Duke Energy

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February 14, 2001

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555

Subject: McGuire Nuclear Station, Units 1 and 2
Docket Nos. 50-369 and 50-370
Proposed Revision to Technical Specifications (TS)
TS 3.3.2 - Engineered Safety Feature Actuation System (ESFAS) Instrumentation
TS 3.4.3 - Reactor Coolant System Pressure and Temperature Limits
TS 3.4.12 - Low Temperature Overpressure Protection System

Pursuant to 10CFR50.90, Duke Energy Corporation (Duke) hereby requests a license amendment which will result in changes to Technical Specifications for McGuire Nuclear Station Units 1 and 2. The proposed amendment revises TS 3.3.2 to specify that the Steam Line Isolation on Steam Line Pressure Negative Rate - High may be blocked below P-11 when Steam Line Isolation on Steam Line Pressure - Low is not blocked. The current TS 3.3.2, Function 4.d.(2) incorrectly specifies that this function may be blocked below P-11 when Safety Injection on Steam Line Pressure - Low is not blocked. The Safety Injection on Steam Line Pressure - Low function was deleted in Amendments 182/164; this deletion was not appropriately reflected in TS 3.3.2.

The proposed amendment revises TS 3.4.3 to update the heatup, cooldown, criticality, and inservice test pressure and temperature (P/T) limits for the Reactor Coolant System (RCS) of each unit to a maximum of 34 Effective Full Power Years (EFPY). The current P/T limits are effective to 16 EFPY and will expire in approximately September 2003 for Unit 1 and January 2004 for Unit 2. The changes to TS 3.4.3 are based on the analyses of latest reactor vessel capsule data and an alternative methodology for determining allowable P/T limits. The analyses of latest reactor vessel capsule data are documented in WCAP-14993, "Analysis of Capsule Y from the Duke Power McGuire Unit 1 Reactor Vessel Radiation Surveillance Program" and WCAP-14799, "Analysis of Capsule W from the Duke Power Company McGuire Unit 2 Reactor

A001

Vessel Radiation Surveillance Program." The alternative methodology for determining allowable P/T limits is described in American Society of Mechanical Engineers (ASME) Code Case N-640, "Alternative Reference Fracture Toughness for Development of P-T Limit Curves for Section XI, Division 1." Attachment 6 contains Code Case N-640 and its technical basis.

The alternative methodology results in less restrictive P/T limits. The alternative methodology also results in a less restrictive 10CFR50, Appendix G temperature requirement for the reactor vessel flange region. This results in the less restrictive P/T limits in the low temperature region of the curve near the vessel head bolt-up temperature. The proposed amendment includes an exemption request pursuant to 10CFR50.12 from certain requirements of 10CFR50.60 and 10CFR50 Appendix G. This technical exemption relies on Code Case N-640 and is included in Attachment 3, Section 3.7. The Nuclear Regulatory Commission (NRC) has approved exemptions and amendments associated with the use of this code case in generating P/T limits at several nuclear power stations including Beaver Valley, Clinton, Dresden, Hatch, Oconee, and Shearon Harris. Attachment 9 lists the licensee application dates and NRC approval dates for these exemptions and amendments. A second technical exemption request from the 10CFR50, Appendix G flange requirements is included in Attachment 3, Section 3.8. This exemption request also relies on Code Case N-640 methodology.

The proposed amendment revises TS 3.4.12, RCS Low Temperature Overpressure Protection (LTOP) System, to reflect the revised P/T limits of TS 3.4.3. Specifically, the temperature and cooldown rate limits are revised to reflect the use of the residual heat removal suction relief valve in Required Actions A.2 and F. The proposed amendment includes a change to add two new required actions in TS 3.4.12. Required Actions A.5.1 and A.5.2 will require a combination of a depressurized RCS and a RCS vent of greater than or equal to 2.75 square inches and two operable PORVs for the condition when any combination of two centrifugal charging and safety injection pumps are capable of injecting into the RCS. This is justified based on the fact that LCO 3.4.12 currently requires two operable PORVs (one for single failure concern), or a depressurized RCS and a RCS vent of greater than or equal to 2.75 square inches, for each centrifugal charging or safety injection pump capable of injecting into the RCS.

TS 3.3.2 Bases is revised to reflect the change to TS 3.3.2 described above. TS 3.4.3 Bases is revised to include a summary description of the new excore cavity dosimetry program at McGuire. The reactor vessel (RV) material specimen surveillance program for McGuire Unit 2 is complete. A similar program for McGuire Unit 1 will be completed in April 2004 when the last surveillance capsule is removed. McGuire will continue to monitor RV neutron fluence through a second program that employs excore cavity dosimetry. This new program meets the requirements of 10CFR50 Appendix H. TS 3.4.12 Bases is revised to reflect the changes to TS 3.4.12 described above. Additionally, TS 3.4.12 LCO Bases is revised to clarify that a secured open PORV means that it is physically secured or locked open to prevent it from being subject to active failure. This clarification is consistent with that for a RCS vent already described in the same Bases. All TS Bases changes included in this proposed amendment are for information only and do not require NRC approval.

Duke requests approval of the proposed TS amendment in a timely manner since it provides operational benefit associated with the changed P/T limits. Duke requests that NRC provide for the following time frames for implementation: the approved amendment be implemented either 90 days prior to the next refueling outage or 90 days following the next refueling outage, subsequent to NRC approval.

- Attachment 1 contains the marked-up TS pages showing the changes.

- Attachment 2 contains the new TS pages.

- Attachment 3 contains the description of the proposed changes and technical justification.

- Attachment 4 contains Westinghouse Topical Report WCAP-15192 for the proposed McGuire Unit 1 heatup and cooldown limit curves.

- Attachment 5 contains Westinghouse Topical Report WCAP-15201 for the proposed McGuire Unit 2 heatup and cooldown limit curves.

- Attachment 6 contains ASME Code Case N-640 and the accompanying technical basis.

- Attachment 7 contains Westinghouse Topical Report WCAP-15315 for the proposed rulemaking on elimination of 10CFR50, Appendix G requirements for the reactor vessel closure flange region.

- Attachment 8 contains the TS and NUREG-1431 marked-up pages showing the editorial error related to TS 3.3.2, Function 4.d.(2).

- Attachment 9 contains a list of application dates and NRC approval dates for industry exemptions and amendments related to Code Case N-640 and P/T limits.

- Pursuant to 10CFR50.92, Attachment 10 documents the determination that the proposed amendment contains No Significant Hazards Considerations.

- Pursuant to 10CFR51.22(c)(9), Attachment 11 provides the basis for the categorical exclusion from performing an Environmental Assessment/Impact Statement.

Implementation of this amendment to the McGuire Technical Specifications will impact the McGuire UFSAR. Changes to the affected UFSAR sections will be made in accordance with 10CFR50.71(e). Completing these UFSAR changes is the only regulatory commitment associated with this amendment. The McGuire Plant Operations Review Committee and the Corporate Nuclear Safety Review Board have reviewed and approved this proposed Technical Specification amendment. Pursuant to 10CFR50.91, a copy of this submittal is being forwarded to the North Carolina Division of Radiation Protection.

The material supplied in support of this amendment is detailed and lengthy. It may be appropriate to schedule a meeting between Duke and the NRC staff to outline this material early in the review process. Duke will consult with the NRC Project Manager in this regard.

If there are any questions regarding this submittal, please contact P. T. Vu at (704) 875-4302.

Very truly yours,

H. B. Barron

HBB/PTV/s

Attachments

xc: w/attachments

L. A. Reyes
NRC Regional Administrator, Region II

S. M. Schaffer
NRC Resident Inspector

R. E. Martin
NRC Project Manager

R. M. Frye
Director, N.C. Division of Radiation Protection

AFFIDAVIT

H. B. Barron, being duly sworn, states that he is Vice President of Duke Energy Corporation; that he is authorized on the part of said corporation to sign and file with the Nuclear Regulatory Commission this amendment to the McGuire Nuclear Station Facility Operating Licenses Numbers NPF-9 and NPF-17 and Technical Specifications; and that all statements and matters set forth herein are true and correct to the best of his knowledge.

H B Barron

H. B. Barron, Vice President

Subscribed and sworn to me: 2/12/2001
Date

Notary Public: Deborah G. Thrap
Deborah G. Thrap

My Commission Expires: 4/6/2002
Date

SEAL

bxc: w/attachments

L. Vaughn
C. Thomas
L. Jones
L. Nicholson
G. Gilbert
A. Garrett
D. Smith (MNS-MSE)
W. Brady
T. Yadon
K. Crane
NSRB
ELL
Master File 1.3.2.9

DUKE POWER COMPANY

MCGUIRE NUCLEAR STATION

ATTACHMENT 1

MARKED-UP TECHNICAL SPECIFICATIONS PAGES

For Information Only

Table 3.3.2-1 (page 2 of 6)
Engineered Safety Feature Actuation System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	TRIP SETPOINT
3. Containment Isolation (continued)						
(3) Safety Injection	Refer to Function 1 (Safety Injection) for all initiation functions and requirements.					
b. Phase B Isolation						
(1) Manual Initiation	1,2,3,4	1 per train, 2 trains	B	SR 3.3.2.7	NA	NA
(2) Automatic Actuation Logic and Actuation Relays	1,2,3,4	2 trains	C	SR 3.3.2.2 SR 3.3.2.4 SR 3.3.2.6	NA	NA
(3) Containment Pressure - High High	1,2,3	4	E	SR 3.3.2.1 SR 3.3.2.5 SR 3.3.2.8	≤ 3.0 psig	≤ 2.9 psig
4. Steam Line Isolation						
a. Manual Initiation						
(1) System	1,2(b),3(b)	2 trains	F	SR 3.3.2.7	NA	NA
(2) Individual	1,2(b),3(b)	1 per line	G	SR 3.3.2.7	NA	NA
b. Automatic Actuation Logic and Actuation Relays	1,2(b),3(b)	2 trains	H	SR 3.3.2.2 SR 3.3.2.4 SR 3.3.2.6	NA	NA
c. Containment Pressure - High High	1,2(b), 3(b)	4	E	SR 3.3.2.1 SR 3.3.2.5 SR 3.3.2.8 SR 3.3.2.9	≤ 3.0 psig	≤ 2.9 psig
d. Steam Line Pressure						
(1) Low	1,2(b), 3(a)(b)	3 per steam line	D	SR 3.3.2.1 SR 3.3.2.5 SR 3.3.2.8 SR 3.3.2.9	≥ 755 psig	≥ 775 psig

(continued)

(a) Above the P-11 (Pressurizer Pressure) interlock.
(b) Except when all MSIVs are closed and de-activated.

