REVIEW OF THE

PUBLIC SERVICE COMPANY OF COLORADO

PROPOSED

INSERVICE INSPECTION PROGRAM

Submitted to:

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by:

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TASK 1 - INSERVICE INSPECTION

INTRODUCTION

Following a period of operation at the Fort St. Vrain (FSV) Nuclear Generating Station the inservice inspection (ISI) program is being evaluated and updated to reflect plant operating experience to date, the applicable portions of and guidance provided by proposed ASME Code Section XI Division 2, and PSC operating license commitments to NRC. Consequently, the inservice inspection program to be followed at FSV is being revised and submitted by Public Service of Colorado (PSC) to NRC for approval. Three submittals of modified FSV Technical Specification Surveillance Requirements have been transmitted to NRC on February 8, March 3, and March 31, 1980. A list of systems/components covered by these submittals is given on page iv.

Review of the proposed modifications to FSV Technical Specification Surveillance Requirements and completeness of the FSV ISI program relative to applicable inservice and testing requirements is the subject of this task.

TASK OUTLINE

The principal activities of this task include:

- Review of original FSV inservice inspection program (current program).

- Review of PSC submittals to NRC outlining the revised inservice inspection program.

- Comparison of the revised inservice inspection program to available regulations, requirements and guides including proposed ASME Boiler and Pressure Vessel Code, Section XI, Division 2,"Rules for Inservice Inspection and Testing of Components for Gas-Cooled Plants," and previous PSC operating license commitments to NRC.

- Recommendation of approval of the revised inservice program in whole or in part and recommendation of changes required to meet the applicable requirements necessary to obtain final NRC approval of the program.

PROCEDURE

The procedure for review of each Technical Specification Surveillance Requirement (SR) of the proposed ISI program was generally as follows:

a. Summarization of original requirements.

b. Identification of proposed changes to requirements.

c. Identification of applicable related requirements of code, regulatory agencies, etc.

d. Review, comparison, and discussion of requirements.

Additional requirements beyond the scope of the current group of SRs are contained in Appendix A. The review procedure in Appendix A generally follows the above format, except that (a) and (b) are replaced by a single introductory section.

The review of each SR and its comparison with Section XI, Division 2 Code requirements is summarized in a Table at the end of each section.

PROPOSED ISI PROGRAM - SECTIONS

Surveillance Requirements for Fort St. Vrain Category I systems are covered in three PSC submittals to NRC dated February 8, March 3 and 31, 1980. These include:

1. PCRV Auxiliary System (P-80014 of 2/8/80)

   SR 5.1.2 - Reserve Shutdown System Surveillance
   SR 5.2.1 - PCRV Overpressure Safety System Surveillance
   SR 5.2.15 - PCRV Penetration Interspace Pressure Surveillance
   SR 5.2.16 - PCRV Closure Leakage Surveillance

2. Prestressed Concrete Reactor Vessel (PCRV) (P-80034 of 3/3/80)

   SR 5.2.2 - Tendon Corrosion and Anchor Assemblies Surveillance
   SR 5.2.3 - Tendon Load Cell Surveillance
   SR 5.2.4 - PCRV Concrete Structure Surveillance
   SR 5.2.5 - Liner Specimen Surveillance
   SR 5.2.13 - PCRV Concrete Helium Permeability Surveillance
   SR 5.2.14 - PCRV Liner Corrosion Surveillance
   SR 5.2.24 - Refueling Penetration Holddown Plates Surveillance

3. PCRV Internals (P-80034 of 3/3/80)

   SR 5.2.22 - PGX Graphite Surveillance
   SR 5.2.25 - Core Support Block Surveillance
   SR 5.2.26 - Region Constraint Devices Surveillance

4. Primary Coolant System Helium Circulators (P-80064 of 3/31/80)

   SR 5.2.17 - Helium Circulator Pelton Wheels, Surveillance
   SR 5.2.18 - Helium Circulators, Surveillance
   SR 5.2.19 - IACM Diesel-Driven Pumps, Surveillance (deletion)
   SR 5.2.27 - Helium Shutoff Valves, Surveillance

5. Secondary Coolant System (P-80064 of 3/31/80)

SR 5.3.1 - Steam/Water Dump System, Surveillance

SR 5.3.2 - Main and Hot Reheat Steam Stop Check Valves, Surveillance

SR 5.3.3 - Bypass and Pressure Relief Valves, Surveillance

SR 5.3.4 - Safe Shutdown Cooling Valves, Surveillance

SR 5.3.9 - Safety Valves, Surveillance

SR 5.3.10 - Secondary Coolant System Instrumentation, Surveillance

CODE DEVELOPMENT, ISSUANCE, AND EFFECTIVITY

Proposed Section XI, Division 2, ASME Boiler and Pressure Vessel Code,"Rules for Inservice Inspection and Testing of Components of Gas-Cooled Systems"was issued in September 1977 for a one year review and comment period. This trial period was extended in September 1978 for an indefinite period. In the meantime, development of the proposed code continued and in June 1979 a new subsection was published as addenda to the proposed code - Subsection IGH, Inservice Inspection of Elevated Temperature Structural Material. In January 1980 the ASME Main committee adopted another new subsection to be added to the proposed code - Subsection IGI, Inservice Inspection of Graphite and Thermal Insulation Materials.

ASME plans to officially issue ASME Section XI, Division 2 by the end of 1981, including the initial proposed 1977 issue together with subsequently adopted subsections IGI and IGH. Continued work by rules committees will include future additions to the Gas-Cooled Plant Code of Subsections IGE on Containments (Class MC Vessels) and IGF on Component Supports. These will be based on generic requirements currently contained in similar subsections for LWRs, and requirements appropriate to unique structures of large HTGRs. (Note: LWR code development includes rules for component supports in the current issue of Section XI Division 1. Rules of inspection for containments have been adopted by ASME technical committees and issuance as addenda is expected shortly - Code Case 81-401).

For purposes of this review, the effective revisions of Code and Addenda appropriate to the FSV inservice inspection program update are considered to be the 1977 proposed code draft and summer 1979 draft issue of Subsection IGH for elevated temperature materials requirements.

TERMINOLOGY

A. The "Code" or "proposed Code" refers to Proposed Section XI, Division 2, ASME Boiler and Pressure Code, "Rules for Inservice Inspection and Testing of Components of Gas-Cooled Systems," draft issue of 1977.

B. Surveillance - The current definition of surveillance as contained in the proposed Code states: " . . . . the continued periodic examination performed on material specimens or components to insure the adequacy of the physical properties of the material."

By code definition, surveillance constitutes a specific inspection method. Other methods are identified as examination (NDE), monitoring and testing. The use of the term in the PSC inservice inspection program covers a much broader interpretation encompassing such methods as visual examination, operational testing, performance monitoring, dimensional check, material examination, and testing.

C. The terms AREA, METHOD, EXTENT and FREQUENCY in the Tables are used as defined by the Code.

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

General

In general, the ISI program proposed by PSC is well thought out, practical, and meets the intent of the various applicable codes and regulations as they would apply to the unique Fort St. Vrain HTGR design.

Summary PSC Submittal

The enclosed tables briefly summarize recommendations concerning the proposed ISI program. Immediate NRC approval is recommended in the case of 19 of the 24 items submitted by PSC. One (1) item is for information only, and requires no further NRC action. Three (3) items are recommended for approval following changes recommended herein. One (1) item is suggested for further investigation by PSC.

Additional Items

Appendix A discusses six (6) additional items that do not presently appear in the ISI program, but are recommended herein for inclusion.

REVIEW OF PROPOSED PSC INSERVICE INSPECTION PROGRAM

SUMMARY OF RECOMMENDATIONS ON
ACCEPTABILITY OF SURVEILLANCE REQUIREMENTS (SRs)

SURVEILLANCE REQUIREMENT			RECOMMENDATION TO NRC		
AREA	NO.	TITLE	APPROVE, AS IS	APPROVE, SUBJECT TO: MODIFICATION	APPROVE, SUBJECT TO: FURTHER STUDY
1. PCRV AUXILIARY SYSTEMS	SR 5.1.2	Reserve Shutdown System Surveillance	X		
	SR 5.2.1	PCRV Overpressure Safety System Surveillance		X	
	SR 5.2.15	PCRV Penetration Interspace Pressure Surveillance	X		
	SR 5.2.16	PCRV Closure Leakage Surveillance	X		
2. PCRV STRUCTURES	SR 5.2.2	Tendon Corrosion and Anchor Assemblies Surveillance	X		
	SR 5.2.3	Tendon Load Cell Surveillance	X		
	SR 5.2.4	PCRV Concrete Structure Surveillance	X		
	SR 5.2.5	Liner Specimen Surveillance	X		
	SR 5.2.13	PCRV Concrete Helium Permeability Surveillance	X		
	SR 5.2.14	PCRV Liner Corrosion Surveillance	X		
	SR 5.2.24	Refueling Penetration Holddown Plates Surveillance	X		
3. PCRV INTERNALS	SR 5.2.22	PGX Graphite Surveillance		X	
	SR 5.2.25	Core Support Block Surveillance			X
	SR 5.2.26	Region Constraint Devices Surveillance	X		

REVIEW OF PROPOSED PSC INSERVICE INSPECTION PROGRAM

SUMMARY OF RECOMMENDATIONS ON
ACCEPTABILITY OF SURVEILLANCE REQUIREMENTS (SRs)

SURVEILLANCE REQUIREMENT			RECOMMENDATION TO NRC		
AREA	NO.	TITLE	APPROVE, AS IS	APPROVE, SUBJECT TO: MODIFICATION	APPROVE, SUBJECT TO: FURTHER STUDY
4. HELIUM CIRCULATOR	SR 5.2.17	Helium Circulator Pelton Wheels, Surveillance	X(1)		
	SR 5.2.18	Helium Circulators, Surveillance		X	
	SR 5.2.19	IACM Diesel-Driven Pumps, Surveillance	No action required		
	SR 5.2.27	Helium Shutoff Valves, Surveillance	X		
5. SECONDARY COOLANT SYSTEMS	SR 5.3.1	Steam/Water Dump System, Surveillance	X		
	SR 5.3.2	Main and Hot Reheat Steam Stop Check Valves, Surveillance	X		
	SR 5.3.3	Bypass and Pressure Relief Valves, Surveillance	X		
	SR 5.3.4	Safe Shutdown Cooling Valves, Surveillance	X		
	SR 5.3.9	Safety Valves, Surveillance	X		
	SR 5.3.10	Secondary Coolant System Instrumentation, Surveillance	X		

Note: (1) Approve PSC action to delete from program.

REVIEW OF PROPOSED PSC INSERVICE INSPECTION PROGRAM

SUMMARY OF RECOMMENDATIONS ON
ADDITIONAL SURVEILLANCE REQUIREMENTS
(From APPENDIX A)

AREA	STRUCTURE/SYSTEM/COMPONENT	RECOMMENDATION TO NRC
1. PCRV Structures	A-1: PCRV Penetrations and Closures	PSC incorporate prescribed requirements
2. PCRV Internals	A-2: Thermal Barriers	Subject to prior investigation, PSC develop new SR
	A-3: Core Lateral Restraints	Subject to prior investigation, PSC develop new SR
3. Helium Purification	A-4: Helium Purification System	Subject to prior investigation, PSC develop new SR
4. Steam Generators	A-5: Steam Generator Tubing	PSC submit bi-metallic weld test data.
5. Piping Systems	A-6: High Energy Piping	PSC develop new SR.

Table E-2

SECTION 1

RESPONSES TO PROPOSED TECHNICAL SURVEILLANCE REQUIREMENTS FOR PCRV AUXILIARY SYSTEM

This section responds to the content of PSC-ISI Program submittal to NRC dated February 8, 1980, and includes the following subjects:

1. SR 5.1.2 Reserve Shutdown System Surveillance

2. SR 5.2.1 PCRV and PCRV Penetration Overpressure Protection Surveillance

3. SR 5.2.15 PCRV Penetration Interspace Pressure Surveillance

4. SR 5.2.16 PCRV Closure Leakage Surveillance

1. SR 5.1.2 Reserve Shutdown System Surveillance

a. The original Technical Specification dealt with surveillance of system functional capability and structural integrity of components. Periodic functional testing of a reserve shutdown assembly in the hot cell facility was also a feature of this surveillance area.

b. The basic requirements of the current SR are being augmented by the proposed modification. Operability of valves used as an alternate means of actuating the hopper pressurization valves, visual examinations of piping located within the refueling penetrations when disturbed for other reasons, and pressurizing valves operability testing together with associated position indicating and fail safe features are now included in the scope of the SR.

c. The proposed code does not include components of this reactor control system within the current scope of the pressure-retaining examinations or functional testing categories, planned maintenance on the principal components of the system being normally that of scheduled replacement. There are no indications at this time of ASME plans to add requirements for components of this system to future code versions.

d. The proposed surveillance exceeds Code requirements.

e. It is recommended that NRC approve the SR and proposed changes thereto for implementation by the Plant Technical Specifications.

For details of requirements see Table 1-1

2. SR 5.2.1 PCRV and PCRV Penetration Overpressure Protection Surveillance

a. The original Technical Specification identified requirements for the periodic testing of PCRV rupture disc and safety valve assemblies, and safety valves protecting steam generator and circulator penetrations. Instrumentation calibration and testing requirements associated with the above overpressure protection components made up the remainder of the surveillance coverage for this area.

b. The proposed PSC program modifies the current program in several areas; intervals between tests for the principal overpressure protection components identified in (a) have been modified slightly, requirements for surveillance of the PCRV safety valve containment tank and associated systems have been added, instrumentation calibration and testing requirements have been expanded for the principal overpressure protection components and added for features of the containment tank.

c. Requirements of the proposed Code applicable to the areas identified by the SR include examinations and testing of pressure-retaining vessel and piping boundaries and examinations of bolting and supports as contained in subsections IGB and IGC. Operational testing of valves and their associated position indication features are identified by Subsection IGV.

d. Unique to the FSV design is the housing of PCRV safety valve assemblies (2) within a pressure vessel (safety valve tank)acting as secondary containment. The primary and secondary boundaries are extended between the PCRV safety pipe penetration and the tank by a double wall pipe. The interspaces between primary and secondary boundaries are continuously monitored for leakage. The piping interspace is pressurized, while the safety tank is not pressurized.

