plant conditions to allow the pump to be stopped and testing these valves each cold shutdown could delay reactor startup. Therefore, testing during cold shutdowns is impractical. The licensee's proposal to perform a leakage test during refueling outages when ample time is available to establish the proper plant conditions and connect the necessary test equipment is an acceptable test method and should provide reasonable assurance of the operational readiness of the valves to close.

Based on the impracticality of exercising these valves quarterly and during cold shutdowns, the burden on the licensee if these Code requirements were imposed, and considering that the licensee's proposal to leak rate test these valves during refueling outages provides a reasonable assurance of their ability to perform their safety function in the closed position, it is recommended that relief be granted as requested pursuant to 10CFR50.55a(g)(6)(i).

4. COLD SHUTDOWN JUSTIFICATIONS

The Southern Nuclear Operating Company has revised one cold shutdown justification concerning the Auxiliary Feedwater system for each unit. This justification was reviewed to verify its technical basis and was found to be acceptable.

5. IST PROGRAM RECOMMENDED ACTION ITEMS

ASME Section XI inconsistencies, omissions, and required licensee actions identified during the review of the licensee's inservice testing program are summarized below. The licensee should resolve these items in accordance with the evaluations presented in this report.

5.1 Provisional relief from quarterly, individual pump testing was recommended for the service water pumps provided the licensee tests each of the five pumps in at least one combination quarterly and monitors individual pump operation each refueling outage and cold shutdowns when conditions permit single pump operation in addition to testing combinations of pumps quarterly. Reference values should be established, and revalidated as required by Code, for dual and single pump operation. The licensee should also address corrective actions to be taken in the event of degraded flow from a pump combination, and the third pump is unavailable to support additional testing necessary to analytically determine individual pump flow rates. (TER Section 2.1)

5.2 Relief from exercising the reactor head vent valves during cold shutdowns was recommended to be denied. These valves should be tested at cold shutdowns in accordance with the Code. Additionally, Rev. 8 of the FSAR does not reflect the current system configuration at Unit 2. (TER Section 3.1)

5.3 Provisional relief for an interim period (i.e., until the installation of modifications which will allow full flow testing at refueling outages) was recommended for the containment spray header and RWST suction check valves provided the licensee confirms that QV-014 will be disassembled and inspected in the interim, as evaluated in May 23, 1991 SE and all the criteria for valve disassembly and inspection contained in Generic Letter 89-04, Position 2 are met for the three valves, including partial stroke exercising of the header check valves at cold shutdowns, if possible. Long term relief is recommended provided the licensee partial stroke exercises the header check valves at cold shutdowns (TER Section 3.2)

5.4 Provisional relief was recommended for the RWST to charging pump suction check valve provided that the licensee partial stroke exercise the valve when shutting down to cold shutdown. (TER Section 3.3)

5.5 The licensee should verify the full stroke capability of each of the safety injection to RCS check valves using installed or ultrasonic flow instrumentation during each refueling outage, and verify the partial stroke capability at cold shutdowns. Relief from the Code required test frequency is recommended provided that the licensee performs this testing with flow. (TER Section 3.4)

5.6 The CST to auxiliary feedwater pump suction check valves relief request (Q1(2)N23-RV-1) was revised to propose leak testing as an alternate test in lieu of valve disassembly and inspection. The request's Basis, however, was not revised and no longer appears relevant. Additionally, the request does not provide any basis for extending the test frequency to refueling outages. Therefore, it is recommended that relief from the Code required frequency be denied. The licensee should perform the leakage tests in accordance with the Code requirements or provide justification for testing the valves only at refueling outages. (TER Section 3.5)

5.7 The licensee has not provided sufficient justification for not testing the backup nitrogen supply to PORV check valve (QV004) at cold shutdowns in accordance with the Code. Therefore, it is recommended that relief from the Code requirements be denied. The licensee should perform testing at cold shutdowns. (TER Section 3.7)

5.8 Although a disassembly and inspection program is acceptable for verifying valve closure, the NRC Staff considers it a maintenance procedure with inherent risks and only limited information on the valves ability to seat promptly upon flow reversal or cessation is gained. Interim relief has been recommended. In the interim, the licensee should investigate the use of non-intrusive testing techniques for the backup nitrogen supply to PORV check valves and should implement them if they can provide information on closure capability, valve degradation, and incipient failure. Additionally, the licensee should evaluate the function and Code category of the valves. (TER Section 3.8)

5.9 The licensee has deleted pump relief request PR-18 and states in the revised IST Program that Code Case N-472 will be used for pump vibration testing. Code Cases listed in Regulatory Guide 1.147 may be included in the IST Program and can be used without relief, provided the Code Cases are used in their entirety. If only portions of Code Cases are used relief is required. Although the NRC Staff encourages the use of OM-6 for pump vibration testing, the licensee should submit a relief request for approval.

6. REFERENCES

1. "Joseph M. Farley Nuclear Plant-Unit 1 Inservice Testing Program for ASME Code Class 1, 2 and 3 Pumps and Valves -Request for Additional Information on Inservice Testing of Service Water Pumps," J.D. Woodward, Southern Nuclear Operating Company, to USNRC, April 10, 1992.