Table 3.3.2-1 (page 3 of 6)
Engineered Safety Feature Actuation System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	TRIP SETPOINT
4. Steam Line Isolation (continued)						
(2) Negative Rate - High	$3^{(b)(c)}$	3 per steam line	D	SR 3.3.2.1 SR 3.3.2.5 SR 3.3.2.8 SR 3.3.2.9	≤ $120^{(d)}$ psi	≤ $100^{(d)}$ psi
5. Turbine Trip and Feedwater Isolation						
a. Automatic Actuation Logic and Actuation Relays	$1,2^{(e)}$	2 trains	I	SR 3.3.2.2 SR 3.3.2.4 SR 3.3.2.6	NA	NA
b. SG Water Level -High High (P-14)	$1,2^{(e)}$	3 per SG	J	SR 3.3.2.1 SR 3.3.2.2 SR 3.3.2.4 SR 3.3.2.5 SR 3.3.2.6 SR 3.3.2.8 SR 3.3.2.9	≤ 85.6%	≤ 83.9%
c. Safety Injection	Refer to Function 1 (Safety Injection) for all initiation functions and requirements.					
d. T_{avg}-Low	$1,2^{(e)}$	1 per loop	J	SR 3.3.2.1 SR 3.3.2.5 SR 3.3.2.8	≥ 551°F	≥ 553°F
coincident with Reactor Trip, P-4	Refer to Function 8.a (Reactor Trip, P-4) for all initiation functions and requirements.					
e. Doghouse Water Level-High High	$1,2^{(e)}$	2 per train per Doghouse	L,M	SR 3.3.2.1 SR 3.3.2.7	13 inches	12 inches
6. Auxiliary Feedwater						
a. Automatic Actuation Logic and Actuation Relays	1,2,3	2 trains	H	SR 3.3.2.2 SR 3.3.2.4 SR 3.3.2.6	NA	NA
b. SG Water Level -Low Low	1,2,3	4 per SG	D	SR 3.3.2.1 SR 3.3.2.5 SR 3.3.2.8 SR 3.3.2.9	≥ 15%	≥ 16.7%

(continued)

(b) Except when all MSIVs are closed and de-activated.

(c) Trip function automatically blocked above P-11 (Pressurizer Pressure) interlock and may be blocked below P-11 when Safety Injection Steam Line Pressure-Low is not blocked. Steam Line Isolation on

(d) Time constant utilized in the rate/lag controller is ≥ 50 seconds.

(e) Except when all MFIVs, MFCVs, and associated bypass valves are closed and de-activated or isolated by a closed manual valve.

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.3 RCS Pressure and Temperature (P/T) Limits

LCO 3.4.3 RCS pressure and RCS temperature shall be limited during RCS heatup and cooldown, criticality, and inservice leak and hydrostatic testing in accordance with:

a. A maximum heatup rate as specified in ~~Figure 3.4.3-1~~ Figures 3.4.3-1 through 3.4.3-4;

b. A maximum cooldown rate as specified in ~~Figure 3.4.3-2~~ Figures 3.4.3-5 and 3.4.3-6; and

c. A maximum temperature change of ≤ 10°F in any 1 hour period during inservice leak and hydrostatic testing operations above the heatup and cooldown limit curves.

APPLICABILITY: At all times.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. ------------NOTE------------ Required Action A.2 shall be completed whenever this Condition is entered. -------------------------------- Requirements of LCO not met in MODE 1, 2, 3, or 4.	A.1 Restore parameter(s) to within limits. AND A.2 Determine RCS is acceptable for continued operation.	30 minutes 72 hours
B. Required Action and associated Completion Time of Condition A not met.	B.1 Be in MODE 3. AND B.2 Be in MODE 5 with RCS pressure < 500 psig.	6 hours 36 hours

(continued)

For Information Only

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. ------------NOTE------------ Required Action C.2 shall be completed whenever this Condition is entered. -------------------------------- Requirements of LCO not met any time in other than MODE 1, 2, 3, or 4.	C.1 Initiate action to restore parameter(s) to within limits. AND C.2 Determine RCS is acceptable for continued operation.	Immediately Prior to entering MODE 4

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.4.3.1	-------------------------------NOTE-------------------------------- Only required to be performed during RCS heatup and cooldown operations and RCS inservice leak and hydrostatic testing. -- Verify RCS pressure, RCS temperature, and RCS heatup and cooldown rates are within limits.	30 minutes

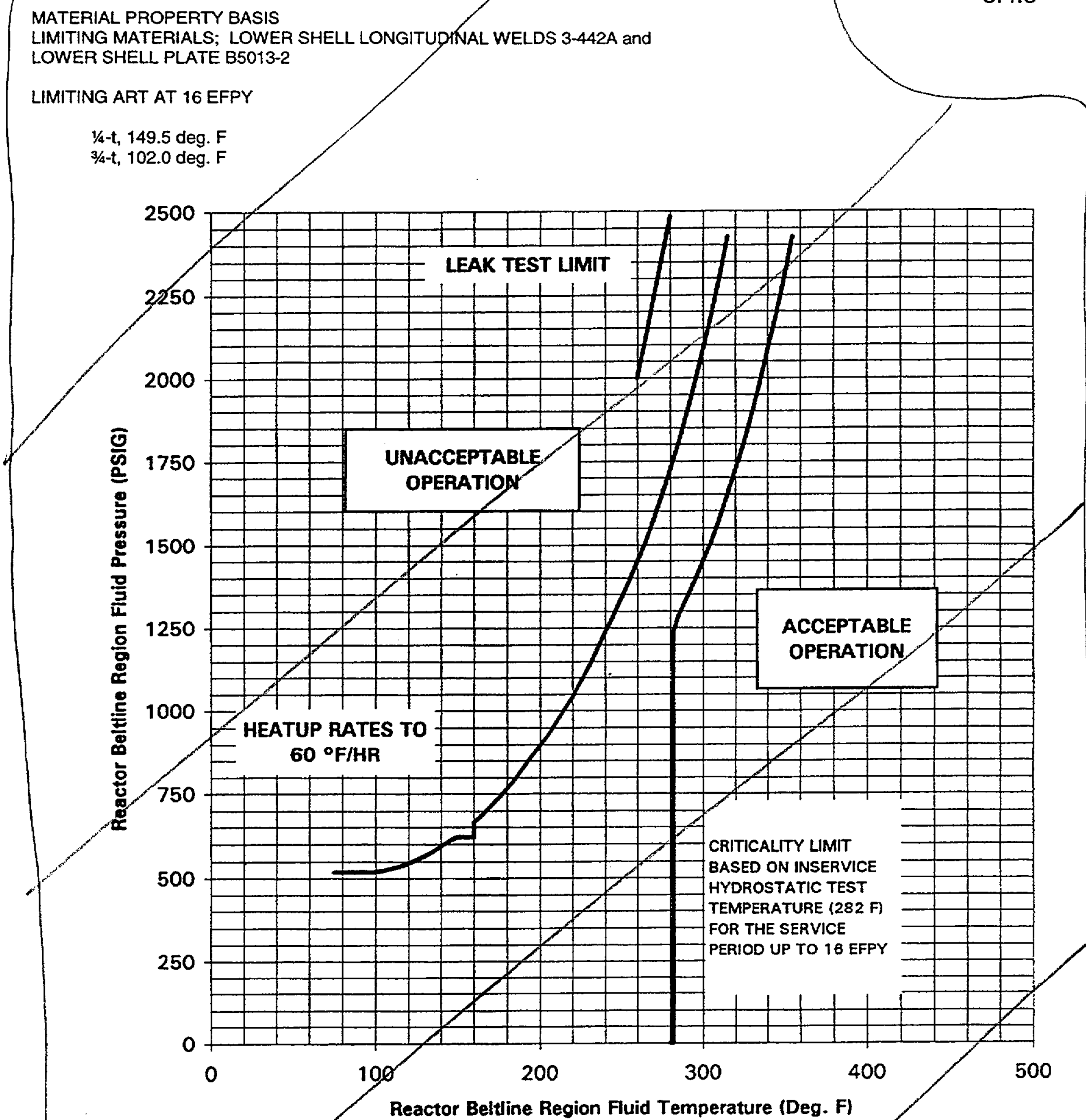

Figure 3.4.3-1 RCS Heatup Limitations
(UNIT 1 ONLY)
(Without margins for Instrumentation Errors)
NRC REG GUIDE 1.99, Rev. 2
Applicable for the first 16 EFPY

Replaced by next two figures

MATERIAL PROPERTY BASIS

LIMITING MATERIAL: LOWER SHELL LONGITUDINAL WELD SEAMS 3-442A & C
LIMITING ART VALUES AT 34 EFPY: 1/4T, 190°F
3/4T, 129°F