Noted in the PSC rationale in support of the proposed surveillance requirements for this area is the position taken that the primary and secondary boundaries are excluded from the volumetric and surface weld examinations by the exempted conditions described by the proposed code, Subsections IGB & IGC-1220. Also noted is the discussion on primary boundary isolation relative to pressure testing, and the subsequent testing method adopted as being that of leak detection during full power operation following each refueling.

Delineated in Table 1-2 are the proposed surveillance requirements of the SR compared with those of the proposed Code. The valve testing area of the proposed SR shows no significant differences in requirements over the proposed code, the methods, extent and frequencies being relatively compatible. However,in the area of pressure-retaining boundary integrity examinations the proposed PSC program does not comply with the intent of the proposed code. Assuming

the validity of the PSC position with respect to exempted category status for volumetric and surface examination of pressure-retaining welds, and consistent with planned rules development for secondary containments, the following should be included in the proposed modification to the SR:

- PCRV safety piping primary boundary visual examinations of all accessible welds, including integrally welded support attachments. Examinations of bolting and support components.

- Safety tank pressure boundary visual examinations of all accessible welds, integral attachments and support components. Tank boundary pressure testing. Torque or tension testing of bolting not normally disturbed for access to tank internals.

- PCRV penetration over pressure protection pipe and valve visual examinations including welded attachments and support components.

e. It is recommended that NRC seek PSC modification of the proposed SR by incorporating the above additional surveillance requirements prior to approving implementation of the SR by the Plant Technical Specifications.

For details of requirements comparison see Tables 1-2 and 1-2a.

3. SR 5.2.15 PCRV Penetration Interspace Pressure Surveillance

a. The original Technical Specification was developed to monitor the performance of instrumentation required to ensure that PCRV penetration interspace pressure is maintained at acceptable limits.

b. The proposed PSC program does not modify the current requirement for this surveillance.

c. The proposed Code does not address the subject. Further, there are no indications that ASME plans to include the subject of instrumentation operability in future code rules development.

d. The above requires no further discussion on the subject.

e. It is recommended that NRC approve the proposed SR for implementation by the Plant Technical Specifications.

For details of requirements comparison see Table 1-3.

4. SR 5.2.16 PCRV Closure Leakage Surveillance

a. The original Technical Specification requirements were established for surveillance of components used for the detection, indication and quantification of PCRV primary and secondary boundary leakage.

b. The proposed change by PSC adds to the SR: (1) testing and calibration of instrumentation for the detection of unacceptable pressure and moisture levels in the core support floor and core support floor columns; (2) control, position indication, and failsafe operation of remote manual isolation valves for the pressurizing, purging and venting of PCRV penetration closures; and (3) testing of check valves in purge lines to refueling and high temperature filter absorber (HTFA) penetrations.

c. The Code position on areas of the SR dealing with instrumentation is as previously stated for companion SR 5.2.15. In the case of pressure-retaining boundary inspection and valve operability testing,requirements are clearly applicable to components of PCRV auxiliary piping systems performing the penetration closure functions as identified by paragraph (b) above. Applicable proposed Code requirements are consequently to be found under Subsections IGC and IGV.

d. Portions of the auxiliary piping systems covered by this SR serve as appendages to containment provided by secondary penetration shells and closures. Normal pressures for these systems exceed reactor coolant pressures. Portions of the systems subject to Class 2 pressure retaining boundary requirements of the proposed Code can be considered as those connecting lines extending beyond the penetration out to and including the first isolation valves. However, the functions of the systems exempt them from the pipe weld joint non-destructive examination requirements of the proposed Code, with periodic pressure testing being performed in lieu of this surveillance method. This is consistent with the intent of the proposed Code.

Planned performance testing of valves, their remote indication and failsafe features are consistent with the intent of the proposed Code. Minor requirements comparison differences (Table 1-3) are noted in the scheduled frequencies for surveillance testing. In light of the various discussions by PSC supporting the proposed surveillance program and in particular those describing plant operating experience to date relating to valve operability surveillance findings, it is concluded that this SR and subsequent proposed changes essentially meet the scope of the proposed Code.

e. It is recommended that the NRC approve the proposed SR for implementation by the Plant Technical Specifications.

For details of requirements comparison see Table 1-3.

SURVEILLANCE REQUIREMENTS (SR): 5.1.2 RESERVE SHUTDOWN SYSTEM SURVEILLANCE

STRUCTURE / SYSTEM / COMPONENT : VARIOUS

TABLE 1-1 Sheet 1

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER[1] REQUIREMENTS	COMMENTS
AREA/ METHOD	a. Hopper - pressurizing test b. ACM quick disconnect valves-operability test c. Reserve shutdown assembly-functional test d. Piping sections in refueling penetration-visual examination e. Pressurizing valve-operability test f. Pressurizing valve-position indicating and failsafe operation test g. System instrumentation and control circuit test	a. through g.: No requirements	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

SURVEILLANCE REQUIREMENTS (SR): 5.1.2 RESERVE SHUTDOWN SYSTEM SURVEILLANCE

TABLE 1-1 Sheet 2

STRUCTURE / SYSTEM / COMPONENT : VARIOUS

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER (1) REQUIREMENTS	COMMENTS
EXTENT/ FREQUENCY	a. Each hopper every 3 months b. Every 3 months c. One assembly every alternate refueling d. Quantities and intervals in consonance with refueling penetration disassembly sequence e. Each subsystem at each refueling f. Each subsystem at each refueling g. Functional test monthly and calibrate annually	a. through g.: No requirements	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

SURVEILLANCE REQUIREMENTS (SR): 5.2.1 PCRV AND PCRV PENETRATION OVERPRESSURE PROTECTION SURVEILLANCE

TABLE 1-2 Sheet 1

STRUCTURE / SYSTEM / COMPONENT : PCRV

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER[1] REQUIREMENTS	COMMENTS
AREA	a. Valve testing: • Isolation Valve • Rupture disc • Safety valve • Position indication circuit for safety/relief train isolation valve b. System instrumentation and control circuits testing	Code Subsection IGV: a. Valve testing: • Isolation Valve • Rupture disc • Safety valve • Remote position indication b. No requirements	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

SURVEILLANCE REQUIREMENTS (SR): 5.2.1 PCRV AND PCRV PENETRATION OVERPRESSURE PROTECTION SURVEILLANCE

TABLE 1-2 Sheet 2

STRUCTURE / SYSTEM / COMPONENT : PCRV

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER[1] REQUIREMENTS	COMMENTS
AREA, Con'd.	c. Pressure-retaining boundaries - vessels (penetrations), piping and valves: • No requirements-exempt category status invoked • No requirements-exempt category status invoked • Bolting • Vessel pressure testing • Piping pressure testing	Code Subsection IGB & IGC: c. Pressure-retaining boundaries vessels (penetrations), piping and valves: • Welds • Supports • Bolting • Vessel pressure testing • Piping pressure testing	PSC postion as per Code paragraphs IGB and IGC-1220. See review text on this SR for recommendations.

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

SURVEILLANCE REQUIREMENTS (SR): 5.2.1 PCRV PENETRATION OVERPRESSURE PROTECTION SURVEILLANCE

STRUCTURE / SYSTEM / COMPONENT : PCRV

TABLE 1-2 Sheet 3

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER (1) REQUIREMENTS	COMMENTS
METHOD	a. Valve testing: • Operational readiness test - Locking verification • Bench test • Set point test • Operation verification test b. Operational readiness test	a. Valve testing: • Operational readiness test - Locking verification • Test, where designed for this capability • Set point test • Operation verification test b. No requirements	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

SURVEILLANCE REQUIREMENTS (SR): 5.2.1 PCRV AND PCRV PENETRATION OVERPRESSURE PROTECTION SURVEILLANCE

STRUCTURE / SYSTEM / COMPONENT : PCRV

TABLE 1-2 Sheet 4

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER[1] REQUIREMENTS	COMMENTS
METHOD, Contd.	c. • No requirements - exempt category status invoked • No requirements - exempt category status invoked • Visual examination • Leak detection test • Leak detection test	c. • Volumetric examination • Volumetric, visual or surface, visual examination • Volumetric, surface, visual examination (Above methods where not exempted from examination by the conditions of IGB and IGC-1220) • Examination during pressure test • Leak detection test	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

SURVEILLANCE REQUIREMENTS (SR): 5.2.1 PCRV AND PCRV PENETRATION OVERPRESSURE PROTECTION SURVEILLANCE

TABLE 1-2 Sheet 5

STRUCTURE / SYSTEM / COMPONENT : PCRV

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER[1] REQUIREMENTS	COMMENTS
EXTENT	a. • Isolation valves (two) • Rupture discs (two) • Safety valves (two) • Applicable isolation valves remote indicators b. Associated with applicable components of safety train	a. • Isolation valves • Quantity at discretion of Owner • Safety valves • Isolation valves remote indicators b. No requirements	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

SURVEILLANCE REQUIREMENTS (SR): 5.2.1 PCRV AND PCRV PENETRATION OVERPRESSURE PROTECTION SURVEILLANCE

STRUCTURE / SYSTEM / COMPONENT : PCRV

TABLE 1-2 Sheet 6

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER (1) REQUIREMENTS	COMMENTS
EXTENT, Cont.	c. PCRV safety valve penetration, tank and piping trains (2)	c. Per the components, parts, portions and quantities identified by Code Tables IGB and IGC-2500-1, where not exempted from examination by the conditions of IGB and IGC-1220.	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

SURVEILLANCE REQUIREMENTS (SR): 5.2.1 PCRV AND PCRV PENETRATION OVERPRESSURE PROTECTION SURVEILLANCE

TABLE 1-2 Sheet 7

STRUCTURE / SYSTEM / COMPONENT : PCRV

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER[1] REQUIREMENTS	COMMENTS
FREQUENCY	a. • Exercise at interval not to exceed five years (each with associated safety valve test) • Examine at interval not to exceed five years (each with associated safety valve test) • Tested at interval not to exceed five years. On alternating basis, one valve at every other refueling. • Remote position indication test in consonance with isolation valve exercising. b. Functional test monthly and calibrate annually	a. • Full stroke exercise during each refueling • If testable, frequency at discretion of Owner • Tested at interval not to exceed five years • Valve remote position indication observed at least once every two years b. No requirements	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

SURVEILLANCE REQUIREMENTS (SR): 5.2.1 PCRV AND PCRV PENETRATION OVERPRESSURE PROTECTION SURVEILLANCE

TABLE 1-2 Sheet 8

STRUCTURE / SYSTEM / COMPONENT : PCRV

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON

SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER (1) REQUIREMENTS	COMMENTS
FREQUENCY Cont.	c. • No requirements-exempt category status invoked	c. • Per the intervals of inspection program A or B of IGA-2400	
	• Bolting, containment tank closure when opened for valve testing	• Per the intervals of inspection program A or B of IGA-2400	
	• At each refueling	• Per the intervals of inspection program A or B of IGA-2400	
	• Following each refueling	• Following each refueling	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

SURVEILLANCE REQUIREMENTS (SR): 5.2.1 PCRV AND PCRV PENETRATION OVERPRESSURE PROTECTION SURVEILLANCE

TABLE 1-2a Sheet 1

STRUCTURE / SYSTEM / COMPONENT : PCRV PENETRATION

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON

SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER[1] REQUIREMENTS	COMMENTS
AREA	a. Valve testing: • Isolation valve • Rupture disc • Safety valve • Remote position indication for safety train isolation valve b. System instrumentation and control circuits testing	Code Subsection IGV: a. Valve testing: • Isolation valve • Rupture disc • Safety valve • Remote position indication b. No requirements	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

SURVEILLANCE REQUIREMENTS (SR): 5.2.1 PCRV AND PCRV PENETRATION OVERPRESSURE PROTECTION SURVEILLANCE

STRUCTURE / SYSTEM / COMPONENT : PCRV PENETRATION

TABLE 1-2a Sheet 2

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER[1] REQUIREMENTS	COMMENTS
AREA, Cont.	c. Pressure-retaining boundaries-piping and valves: • No requirements-exempt category status invoked • No requirements-exempt category status invoked • No requirements-exempt category status invoked • Piping pressure testing	Code Subsection IGC: c. Pressure-retaining boundaries-piping and valves: • Welds • Bolting • Supports • Piping pressure testing	PSC position as per Code para. IGC-1220.