2. "Joseph M. Farley Nuclear Plant-Unit 1 Inservice Testing Program for ASME Code Class 1, 2 and 3 Pumps and Valves -Request for Relief from Impractical Requirements." J.D. Woodward, Southern Nuclear Operating Company, to USNRC, April 10, 1992.

3. "Interim Approval and Request for Additional Information Relating to Inservice Testing Program Relief Requests for Farley Units 1 and 2 (TAC NOS. M81197, M81198, M82251 and M82252)", USNRC to Southern Nuclear Operating Company, February 14, 1992.

4. "Joseph M. Farley Nuclear Plant-Unit 2 Inservice Testing Program for ASME Code Class 1, 2 and 3 Pumps and Valves -Request for Relief from Impractical Requirements," Unit 2, J.D. Woodward, Southern Nuclear Operating Company, to USNRC, December 30, 1991.

5. "Joseph M. Farley Nuclear Plant-Unit 1 Inservice Testing Program for ASME Code Class 1, 2 and 3 Pumps and Valves -Request for Relief from Impractical Requirements," J.D. Woodward, Southern Nuclear Operating Company, to USNRC, December 30, 1991.

6. "Joseph M. Farley Nuclear Plant Inservice Testing of ASME Code Class 1, 2 and 3 Pumps and Valves-Deferral of Implementation", Units 1 and 2, J.D. Woodward, APCO, to USNRC, December 3, 1991.

7. "Joseph M. Farley Nuclear Plant-Unit 1 Second Ten-Year Interval Inservice Testing (IST) Program for ASME Code Class 1, 2, and 3 Pumps and Valves," J.D. Woodward, APCO, to USNRC, July 26, 1991.

8. "Joseph M. Farley Nuclear Plant-Unit 2 Ten-Year Inservice Testing (IST) Program for ASME Code Class 1, 2, and 3 Pumps and Valves," Unit 2, J.D. Woodward, APCO, to USNRC, July 29, 1991.

9. "Relief Request for the Inservice Testing Program for Pumps and Valves at the Joseph M. Farley Nuclear Plant, Units 1 and 2, (TAC Nos. 65489 and 71579)," A. J. Mendiola, USNRC, to W. G. Hairston, III, APCO, May 23, 1991.

10. "NRC Inspection Report Nos. 50-348/91-20 and 50-364/91-20,"D.M. Verrelli, USNRC to W.G. Hairston, III, APCO, December 4, 1991.

11. NRC Regulatory Guide 1.147, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1," Revision 8, November 1990.

12. ASME Boiler and Pressure Vessel Code, Section XI, Rules for Inservice Inspection of Nuclear Power Plant Components, 1983 Edition including Summer 1983 Addenda.

13. Farley FSAR and Technical Specifications.

14. ASME/ANSI OMa-1988, Part 6, "Inservice Testing of Pumps in Light-Water Reactor Power Plants."

15. ASME/ANSI OMa-1988, Part 10, "Inservice Testing of Valves in Light-Water Reactor Power Plants."

16. 10CFR50.55a

17. Standard Review Plan, NUREG 0800, Section 3.9.6, Inservice Testing of Pumps and Valves, Rev. 2, July 1981.

18. NRC Generic Letter 89-04, "Guidance on Developing Acceptable Inservice Testing Progra...," April 3, 1989.

19. Minutes of the Public Meetings on Generic Letter 89-04, October 25, 1989.

20. Supplement to the Minutes of the Public Meetings on Generic Letter 89-04, September 26, 1991.

21. NRC Generic Letter No. 90-06, Resolution of Generic Issue 70, "Power-Operated Relief Valve and Block Valve Reliability," and Generic Issue 94, "Additional Low-Temperature Overpressure Protection for Light-Water Reactors," Pursuant to 10CFR50.54(f).

22. "Joseph M. Farley Nuclear Plant Units 1 and 2 Response to Generic Letter (GL) 90-06: Resolution of Generic Issue 70, "Power-Operated Relief Valve and Block Valve Reliability," and Generic Issue 94, "Additional Low-Temperature Overpressure Protection for Light-Water Reactors," W.G. Hairston, III, APCO, to USNRC, December 14, 1990.

23. NUREG-1275, Volume 6, "Operating Experience Feedback Report-Solenoid-Operated Valve Problems," February 1991.

24. "Joseph M. Farley Nuclear Plant Inservice Testing (IST)", B.L. Moore, Southern Nuclear Operating Company, to S. Hoffman, USNRC, February 10, 1992, with attached P&IDs:

P&ID	Sheet	System	Revision
D-170060	1	Diesel Generator Fuel Oil	11
D-170119	1	Service Water	23
D-175002	2	Component Cooling Water	17
D-175007	1	Auxiliary Feedwater	18
D-175034	1	Instrument Air	23
	3		5
D-175037	1	Reactor Coolant	20
D-175038	1	Safety Injection	24
	3		14
D-175039	1	CVCS	18
D-175041	1	Residual Heat Removal	11
D-205002	2	Component Cooling Water	10
D-205007	1	Auxiliary Feedwater	15
D-205034	4	Instrument Air	8
D-205037	1	Reactor Coolant	16
D-205038	1	Safety Injection	20
	3		17
D-205039	1	CVCS	21
D-205041	1	Residual Heat Removal	10