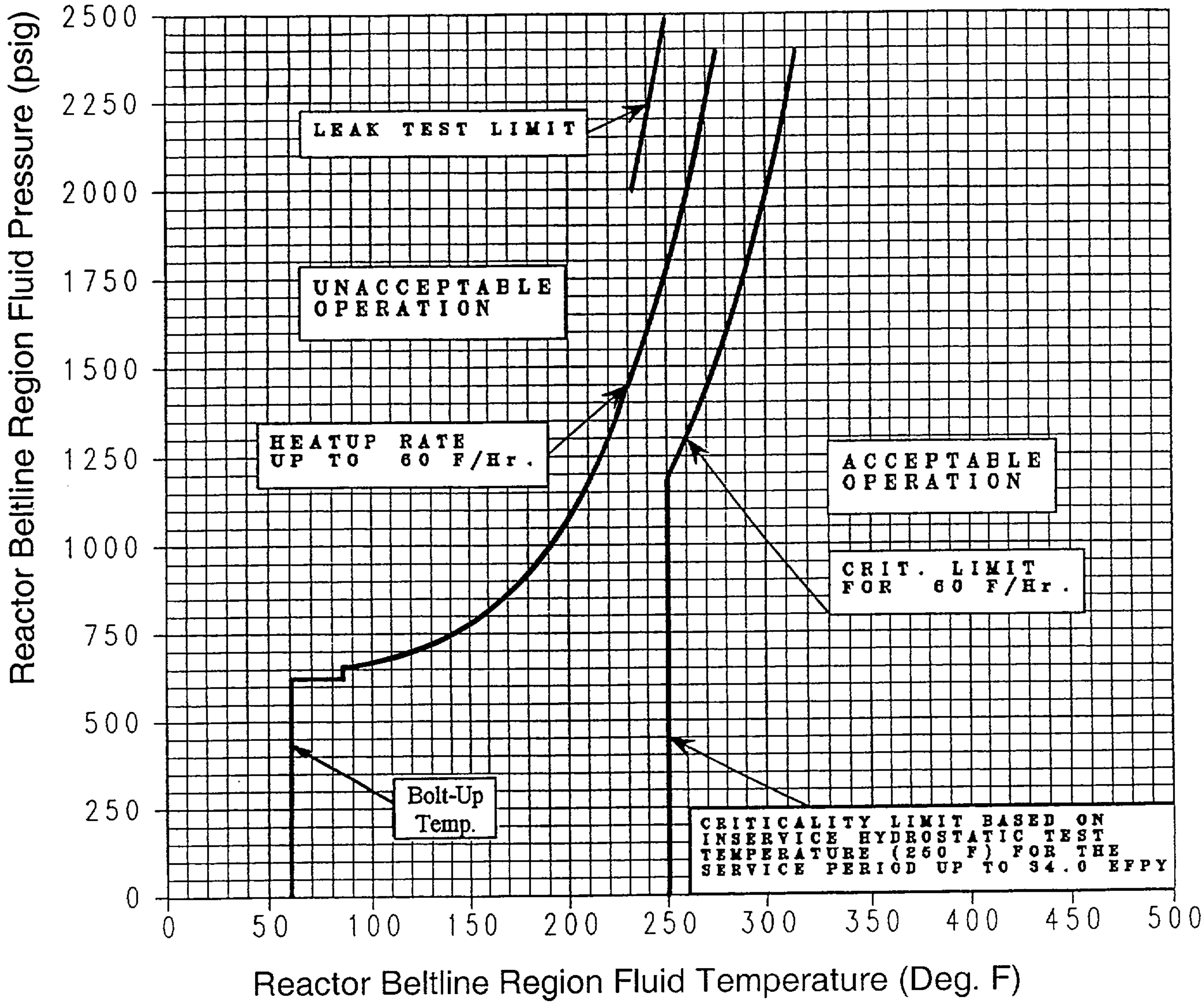

Figure 3.4.3-1

McGuire Unit 1 Reactor Coolant System Heatup Limitations (Heatup Rate of 60° F/hr) Applicable to 34 EFPY (Without Margins for Instrumentation Errors)

MATERIAL PROPERTY BASIS

LIMITING MATERIAL: LOWER SHELL LONGITUDINAL WELD SEAMS 3-442A & C
LIMITING ART VALUES AT 34 EFPY: 1/4T, 190°F
3/4T, 129°F

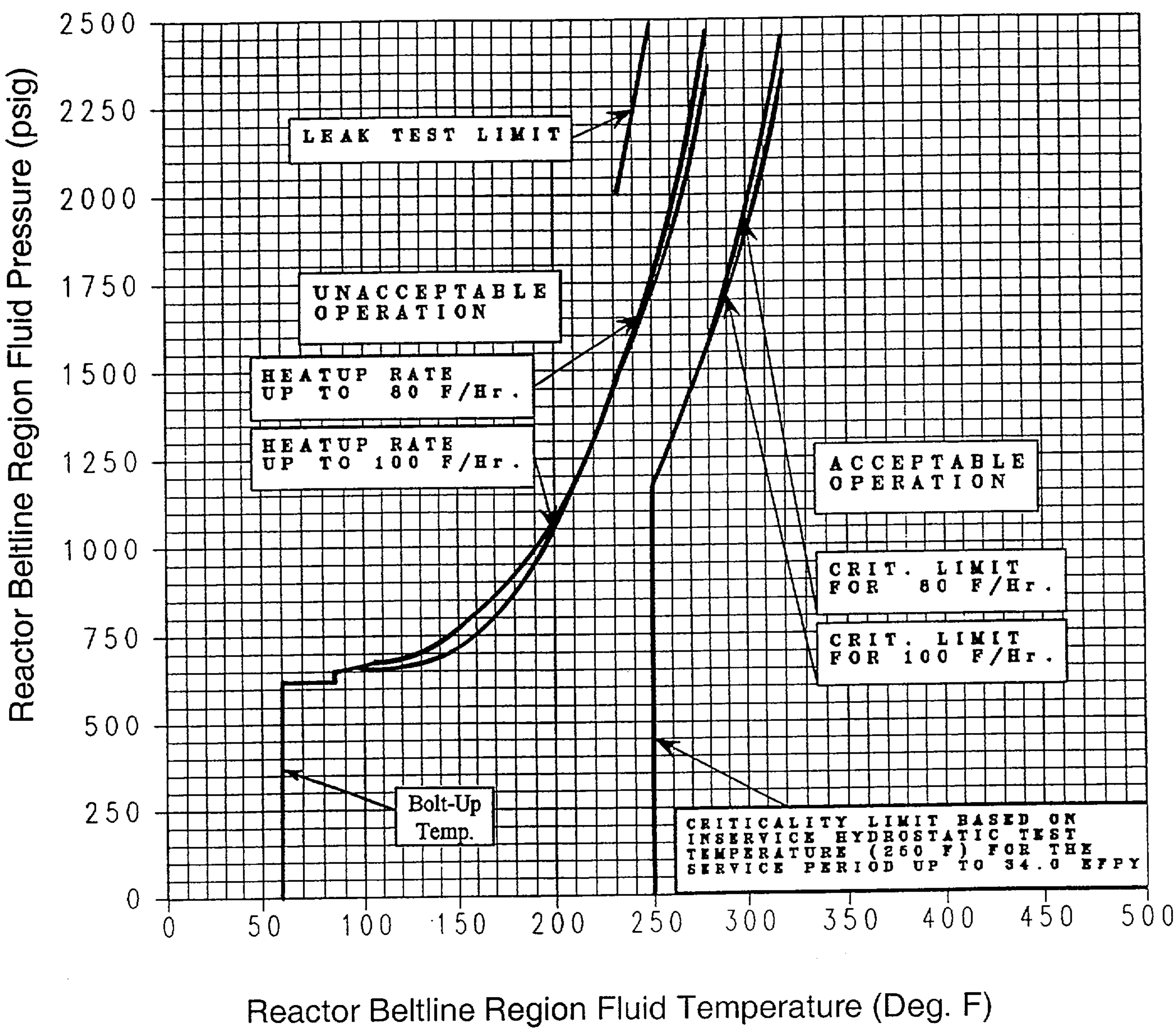

Figure 3.4.3-2

McGuire Unit 1 Reactor Coolant System Heatup Limitations (Heatup Rates of 80 and 100° F/hr) Applicable to 34 EFPY (Without Margins for Instrumentation Errors)

