July 11, 2006

Mr. Karl W. Singer
Chief Nuclear Officer and
Executive Vice President
Tennessee Valley Authority
6A Lookout Place
1101 Market Street
Chattanooga, Tennessee 37402-2801

SUBJECT: WATTS BAR NUCLEAR PLANT, UNIT 1 — RELIEF REQUEST NO. ISPT-09 FOR THE FIRST TEN-YEAR INSERVICE INSPECTION INTERVAL (TAC NO. MC8305)

Dear Mr. Singer:

By letter dated September 8, 2005, Tennessee Valley Authority (TVA), the licensee for the Watts Bar Nuclear Plant, Unit 1 (WBN), submitted Relief Request (RR) No. ISPT-09. In this submittal, TVA requested relief from the requirements of Paragraph (g)(4), Section 50.55a of Title 10, *Code of Federal Regulations*, and the system leakage test requirements that are specified in Table IWB-2500-1, Examination Category B-P, and Paragraph IWA-5222(a) of Section XI of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code). RR No. ISPT-09 is applicable for the First Ten-Year Inservice Inspection Interval for WBN, and pertains to the system leakage test requirements for ASME Code Class 1 portions of the safety injection and residual heat removal systems.

The Nuclear Regulatory Commission (NRC) staff has completed its review of RR No. ISPT-09, and has determined that the licensee's request for alternative pressure tests is acceptable for implementation under the hardship provisions of 10 CFR 50.55a(a)(3)(ii). The NRC staff's safety evaluation is enclosed.

Sincerely,

/RA by L. Raghavan for/

Michael L. Marshall, Jr., Chief
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-390

Enclosure: Safety Evaluation

cc w/enclosure: See next page

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NAME	DPickett	RSola	***S. Sheng for*** K. Gruss (via memo)	SHamrick *	***L. Raghavan for*** LMMarshall
DATE	6/27/06	6/26/06	5/15/06	7/6/06	7/11/06

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Mr. Karl W. Singer
Tennessee Valley Authority

WATTS BAR NUCLEAR PLANT

cc:

Mr. Ashok S. Bhatnagar, Senior Vice President
Nuclear Operations
Tennessee Valley Authority
6A Lookout Place
1101 Market Street
Chattanooga, TN 37402-2801

Mr. Larry S. Bryant, Vice President
Nuclear Engineering & Technical Services
Tennessee Valley Authority
6A Lookout Place
1101 Market Street
Chattanooga, TN 37402-2801

Mr. Robert J. Beecken, Vice President
Nuclear Support
Tennessee Valley Authority
6A Lookout Place
1101 Market Street
Chattanooga, TN 37402-2801

Mr. Michael D. Skaggs
Site Vice President
Watts Bar Nuclear Plant
Tennessee Valley Authority
P.O. Box 2000
Spring City, TN 37381

General Counsel
Tennessee Valley Authority
ET 11A
400 West Summit Hill Drive
Knoxville, TN 37902

Mr. John C. Fornicola, Manager
Nuclear Assurance and Licensing
Tennessee Valley Authority
6A Lookout Place
1101 Market Street
Chattanooga, TN 37402-2801

Mr. Glenn W. Morris, Manager
Corporate Nuclear Licensing
and Industry Affairs
Tennessee Valley Authority
4X Blue Ridge
1101 Market Street
Chattanooga, TN 37402-2801

Mr. Paul L. Pace, Manager
Licensing and Industry Affairs
Watts Bar Nuclear Plant
Tennessee Valley Authority
P.O. Box 2000
Spring City, TN 37381

Mr. Jay Laughlin, Plant Manager
Watts Bar Nuclear Plant
Tennessee Valley Authority
P.O. Box 2000
Spring City, TN 37381

Senior Resident Inspector
Watts Bar Nuclear Plant
U.S. Nuclear Regulatory Commission
1260 Nuclear Plant Road
Spring City, TN 37381

County Executive
375 Church Street
Suite 215
Dayton, TN 37321

County Mayor
P. O. Box 156
Decatur, TN 37322

Mr. Lawrence E. Nanney, Director
Division of Radiological Health
Dept. of Environment & Conservation
Third Floor, L and C Annex
401 Church Street
Nashville, TN 37243-1532