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

SURVEILLANCE REQUIREMENTS (SR): 5.2.1 PCRV AND PCRV PENETRATION OVERPRESSURE PROTECTION SURVEILLANCE

STRUCTURE / SYSTEM / COMPONENT : PCRV PENETRATION

TABLE 1-2a Sheet 3

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER (1) REQUIREMENTS	COMMENTS
METHOD	a. • Operational readiness test - Locking verification • Visual examination (non-testable design) • Set point test • Operation verification test b. Operational readiness test	a. • Operational readiness test - Locking verification • Test, where designed for this capability • Set point test • Operation verification test b. No requirements	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

SURVEILLANCE REQUIREMENTS (SR): 5.2.1 PCRV AND PCRV PENETRATION OVERPRESSURE PROTECTION SURVEILLANCE

STRUCTURE / SYSTEM / COMPONENT : PCRV PENETRATION

TABLE 1-2a Sheet 4

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER[1] REQUIREMENTS	COMMENTS
METHOD, Cont.	c. • No requirements-exempt category status invoked • Volumetric, surface, visual examination • Surface, visual examination • Leak detection test	c. • Volumetric examination • Volumetric, surface, visual examination • Surface, visual examination (Above methods where not exempted from examination by the conditions of IGC-1220) • Leak detection test	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

SURVEILLANCE REQUIREMENTS (SR): 5.2.1 PCRV AND PCRV PENETRATION OVERPRESSURE PROTECTION SURVEILLANCE

STRUCTURE / SYSTEM / COMPONENT : PCRV PENETRATION

TABLE 1-2a Sheet 5

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER[1] REQUIREMENTS	COMMENTS
EXTENT	a. • Isolation valves (two) for each penetration (or penetration group) interspace	a. • Isolation valves	
	• Selected number of discs and knives	• Quantity at discretion of Owner	
	• Safety valves (two) for each penetration (or penetration group) interspace	• Safety valves	
	• Applicable isolation valves remote indicators	• Isolation valves remote indicators	
	b. Associated with applicable components of safety train	b. No requirements	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

SURVEILLANCE REQUIREMENTS (SR): 5.2.1 PCRV AND PCRV PENETRATION OVERPRESSURE PROTECTION SURVEILLANCE

STRUCTURE / SYSTEM / COMPONENT : PCRV PENETRATION

TABLE 1-2a Sheet 6

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER (1) REQUIREMENTS	COMMENTS
EXTENT,Cont.	c. All penetration safety valve piping trains	c. Per the components, parts, portions and quantities identified by Code Table IGC-2500-1 where not exempted from examination by the conditions of IGC-1220.	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

SURVEILLANCE REQUIREMENTS (SR): 5.2.1 PCRV AND PCRV PENETRATION OVERPRESSURE PROTECTION SURVEILLANCE

TABLE 1-2a Sheet 7

STRUCTURE / SYSTEM / COMPONENT : PCRV PENETRATION

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER (1) REQUIREMENTS	COMMENTS
FREQUENCY	a. • Exercise at interval of approximately two and one half years • Examine at interval not to exceed five years • Tested at interval not to exceed five years, with approximately two and one half years between tests • Remote position indication test in consonance with isolation valve exercising	a. • Full stroke exercise during each refueling • If testable, frequency at discretion of Owner • Tested at interval not to exceed five years • Valve remote position indication observed at least once every two years	
	b. Functional test monthly and calibrate annually	b. No requirements	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

SURVEILLANCE REQUIREMENTS (SR): 5.2.1 PCRV AND PCRV PENETRATION OVERPRESSURE PROTECTION SURVEILLANCE

STRUCTURE / SYSTEM / COMPONENT : PCRV PENETRATION

TABLE 1-2a Sheet 8

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER[1] REQUIREMENTS	COMMENTS
FREQUENCY, Cont.	c. • No requirements-exempt category status invoked • Quarterly (per SR 5.2.16)	c. • Per the intervals of inspection Program A or B of IGA-2400 • Following each refueling	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

5.2.15 PCRV PENETRATION INTERSPACE PRESSURE SURVEILLANCE

SURVEILLANCE REQUIREMENTS (SR): 5.2.16 PCRV CLOSURE LEAKAGE SURVEILLANCE

TABLE 1-3 Sheet 1

STRUCTURE / SYSTEM / COMPONENT : PCRV AUXILIARY SYSTEM

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER (1) REQUIREMENTS	COMMENTS
AREA	a. System instrumentation and control circuits testing. b. Valve testing. c. Valve remote position indication testing. d. Valve failsafe actuator testing. e. • Piping pressure-retaining boundaries: no requirements - exempt category status invoked. • Piping pressure testing	Code Subsection IGV: a. No requirements b. Valve testing. c. Valve remote position indication testing. d. Valve failsafe actuator testing. Code Subsection IGC: e. • Piping pressure-retaining boundaries: welds & bolting - exempted from examination by the conditions of Subarticle IGC-1220 • Piping pressure testing.	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

5.2.15 PCRV PENETRATION INTERSPACE PRESSURE SURVEILLANCE

SURVEILLANCE REQUIREMENTS (SR): 5.2.16 PCRV CLOSURE LEAKAGE SURVEILLANCE

TABLE 1-3 Sheet 2

STRUCTURE / SYSTEM / COMPONENT : PCRV AUXILIARY SYSTEM

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON

SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER (1) REQUIREMENTS	COMMENTS
METHOD	a. Operational readiness test	a. No requirements	
	b. Operational readiness test	b. Operational readiness test	
	c. Operation verification test	c. Operation verification test	
	d. Operation verification test	d. Operation verification test	
	e. • No requirements - exempt category status invoked	e. • No requirements - exempted from examination by the conditions of IGC-1220	
	• Leak detection test	• Leak detection test	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

SURVEILLANCE REQUIREMENTS (SR): 5.2.15 PCRV PENETRATION INTERSPACE PRESSURE SURVEILLANCE
5.2.16 PCRV CLOSURE LEAKAGE SURVEILLANCE

TABLE 1-3 Sheet 3

STRUCTURE / SYSTEM / COMPONENT : PCRV AUXILIARY SYSTEM

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER (1) REQUIREMENTS	COMMENTS
EXTENT	Isolation valves and penetration pressurization, purge and vent piping pressure-retaining boundaries.	Isolation valves and penetration pressurization, purge and vent piping pressure-retaining boundaries.	
FREQUENCY	a. Functionally test monthly and calibrate annually. b. • Automatic isolation valve test each year. • Check valve and remote manual isolation valve test once every fifth year. c. Valve remote position indication test once every fifth year.	a. No requirements b. • Valve full stroke exercise during each refueling. • Check valve exercise once every three months (or each refueling). Valve full stroke exercise during each refueling. c. Valve remote position indication observed at least once every two years.	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

5.2.15 PCRV PENETRATION INTERSPACE PRESSURE SURVEILLANCE

SURVEILLANCE REQUIREMENTS (SR): 5.2.16 PCRV CLOSURE LEAKAGE SURVEILLANCE

TABLE 1 - 3 Sheet 4

STRUCTURE / SYSTEM / COMPONENT : PCRV AUXILIARY SYSTEM

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER[1] REQUIREMENTS	COMMENTS
FREQUENCY, Cont'd	d. Valve failsafe actuator test once every fifth year.	d. Valve failsafe actuator test during each refueling.	
	e. • No requirements - exempt category status invoked. • Quarterly	e. • No requirements - exempted category • Following each refueling	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

SECTION 2

RESPONSES TO PROPOSED TECHNICAL SURVEILLANCE REQUIREMENTS FOR PRESTRESSED CONCRETE REACTOR VESSEL (PCRV)

This section responds in part to the content of PSC-ISI Program submittal to NRC dated March 3, 1980, and includes the following subjects:

1. SR 5.2.2 Tendon Corrosion and Anchor Assemblies Surveillance

2. SR 5.2.3 Tendon Load Cell Surveillance

3. SR 5.2.4 PCRV Concrete Structure Surveillance

4. SR 5.2.5 PCRV Liner Specimen Surveillance

5. SR 5.2.13 PCRV Concrete Helium Permeability Surveillance

6. SR 5.2.14 PCRV Liner Corrosion Surveillance

7. SR 5.2.24 Refueling Penetration Holddown Plate Surveillance

8. PCRV Penetrations and Closures

1. SR 5.2.2 Tendon Corrosion and Anchor Assemblies Surveillance

a. The basis for the original Technical Specification was the continued assurance of the adequacy of the corrosion protection measures applied to PCRV prestressing system components.

b. The proposed requirements modify the current position by clarifying tendon wire specimen requirements and intervals between surveillance, and by adding visual examination requirements for verification of the structural integrity of prestressing anchor assemblies.

c. Requirements for prestressing system inspections are contained in Subsection IGK of the proposed Code Section XI, Division 2. They include visual and material surveillance inspections conducted to assure the ontinued integrity of structures and effectiveness of corrosion protection methods.

Regulatory Guide 1.35 identifies inservice inspection requirements for ungrouted tendons in prestressed concrete containments. Several of the requirements are applicable to PCRV structures located inside containment and thus protected from deleterious environmental effects to which the regulatory guide is principally directed. The inservice inspection areas of the regulatory guide appropriate to the PCRV are considered to include wire specimen material tests, visual examinations of prestressing anchor assemblies and adjacent concrete structures, load cell monitoring and measures as will assure tendon corrosion protection.

d. The proposed FSV program for surveillance of the PCRV prestressing system complies with current proposed Code Subsection IGK requirements and those portions of Regulatory Guide 1.35 analogous to the FSV configuration and prestressing system design. Minor differences exist in the surveillance schedule but these are of little consequence in the application of effective surveillance measures which this program provides.

e. It is recommended that NRC apprcve the proposed SR for implementation by the Plant Technical Specifications.

For details of requirements comparison see Table 2-1.

2. SR 5.2.3 Tendon Load Cell Surveillance

a. Prestressing tendon assemblies include a number fitted with load cells as a means of monitoring the capacity of the PCRV to withstand internal pressure. Periodic checks (liftoff tests) on the load cell reference points constitute the planned surveillance activity for these structural components.

b. The proposed modification to the current requirement calls for the periodic testing of the load cell alarm circuit used to indicate a significant shift in the tendon load setting(s).

c. Prestressing system instrumentation (load cell) checks are not addressed by proposed Code Section XI, Division 2. However, the necessity to monitor prestress forces is recognized by the content of Subarticle IGK-3400 which addresses monitoring interval and what constitutes an acceptable rate for the acquisition of data.

d. The above paragraphs require no further discussion.

e. It is recommended that NRC approve the proposed SR for implementation by the Plant Technical Specifications.

For details of requirements comparison see Table 2-2.

3. SR 5.2.4 PCRV Concrete Structure Surveillance

a. The original surveillance requirements were devised to record and track developing crack patterns by visual examination of PCRV surfaces,at and following the structural integrity test and at predetermined intervals thereafter.

b. The proposed modification to the current requirement compliments the visual examination by the addition of surveillance checks for significant dimensional changes at key structural areas of the PCRv profile, including deformations, during vessel pressurization from atmospheric pressure to operating pressure prior to initial power operation and at predetermined intervals thereafter. Periodic visual examinations of PCRV support structures are further additions to the proposed program.

c. Requirements for inspection of CRV surfaces and surveillance of concrete structures are contained in Subsection IGK of proposed Section XI, Division 2. Included in the requirements are visual examination of all concrete surfaces not covered by embedded or anchored items. These examinations cover top and bottom CRV heads,and CRV sidewall. Still to be developed in this inspection area are requirements for CRV support structures.

d. The surveillance requirements being proposed by PSC and those of the proposed Code are generally in agreement. The Code refers to areas of expected high tensile strain, such as the penetration array on the tophead, and ligaments between major components such as steam generators and circulators. No such distinction is drawn

in the PSC Technical Specification. The frequencies of inspection are compatable. The proposed extent of inspection planned by PSC following start-up for visual examination of concrete surfaces covers a greater area than the corresponding code requirements; 100% all areas by PSC as against 100% controlled areas plus 25% uncontrolled areas by code.

The PSC proposed program of visual examination and material surveillance as delineated by SR 5.2.4 meets the intent and scope of proposed Code Subsection IGK for inspection of concrete structures.

e. It is recommended that NRC approve the proposed SR for implementation by the Plant Technical Specifications.

For details of requirements comparison see Table 2-3.

4. SR 5.2.5 Liner Specimen Surveillance

a. The basis for the original Technical Specification was the assurance that the structural characteristics of material used for the PCRV liner are not degraded following exposure to the effects of irradiation, by the performance of mechanical tests prescribed for specimens removed from the reactor at scheduled intervals.

b. The proposed change to this SR deals with the inspection interval. The interval schedule for specimen removal now relates to the "refueling cycle" rather than to "years of power operation".

c. General requirements for liner material surveillance are included in Subsection IGK of the proposed code. Specific requirements on specimen quantities and surveillance intervals have yet to be determined by ASME.

d. The PSC inservice inspection program and subsequent proposed changes for surveillance of liner material meet the intent of the proposed code and provide a suitable scope of inspection. Further, the PSC program appears to comply with the analogous liner material requirements of 10 CFR 50 Criterion 36 and the applicable specimen tests of ASTM-E-185-70 which constitute the bases for liner material surveillance rules being developed by ASME Section XI, Division 2.

e. It is recommended that NRC approve the proposed SR for implementation by the Plant Technical Specifications.

For details of requirements comparison see Table 2-4.

5. SR 5.2.13 PCRV Concrete Helium Permeability Surveillance

a. The original Technical Specification was developed of necessity to obtain additional supportive data on PCRV integrity.

b. The proposed PSC program does not modify the current requirements for this surveillance subject.

c. The proposed code does not address the subject. Further, there are no indications that ASME plans to include the subject in future code rules development.

d. The above requires no further discussion on the subject.

e. It is recommended that the NRC approve the proposed SR for implementation by the Plant Technical Specifications.

For details of requirements comparison see Table 2-5.

6. SR 5.2.14 PCRV Liner Corrosion Surveillance

a. The original Technical Specification requirements were established for the detection of liner material degradation from undefined causes.

b. The proposed PSC program does not modify the current requirements for this surveillance subject.

c. The proposed code does not address the subject. Further, there are no indications that ASME plans to include the subject in future code rules development.

d. The above requires no further discussion on the subject.

e. It is recommended that NRC approve the proposed SR for implementation by the Plant Technical Specifications.

For details of requirements see Table 2-4.

7. SR 5.2.24 Refueling Penetration Holddown Plate Surveillance

a. The proposed program for this SR is a new addition to the Technical Specifications, developed due to the high frequency of removal and reinstallation of the components and subsequent potential for damage to bolting.

b. As described, this is a new SR.

c. The component of concern may be characterized as being analogous to limit stop components located external to PCRV penetration closures for which periodic visual examinations are required by the proposed Code, Subsection IGG, examination category I-B-1. For comparison purposes however, it has been elected not to categorize the component as such.

d. The above requires no further discussion on the subject.

e. It is recommended that NRC approve the proposed SR for implementation by the Plant Technical Specifications.

For details of requirements see Table 2-6.

8. PCRV Penetrations and Closures

As a structural element of the PCRV this subject can be characterized as an area of inservice inspection interest and consequently subject to some form of examination. Leak rate testing of penetrations is the subject of SR 5.2.16; otherwise penetration pressure retaining boundary integrity examinations are not addressed by the current surveillance program. The PSC position on surveillance of these structures is summarized in Appendix A, Item A-1 together with proposed Code applicable requirements and subsequent recommendations for surveillance.