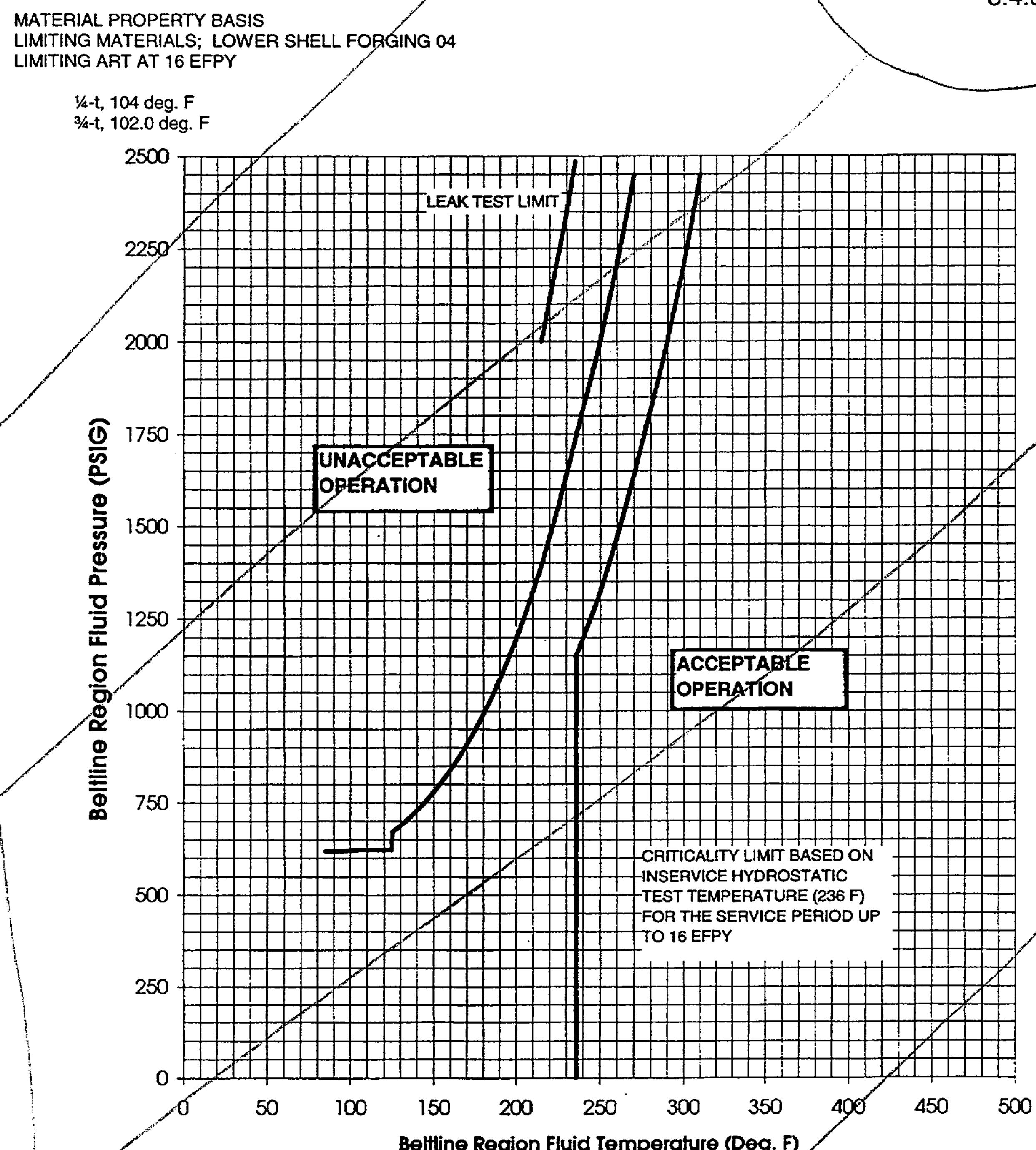

Figure 3.4.3-1 RCS Heatup Limitations
(Unit 2 Only)
(Without margins for Instrumentation Errors)
NRC REG GUIDE 1.99, Rev. 2
Applicable for the First 16 EFPY

Replaced by next two figures

MATERIAL PROPERTY BASIS

LIMITING MATERIAL: LOWER SHELL FORGING 04
LIMITING ART VALUES AT 34 EFPY: 1/4T, 124.5°F
3/4T, 92.0°F

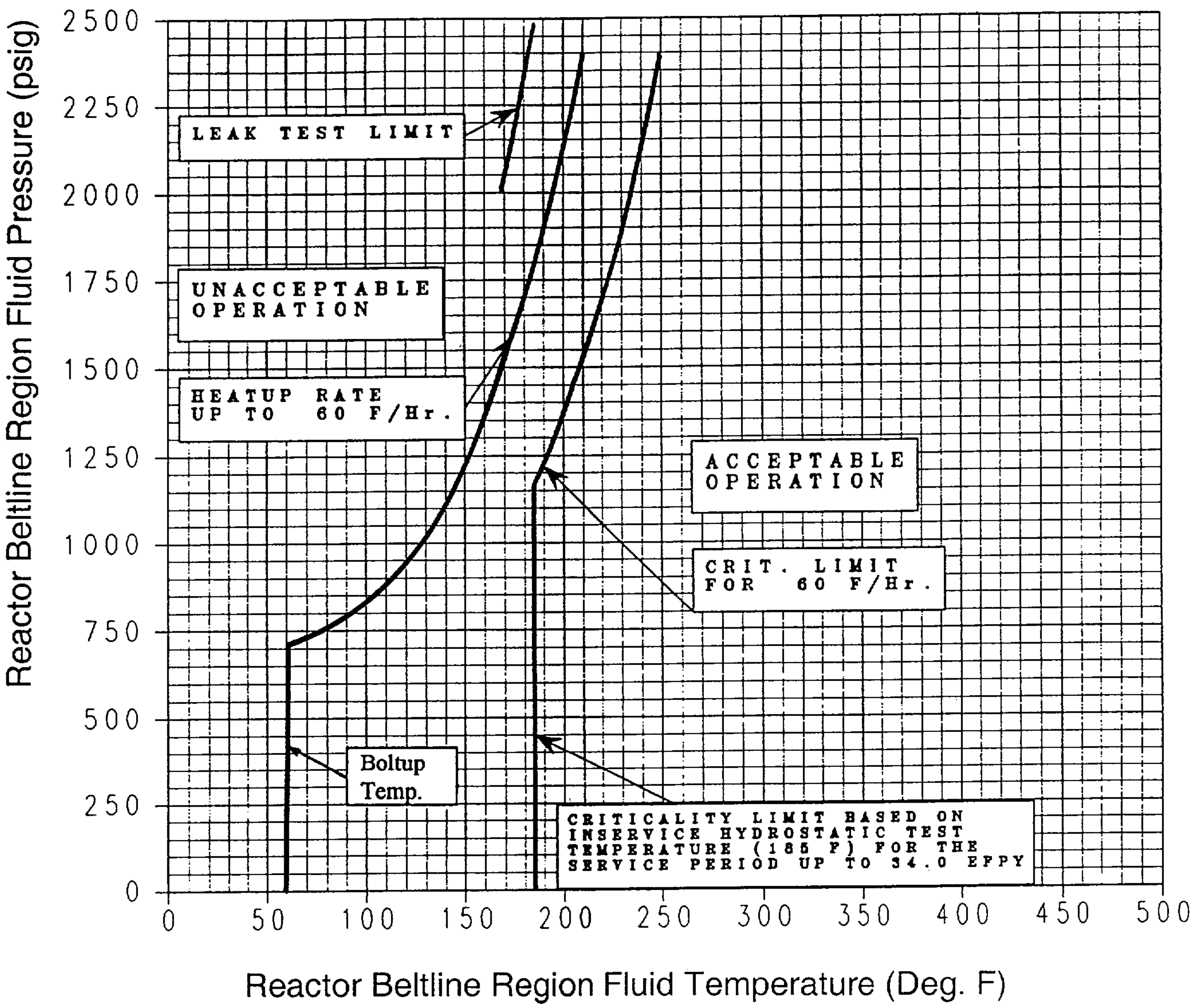

Figure 3.4.3-3

McGuire Unit 2 Reactor Coolant System Heatup Limitations (Heatup Rate of 60° F/hr) Applicable to 34 EFPY (Without Margins for Instrumentation Errors)

MATERIAL PROPERTY BASIS

LIMITING MATERIAL: LOWER SHELL FORGING 04
LIMITING ART VALUES AT 34 EFPY: 1/4T, 124.5°F
3/4T, 92.0°F

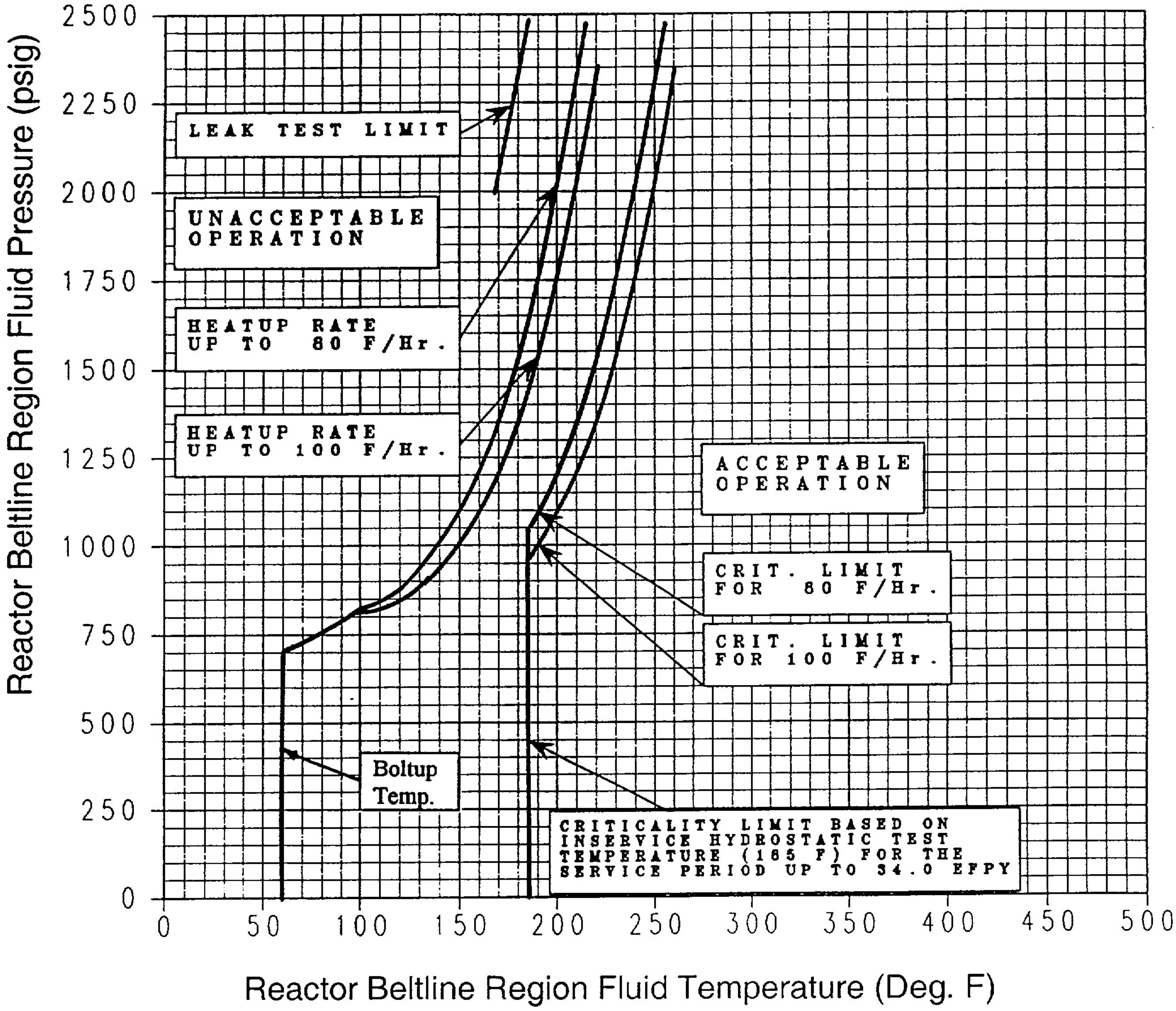

Figure 3.4.3-4

McGuire Unit 2 Reactor Coolant System Heatup Limitations (Heatup Rates of 80 and 100° F/hr) Applicable to 34 EFPY (Without Margins for Instrumentation Errors)