Ms. Ann P. Harris
341 Swing Loop Road
Rockwood, Tennessee 37854

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

FIRST 10-YEAR INTERVAL INSERVICE INSPECTION PROGRAM

TENNESSEE VALLEY AUTHORITY

REQUEST FOR RELIEF NO. ISPT-09

WATTS BAR NUCLEAR PLANT, UNIT 1

FACILITY OPERATING LICENSE NO. NPF-90

DOCKET NO: 50-390

1.0 INTRODUCTION

By letter dated September 8, 2005 (Reference 1), Tennessee Valley Authority (TVA), the licensee for the Watts Bar Nuclear Plant, Unit 1 (WBN), submitted Relief Request (RR) No. ISPT-09. In this submittal, TVA requested relief from the requirements of Paragraph (g)(4), Section 50.55a of Title 10, *Code of Federal Regulations* (10 CFR), and the system leakage test requirements that are specified in Table IWB-2500-1, Examination Category B-P, and Paragraph IWA-5222(a) of Section XI of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code). RR No. ISPT-09 is applicable to the First Ten-Year Inservice Inspection Interval (1st 10-Year ISI Interval) for WBN, and pertains to the system leakage test requirements for ASME Code Class 1 portions of the safety injection (SI), residual heat removal (RHR), and auxiliary spray (AUX-S) systems.

The licensee responded to the staff's Request for Additional Information (RAI) in a letter to the Nuclear Regulatory Commission (the Commission, NRC) dated March 31, 2006 (Reference 2). Henceforth, all RAI responses referenced in this evaluation refer to this RAI response letter.

2.0 REGULATORY EVALUATION

Inservice Inspection (ISI) of ASME Code Class 1, 2, and 3 components is performed in accordance with Section XI and applicable addenda as required by 10 CFR 50.55a(g), except where specific written relief has been granted by the Commission pursuant to 10 CFR 50.55a(g)(6)(i). The regulation in 10 CFR 50.55a(a)(3) states, in part, that alternatives to the requirements of paragraph (g) may be used, when authorized by the NRC, if: (i) the proposed alternatives would provide an acceptable level of quality and safety or (ii) compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

Enclosure

Pursuant to 10 CFR 50.55a(g)(4), ASME Code Class 1, 2, and 3 components (including supports) shall meet the requirements, except the design and access provisions, and the pre-service examination requirements, set forth in Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," to the extent practical within the limitations of design, geometry, and materials of construction of the components. The regulations require that inservice examination of components and system pressure tests conducted during the first ten-year interval and subsequent intervals must comply with the requirements in the latest edition and addenda of Section XI incorporated by reference in 10 CFR 50.55a(b) twelve months prior to the start of the 120-month interval, as subject to the limitations in the rule.

The ISI Code of Record for the 1st 10-year inspection interval for WBN is the 1989 Edition of the Section XI, no Addenda. Pursuant to 10 CFR 50.55a(g)(4)(iv), inservice examination of components and system pressure tests may meet the requirements set forth in subsequent editions and addenda that are incorporated by reference in paragraph (b) of this section, subject to the limitations and modifications listed in paragraph (b) of this section, and subject to Commission approval. Portions of editions and addenda may be used provided that all related requirements of the respective editions or addenda are met.

3.0 <u>TECHNICAL EVALUATION</u>

3.1 Applicable Components

The components identified in the attached table “Component Descriptions for Relief Request No. ISPT-09,” are based on the amended component descriptions in Reference 2. The component descriptions identify which valves define the boundaries of the applicable line segments. The table also provides the test pressures for performing the licensee’s alternative system leakage tests of the applicable SI and RHR lines segments.

The applicable SI, RHR, and AUX-S line segments are categorized as ASME Code Class 1 because the line segments are aligned to the reactor coolant pressure boundary (RCPB) out to and inclusive of the second containment isolation valve (CIV) for the systems. With the exception of CIVs in one of the applicable RHR line segments and one of the CIVs in the applicable AUX-S segment, each of the line segments is isolated from the RCPB by self-actuating check valves (CVs).

For one of the RHR piping segments and for one of the CIVs in the applicable AUX-S line segment, the CIVs are motor-operated flow control valves (FCVs). The FCVs are interlocked to ensure redundant isolation of the RCPB from the ASME Code Class 2 portion of the RHR which is subject to a lower design pressure (600 pounds per square inch gauge (psig)). The Technical Requirements Manual for WBN specifies that TVA should maintain the FCV’s in the closed and de-energized configuration prior to raising the reactor coolant system (RCS) pressure above 425 psig. Plant operating instructions specify that the FCVs are to be maintained in the closed configuration prior to raising the RCS pressure above 370 psig or the RCS temperature above 350 degrees Fahrenheit (EF).