SURVEILLANCE REQUIREMENTS (SR): 5.2.2 TENDON CORROSION & ANCHOR ASSEMBLIES SURVEILLANCE

STRUCTURE / SYSTEM / COMPONENT : PCRV STRUCTURES

TABLE 2-1

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON

SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER[1] REQUIREMENTS	COMMENTS
AREA	a. Prestressing anchor assemblies b. Prestressing tendon wire samples (unstressed)	Code Subsection IGK: a. Prestressing anchor assemblies b. Prestressing tendon wire samples (unstressed)	See Note (2)
METHOD	a. Visual examination b. Surveillance (of material)	a. Visual examination b. Surveillance (of material)	
EXTENT AND FREQUENCY	a. 5% assemblies examined at end of first and third year following initial prestressing and at five years intervals thereafter. b. Samples from 1% prestressing members examined at end of first and third year following prestressing and at five years intervals thereafter.	a. 25% assemblies examined during each inspection interval. b. Two prestressing members at end of first year and one at end of third and fifth year following CRV structural acceptance test, with minimum 1% at five year intervals following commercial service.	a. Code inspection interval based on large HTGR-40 years life with optional intervals programs permitted (IGK-2400)

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.
(2) See text outlining applicable requirements of Reg. Guide 1-35.

SURVEILLANCE REQUIREMENTS (SR): 5.2.3 TENDON LOAD CELL SURVEILLANCE

TABLE 2-2

STRUCTURE / SYSTEM / COMPONENT : PCRV STRUCTURES

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON

SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER (1) REQUIREMENTS	COMMENTS
AREA	a. Tendon load cells and b. Load cell alarm circuitry	No requirements indentified.	
METHOD	a. Calibration test b. Functional test	No requirements identified.	
EXTENT AND FREQUENCY	a. 10% load cells, i.e., 3 of 27, at end of first and third years following initial prestressing and at five year intervals thereafter. b. Annually	No requirements identified.	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

SURVEILLANCE REQUIREMENTS (SR): PCRV CONCRETE STRUCTURE SURVEILLANCE

STRUCTURE / SYSTEM / COMPONENT : PCRV STRUCTURES

TABLE 2-3 Sheet 1

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER[1] REQUIREMENTS	COMMENTS
AREA	a. PCRV concrete structure	Code Subsection IGK: a. CRV tophead and bottomhead - Areas shall include control areas which shall be established thus: - At structural integrity test, 100% of concrete surface shall be examined (CRV areas A, B, and C).(2) - 25% of surface of expected high surface tensile strain during vessel pressurization shall be included in control areas (CRV area A). - 50% of surface of ligaments[3] between steam generator penetrations included in control areas (CRV area B). - All cracks, any portion of which is $\geq$ 0.015 in. wide, shall be included in control areas (CRV areas A and B).	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.
(2) Areas of CRV: A - Tophead, B - Bottomhead, C - Sidewall.
(3) Ligament is defined as area contained by tangents connecting two sides of two penetrations, i.e., main steam penetration and FW, HRH, and CRH penetrations.

SURVEILLANCE REQUIREMENTS (SR): PCRV CONCRETE STRUCTURE SURVEILLANCE

STRUCTURE / SYSTEM / COMPONENT : PCRV STRUCTURES

TABLE 2-3 Sheet 2

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON

SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER[1] REQUIREMENTS	COMMENTS
AREA		- 25% of total concrete surface area shall be included in control area (CRV areas A and B). - Cracks $\geq$ 0.015 in. wide found during examination of uncontrolled areas shall be included in control areas for future inspections (CRV areas A and B). Sidewall - - Areas shall include entire concrete surface. Concrete surface being all areas not covered by embedded or anchored items (CRV area C).	
	b. PCRV concrete support structure.	b. Area requirements in course of preparation.	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

SURVEILLANCE REQUIREMENTS (SR): PCRV CONCRETE STRUCTURE SURVEILLANCE

TABLE 2-3 Sheet 3

STRUCTURE / SYSTEM / COMPONENT : PCRV STRUCTURES

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER (1) REQUIREMENTS	COMMENTS
METHOD	Visual Examination	Visual Examination	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

SURVEILLANCE REQUIREMENTS (SR): PCRV CONCRETE STRUCTURE SURVEILLANCE

TABLE 2-3 Sheet 4

STRUCTURE / SYSTEM / COMPONENT : PCRV STRUCTURES

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER[1] REQUIREMENTS	COMMENTS
EXTENT	a. PCRV concrete structure - - 100% of visible concrete surfaces during each inspection interval. - Concrete cracks $\geq$ 0.015 in. wide shall be recorded. - Recorded cracks shall be assessed for changes in length and new cracks recorded in subsequent examinations.	a. CRV Tophead and Bottomhead - - 100% of controlled area shall be examined during each inspection interval. - During each inspection interval, 25% of uncontrolled areas shall be visually examined. During successive intervals a different 25% of uncontrolled areas shall be examined. - Cracks found within control areas shall be documented. For cracks $\geq$ 0.015 in.wide, location, length and width shall be recorded.	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

SURVEILLANCE REQUIREMENTS (SR): PCRV CONCRETE STRUCTURE SURVEILLANCE

STRUCTURE / SYSTEM / COMPONENT : PCRV STRUCTURES

TABLE 2-3 Sheet 5

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER[1] REQUIREMENTS	COMMENTS
EXTENT		- If demonstrated during structural integrity test that crack width is insensitive to CRV internal pressure, crack mapping can be performed in either pressurized or unpressurized state. Sidewall - - 25% of sidewall concrete surfaces shall be examined during each inspection interval to detect gross degradation.	
	b. 100% of visible concrete for evidence of structural deterioration.	b. Extent of examination in course of preparation.	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

SURVEILLANCE REQUIREMENTS (SR): PCRV CONCRETE STRUCTURE SURVEILLANCE

STRUCTURE / SYSTEM / COMPONENT : PCRV STRUCTURES

TABLE 2-3 Sheet 6

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER (1) REQUIREMENTS	COMMENTS
FREQUENCY	a. At structural integrity test and after first and third year following initial power operation. Subsequent inspections at ten year intervals thereafter.	a. At structural integrity test and subsequent intervals of inspection at ten year intervals.	
	b. At ten year intervals when performing PCRV crack mapping surveillance.	b. In course of preparation.	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

SURVEILLANCE REQUIREMENTS (SR): PCRV CONCRETE STRUCTURE SURVEILLANCE

TABLE 2-3 Sheet 7

STRUCTURE / SYSTEM / COMPONENT : PCRV STRUCTURES

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER (1) REQUIREMENTS	COMMENTS
AREA	Vessel mid-height and center of tophead.	Code Subsection IGK: Vessel mid-height and center of tophead.	
METHOD	Dimensional surveillance of overall deformations, and deflections.	Dimensional surveillance of overall deformations, and deflections.	
EXTENT AND FREQUENCY	Above areas during a vessel pressurization from atmospheric to operating pressure prior to initial power operation and during first depressurization after first, third and fifth year. Subsequent surveillance performed at five year intervals.	Above areas during a vessel pressurization from atmospheric to operating pressure just prior to commercial service then following at first, third and fifth years. Thereafter, at five year intervals.	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

5.2.5 PCRV LINER SPECIMEN SURVEILLANCE

SURVEILLANCE REQUIREMENTS (SR): 5.2.14 PCRV LINER CORROSION SURVEILLANCE

TABLE 2-4

STRUCTURE / SYSTEM / COMPONENT : PCRV STRUCTURES

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON

SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER (1) REQUIREMENTS	COMMENTS
AREA	a. Liner material b. Liner representative areas.	Code Subsection IGK: a. Liner material b. No requirements.	
METHOD	a. Charpy impact tests b. Ultrasonic examination	a. Charpy impact tests b. No requirements.	
EXTENT AND FREQUENCY	a. After fifth refueling cycle, three sets of twelve liner and weld material specimens removed and tested to obtain Charpy impact data. Subsequent removal and testing of similar specimen quantities conducted at each ten year refueling cycle thereafter. b. During first schedule pressurization after end of the third and fifth year following initial power operation. Subsequent examinations at first scheduled depressurization following each ten year interval.	a. In course of preparation. b. No requirements.	a. Per PSC program impact tests will follow practices of ASTM 185-70. Specimen removal and testing frequency adjustable based on prior results following fifth refueling cycle.

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

SURVEILLANCE REQUIREMENTS (SR): 5.2.13 PCRV CONCRETE HELIUM PERMEABILITY SURVEILLANCE

TABLE 2-5

STRUCTURE / SYSTEM / COMPONENT : PCRV STRUCTURES

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER (1) REQUIREMENTS	COMMENTS
AREA	PCRV concrete structure	No requirements	
METHOD	Permeation test	No requirements	
EXTENT AND FREQUENCY	Prior to initial startup and following end of third year of initial power operation. Subsequent tests at five year intervals.	No requirements	Surveillance test intervals subject to adjustment based on analysis of prior results, following fifth year of initial power operation.

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

SURVEILLANCE REQUIREMENTS (SR): 5.2.24 REFUELING PENETRATION HOLDDOWN PLATE SURVEILLANCE

TABLE 2-6

STRUCTURE / SYSTEM / COMPONENT : PCRV STRUCTURES

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER (1) REQUIREMENTS	COMMENTS
AREA	Bolting	No requirements.	
METHOD	Visual examination	No requirements.	
EXTENT AND FREQUENCY	For holddown plates removed at each refueling shutdown.	No requirements.	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

SECTION 3

RESPONSES TO
PROPOSED TECHNICAL SURVEILLANCE REQUIREMENTS
FOR
PCRV INTERNALS

This section responds in part to the content of PSC - ISI Program submittal to NRC dated March 3, 1980, and includes the following subjects:

1. SR 5.2.22 PGX Graphite Surveillance

2. SR 5.2.25 Core Support Block Surveillance

3. SR 5.2.26 Region Constraint Devices Surveillance

4. PCRV Thermal Barriers

5. Core Lateral Restraints

1. SR 5.2.22 PGX Graphite Surveillance

a. The original Technical Specification did not contain requirements for graphite. Surveillance requirements were subsequently added by Amendment #20 dated May 25, 1979, with quantities, removal frequencies and examination methods being identified for removable material specimens located in selected regions of the core.

b. The proposed requirements modify the current requirements by the deletion of "non-destructive" examination from the range of tests to be performed on material specimens removed from the core.

c. Requirements for core support graphite materials are contained in proposed Code Subsection IGG, examination category I-C-1. These consist of visual examination of core support structures and surveillance of core support post graphite materials. Additional material surveillance requirements for core support graphites are identified in new proposed Subsection IGI. It is the intention of ASME that the material surveillance requirements of this new draft subsection ultimately replace the requirements of Subsection IGG.

Reference is made in the notes to examination Table IGG-2600-1 to emerging new techniques for material properties examination appropriate to core support structures and their consequent

applications. The reference concerns methods of volumetric examination of graphite support structures currently being evaluated by laboratories.

d. The PCRV internal arrangements for large HTGRs can readily accommodate proposed Code Section XI Division 2 requirements, whereas the FSV design was developed with less emphasis on accessibility to conduct inspections of core support structures. There is a current program to evaluate PGX graphite behavior material performance in selected regions of the core at FSV. In identifying the core support posts as the principal component for material surveillance attention, it is not inferred by the proposed Code that other components of graphite core support structures are of any lesser concern. Graphite support structures as a whole warrant surveillance attention and it is with this expressed intent that the proposed Code addresses all principal structural graphite support elements. This position is conveyed in the thrust of proposed Code Subsection IGI recently adopted by ASME. This new subsection addresses the potential for variations in structural graphite properties and the consequent necessity for surveillance testing over

a wide range of candidate materials representative of the same general type of graphite. In the case of FSV, this would include the use of ATJ graphite as a structural material.

It is concluded that while the current graphite surveillance program being implemented at FSV responds meaningfully to a particular problem, the necessity exists for the application of a wider scope of surveillance. PGX and ATJ material representative of each type of support component should therefore be included in an expanded scope for core graphite surveillance specimen placement and testing.

e. It is recommended that NRC seek PSC modification of the proposed SR by incorporating the above additional surveillance requirements prior to approving implementation of the SR by the Plant Technical Specifications.

For details of requirements comparison see Table 3-1.

2. SR 5.2.25 Core Support Block Surveillance

a. The original Technical Specification and subsequent amendments did not contain requirements for core support graphite blocks.

b. The new proposed requirements call for remote visual examination of core support block top surface regions fitted with PGX graphite specimens, at frequencies consistent with the graphite specimen removal schedule of Technical Specification SR 5.2.22.

c. Core support block visual examinations are covered by proposed Code Section XI Division 2 Subsection IGG, examination category I-C-1.

d. The proposed surveillance for visual examination of top surface areas of core support blocks expected to exhibit high tensile stresses addresses an issue unique to the burn off phenomenon experienced with PGX graphite. No provision is made for selected viewing by the proposed Code. General viewing of representative core support structures is intended.

On large HTGR this is achieved by general viewing of components of the core outlet plenum by a remote viewing device inserted into the region of interest from above by means of the Fuel Handling Machine via a suitable channel in a fuel region core support block, or from below via one of several special inspection penetrations.

Viewing within the core outlet plenum is not expected to discern degradation other than gross surface deformation and displaced components, such as tilted support posts. Although limited, these examinations can be expected to provide adequate assurance of the overall condition of graphite structural members when combined with the material surveillance requirements of SR 5.2.22. It is therefore considered appropriate that PSC investigate the application of visual examination techniques to components located within the core outlet plenum and include this examination area and method in the SR where determined to be practicable.

e. It is recommended that NRC defer approval of the proposed SR pending the outcome of further study by PSC of the above proposed increase to the scope of examination.

For other aspects of viewing in this core region and subsequent review conclusions see the previous discussion under SR 5.2.22 and item A-2 of Appendix A.
For details of requirements comparison see Table 3-1.

3. SR 5.2.26 Region Constraint Devices Surveillance

a. This is a new Technical Specification. Region Constraint Devices restrain fuel region movements during power operation. Permanency of this new installation will depend on the ability of the design to perform its function.

b. As described, this is a new requirement.

c. The installation of fuel region constraint devices is unique to the FSV plant. There are no proposed Code requirements which cover inservice inspection of similar devices on large HTGR.

d. The proposed Technical Specification describing the devices and the planned method for periodic visual examination and dimensional checks, at the frequencies and of the scope prescribed, should assure the integrity of these devices and mating fuel column components.

e. It is recommended that NRC approve the proposed SR for implementation by the Plant Technical Specifications.

For detail requirements see Table 3-2.

4. PCRV Thermal Barriers

This area of inservice inspection interest is discussed and subsequent recommendations for surveillance provided in Appendix A, Item A-2.