MATERIAL PROPERTY BASIS
LIMITING MATERIALS; LOWER SHELL LONGITUDINAL WELDS 3-442A and LOWER SHELL PLATE B5013-2

LIMITING ART AT 16 EFPY

¼-t, 149.5 deg. F
¾-t, 102.0 deg. F

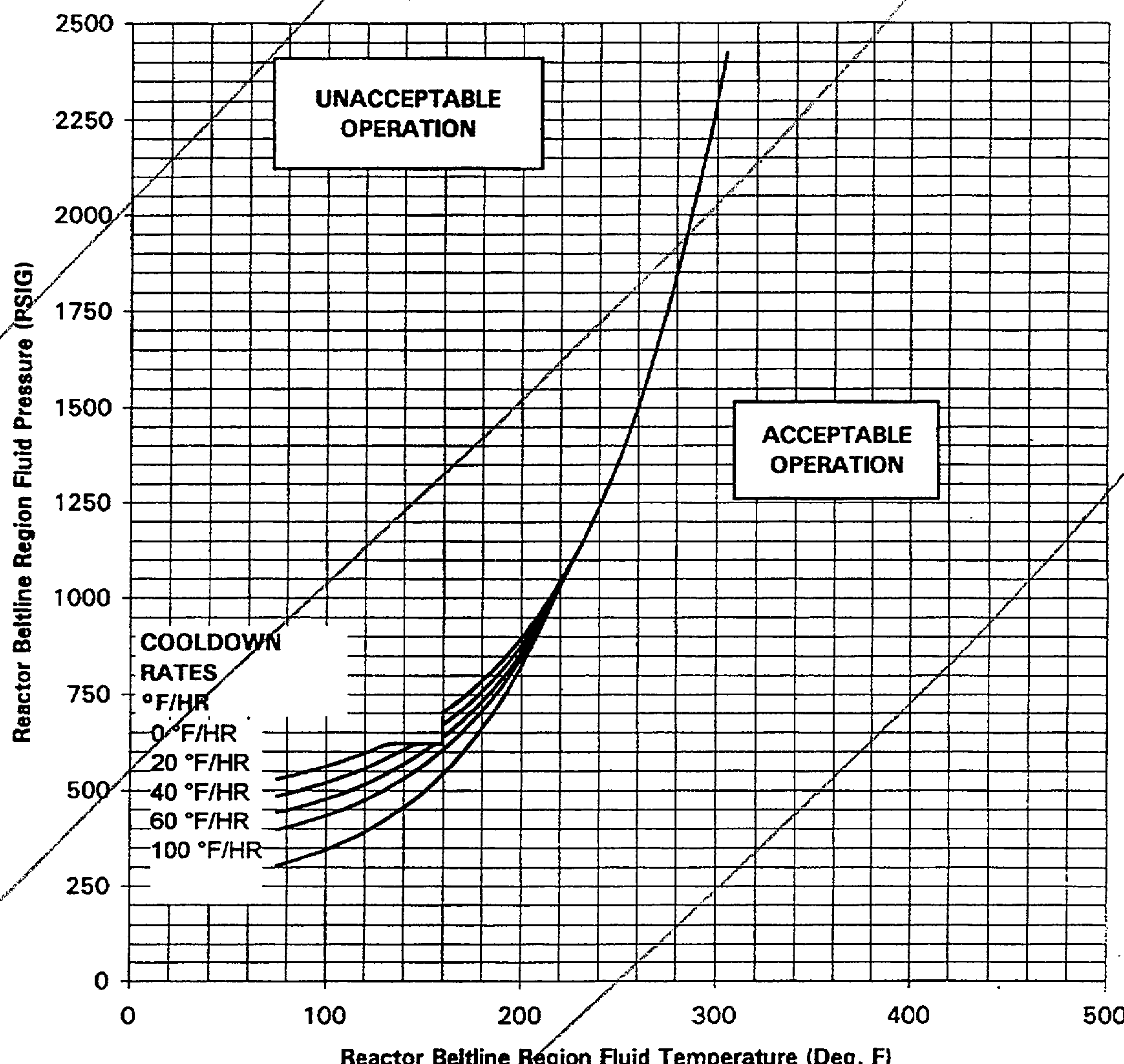

Figure 3.4.3-2 RCS Cooldown Limitations
(UNIT 1 ONLY)
Cooldown Rates up to 100 deg. F/HR
(Without margins for Instrumentation Errors)
NRC REG GUIDE 1.99, Rev. 2
Applicable for the first 16 EFPY

(Replaced by next figure

MATERIAL PROPERTY BASIS

LIMITING MATERIAL: LOWER SHELL LONGITUDINAL WELD SEAMS 3-442A & C
LIMITING ART VALUES AT 34 EFPY: 1/4T, 190°F
3/4T, 129°F

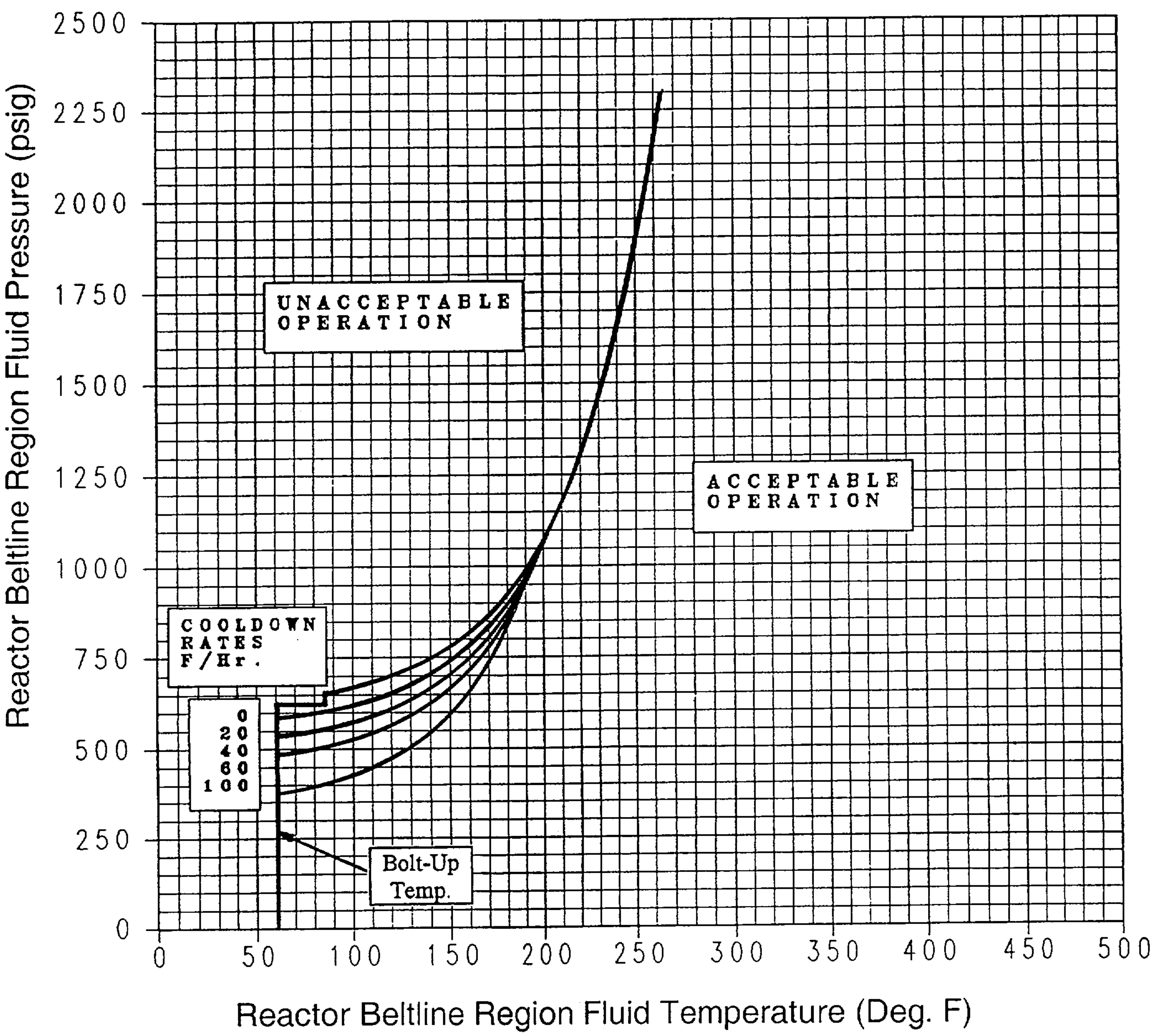

Figure 3.4.3-5

McGuire Unit 1 Reactor Coolant System Cooldown Limitations (Cooldown Rates of 0, 20, 40, 60 and 100° F/hr) Applicable to 34 EFPY (Without Margins for Instrumentation Errors)