3.2 Applicable Code Edition and Requirements

TVA requested relief from the following Section XI requirements, as invoked by reference in 10 CFR 50.55a(g)(4):

- Section XI, Table IWB-2500-1, Examination Category B-P, "All Pressure Retaining Components," Inspection Item B15.51, "Piping," and Inspection Item B15.71, "Valves:" Inspection Items B15.51 and B15.71 require that the licensee perform inservice hydrostatic pressure tests and VT-2 visual examinations of all ASME Code Class 1 pressure retaining piping and valves in accordance with the requirements of Section XI, Paragraph IWB-5222. The inspection items require that the inservice hydrostatic pressure test be performed at a frequency of once during every 10-Year ISI interval.

- Section XI, Paragraph IWB-5222 and Table IWB-5222-1: TVA stated that, pursuant to 10 CFR 50.55a(a)(3)(ii), relief is also being requested from compliance with the requirements of Section XI, Paragraph IWB-5222(a) and Table IWB-5222-1, which pertain to requirements for pressurizing the RCPB during hydrostatic pressure tests. The nominal operating temperature of the RCPB at 100 percent rated power is above 500 EF. The nominal operating pressure of the RCPB at 100 percent rated power is 2235 psig. Thus, Table IWB-5222-1 requires that TVA perform the required hydrostatic pressure test at a test pressure of 2280 psig (i.e., 1.02 * 2235 psig).

- In response to RAI No. 1, TVA clarified that the 1989 Edition of Section XI is the Code of Record for WBN. TVA also clarified that Inspection Items B15.51 and B15.71 are the inspection items in Section XI, Table IWB-2500-1, Examination Category B-P that are applicable to RR No. ISPT-09.

3.3 Basis for the Relief Request

The applicable RHR, SI, and AUX-S line segments are each designed with two system CIVs in order to comply with the requirements of 10 CFR Part 50, Appendix A, "General Design Criteria", Criterion 55, *Reactor Coolant Pressure Boundary Penetrating Containment*. The RCPB extends to, and is inclusive of, the second CIV in the piping segments.

TVA is requesting relief from compliance with the requirements that are specified in: (1) Section XI, Table IWB-2500-1, Examination Category B-P, Inspection Items B15.51 and B15.71; (2) Section XI, Paragraph IWB-5222(a); and (3) Section XI, Table IWB-5222-1. TVA stated that the relief is being requested for the 1st 10-Year ISI Interval for WBN.

TVA stated that implementation of the required hydrostatic pressure tests on the applicable RHR, SI, and AUX-S line segments would require either: (1) opening up the first CIV in the line segments, (2) installing temporary bypasses around the first CIV, or (3) modifying the systems to bypass the first CIV. TVA stated that implementing any of these actions would require it to defeat the double containment isolation function of the inboard and outboard CIVs, which are required to be configured in the closed position when in operating MODES 1, 2, or 3. TVA stated that this constitutes a hardship for the facility as defined in 10 CFR 50.55a(a)(3)(ii).

3.4 Proposed Alternative

In lieu of compliance with the applicable hydrostatic pressure test requirements, TVA proposed to perform alternative system leakage tests of the applicable line segments at reduced test pressures.

- The line segment from the high and intermediate pressure portions of the SI system and the SI accumulators will be pressurized using the SI pumps to approximately 1500 psig, which is the pressure of the SI pumps while running in recirculation flow mode.

- The lines segments in the flow path from the cold leg accumulator outlet isolation valve to the RCPB cold leg piping will be pressurized to the 610!660 psig range using the accumulators, as required by plant Technical Specifications.

- The lines segments in the RHR system will be pressurized to approximately 350 psig and visually examined while the RHR is providing shutdown cooling during startup following the refueling outage.

- The AUX-S line segment will be examined at the pressure existing between the isolation valve 1-FCV-62-84 and 1-CKV-62-661. TVA stated that, although there are no test connections within this line segment that would permit direct measurement of the pressure between the valves, the line would be subject to a minimum test pressure of 325 psig, which would be the pressure when the AUX-S system is actuated during plant startup, prior to initiating a reactor coolant pump (RCP). The AUX-S system would be isolated from the RCPB following initiation of a RCP.