5. Core Lateral Restraints

This area of inservice inspection interest is discussed and subsequent recommendations for surveillance provided in Appendix A, Item A-3.

SURVEILLANCE REQUIREMENTS (SR): 5.2.22 PGX GRAPHITE SURVEILLANCE
5.2.25 CORE SUPPORT BLOCK SURVEILLANCE

TABLE 3-1
Sheet 1

STRUCTURE / SYSTEM / COMPONENT : PCRV INTERNALS

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON

SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER[1] REQUIREMENTS	COMMENTS
AREA	Core Support Structures -	Code Subsection IGG: Core Support Structures -	
	• Core support blocks	• Representative surfaces of components serving as vertical supports	See review texts on these SRs for recommendations.
	• PGX graphite surveillance specimens installed in selected core support blocks.	• Material surveillance coupons fabricated from core support floor removeable plug of same material as core support posts.	See review texts on these SRs for recommendations.
		Code Subsection IGI: • Materials of core support structures: support posts and blocks, including side reflector blocks and support blocks.	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

SURVEILLANCE REQUIREMENTS (SR): 5.2.22 PGX GRAPHITE SURVEILLANCE
5.2.25 CORE SUPPORT BLOCK SURVEILLANCE

STRUCTURE / SYSTEM / COMPONENT : PCRV INTERNALS

TABLE 3-1
Sheet 2

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER[1] REQUIREMENTS	COMMENTS
METHOD	• Visual examination	• Visual examination, where not exempted from examination by the conditions of Subarticle IGG-1220.	Code: Newly developed material surveillance techniques as they become available, to augment visual examination.
	• PGX graphite material surveillance specimens examinations including oxidation rates/profile evaluations and dimensional checks	• Material surveillance coupons examinations (undefined), where not exempted from examinations by the conditions of Subarticle IGG-1220.	
		• Materials specimen tests (mechanical and other properties), where not exempted from examination by the conditions of IGI-1220.	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

SURVEILLANCE REQUIREMENTS (SR): 5.2.22 PGX GRAPHITE SURVEILLANCE
5.2.25 CORE SUPPORT BLOCK SURVEILLANCE

STRUCTURE / SYSTEM / COMPONENT : PCRV INTERNALS

TABLE 3-1
Sheet 3

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER[1] REQUIREMENTS	COMMENTS
EXTENT	• Top surfaces of core support blocks for fuel regions fitted with PGX graphite specimens.	• Examination shall include representative portion of exposed and accessible areas. At least 25% of support blocks and posts inspected during each inspection interval.	
	• PGX graphite specimens installed in five bottom transition reflector elements, sixteen specimens per reflector element.	• Examinations during each inspection interval of material surveillance coupons from three separate core support block plugs. • Material specimens of each type of graphite for support structures exposed to most severe service conditions for the type. Specimen types and quantities to be determined by Owner.	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

5.2.22 PGX GRAPHITE SURVEILLANCE

5.2.25 CORE SUPPORT BLOCK SURVEILLANCE

SURVEILLANCE REQUIREMENTS (SR): _____

STRUCTURE / SYSTEM / COMPONENT : PCRV INTERNALS

TABLE 3-1

Sheet 4

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON

SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER[1] REQUIREMENTS	COMMENTS
FREQUENCY	• In consonance with PGX graphite specimen withdrawal schedule.	• Per the intervals of inspection Program A or B of Subarticle IGA-2400.	
	• Transition element assembly containing PGX graphite specimens withdrawn during: Second, fourth, sixth, ninth and seventeenth refuelings.	• Per the intervals of inspection Program A or B of Subarticle IGA-2400.	
		• Surveillance specimen removal intervals: - First to second refueling (incl.) - Second to fourth (incl.) refueling - Eighth to ninth refueling (incl.) - Twenty-second to twenty-third refueling (incl.)	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

SURVEILLANCE REQUIREMENTS (SR): 5.2.25 REGION CONSTRAINT DEVICE (RCD) SURVEILLANCE

STRUCTURE / SYSTEM / COMPONENT : PCRV INTERNALS

TABLE 3-2
Sheet 1

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER (1) REQUIREMENTS	COMMENTS
AREA	Fuel Region Constraint Devices	Not applicable	These devices, located on top of fuel columns of three adjacent fuel regions, were temporarily installed to eliminate core temperature fluctuations experienced following plant startup. Depending upon thier performance, the continued necessity for the SR will be determined following each inspection.
METHOD	Visual examination	Not applicable	
	Location verification and engagement/ disengagement checks	Not applicable	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

SURVEILLANCE REQUIREMENTS (SR): 5.2.26 REGION CONSTRINT DEVICE (RCD) SURVEILLANCE

TABLE 3-2

STRUCTURE / SYSTEM / COMPONENT : PCRV INTERNALS

Sheet 2

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER (1) REQUIREMENTS	COMMENTS
EXTENT	• Devices within visible range (remote TV) from core region being refueled.	Not applicable	
	• Devices disturbed during refueling	Not applicable	
FREQUENCY	At each refueling	Not applicable	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

SECTION 4

RESPONSES TO PROPOSED TECHNICAL SURVEILLANCE REQUIREMENTS FOR PRIMARY COOLANT SYSTEM HELIUM CIRCULATORS

This section responds in part to the content of PSC-ISI Program submittal to NRC dated March 31, 1980, and includes the following subjects:

1. SR 5.2.17 Helium Circulator Pelton Wheels Surveillance

2. SR 5.2.18 Helium Circulators Surveillance

3. SR 5.2.19 IACM Diesel-Driven Pumps Surveillance

4. SR 5.2.27 Helium Shutoff Valves Surveillance

1. SR 5.2.17 Helium Circulator Pelton Wheels Surveillance

a. The original Technical Specification was developed as a response to the discovery of evidence of cavitation and erosive effects on Pelton Wheel buckets, resulting in the eventual replacement of these components by a modified design. A program of surveillance was initiated for the replacement components that required the examination of a Pelton Wheel during the first turbine generator removal. This one-time examination did not produce further evidence of the original problem, or uncover other potential structural problems associated with the area of interest.

b. Further periodic surveillance of these components will be retained under SR 5.2.18 and the subject SR deleted from the Technical Specification.

c. There are no Code requirements for examination of these components. Further, there are no indications that ASME plans to include the subject in future Code rules development.

d. No further discussion is required.

e. It is recommended that NRC approve PSC action to delete the SR from the Plant Technical Specification.

2. SR 5.2.18 Helium Circulators Surveillance

a. The original Technical Specification established the frequency for circulators replacement and the scope of surveillance, including methods to be used and areas to be covered for these components, the functions of which include that of emergency core cooling.

b. The proposed modifications to the current requirements clarify, but do not modify, the surveillance intervals (ten years) to be followed. Additional requirements have been added in the form of visual examinations for other helium circulator components made accessible in the course of replacement operations for compressor rotor and turbine drive components.

c. Code requirements for circulators fall into three categories of inspection: as pressure-retaining boundaries, as reactor internals;and, as components subject to operational readiness testing. Pressure-retaining boundary requirements are appropriate to circulator casings which form part of primary and secondary boundaries. Reactor internals and performance readiness testing requirements apply to those compressors of the core auxiliary cooling system which are provided with an emergency power source. The requirements are contained in the proposed Code Section XI Division 2; subsections IGB, IGC, IGG and IGQ.

As the bases for code rules development, large HTGR conceptual designs locate the emergency core cooling circulator within the primary boundary. Part of the circulator casing may form a portion of the primary boundary or may function as a support component for the unit. Another feature of design which may warrant inservice inspection attention is the loop service regime with respect to temperature. Code subsection IGH identifies components subject to inspection requirements for materials exposed to elevated temperature service. Areas of large HTGR conceptual designs associated with emergency core cooling are potential candidates for surveillance of materials under the provisions of IGH.

d. Operating modes and features of design for the helium circulator which may influence the applicability of ASME Code requirements to the FSV plant include:

- Unit function includes that of emergency core cooling.
- Configuration conducive to ease of unit and parts replacement.
- Component materials not exposed to long term effects of elevated temperature service.
- Continuous monitoring capability to verify performance characteristics.
- Normal operation expected to provide adequate exercising frequency for some active components to demonstrate performance. For other active components, limitations on exercising during plant operation identified.

Figure 1 depicts the principal areas of inspection for components of primary loop circulation pertinent to the discussion: the penetration, helium circulator, helium shut-off valve and coolant-loop ducting. The schematic is representative of the FSV concept. It identifies and categorizes areas of inspection interest relative to the proposed requirements of the Code and to those of the PSC program. As a further aid for reviewing the comparative differences in the proposed requirements, attention is directed to Table 2-1 on this SR.

FSV operating experience to date (specifically circulator change-outs and subsequent materials investigative testing and analyses of forms and causes of degradation to drive components) has provided the bases for a meaningful program of surveillance for circulator components. Pressure-retaining boundary examinations should also be an important facet of the planned surveillance program. The position that the double closure concept exempts primary and secondary boundaries from volumetric and surface examinations of welds and bolting neglects the safe shutdown cooling function of this component. For further discussion of this point see Appendix A, item A-1. The occasions for circulator change out provide the opportunity for extensive inspection of penetration interspace boundaries and structures. It is recommended that these inspections include the following:

- Penetration primary boundaries forming part of circulator casings, or performing support functions or other functions vital to circulator structural integrity to be examined to the maximum extent practicable. This to include surface examination of accessible welds at structural discontinuities in representative areas of pressure-retaining boundaries, including support attachment welds, and visual examinations of bolting.

- Penetration secondary boundaries (shells and closures) to be examined in accordance with Appendix A, item A-1 recommendations. This as a surveillance requirement for PCRV Structures.

e. It is recommended that NRC seek PSC modification of the proposed SR by incorporating the above additional surveillance requirements prior to approving implementation of the SR by the Plant Technical Specifications.

For details of requirements comparison see Table 2-1.

3. SR 5.2.19 IACM Diesel-Driven Pumps Surveillance

Under a previous ammendment to the Technical Specifications this SR was deleted.

4. SR 5.2.27 Helium Shutoff Valves Surveillance

a. This is a new Technical Specification requiring the surveillance of helium shutoff valve operation by monitoring annually or at the next scheduled plant shutdown if such monitoring has not been performed during the previous year.

b. As described, this is a new requirement.

c. Proposed Code requirements for this component are identified under the check valve category of Subsection IGV.

d. The "failure to seat" consequences of helium circulator valve operation are noted in the PSC rationale in support of the proposed surveillance requirements. The ability to detect malfunction of the valve by installed instrumentation is also noted. The proposed surveillance is considered to be consistent with the intent of the Code.

e. It is recommended that NRC approve the proposed SR for implementation by the Plant Technical Specifications.

For details of requirements comparison see Table 2-2.

SURVEILLANCE REQUIREMENTS (SR): SR 5.2.17 HELIUM CIRCULATORS SURVEILLANCE

TABLE 2-1

STRUCTURE / SYSTEM / COMPONENT : PRIMARY COOLANT SYSTEM

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER (1) REQUIREMENTS	COMMENTS
AREA		Code Subsections IGB	
	a. Pressure-retaining boundaries -	a. Pressure-retaining boundaries -	Applicable categories of Code Tables IGB-2500-1. PSC position as per Code Para. IGB-2500-1.
	Circulator casing: • No requirements - exempt category status invoked for non-removable portions. • Removable portions.	• Circulator casing forming portions of primary pressure-retaining boundaries, welds and bolting	
	b. Circulator supports: • Attachments integrally welded to pressure-retaining casings (non-removable). • Support components, bolted attachments (non-removable).	b. Circulator support members integrally welded to pressure-retaining casings, and support components.	Applicable categories of Code Tables IGB
		Code Subsection IGG	
	• Not applicable.	• Circulator supports (reactor internals category)	Code Table IGG-2500-1, Category I-E-1.

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

SURVEILLANCE REQUIREMENTS (SR): SR 5.2.17 HELIUM CIRCULATORS SURVEILLANCE

TABLE 2-1

STRUCTURE / SYSTEM / COMPONENT : PRIMARY COOLANT SYSTEM

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER[1] REQUIREMENTS	COMMENTS
AREA	c. • Circulator wheel rotor, drive turbine wheel and Pelton wheel • All other components of removed circulator	c. • No requirements. • No requirements.	
		Code Subsection IGQ:	
	d. Circulator operation	d. Compressor (circulator) testing.	
		Code Subsection IGV:	
	e. Valve testing (shaft brake & shutdown seal)	e. Valve testing (automatic isolation valve)	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

SURVEILLANCE REQUIREMENTS (SR): SR 5.2.17 HELIUM CIRCULATORS SURVEILLANCE

STRUCTURE / SYSTEM / COMPONENT : PRIMARY COOLANT SYSTEM

TABLE 2-1

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER[1] REQUIREMENTS	COMMENTS
METHOD	a. • No requirements-exempt category status invoked for non-removable portions. • Visual examination of removed items	a. • Volumetric, surface and visual examinations, as appropriate.	See review text on this SR for recommendations.
	b. • No requirements-exempt category status invoked for non-removable portions.	b. Volumetric,surface and visual examinations, as appropriate.	See review text on this SR for recommendations.
	• No requirements	• Visual examination.	
	• Not applicable	• Visual examination	Code: When made accessible for other reasons.
	c. • Volumetric and surface examinations. • Visual examination.	c. • No requirements. • No requirements.	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

SURVEILLANCE REQUIREMENTS (SR): SR 5.2.17 HELIUM CIRCULATORS SURVEILLANCE

STRUCTURE / SYSTEM / COMPONENT : PRIMARY COOLANT SYSTEM

TABLE 2-1

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER (1) REQUIREMENTS	COMMENTS
METHOD	d. Performance verification during normal operation.	d. Operational readiness test.	
	e. Performance verification during normal operation.	e. Operational readiness test.	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

SURVEILLANCE REQUIREMENTS (SR): SR 5.2.17 HELIUM CIRCULATORS SURVEILLANCE

STRUCTURE / SYSTEM / COMPONENT : PRIMARY COOLANT SYSTEM

TABLE 2-1

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER (1) REQUIREMENTS	COMMENTS
EXTENT	a. Casing of replaced circulator.	a. Per the components, parts, portions and quantities identified by above references.	Code: Generally one component in each group of similar components serving same function.
	b. • All support members and components made accessible during circulator replacement.	b. • Per the components, parts, portions & quantities identified by above references. • 100% of all support components in one circulator.	Code: Generally one component in each group of similar components serving same function.