MATERIAL PROPERTY BASIS

LIMITING MATERIALS; LOWER SHELLFORGING 04

LIMITING ART AT 16 EFPY:
¼-t, 104 deg. F
¾-t, 73 deg. F

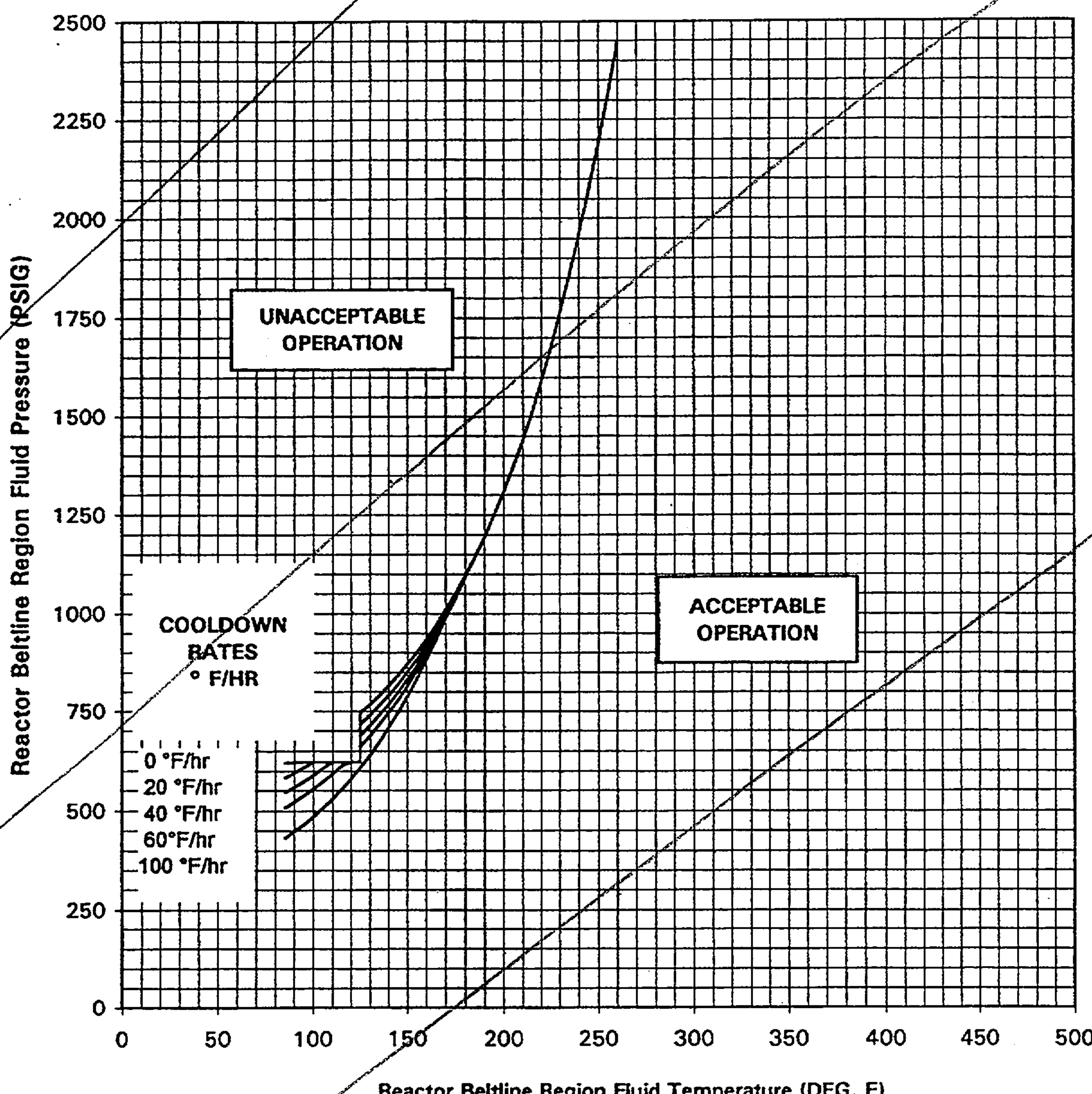

Figure 3.4.3-2 RCS Cooldown Limitations
(UNIT 2 ONLY)
Cooldown Rates up to 100 deg F/HR
(without Margins for Instrumentation Errors)
NRC REG GUIDE 1.99, Rev. 2
Applicable for the First 16 EFPY

(Replaced by next figure

MATERIAL PROPERTY BASIS

LIMITING MATERIAL: LOWER SHELL FORGING 04
LIMITING ART VALUES AT 34 EFPY: 1/4T, 124.5°F
3/4T, 92.0°F

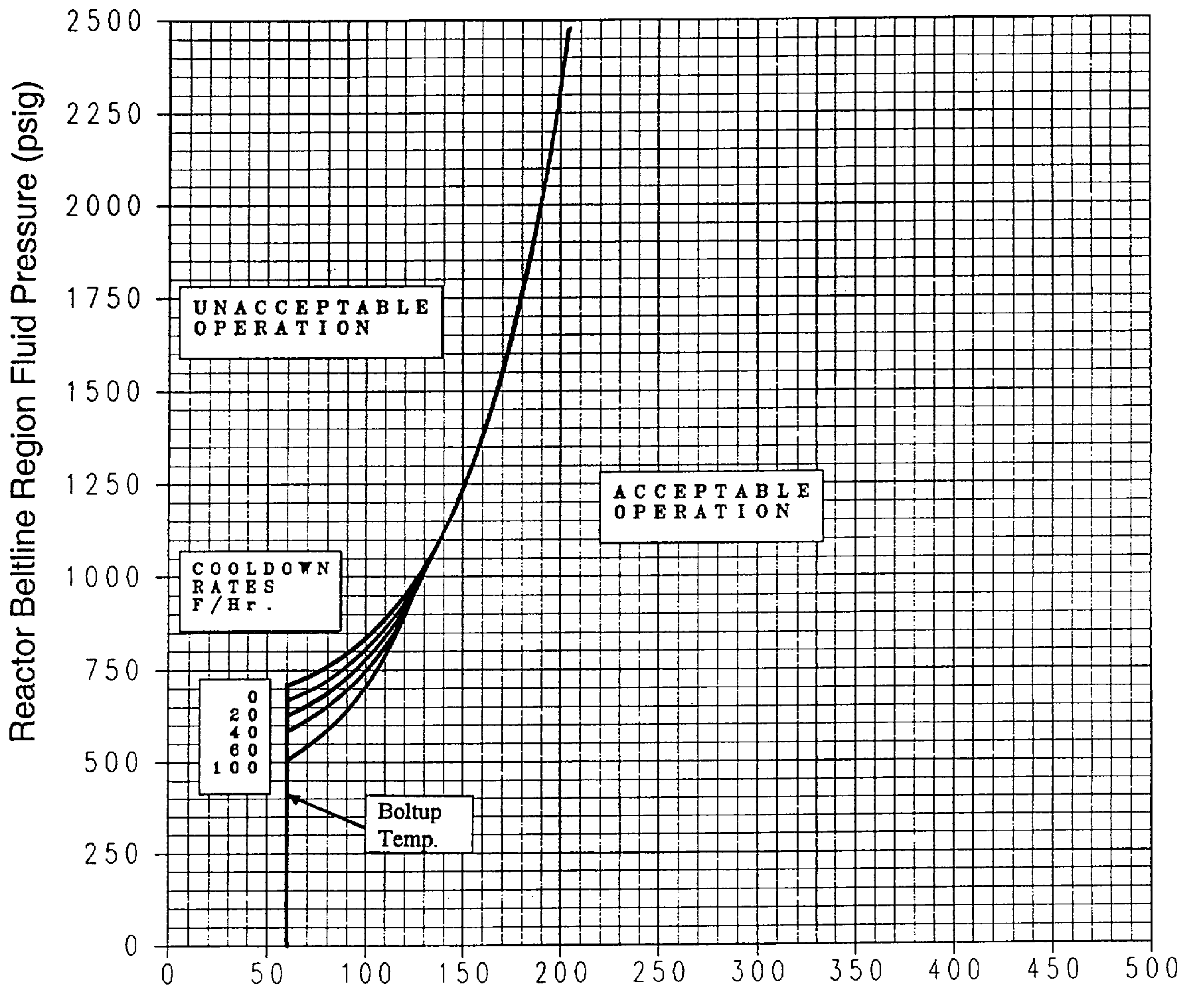

Figure 3.4.3-6

McGuire Unit 2 Reactor Coolant System Cooldown Limitations (Cooldown Rates of 0, 20, 40, 60 and 100° F/hr) Applicable to 34 EFPY (Without Margins for Instrumentation Errors)

For Information Only

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.12 Low Temperature Overpressure Protection (LTOP) System

LCO 3.4.12

An LTOP System shall be OPERABLE with a maximum of one centrifugal charging pump or one safety injection pump capable of injecting into the RCS and the accumulators isolated and either a or b below:

a. Two power operated relief valves (PORVs) with lift setting $\leq$ 385 psig or

b. The RCS depressurized and an RCS vent of $\geq$ 2.75 square inches.

--NOTE--
A PORV secured in the open position may be used to meet the RCS vent requirement provided that its associated block valve is open and power removed.