TVA stated that the alternative system leakage tests would be subject to the minimum hold time that is required in accordance with Section XI, Paragraph IWA-5213(d) and to the minimum test temperatures that are required in accordance with Section XI, Paragraph IWB-5230. These criteria for minimum hold times and minimum test temperatures are acceptable because they will be implemented in compliance with Section XI, as invoked by 10 CFR 50.55a.

3.5 Evaluation

The licensee's proposed alternative system leakage tests are intended to test the subject piping segments at the corresponding system test pressures and temperatures when the systems are configured for containment isolation in MODE 3, or in MODE 2, prior to initiation of a RCP.

TVA's proposed alternative system leakage tests are based on the leak rate (L_P) that could be expected to result if the pressure test were performed at the lower system leakage test pressures (P_P in psig). TVA used the following equation to estimate the leak rates that would result from a postulated through-wall crack in the line segments, as exposed to the lower system leakage test pressures:

$$L_p = L_{XI} \text{ x } (P_p / P_{XI})^{1/2} \qquad \text{Equation 1.}$$

In Equation 1, L_P represents the leak rate that is anticipated from a through-wall crack at the lower test pressure; L_{XI} represents leak rate that would be expected to occur if the test were performed at (i.e., normalized to) the required hydrostatic test pressure; P_p is the alternative test pressure (in psig); and P_{XI} is the required hydrostatic test pressure of 2280 psig. TVA stated that Equation 1 is based on ASME Operation and Maintenance (OM) Standard 10, paragraph 4.2.2.3(b)(4). This is acceptable because Standard 10 of the ASME OM Code is the applicable OM Code that has been endorsed when applying the 1989 Edition of the ASME Code.

Using Equation (1), TVA estimated that, if the applicable line segments were to contain through-wall flaws, the alternative system leakage tests would result in the following leak rates:

- SI accumulator line segments (P_P = 610 ! 660 psig): L_P will be 52 - 54 percent of L_{XI}
- SI line segments (P_P = 1500 psig): L_P will be 81 percent L_{XI}
- RHR line segments (P_P = 350 psig): L_P will be 39 percent of L_{XI}
- AUX-S line segment (minimum P_P \$ 325 psig): L_P will be equal to or greater than 38 percent of L_{XI}

These leak rates are high enough to be detected by the licensee's VT-2 examinations. Any evidence of pressure boundary leakage that is detected during implementation of the alternative system leakage tests will require the licensee to enter the degraded pressure boundary components into the "Corrective Actions" provisions of Section XI, Paragraph IWA-5250.

Pressurization of the subject piping segments in accordance with applicable hydrostatic test requirements would require the licensee to defeat the double containment isolation design requirement or implement significant plant modifications. Either approach would subject the licensee to an undue burden with no compensating increase in quality or safety. The licensee's basis demonstrates that the alternative system leakage tests are capable of resulting in detectable leak rates from the applicable line segments. Therefore, the staff concludes that the licensee's proposed alternative system leakage tests will provide sufficient monitoring of the structural integrity of the subject components, in lieu of the required hydrostatic pressure tests. Furthermore, the licensee will perform additional examinations of the RCPB in accordance with other Examination Categories in Section XI, Table IWB-2500-1, and also perform augmented system walkdowns of the RCPB for evidence of boric acid leakage as part of its Generic Letter 88-01 inspections. These additional examinations provide additional monitoring of the structural integrity of the RCPB.

Based on this assessment, the staff concludes that compliance with the hydrostatic pressure test requirements during the 1st 10-Year ISI Interval will create a hardship for the licensee. The staff also concludes that TVA has proposed acceptable alternative system leakage tests for these line segments.

4.0 CONCLUSION

The staff has reviewed the request for relief in RR No. ISPT-09 along with the proposed alternative system leakage tests for the ASME Code Class 1 SI, RHR, and AUX-S line segments against the hardship provisions of 10 CFR 50.55a(a)(3)(ii). Based on its evaluation, the staff concludes that: (1) TVA provided a sufficient basis to demonstrate that compliance with the requirements of Section XI, Table IWB-2500-1, Examination Category B-P, Inspection Items B15.51 and B15.71, and the requirements of Section XI, Paragraph IWB-5222 and Section XI, Table IWB-5222-1 (as applied to these line segments) would create a hardship or unusual difficulty for WBN without a compensating increase in the level of quality and safety and, (2) TVA's proposed alternative system leakage tests for these line segments are acceptable.