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

SURVEILLANCE REQUIREMENTS (SR): SR 5.2.17 HELIUM CIRCULATORS SURVEILLANCE

TABLE 2-1

STRUCTURE / SYSTEM / COMPONENT : PRIMARY COOLANT SYSTEM

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER (1) REQUIREMENTS	COMMENTS
EXTENT	c. • Components of replaced circulator, identified in (a) above.	c. • No requirements.	
	d. All circulators (primary coolant loop).	d. All auxiliary circulators (primary coolant loop).	Circulators with emergency core cooling function.
	e. All circulators, shaft break and shutdown seals.	e. All isolation valves.	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

SURVEILLANCE REQUIREMENTS (SR): SR 5.2.17 HELIUM CIRCULATORS SURVEILLANCE

TABLE 2-1

STRUCTURE / SYSTEM / COMPONENT : PRIMARY COOLANT SYSTEM

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER[1] REQUIREMENTS	COMMENTS
FREQUENCY	a. One circulator during first main turbine-generator overhaul and one uninspected circulator at each ten year interval thereafter.	a. Per the intervals of inspection Program A or B of Subarticle IGA-2400.	
	b. One circulator during first main turbine-generator overhaul and one uninspected circulator at each ten year interval thereafter.	b. Per the intervals of inspection Program A or B of Subarticle IGA-2400.	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

SURVEILLANCE REQUIREMENTS (SR): SR 5.2.17 HELIUM CIRCULATORS SURVEILLANCE

STPUCTURE / SYSTEM / COMPONENT : PRIMARY COOLANT SYSTEM

TABLE 2-1

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER (1) REQUIREMENTS	COMMENTS
FREQUENCY	c. • Components of one circulator during first main turbine-generator overhaul and one uninspected circulator at each ten year interval thereafter.	c. • No requirements.	
	• As above for initial inspection and thereafter of components made accessible by disassembly to inspect circulator wheels.	• No requirements.	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

SURVEILLANCE REQUIREMENTS (SR): SR 5.2.17 HELIUM CIRCULATORS SURVEILLANCE

STRUCTURE / SYSTEM / COMPONENT : PRIMARY COOLANT SYSTEM

TABLE 2-1

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER[1] REQUIREMENTS	COMMENTS
FREQUENCY	d. Quarterly test when not operated more frequently during normal operation. e. Yearly test when not operated more frequently during normal operation.	d. • Monthly readiness test. • Annual full flow test. e. Valve full stroke exercise during each refueling.	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

SURVEILLANCE REQUIREMENTS (SR): SR 5.2.27 HELIUM SHUTOFF VALVES SURVEILLANCE

STRUCTURE / SYSTEM / COMPONENT : PRIMARY COOLANT SYSTEM

TABLE 2-2

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON

SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER[1] REQUIREMENTS	COMMENTS
		Code Subsection IGV:	
AREA	a. Valve testing.	a. Valve testing.	
METHOD	b. Operational readiness test.	b. Operational readiness test.	
EXTENT	c. All helium circulator shutoff valves.	c. Isolation check valves.	
FREQUENCY	d. Monitored annually.	d. Check valve exercise once every three months (or each refueling, when impracticable during operation).	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

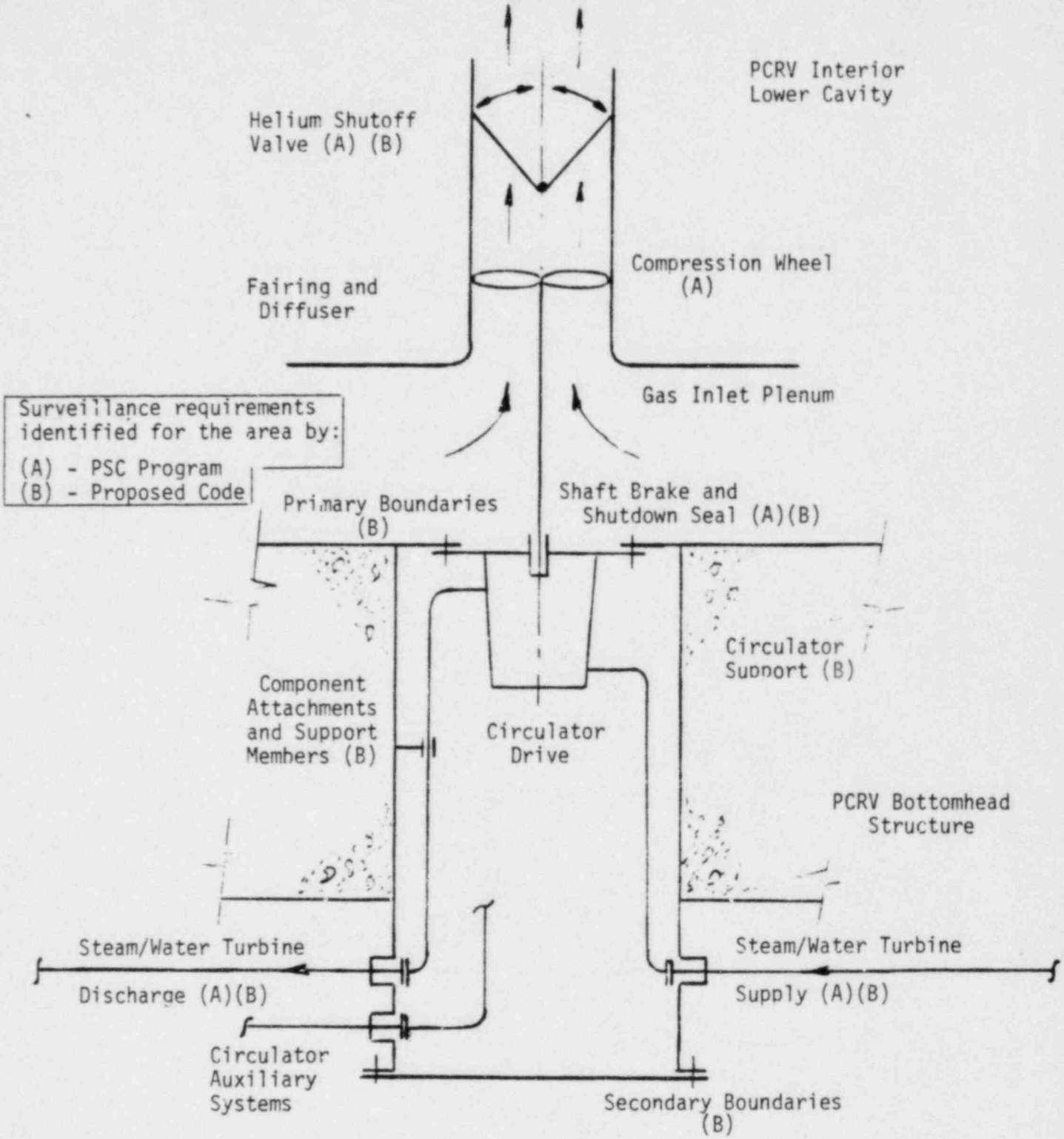

FIGURE 1

CIRCULATOR PENETRATION & INLET GAS PLENUM,

SCHEMATIC SHOWING PRINCIPAL

COMPONENTS & AREAS OF INSPECTION

SECTION 5

RESPONSES TO
PROPOSED TECHNICAL SURVEILLANCE REQUIREMENTS
FOR
SECONDARY COOLANT SYSTEM

This section responds in part to the content of PSC - ISI Program submittal to NRC dated March 31, 1980, and includes the following subjects:

1.	SR 5.3.1	Steam/Water Dump System Surveillance
2.	SR 5.3.2	Main and Hot Reheat Steam Stop Check Valves Surveillance
3.	SR 5.3.3	Bypass and Pressure Relief Valves Surveillance
4.	SR 5.3.4	Safe Shutdown Cooling Valves Surveillance
5.	SR 5.3.9	Safety Valves Surveillance
6.	SR 5.3.10	Secondary Coolant System Instrumentation Surveillance

1. SR 5.3.1 Steam/Water Dump System Surveillance

a. The original Technical Specification was developed for the periodic operational testing of valves used to dump steam generator inventory to the dump tank in the event of a steam generator tubing failure. Included in the surveillance were requirements for functional checks and calibration of tank level, pressure, temperature indicators and other associated instrumentation.

b. The proposed PSC program does not modify the current requirements for this surveillance subject.

c. Proposed Code requirements applicable to operational testing of the dump valves are identified under Category B valves of Subsection IGV.

d. The proposed surveillance for dump system valve testing is consistent with the intent and scope of the Code.

Component structural integrity requirements beyond those of normal monitoring for leakage of pressure retaining boundaries is not considered to be necessary, as described by the PSC rationale provided in support of the proposed scope for surveillance of secondary coolant systems. This position is addressed in the discussions of Appendix A as a separate topic. Meantime, the review of this SR is limited to that on valve operability testing.

e. It is recommended that NRC approve the proposed SR for implementation by the Plant Technical Specifications.

For details of requirements comparison see Table 5-1

2. SR 5.3.2 Main and Hot Reheat Steam Stop Check Valves Surveillance

a. The original Technical Specification was developed to verify operability of the main and reheat steam stop check valves by periodic stroking.

b. The proposed PSC program does not modify the current requirements for this surveillance subject.

c. Proposed Code requirements for exercising the stop check valves are identified in Subsection IGV, Subarticle IGV-3400.

d. The proposed surveillance for periodic exercising of main and hot reheat steam stop check valves is consistent with the intent and scope of the Code.

Component structural integrity requirements beyond those of normal monitoring for leakage of pressure retaining boundaries is not considered to be necessary, as described by the PSC rationale provided in support of the proposed scope for surveillance of secondary coolant systems. This position is addressed in the discussions of Appendix A as a separate topic. Meantime, the review of this SR is limited to that on valve operability testing.

e. It is recommended that NRC approve the proposed SR for implementation by the Plant Technical Specifications.

3. SR 5.3.3 Bypass and Pressure Relief Valves Surveillance

a. The original Technical Specification was developed for the periodic operational testing of valves used for (a) bypassing of main steam for safe shutdown cooling components, including circulator drive, following turbine trip or loop isolation, (b) main steam relief during these events and (c) assurance of continuous steam flow from circulators during decay heat removal. Valves include main steam and hot reheat steam bypasses and power operated pressure reliefs.

b. The proposed PSC program does not modify the current requirements for this surveillance subject.

c. Operability testing of valves covered by the proposed SR are identified in proposed Code Subsection IGV, under Category B valves.

d. The proposed surveillance for the performance of operability testing of the valves identified above is consistent with the intent and scope of the Code.

Component structural integrity requirements beyond those of normal monitoring for leakage of pressure retaining boundaries is not considered to be necessary, as described by the PSC rationale provided in support of the proposed scope for surveillance of secondary coolant systems. This position is addressed in the discussions of Appendix A as a separate topic.

Meantime, the review of this SR is limited to that on valve operability testing.

e. It is recommended that NRC approve the proposed SR for implementation by the Plant Technical Specifications.

4. SR 5.3.4 Safe Shutdown Cooling Valves Surveillance

a. The original Technical Specification was developed for periodic operability testing of valves vital to the safe shutdown cooling mode, and activated remotely by pneumatic, hydraulic or electrical means.

b. The proposed program modifies the current program by extending the valve testing interval by approximately 6 months and by including check valves vital to initiation of the safe shutdown cooling mode.

c. Valve testing requirements appropriate to this area are identified in proposed Code Subsection IGV. These include valve exercising, including confirmation of check valve operation, verification of remote position indication and stroke time measurements for power operated valves.

d. The proposed surveillance for the valves identified by the proposed SR and subsequent modification thereto, Paragraph b, is considered to be consistent with the intent and scope of the proposed Code.

Component structural integrity requirements beyond those of normal monitoring for leakage of pressure retaining boundaries is not considered to be necessary, as described by the PSC rationale provided in support of the proposed scope for surveillance of secondary coolant systems. This position is

addressed in the discussions of Appendix A as a separate topic. Meantime, the review of this SR is limited to that on valve operability testing.

e. It is recommended that NRC approve the proposed SR and proposed changes thereto for implementation by the Plant Technical Specifications.

5. SR 5.3.9 Safety Valves Surveillance

a. This is a new Technical Specification developed for the periodic testing of safety valves installed in main steam, reheat steam and generator steam/water dump systems.

b. As described, this is a new requirement.

c. Operability testing of valves covered by the proposed SR are identified in proposed Code Subsection IGV, under Category C valves.

d. The proposed surveillance for the valves identified by the proposed SR is consistent with the intent and scope of the proposed Code.

Component structural integrity requirements beyond those of normal monitoring for leakage of pressure retaining boundaries is not considered to be necessary, as described by the PSC rationale provided in support of the proposed scope for surveillance of secondary coolant systems. This position is addressed in the discussions of Appendix A as a separate topic, meantime, the review of this SR is limited to that on valve operability testing.

e. It is recommended that NRC approve the proposed SR for implementation by the Plant Technical Specifications.

6. SR 5.3.10 Secondary Coolant System Instrumentation Surveillance

a. This is a new Technical Specification developed to verify the performance of instrumentation used to detect conditions in portions of the secondary coolant system vital to the safe shutdown cooling mode.

b. As described, this is a new requirement.

c. The proposed Code does not address the subject of instrumentation performance.

d. The proposed Code position requires no further discussion on the subject.

e. It is recommended that NRC approve the proposed SR for implementation by the Plant Technical Specifications.