APPLICABILITY:

MODE 4 when any RCS cold leg temperature is $\leq$ 300°F,
MODE 5,
MODE 6 when the reactor vessel head is on.

--NOTE--
Accumulator isolation is only required when accumulator pressure is greater than or equal to the maximum RCS pressure for the existing RCS cold leg temperature allowed by the P/T limit curves provided in Specification 3.4.3.

ACTIONS

-----------------------------------NOTE-----------------------------------
LCO 3.0.4 is not applicable.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Two centrifugal charging pumps capable of injecting into the RCS. OR One centrifugal charging pump and one safety injection pump capable of injecting into the RCS. OR Two safety injection pumps capable of injecting into the RCS.	A.1 --------------NOTE------------- Two centrifugal charging pumps may be capable of injecting into the RCS during pump swap operation for ≤ 15 minutes. ---------------------------------- Initiate action to verify a maximum of one centrifugal charging pump or one safety injection pump is capable of injecting into the RCS.	Immediately
	OR	
	A.2.1 Verify RHR suction relief valve is OPERABLE and the suction isolation valves are open.	Immediately
	AND	
	A.2.2.1 Verify RCS cold leg temperature ~~≥ 167°F.~~	Immediately >159°F (Unit 1) or >89°F (Unit 2).
	OR	
	A.2.2.2 Verify RCS cold leg temperature ~~> 107°F and cooldown rate < 20°F/hr.~~	Immediately >74°F and cooldown rate < 20°F/hr (Unit 1), or >74°F and cooldown rate < 60°F/hr (Unit 2).
	OR	

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. (continued)	A.3 Verify two PORVs secured open and associated block valves open and power removed.	Immediately
	<u>OR</u>	
	A.4 Depressurize RCS and establish RCS vent of ≥ 4.5 square inches.	Immediately
	<u>OR</u>	
	A.5.1 Depressurize RCS and establish RCS vent of ≥ 2.75 square inches.	Immediately
	<u>AND</u>	
	A.5.2 Verify two PORVs are OPERABLE.	Immediately
B. An accumulator not isolated when the accumulator pressure is greater than or equal to the maximum RCS pressure for existing cold leg temperature allowed in Specification 3.4.3.	B.1 Isolate affected accumulator.	1 hour
C. Required Action and associated Completion Time of Condition B not met.	C.1 Increase RCS cold leg temperature to > 300°F.	12 hours
	<u>OR</u>	
	C.2 Depressurize affected accumulator to less than the maximum RCS pressure for existing cold leg temperature allowed by Specification 3.4.3.	12 hours
D. One PORV inoperable in MODE 4.	D.1 Restore PORV to OPERABLE status.	7 days

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
E. One PORV inoperable in MODE 5 or 6.	E.1 Suspend all operations which could lead to a water solid pressurizer.	Immediately
	AND	
	E.2 Restore PORV to OPERABLE status.	24 hours
F. Required Action and associated Completion Time of Condition E not met.	F.1. Verify RCS cold leg temperature ~~≥ 167°F~~. > 159°F (Unit 1) or > 89°F (Unit 2).	1 hour
	AND	
	F.2 Verify RHR suction relief valve is OPERABLE and the suction isolation valves are open.	1 hour
G. Two PORVs inoperable. OR Required Action and associated Completion Time of Condition C, D, E, or F not met. OR LTOP System inoperable for any reason other than Condition A, B, C, D, E, or F.	G.1 Depressurize RCS and establish RCS vent of ≥ 2.75 square inches.	8 hours

For Information Only

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.4.12.1	Verify a maximum of one centrifugal charging pump or one safety injection pump is capable of injecting into the RCS.	12 hours
SR 3.4.12.2	Verify each accumulator is isolated.	12 hours
SR 3.4.12.3	Verify RHR suction isolation valves are open when the RHR suction relief valve is used for overpressure protection.	12 hours
SR 3.4.12.4	----------NOTE---------- Only required to be performed when complying with LCO 3.4.12.b. -------------------- Verify RCS vent ≥ 2.75 square inches open.	12 hours for unlocked open vent valve(s) AND 31 days for locked open vent valve(s)
SR 3.4.12.5	Verify PORV block valve is open for each required PORV.	72 hours

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.4.12.6	-----NOTE----- Not required to be met until 12 hours after decreasing RCS cold leg temperature to ≤ 300°F. ---------- Perform a COT on each required PORV, excluding actuation.	31 days
SR 3.4.12.7	Perform CHANNEL CALIBRATION for each required PORV actuation channel.	18 months

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

Manual and automatic initiation of steam line isolation must be OPERABLE in MODES 1, 2, and 3 when there is sufficient energy in the RCS and SGs to have an SLB or other accident. This could result in the release of significant quantities of energy and cause a cooldown of the primary system. The Steam Line Isolation Function is required in MODES 2 and 3 unless all MSIVs are closed and de-activated. In MODES 4, 5, and 6, there is insufficient energy in the RCS and SGs to experience an SLB or other accident releasing significant quantities of energy.

c. Steam Line Isolation-Containment Pressure-High High

This Function actuates closure of the MSIVs in the event of a LOCA or an SLB inside containment to maintain three unfaulted SGs as a heat sink for the reactor, and to limit the mass and energy release to containment. The Containment Pressure - High High function is described in ESFAS Function 2.C.

Containment Pressure-High High must be OPERABLE in MODES 1, 2, and 3, when there is sufficient energy in the primary and secondary side to pressurize the containment following a pipe break. This would cause a significant increase in the containment pressure, thus allowing detection and closure of the MSIVs. The Steam Line Isolation Function remains OPERABLE in MODES 2 and 3 unless all MSIVs are closed and de-activated. In MODES 4, 5, and 6, there is not enough energy in the primary and secondary sides to pressurize the containment to the Containment Pressure-High High setpoint.

d. Steam Line Isolation-Steam Line Pressure

(1) Steam Line Pressure-Low

Steam Line Pressure-Low provides closure of the MSIVs in the event of an SLB to maintain three unfaulted SGs as a heat sink for the reactor, and to limit the mass and energy release to containment. This Function provides closure of the MSIVs in the event of a feed line break to ensure a supply of steam for the turbine driven AFW pump.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

Steam Line Pressure-Low Function must be OPERABLE in MODES 1, 2, and 3 (above P-11), with any main steam valve open, when a secondary side break or stuck open valve could result in the rapid depressurization of the steam lines. This signal may be manually blocked by the operator below the P-11 setpoint. Below P-11, an inside containment SLB will be terminated by automatic actuation via Containment Pressure-High High. Stuck valve transients and outside containment SLBs will be terminated by the Steam Line Pressure-Negative Rate-High signal for Steam Line Isolation below P-11 when SI has been manually blocked. The Steam Line Isolation Function is required in MODES 2 and 3 unless all MSIVs are closed and de-activated. This Function is not required to be OPERABLE in MODES 4, 5, and 6 because there is insufficient energy in the secondary side of the unit to have an accident.

Steam Line Pressure-Low

(2) Steam Line Pressure-Negative Rate-High

Steam Line Pressure-Negative Rate-High provides closure of the MSIVs for an SLB when less than the P-11 setpoint, to maintain at least one unfaulted SG as a heat sink for the reactor, and to limit the mass and energy release to containment. When the operator manually blocks the Steam Line Pressure-Low main steam isolation signal when less than the P-11 setpoint, the Steam Line Pressure-Negative Rate-High signal is automatically enabled. Steam Line Pressure-Negative Rate-High provides no input to any control functions. Thus, three OPERABLE channels are sufficient to satisfy requirements with a two-out-of-three logic on each steam line.

Steam Line Pressure-Negative Rate-High must be OPERABLE in MODE 3 when less than the P-11 setpoint, when a secondary side break or stuck open valve could result in the rapid depressurization of the steam line(s). In MODES 1 and 2, and in MODE 3, when above the P-11 setpoint, this signal is automatically disabled and the Steam Line Pressure-Low signal is automatically enabled. The Steam Line Isolation Function is required to be OPERABLE in

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

MODES 2 and 3 unless all MSIVs are closed and de-activated. In MODES 4, 5, and 6, there is insufficient energy in the primary and secondary sides to have an SLB or other accident that would result in a release of significant enough quantities of energy to cause a cooldown of the RCS.

5. Turbine Trip and Feedwater Isolation

The primary functions of the Turbine Trip and Feedwater Isolation signals are to prevent damage to the turbine due to water in the steam lines, and to stop the excessive flow of feedwater into the SGs. These Functions are necessary to mitigate the effects of a high water level in the SGs, which could result in carryover of water into the steam lines and excessive cooldown of the primary system. The SG high water level is due to excessive feedwater flows.

The function is actuated when the level in any SG exceeds the high high setpoint, and performs the following functions:

- Trips the main turbine;
- Trips the MFW pumps; and
- Initiates feedwater isolation (shuts the MFW control valves, bypass feedwater control valves, feedwater isolation valves, and the MFW to AFW nozzle bypass valves).

Turbine Trip and Feedwater Isolation signals are both actuated by SG Water Level-High High, or by an SI signal. The RTS also initiates a turbine trip signal whenever a reactor trip (P-4) is generated. A Feedwater Isolation signal is also generated on a high water level in the reactor building doghouses. In the event of SI, the unit is taken off line and the turbine generator must be tripped. The MFW System is also taken out of operation and the AFW System is automatically started. The SI signal was discussed previously.

a. Turbine Trip and Feedwater Isolation-Automatic Actuation Logic and Actuation Relays

Automatic Actuation Logic and Actuation Relays consist of the same features and operate in the same manner as described for ESFAS Function 1.b.