Therefore, based on the staff's assessment, the staff concludes that RR No. ISPT-09 may be granted for the 1st 10-Year ISI Interval pursuant to the hardship provisions of 10 CFR 50.55a(a)(3)(ii).

5.0 REFERENCES

1. Serial Letter from P. L. Pace (TVA) to the Nuclear Regulatory Commission Document Control Desk, "Watts Bar Nuclear Plant (WBN), Unit 1 - American Society of Mechanical Engineers (ASME), Section XI Inservice Pressure Testing Program Request for Relief ISPT-09," dated September 8, 2005.

2. Serial Letter from P. L. Pace (TVA) to the Nuclear Regulatory Commission Document Control Desk, "Watts Bar Nuclear Plant (WBN), Unit 1 - American Society of Mechanical Engineers (ASME), Section XI Inservice Pressure Testing Program Request for Relief ISPT-09," dated March 31, 2006.

Principal Contributor: James Medoff

Date: July 11, 2006

Attachment: As stated

Component Descriptions for Relief Request No. ISPT-09

Component Description	Pipe Diameter (Inches)	Line Segment Length (Inches)	Pipe Design Pressure (psig)	Alternate Test Pressure (psig)
Safety Injection Accumulator No. 1 Piping Segments from the Outlet Isolation Valve to the Reactor Coolant System, Including the Branch Connections from the RHR and SIS				
Safety Injection Accumulator No. 1 Outlet Isolation Valve to Outlet Check Valve (FCV-63-118 to CKV-63-622)	10	23	2485	610 - 660
Safety Injection Accumulator No. 1 Outlet Check Valve to Loop 1 Cold Leg (CKV-63-622 to CKV-63-560)	10	18	2485	1500
6-Inch Branch Connection from the 10-Inch Safety Injection Accumulator No. 1 Outlet Piping to the Low Pressure Safety Injection (RHR) Check Valve CKV-63-633	6	23	2485	1500
2-Inch Branch Connection from the 6-Inch RHR System Branch to the Safety Injection System Check Valve CKV-63-551	2	10	2485	1500
Safety Injection Accumulator No. 2 Piping Segments from the Outlet Isolation Valve to the Reactor Coolant System, Including the Branch Connections from the RHR and SIS				
Safety Injection Accumulator No. 2 Outlet Isolation Valve to Outlet Check Valve (FCV-63-98 to CKV-63-623)	10	16	2485	610 - 660
Safety Injection Accumulator No. 2 Outlet Check Valve to Loop 2 Cold Leg (CKV-63-623 to CKV-63-561)	10	15	2485	1500
6-Inch Branch Connection from the 10-Inch Safety Injection Accumulator No. 2 Outlet Piping to the Low Pressure Safety Injection (RHR) Check Valve CKV-63-632	6	12	2485	1500

Component Description	Pipe Diameter (Inches)	Line Segment Length (Inches)	Pipe Design Pressure (psig)	Alternate Test Pressure (psig)
Safety Injection Accumulator No. 2 Piping Segments (Continued)				
2-Inch Branch Connection from the 6-Inch RHR System Branch to the Safety Injection System Check Valve CKV-63-553	2	21	2485	1500
Safety Injection Accumulator No. 3 Piping Segments from the Outlet Isolation Valve to the Reactor Coolant System, Including the Branch Connections from the RHR and SIS				
Safety Injection Accumulator No. 3 Outlet Isolation Valve to Outlet Check Valve (FCV-63-80 to CKV-63-624)	10	9	2485	610 - 660
Safety Injection Accumulator No. 3 Outlet Check Valve to Loop 3 Cold Leg (CKV-63-624 to CKV-63-562)	10	17	2485	1500
6-Inch Branch Connection from the 10-Inch Safety Injection Accumulator No. 3 Outlet Piping to the Low Pressure Safety Injection (RHR) Check Valve CKV-63-634	6	17	2485	1500
2-Inch Branch Connection from the 6-Inch RHR System Branch to the Safety Injection System Check Valve CKV-63-555	2	20	2485	1500
Safety Injection Accumulator No. 4 Piping Segments from the Outlet Isolation Valve to the Reactor Coolant System, Including the Branch Connections from the RHR and SIS				
Safety Injection Accumulator No. 4 Outlet Isolation Valve to Outlet Check Valve (FCV-63-67 to CKV-63-625)	10	22	2485	610 - 660
Safety Injection Accumulator No. 4 Outlet Check Valve to Loop 4 Cold Leg (CKV-63-625 to CKV-63-563)	10	24	2485	1500
6-Inch Branch Connection from the 20-Inch Safety Injection Accumulator No. 4 Outlet Piping to the Low Pressure Safety Injection (RHR) Check Valve CKV-63-635	6	21	2485	1500
2-Inch Branch Connection from the 6-Inch RHR System Branch to the Safety Injection System Check Valve CKV-63-557	2	7	2485	1500