SURVEILLANCE REQUIREMENTS (SR): 5.3.1, 5.3.2, 5.3.3, 5.3.4 and 5.3.9

STRUCTURE / SYSTEM / COMPONENT : SECONDARY COOLANT SYSTEM, VALVES SURVEILLANCE

TABLE 5-1 Sheet 1

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER[1] REQUIREMENTS	COMMENTS
AREA	Valve testing • Power operated isolation valves, including check valves. • Safety valves • Locked valves	Code Subsection IGV Valve testing • As for valve Categories B, C, and E.	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

SURVEILLANCE REQUIREMENTS (SR): 5.3.1, 5.3.2, 5.3.3, 5.3.4 and 5.3.9

TABLE 5-1 Sheet 2

STRUCTURE / SYSTEM / COMPONENT : SECONDARY COOLANT SYSTEM, VALVES SURVEILLANCE

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER[1] REQUIREMENTS	COMMENTS
METHOD	• Operational readiness tests, including: Exercising Stroke time measurement Disc position verification Remote position indication verification • Setpoint test • Locking verification	• By the applicable methods identified for category B valves, including: Exercising Stroke time measurement Disc position verification Remote position indication verification • Setpoint test • Locking verification	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

SURVEILLANCE REQUIREMENTS (SR): 5.3.1, 5.3.2, 5.3.3, 5.3.4 and 5.3.9

TABLE 5-1 Sheet 3

STRUCTURE / SYSTEM / COMPONENT : SEOCNDARY COOLANT SYSTEM, VALVES SURVEILLANCE

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER (1) REQUIREMENTS	COMMENTS
EXTENT	All essential valves associated with initiation of the safe shutdown cooling mode.	Valves, including their activating and position indicating systems, required in shutting down the reactor.	
FREQUENCY	• For valves not exercised during normal operation, tested annually or at next scheduled shutdown where not tested during previous year. (Incl. remote position indication.) Tested every three months (steam/water dump valves)	• Full stroke exercised during each refueling. Valve remote position indication observed at least once every two years.	
	• Tested at interval not to exceed five years	• Tested at interval not to exceed five years	
	• Examined with associated upstream isolation valve	• Examined at frequency for other associated system isolation valves	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

APPENDIX A

ADDITIONAL SURVEILLANCE REQUIREMENTS

Identified by this Appendix are areas of inservice inspection interest considered to warrant greater attention in order to meet the intent and scope of the proposed Code. These include areas addressed by PSC in rationale supporting the scope of surveillance proposed by the SRs, as well as related areas not identified by proposed SRs. Recommendations for additional surveillance are, in most cases, predicated on the outcome of prior investigation by PSC to determine applicability; consequently they are not expected to result in automatic adoption.

Included in these additional areas of inservice inspection interest are the following structures, systems and components:

A-1	PCRV Penetrations and Closures
A-2	PCRV Thermal Barriers
A-3	Core Lateral Restraints
A-4	Helium Purification System
A-5	Steam Generator Tubing
A-6	High Energy Piping

APPENDIX A

A-1 PCRV Penetrations and Closures

a. PCRV penetration configurations for the FSV design consist of two independent closures arranged in series and which provide primary and secondary containment. The interspace between closures is normally pressurized to a level slightly over primary coolant pressure. Secondary closure structures shells and closures, consequently, see interspace pressure.

Pressure retaining boundary surveillance requirements proposed by PSC for these Class 1 structures are confined to periodic pressure testing to detect loss of penetration structural integrity (SR 5.2.16). The rationale behind this surveillance position is that with this penetration assembly design (double closures) simultaneous failure of both primary and secondary closures is considered to be an incredible event. Consequently, periodic monitoring for leakage constitutes the only form of inservice inspection required. The PSC rationale further supports this scope of surveillance by citing the exempted categories of the proposed Code as being applicable exclusions: "both primary and secondary closures are exempted from volumetric and surface examinations since they are not utilized for shutdown heat removal, or chemical ingress detection or control, and failure of the component would not result in a primary coolant system depressurization which exceeds the rate established for the

design basis depressurization accident."

b. Proposed Code Section XI, Division 2 provides rules for inspection and testing of PCRV penetration assemblies based on a single (primary) penetration closure design, representative of the current large HTGR concept. The requirements for penetration structures include volumetric or surface examination of pressure-retaining welds and bolting, visual examination of flow restrictors and limit stops, examinations for leakage and pressure testing. The applicable areas of the Code are Subsections IGB and IGC for Class 1 and Class 2 penetrations respectively, and Subsection IGG for limit stops and flow restrictors.

c. The FSV penetration double closure design concept places this component in a unique inspection category not directly addressed by the proposed code. The PSC rationale would invoke exempted status from volumetric and surface examinations based on component function and design. However, the basic precepts of the proposed Code governing the scope of examination for PCRV penetrations are generally applicable to the FSV design. The following FSV penetrations fall within <u>non-exempted</u> categories:

- <u>Steam Generator</u> and <u>Helium Circulator</u> penetrations utilized for <u>shutdown heat removal</u> operations.

- Refueling penetrations utilized for nuclear reactivity control.

- High Temperature Filter Absorber and Helium Purification Piping penetrations utilized for chemical ingress control.

All other FSV penetrations, failure of which will not result in a DBDA, may be considered as being exempted from volumetric and surface examinations for pressure-retaining boundaries. These include:

- Top and Bottom Access penetrations
- Safety Valve penetrations
- Instrumentation penetrations

With due consideration of the FSV penetration design configuration and consistent with the intent of the proposed Code the following proposed surveillance requirements are recommended:

For non-exempted components -
Surveillance of a representative number of penetration assembly areas designed as secondary containment (shells and closures) to be performed to the maximum extent practicable over the life of the plant, as noted below.

- Surface examination of accessible pressure-retaining circumferential welds[1] in penetration shells and closures; integral attachment welds not backed by concrete; and circumferential welds[1] in penetration shells backed by concrete but outboard of any shear anchor. Examinations may be performed from the outside of the penetration or from the inter-space region where removal of the penetration closure is a regularly scheduled event (refueling, circulator change-out, etc.).

- Visual examination of bolting. Additionally, tension testing of bolting not normally disassembled for maintenance or any other scheduled event.

- Visual examination of accessible limit stops and structures identified as flow restrictors.

- Leak testing.

For exempted components -

Surveillance of penetration assemblies designed as secondary containment (shells and closures) to be performed to the maximum extent practicable over the life of the plant, as noted below.

- Visual examination of pressure retaining welds[1] in accessible areas of penetration shells and closures outboard of concrete.

- Visual examination of bolting, torque and tension testing.

- Visual examination of accessible limit stops and structures identified as flow restrictors.

- Leak testing.

d. It is recommended that NRC seek modification of the proposed PSC inservice inspection program to include the prescribed additional surveillance requirements in the PCRV structures section of the Plant Technical Specifications.

(1) Primarily, welds at structural discontinuities.

For details of requirements comparison see Table A-1.

SURVEILLANCE REQUIREMENTS (SR): --

TABLE A-1 Sheet 1

STRUCTURE / SYSTEM / COMPONENT : PCRV PENETRATIONS & CLOSURES

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON

SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER[1] REQUIREMENTS	COMMENTS
AREA	Primary and secondary penetrations and closures:	Code Subsections IGB & IGC:	
		Primary and secondary penetrations and closures:	Applicable categories of Code Tables IGB & IGC-2500-1.
	• No requirements - exempt category status invoked.	• Pressure retaining welds and bolting.	
	• System pressure testing	• System pressure testing	
		Code Subsection IGG:	Code Table IGG-2500-1, Categories I-A-1 & I-B-1.
	• No requirements	• Flow restrictors and limit stops	
METHOD	• No requirements-exempt category status invoked.	• Volumetric, surface and visual examinations, as appropriate. (Above methods where not exempted from examination by the conditions of IGB & IGC-1220)	
	• Leak detection test.	• Leak detection test	
	• No requirements	• Visual examination	When made accessible for other reasons.

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

SURVEILLANCE REQUIREMENTS (SR): --

TABLE A-1 Sheet 2

STRUCTURE / SYSTEM / COMPONENT : PCRV PENETRATIONS & CLOSURES

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER[1] REQUIREMENTS	COMMENTS
EXTENT	All penetrations and penetration closure interspace pressure retaining boundaries.	Per the components, parts, portions and quantities indentified by Code Tables IGB, IGC and IGG-2500-1, where not exempted from examination by the conditions of IGB, IGC and IGG-1220.	
FREQUENCY	Quarterly (Per SR 5.2.16 for piping)	Per the intervals of inspection Program A or B of IGA-2400.	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

APPENDIX A

A-2 Thermal Barriers

a. The PSC surveillance requirements position for thermal barriers can be summarized as follows:

- Monitoring of thermal barrier performance, as indicative of the structural integrity of thermal barrier assemblies and materials, by means of liner cooling water system instrumentation.

- Remote visual examination of upper core plenum areas as an investigative means only to verify degraded thermal barrier performance detected by liner water cooling system instrumentation, and not as a scheduled surveillance requirement.

The proposed PSC Program does not contain requirements specific to thermal barriers, but rather, by imposing surveillance requirements on the instrumentation for the liner cooling water system, the continued monitoring of thermal barrier performance can be assured.

b. Proposed Code Subsection IGG, examination category I-D-1 identifies visual examination requirements for thermal barriers including specific areas, quantities and frequencies. Additionally, requirements for metallic portions of thermal barriers exposed to elevated temperature service are

contained in Subsection IGH, examination category I-C-1, and requirements for insulation materials are covered by draft Subsection IGI, examination category I-B-1. It should be noted that with the current material surveillance specimen requirements of the above code subsections the selections, quantities and in-core locations for sample coupons are at the discretion of the Owners.

c. The PSC rationale for thermal barrier inservice inspection emphasizes the capability for detecting thermal barrier component degradation by the performance of the liner cooling water system. Exempted category status under the conditions identified in proposed Code Subarticles IGG and IGI-1220 is sought. Periodic removal of certain PCRV appendages and their use as possible sources for thermal barrier surveillance specimens is also discussed. However, since thermal barrier specimens on the removable components identified would not represent the general design they were not used for material surveillance purposes.

It is the intent of the Code that visual examination combined with material surveillance of thermal barrier components be conducted in cavity areas where failures could affect safety functions. Lower plenum areas, including duct entrances to emergency cooldown equipment, are of particular

interest.

Exempted category status for surveillance of metallic and insulation materials of thermal barriers is validly based on the capability of the liner cooling water system configuration and instrumentation to detect impaired thermal barrier performance. However, the necessity for visual examination of representative thermal barrier structures still exists, especially in the core outlet plenum area and in the steam generator inlet ducting. Consequently, it is concluded that this should be a feature of the proposed surveillance program. It is considered appropriate that PSC investigate the application of visual examination techniques to thermal barriers located within the core outlet plenum and steam generator inlets and develop this examination as the topic of a new SR.

d. It is recommended that NRC seek PSC development of a new SR based on the outcome of the proposed investigation.

For details of requirements comparison see Table A-2.

SURVEILLANCE REQUIREMENTS (SR): --

STRUCTURE / SYSTEM / COMPONENT : PCRV INTERNALS - THERMAL BARRIERS

TABLE A-2

Sheet 1

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER[1] REQUIREMENTS	COMMENTS
AREA	• No requirements	Code Subsection IGG: • Representative surfaces in upper and lower core plenums and core cavity end of auxiliary loop cross ducts.	See review text on this subject for recommendation.
	• Not applicable	Code Subsection IGH: • Plate, bar, forging, bimetallic welds exposed to elevated temperature service	PSC: Exempted category status invoked.
	• Not applicable	Code Subsection IGI: • Thermal insulation, fibrous and ceramic	PSC: Exempted category status invoked.

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

SURVEILLANCE REQUIREMENTS (SR): --

STRUCTURE / SYSTEM / COMPONENT : PCRV INTERNALS - THERMAL BARRIERS

TABLE A-2
Sheet 2

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER (1) REQUIREMENTS	COMMENTS
METHOD	• No requirements	• Visual examination where not exempted from examination by the conditions of Subarticle IGG-1220.	
	• Not applicable	• Metallic materials specimen tests (mechanical properties), where not exempted from examination by the conditions of Subarticle IGH-1220.	
	• Not applicable	• Insulation materials specimen tests (mechanical and other properties), where not exempted from examination by the conditions of Subarticle IGI-1220.	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

SURVEILLANCE REQUIREMENTS (SR): --

TABLE A-2

STRUCTURE / SYSTEM / COMPONENT : PCRV INTERNALS - THERMAL BARRIERS

Sheet 3

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER (1) REQUIREMENTS	COMMENTS
EXTENT	• No requirements	• Examination during each refueling shall cover representative portion of exposed and accessible areas. At least 25% of surface examined during each inspection interval.	
	• Not applicable	• Material specimens of each type of metallic structural material exposed to temperatures and environment representative of service conditions. Specimen types and quantities to be determined by Owner.	
	• Not applicable	• Material specimens of each type of insulation material exposed to most severe service conditions for the type. Specimen types and quantities to be determined by Owner.	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

SURVEILLANCE REQUIREMENTS (SR): --

STRUCTURE / SYSTEM / COMPONENT : PCRV INTERNALS - THERMALS BARRIERS

TABLE A-2

Sheet 4

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER (1) REQUIREMENTS	COMMENTS
FREQUENCY	• No requirements	• Per the intervals of inspection Program A or B of Subarticle IGA-2400.	
	• Not applicable	• Surveillance specimen removal intervals: - First to second refueling (incl.) - Second to fourth (incl.) refueling - Eighth to ninth refueling (incl.) - Twenty-second to twenty-third refueling (incl.)	
	• Not applicable	• Surveillance specimen removal intervals as above.	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

A-3 Core Lateral Restraints

a. There are no Technical Specification surveillance requirements for core lateral restraints. For reasons provided by the PSC rationale, surveillance requirements are not prescribed for this component. These are given as: lack of indications for concern and, component inaccessibility.

b. Proposed Code Section XI Division 2 contains requirements for inspection of these components under Subsection IGG, examination category I-G-1. The form of inspection is surveillance of specimens fabricated from materials for springs used in core lateral restraint designs for large HTGR. Radiation environment and temperature are the basic concerns behind the surveillance requirements. Code Subsection IGH, examination category I-E-1 also contains requirements for these components in the form of surveillance tests for metallic structural material specimens following exposure to elevated temperature service.

Future plans for rules development by ASME include the arranging of all material surveillance requirements for these components under a single applicable subsection and not spread over two areas of the proposed Code as in the current edition.

c. As previously mentioned, core lateral restraint designs for large HTGR include springs, both coil and leaf types. Safety function demands on these active parts necessitate material integrity verification by the periodic testing of material specimens following exposure. The FSV design for core lateral restraints does not include spring packs; however, other structural members of this component may be subjected to elevated temperatures and other conditions of service which could result in the occurance of significant material degradation. The position of no planned surveillance for these components should therefore be supported by design analysis demonstrating that unacceptable degradation will not occur under the service conditions to which the components are exposed. Where this cannot be ascertained it is important that surveillance be performed to verify component functional integrity as a feature of the proposed inservice inspection program.

d. It is recommended that NRC seek PSC development of a new SR or documentation of analysis data which demonstrates that plant safety will not be compromised by lack of a core lateral support surveillance program.

For details of requirements comparison see Table A-3.

SURVEILLANCE REQUIREMENTS (SR): --

TABLE A-3

STRUCTURE / SYSTEM / COMPONENT : PCRV INTERNALS - CORE LATERAL RESTRAINTS

Sheet 1

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER[1] REQUIREMENTS	COMMENTS
AREA	• Not applicable	Code Subsection IGG: • Core lateral restraint spring material coupons housed in regions representative of most severe core lateral restraint environment.	
	• No requirements	Code Subsection IGH: • Plate, bar, forging exposed to elevated temperature service	PSC - Potential applicability depending on design analyses. (see review text.)
METHOD	• Not applicable	• Material specimen tests (mechanical properties), where not exempted from examination by the conditions of Subarticle IGG-1220.	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

SURVEILLANCE REQUIREMENTS (SR): --

STRUCTURE / SYSTEM / COMPONENT : PCRV INTERNALS - CORE LATERAL RESTRAINTS

TABLE A-3
Sheet 2

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER[1] REQUIREMENTS	COMMENTS
METHOD, CONT.	• No requirements	• Materials specimen tests (mechanical properties), where not exempted from examination by the conditions of Subarticle IGH-1220.	
EXTENT	• Not applicable	• Nine coupons of each type of spring material during each inspection interval.	
	• No requirements	• Material specimens of each type of structural material exposed to temperatures and environment representative of service conditions. Specimen types and quantities to be determined by Owner.	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

SURVEILLANCE REQUIREMENTS (SR): --

STRUCTURE / SYSTEM / COMPONENT : PCRV INTERNALS - CORE LATERAL RESTRAINTS

TABLE A-3
Sheet 3

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER (1) REQUIREMENTS	COMMENTS
FREQUENCY	• Not applicable	• Per the intervals of inspection Program A or B of Subarticle IGA-2400.	
	• No requirement	• Surveillance specimen removal intervals: - First to second refueling (incl.) - Second to fourth (incl.) refueling - Eighth to ninth refueling (incl.) - Twenty-second to twenty-third refueling (incl.)	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

APPENDIX A

A-4 Helium Purification System

a. The subject system is directly connected to the PCRV, with portions serving as primary and secondary boundaries. Included in the functions of the system is that of chemical control of reactor coolant.

No SR covering this Category I item can be identified nor has the subject been discussed by PSC in the proposed program submittals of Category I items to NRC.

b. The function of the system places it in the non-exempt category by the conditions of proposed Code Subarticles IWB and IWC-1220 and therefore subject to appropriate non-destructive examination requirements for pressure-retaining components delineated in Tables IGB and IGC-2600-1. Also applicable is Subarticle IGV for testing of valves.

c. It is proposed that this subject be included in the PSC surveillance program for those features of inservice inspection interest vital to the continued availability and safe operation of the system, including areas of structural integrity and component operability. The proposed requirements to be developed on the following bases:

- For primary boundary components, including vessels and piping, when not contained within a monitored secondary boundary designed to withstand primary pressure:

  - Surface examination of accessible pressure retaining welds at structural discontinuities and integral attachments.
  - Visual examination of bolting and additionally, tension testing of bolting where not disassembled for maintenance or other reasons.
  - Visual examination of support members.
  - Leak testing.

- For piping boundaries acting as secondary containment:

  - Visual examination of accessible pressure retaining welds and support members.
  - Leak testing.

- For system isolation valves:

  - Verification of valve operability.
  - Leak testing.
  - Other tests determined appropriate to valve type and function.

d. It is recommended that NRC seek the inclusion of the subject system in the proposed PSC inservice inspection program on the bases of the above prescribed surveillance requirements.

SURVEILLANCE REQUIREMENTS (SR): --

STRUCTURE / SYSTEM / COMPONENT : HELIUM PURIFICATION SYSTEM

TABLE A-4 Sheet 1

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER[1] REQUIREMENTS	COMMENTS
AREA	Pressure-retaining components: • No requirements	Code Subsections IGB & IGC Pressure-retaining components: • Welds in vessels, piping & valves and integral attachment welds. • Bolting • Supports • System pressure testing	Applicable categories of Code Tables IGB & IGC-2500-1
	• No requirements	Code Subsection IGV Valve operability testing	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

SURVEILLANCE REQUIREMENTS (SR): --

TABLE A-4 Sheet 2

STRUCTURE / SYSTEM / COMPONENT : HELIUM PURIFICATION SYSTEM

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER (1) REQUIREMENTS	COMMENTS
METHOD	• No requirements	• Volumetric, surface and visual examinations, as appropriate	
		• Leak detection test	
	• No requirements	• Operability verification and leakage test (valves)	
EXTENT	No requirements	Per components, parts, portions and quantities identified by Code Tables IGB and IGB-2500-1 and Subarticle IGV-3000.	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

SURVEILLANCE REQUIREMENTS (SR): --

TABLE A-4 Sheet 3

STRUCTURE / SYSTEM / COMPONENT : HELIUM PURIFICATION SYSTEM

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER (1) REQUIREMENTS	COMMENTS
FREQUENCY	No requirement	Per the intervals of inspection program A or B of IGA-2400 for pressure retaining boundaries and IGV-3000 for valve testing.	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

A-5 Steam Generator Tubing

a. There is no present program for periodic surveillance inspection of steam generator tubing at FSV. The primary side of the steam generators is continuously monitored during normal operation for water ingress. Presumably, any tube leakage or tubing failure would be detected by the primary side moisture monitoring system.

b. ASME Section XI, Subsection IGH requires surveillance tests of steam generator tubing materials.

NRC Regulatory Guide 1.83, identified in NRC letter to PSC dated January 15, 1981, requires periodic eddy current examination of steam generator tubing in LWR's.

Reg. Guide 1.121 establishes tube plugging limits for LWR steam generators.

Standard Review Plan 5.4.2.2 discusses steam generator surveillance requirements for new plants.

c. FSV steam generator tubing is generally inaccessible for tubing inspection both due to lack of physical access to the

tubing area and unit configuration. The reheat tube bundle at the top of the steam generators is subject to the most severe operating conditions. Helical tubing in the main section is subheadered and is connected to the superheat section at the top through a series of bi-metallic welds. The superheat section is located inside the helical bundle. Bimetallic welds in the top of the steam generators between the main and superheat sections are subjected to severe thermal conditions. One failure has occurred in this region.

Having two (2) steam generator loops assures adequate safe shutdown cooling in the event of a failure in one loop (each loop containing six steam generator modules). This assumes that location of a steam generator failure is correctly diagnosed and isolated.

Operation of the Steam/Water Dump System and Moisture Monitoring System (primary side leak detection) assures water ingress control.

Operation of the Main Steam (tube side) portion of the steam generator at a pressure well above the primary side assures that a tubing failure or slight tube leakage does not result in the release of primary system containments to the secondary side. It should be noted that the reheat bundle is at a slightly lower pressure on the secondary side. The reheat system is monitored for primary system leakage.

Operating history of the steam generators has resulted in only one tube failure.

Heavy wall tubing minimizes the possibility of failures due to erosion or fretting wear.

Primary side helium purity limits chemical corrosion to the secondary tubeside.

d. Based on the above, Steam Generator tubing inspection is not considered necessary to assure the long term heat removal and water ingress protection of the primary system.

It is, however, recommended that data be supplied to the NRC which describes material tests performed to date to assure the long term thermal performance of the bi-metallic welds at the top of the steam generators.

SURVEILLANCE REQUIREMENTS (SR): --

STRUCTURE / SYSTEM / COMPONENT : STEAM GENERATORS (TUBING)

TABLE A-5 Sheet 1

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER[1] REQUIREMENTS	COMMENTS
AREA	No requirements	Code Subsection IGH: Tubing, plates, forgings, welds (including bimetallic welds)	High temperature materials
METHOD	No requirements	Material surveillance specimen tests (mechanical properties), where not exempted from examination by the conditions of Subarticle IGH-1220	Tests to detect degradation due to effects of high temperature operation

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

SURVEILLANCE REQUIREMENTS (SR): --

TABLE A-5 Sheet 2

STRUCTURE / SYSTEM / COMPONENT : STEAM GENERATORS (TUBING)

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON

SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER[1] REQUIREMENTS	COMMENTS
EXTENT	No requirements	Material specimens of each type of structural material exposed to temperature and environment representative of service conditions. Specimen types and quantities to be determined by Owner.	
FREQUENCY	No requirements	Surveillance specimen removal intervals: - First to second refueling (incl.) - Second to fourth (incl.) refueling - Eighth to ninth refueling (incl.) - Twenty-second to twenty-third refueling (incl.)	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

A-6 High Energy Piping

a. There is presently no surveillance program to assure the long term structural integrity of high energy piping systems.

b. Paragraph 50.55a (g) (6) (iii) of the Code of Federal Regulations, Part 10, requires "augmented inservice inspections" to be performed in those areas identified by the NRC. High energy piping systems have been identified as areas of concern, (Refs: (1) (2) (3) (4) (5) (6) (7).

"Augmented ISI to Protect Against Postulated Piping Failures" is discussed in Section II.8 of Reference (6). The purpose of this inspection is "to assure that such failures would not cause the loss of needed functions of safety-related systems and to assure that the plant could be safely shut down in the event of such failures." (5)

High energy fluid systems are identified as those in which

1. Pressure exceeds 275 psig, or
2. Temperature exceeds 200^{o}F.

In the case of FSV, examples of high energy fluid systems include the following:

- Main Steam
- Main Feedwater
- Reheat Steam

- Helium Purification
- Buffer Helium

c. FSV systems and components outside the PCRV which should be protected against the effects of high energy piping system failures include at least the following:

- Feedwater and Steam piping
- Circulator Drive piping
- Reactor Monitoring System cabling
- Reserve Shutdown equipment
- PCRV tendon anchorages
- PCRV penetrations
- Moisture Monitoring cables
- PCRV Liner Cooling System piping and instrument cabling

As described in Reference (7), the adverse effects of postulated high energy piping failures on systems and equipment important to safety can be mitigated by the following design features:

1. Pipe whip restraints
2. Protective guards to minimize the effects of pipe whip, jet impingement, and piping failures.
3. Conservative design in critical areas
4. Augmented ISI in critical areas

Critical areas may be defined as those which contain both high energy piping and systems important to safety.

The intent of this review is to identify augmented ISI as a means to provide a significant degree of assurance that pipe whip, jet impingement, and structural damage will not result in loss of safety system functions.

d. It is recommended that PSC be requested to review the above and provide the following:

1. Define systems and components important to safety as follows:
   (a) Required to assure the long term integrity of the reactor coolant pressure boundary.
   (b) Required to assure safe shutdown and core heat removal following a shutdown.
   (c) Required to prevent the release of contaminents which would result in offsite doses above acceptable limits.

2. Identify high energy piping systems, as defined in (b) above, which are physically located in critical areas, as described in (c) above.

3. Identify systems important to safety that could suffer loss of function as a result of a high energy piping failure.

4. Describe a program of augmented ISI to mitigate the potential effects of high energy piping failures in critical areas. Augmented ISI may include the following:

(a) Nondestructive examination of welds,

(b) Visual inspection during hydrostatic testing,

(c) Examination of pipe supports both during operating and shutdown conditions.

REFERENCES

(1) 10 CFR Part 50, Licensing Requirements for Production and Utilization Facilities

(2) NRC letter (A.Giambusso - DOL) to applicants and licensees, December 1972, "General Information Required for Consideration of Effects of a Piping System Break Outside Containment."

(3) NRC letter (J.F. O'Leary - DOL) to applicants, July 1972, "Criteria for Determination of Postulated Break and Leakage Locations in High and Moderate Energy Fluid Piping Systems Outside of Containment Structures."

(4) ASME Section XI, Division 2, Code for "Inservice Inspection and Testing of Components of Gas-Cooled Plants."

(5) Standard Review Plan (NUREG-75/087) Section 3.6.1 "Plant Design for Protection Against Postulated Piping Failures in Fluid Systems Outside Containment."

(6) Standard Review Plan Section 6.6, "Inservice Inspection of Class 2 and 3 Components."

(7) Branch Technical Position, MEB 3-1, "Protection Against Postulated Piping Failures in Fluid Systems Outside Containment."

SURVEILLANCE REQUIREMENTS (SR): --

STRUCTURE / SYSTEM / COMPONENT : HIGH ENERGY PIPING/SECONDARY COOLANT SYSTEM

TABLE A-6 Sheet 1

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER[1] REQUIREMENTS	COMMENTS
		Code Subsection IGC	
AREA	Pressure-retaining components No requirements	Pressure-retaining components: • Welds in piping and valves, and integral attachment welds. • Bolting • Supports • System pressure testing	Applicable categories of Code Table IGC-2500-1. High energy piping t ➢ 200°F, p ➢ 275 psig. Applicable weld joints subject to augmented inservice inspection - see text.
METHOD	No requirements	• Volumetric, surface and visual examinations, as appropriate • Hydrostatic test	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.

SURVEILLANCE REQUIREMENTS (SR): --

TABLE A-6 Sheet 2

STRUCTURE / SYSTEM / COMPONENT : HIGH ENERGY PIPING/SECONDARY COOLANT SYSTEM

INSERVICE SURVEILLANCE - REQUIREMENTS COMPARISON			
SCOPE OF SURVEILLANCE	PSC - PROPOSED PROGRAM REQUIREMENTS	APPLICABLE CODE, OTHER (1) REQUIREMENTS	COMMENTS
EXTENT	No requirements	Per the components, parts, portions and quantities identified by Code Table IGC-2500-1	See SRP 3.6.1
FREQUENCY	No requirements	Per the intervals of inspection Program A or B of IGA-2400.	

NOTES: (1) Source may include 10 CFR 50, Reg. Guides or operating license commitments as identified.