Component Description	Pipe Diameter (Inches)	Line Segment Length (Inches)	Pipe Design Pressure (psig)	Alternate Test Pressure (psig)
High Pressure [BIT Injection] Safety Injection System Piping Segments from Check Valve CKV-63-581 to the Reactor Coolant System				
High Pressure Safety Injection Piping from CKV-63-581 to Loop 3 Cold Leg Injection Check Valve CKV-63-588 (includes three row descriptions to account for the reductions in the diameter of the piping segment)	3	20	2485	1500
	2.5	83	2485	1500
	1.5	39	2485	1500
1.5-Inch Branch Connection from the 3-Inch Common Header coming from CKV-63-581 to Loop 1 Cold Leg Injection Check Valve CKV-586	1.5	123	2485	1500
1.5-Inch Branch Connection from the 3-Inch Common Header coming from CKV-63-581 to Loop 4 Cold Leg Injection Check Valve CKV-589	1.5	25	2485	1500
1.5-Inch Branch Connection from the 2.5-Inch Common Header coming from CKV-63-581 to Loop 2 Cold Leg Injection Check Valve CKV-587	1.5	107	2485	1500
RHR Hot Leg Injection Piping Segments Aligned to Loop 1: From Check Valve CKV-63-640 to the Reactor Coolant System (Includes the Branch Connection from the Safety Injection System)				
Low Pressure Safety Injection Piping from RHR Check Valve CKV-63-640 to the Loop 1 Hot Leg Check Valve CKV-63-641 (includes two row descriptions to account for the reduction in the diameter of the piping segment)	8	29	2485	1500
	6	2	2485	1500
2-Inch Branch Connection from the 8-Inch RHR Piping to Safety Injection System Check Valve CKV-63-543	2	5	2485	1500
RHR Hot Leg Injection Piping Segments Aligned to Loop 3: From Check Valve CKV-63-643 to the Reactor Coolant System (Includes the Branch Connection from the Safety Injection System)				
Low Pressure Safety Injection Piping from RHR Check Valve CKV-63-643 to the Loop 3 Hot Leg Check Valve CKV-63-644	8	42	2485	1500

Component Description	Pipe Diameter (Inches)	Line Segment Length (Inches)	Pipe Design Pressure (psig)	Alternate Test Pressure (psig)
2-Inch Branch Connection from the 8-Inch RHR Piping to Safety Injection System Check Valve CKV-63-545	2	7	2485	1500
SI Hot Leg Injection Piping Segment from Check Valve CKV-63-647 to the Reactor Coolant System				
Safety Injection Pump Piping from Check Valve CKV-63-547 to Check Valve CKV-63-559 (includes two row descriptions to account for the expansion of the diameter of the piping segment)	2	60	2485	1500
	6	0.5	2485	1500
SI Hot Leg Injection Piping Segment from Check Valve CKV-63-647 to the Reactor Coolant System				
Safety Injection Pump Piping from Check Valve CKV-63-549 to Check Valve CKV-63-558 (includes two row descriptions to account for the expansion of the diameter of the piping segment)	2	44	2485	1500
	6	0.5	2485	1500
RHR Loop 4 Suction Piping Segment from Flow Control Valve FCV-74-2 and its Bypass Valve FCV-74-8 to the Reactor Coolant System				
RHR Piping Between Flow Control Valves FCV-74-1 and FCV-74-2, including the branch connection in the piping segment leading to bypass valve FCV-74-9 and the branch connection in the piping segment leading to bypass valve FCV-74-8 (The first row entry corresponds to the main piping segment consisting of the 14-inch diameter piping. The second row entry corresponds to the total amount of 10-inch diameter piping in the branch connections)	14	50	2485	1500
	10	22	2485	1500
Auxiliary Spray System Piping				
Auxiliary Spray System Piping from Flow Control Valve FCV-62-84 to Check Valve CKV-62-661	3	41	2485	325 - 2235