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.3 RCS Pressure and Temperature (P/T) Limits

BASES

BACKGROUND

All components of the RCS are designed to withstand effects of cyclic loads due to system pressure and temperature changes. These loads are introduced by startup (heatup) and shutdown (cooldown) operations, power transients, and reactor trips. This LCO limits the pressure and temperature changes during RCS heatup and cooldown, within the design assumptions and the stress limits for cyclic operation.

This Specification contains P/T limit curves for heatup, cooldown, inservice leak and hydrostatic (ISLH) testing, and data for the maximum rate of change of reactor coolant temperature.

Each P/T limit curve defines an acceptable region for normal operation. The usual use of the curves is operational guidance during heatup or cooldown maneuvering, when pressure and temperature indications are monitored and compared to the applicable curve to determine that operation is within the allowable region.

The LCO establishes operating limits that provide a margin to brittle failure of the reactor vessel and piping of the reactor coolant pressure boundary (RCPB). The vessel is the component most subject to brittle failure, and the LCO limits apply mainly to the vessel. The limits do not apply to the pressurizer, which has different design characteristics and operating functions.

10 CFR 50, Appendix G (Ref. 1), requires the establishment of P/T limits for specific material fracture toughness requirements of the RCPB materials. Reference 1 requires an adequate margin to brittle failure during normal operation, anticipated operational occurrences, and system hydrostatic tests. It mandates the use of the American Society of Mechanical Engineers (ASME) Code, Section III, Appendix G (Ref. 2).

The neutron embrittlement effect on the material toughness is reflected by increasing the nil ductility reference temperature (RT_{NDT}) as exposure to neutron fluence increases.

The actual shift in the RT_{NDT} of the vessel material will be established periodically by removing and evaluating the irradiated reactor vessel material specimens, in accordance with ASTM E 185 (Ref. 3) and

BACKGROUND (continued)

Appendix H of 10 CFR 50 (Ref. 4). The operating P/T limit curves will be adjusted, as necessary, based on the evaluation findings and the recommendations of Regulatory Guide 1.99 (Ref. 5).

Insert 1

The P/T limit curves are composite curves established by superimposing limits derived from stress analyses of those portions of the reactor vessel and head that are the most restrictive. At any specific pressure, temperature, and temperature rate of change, one location within the reactor vessel will dictate the most restrictive limit. Across the span of the P/T limit curves, different locations are more restrictive, and, thus, the curves are composites of the most restrictive regions.

The heatup curve represents a different set of restrictions than the cooldown curve because the directions of the thermal gradients through the vessel wall are reversed. The thermal gradient reversal alters the location of the tensile stress between the outer and inner walls.

The criticality limit curve includes the Reference 1 requirement that it be ≥ 40°F above the heatup curve or the cooldown curve, and not less than the minimum permissible temperature for ISLH testing. However, the criticality curve is not operationally limiting; a more restrictive limit exists in LCO 3.4.2, "RCS Minimum Temperature for Criticality."

The consequence of violating the LCO limits is that the RCS has been operated under conditions that can result in brittle failure of the RCPB, possibly leading to a nonisolable leak or loss of coolant accident. In the event these limits are exceeded, an evaluation must be performed to determine the effect on the structural integrity of the RCPB components. The ASME Code, Section XI, Appendix E (Ref. 6), provides a recommended methodology for evaluating an operating event that causes an excursion outside the limits.

APPLICABLE SAFETY ANALYSES

The P/T limits are not derived from Design Basis Accident (DBA) analyses. They are prescribed during normal operation to avoid encountering pressure, temperature, and temperature rate of change conditions that might cause undetected flaws to propagate and cause nonductile failure of the RCPB, an unanalyzed condition. Although the P/T limits are not derived from any DBA, the P/T limits are acceptance limits since they preclude operation in an unanalyzed condition.

RCS P/T limits satisfy Criterion 2 of 10 CFR 50.36 (Ref. 7).

Insert 1:

A second program that employs excore cavity dosimetry to monitor the reactor vessel neutron fluence has been installed in both units. This program meets the requirements of 10 CFR 50 Appendix H (Ref. 4).

LCO

The two elements of this LCO are:

a. The limit curves for heatup, cooldown, and ISLH testing; and

b. Limits on the rate of change of temperature.

The LCO limits apply to all components of the RCS, except the pressurizer. These limits define allowable operating regions and permit a large number of operating cycles while providing a wide margin to nonductile failure.

The limits for the rate of change of temperature control the thermal gradient through the vessel wall and are used as inputs for calculating the heatup, cooldown, and ISLH testing P/T limit curves. Thus, the LCO for the rate of change of temperature restricts stresses caused by thermal gradients and also ensures the validity of the P/T limit curves.

Violating the LCO limits places the reactor vessel outside of the bounds of the stress analyses and can increase stresses in other RCPB components. The consequences depend on several factors, as follows:

a. The severity of the departure from the allowable operating P/T regime or the severity of the rate of change of temperature;

b. The length of time the limits were violated (longer violations allow the temperature gradient in the thick vessel walls to become more pronounced); and

c. The existences, sizes, and orientations of flaws in the vessel material.

APPLICABILITY

The RCS P/T limits LCO provides a definition of acceptable operation for prevention of nonductile failure in accordance with 10 CFR 50, Appendix G (Ref. 1). Although the P/T limits were developed to provide guidance for operation during heatup or cooldown (MODES 3, 4, and 5) or ISLH testing, their Applicability is at all times in keeping with the concern for nonductile failure. The limits do not apply to the pressurizer.

During MODES 1 and 2, other Technical Specifications provide limits for operation that can be more restrictive than or can supplement these P/T limits. LCO 3.4.1, "RCS Pressure, Temperature, and Flow Departure from Nucleate Boiling (DNB) Limits"; LCO 3.4.2, "RCS Minimum Temperature for Criticality"; and Safety Limit 2.1, "Safety Limits," also provide operational restrictions for pressure and temperature and

APPLICABILITY (continued)

maximum pressure. Furthermore, MODES 1 and 2 are above the temperature range of concern for nonductile failure, and stress analyses have been performed for normal maneuvering profiles, such as power ascension or descent.

ACTIONS

A.1 and A.2

Operation outside the P/T limits during MODE 1, 2, 3, or 4 must be corrected so that the RCPB is returned to a condition that has been verified by stress analyses.

The 30 minute Completion Time reflects the urgency of restoring the parameters to within the analyzed range. Most violations will not be severe, and the activity can be accomplished in this time in a controlled manner.

Besides restoring operation within limits, an evaluation is required to determine if RCS operation can continue. The evaluation must verify the RCPB integrity remains acceptable and must be completed before continuing operation. Several methods may be used, including comparison with pre-analyzed transients in the stress analyses, new analyses, or inspection of the components.

ASME Code, Section XI, Appendix E (Ref. 6), may be used to support the evaluation. However, its use is restricted to evaluation of the vessel beltline.

The 72 hour Completion Time is reasonable to accomplish the evaluation. The evaluation for a mild violation is possible within this time, but more severe violations may require special, event specific stress analyses or inspections. A favorable evaluation must be completed before continuing to operate.

Condition A is modified by a Note requiring Required Action A.2 to be completed whenever the Condition is entered. The Note emphasizes the need to perform the evaluation of the effects of the excursion outside the allowable limits. Restoration alone per Required Action A.1 is insufficient because higher than analyzed stresses may have occurred and may have affected the RCPB integrity.

ACTIONS (continued)

B.1 and B.2

If a Required Action and associated Completion Time of Condition A are not met, the plant must be placed in a lower MODE because either the RCS remained in an unacceptable P/T region for an extended period of increased stress or a sufficiently severe event caused entry into an unacceptable region. Either possibility indicates a need for more careful examination of the event, best accomplished with the RCS at reduced pressure and temperature. In reduced pressure and temperature conditions, the possibility of propagation with undetected flaws is decreased.

If the required restoration activity cannot be accomplished within 30 minutes, Required Action B.1 and Required Action B.2 must be implemented to reduce pressure and temperature.

If the required evaluation for continued operation cannot be accomplished within 72 hours or the results are indeterminate or unfavorable, action must proceed to reduce pressure and temperature as specified in Required Action B.1 and Required Action B.2. A favorable evaluation must be completed and documented before returning to operating pressure and temperature conditions.

Pressure and temperature are reduced by bringing the plant to MODE 3 within 6 hours and to MODE 5 with RCS pressure < 500 psig within 36 hours.

The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

C.1 and C.2

Actions must be initiated immediately to correct operation outside of the P/T limits at times other than when in MODE 1, 2, 3, or 4, so that the RCPB is returned to a condition that has been verified by stress analysis.

The immediate Completion Time reflects the urgency of initiating action to restore the parameters to within the analyzed range. Most violations will not be severe, and the activity can be accomplished in this time in a controlled manner.

ACTIONS (continued)

Besides restoring operation within limits, an evaluation is required to determine if RCS operation can continue. The evaluation must verify that the RCPB integrity remains acceptable and must be completed prior to entry into MODE 4. Several methods may be used, including comparison with pre-analyzed transients in the stress analyses, or inspection of the components.

ASME Code, Section XI, Appendix E (Ref. 6), may be used to support the evaluation. However, its use is restricted to evaluation of the vessel beltline.

Condition C is modified by a Note requiring Required Action C.2 to be completed whenever the Condition is entered. The Note emphasizes the need to perform the evaluation of the effects of the excursion outside the allowable limits. Restoration alone per Required Action C.1 is insufficient because higher than analyzed stresses may have occurred and may have affected the RCPB integrity.

SURVEILLANCE REQUIREMENTS

SR 3.4.3.1

Verification that operation is within the specified limits is required every 30 minutes when RCS pressure and temperature conditions are undergoing planned changes. This Frequency is considered reasonable in view of the control room indication available to monitor RCS status. Also, since temperature rate of change limits are specified in hourly increments, 30 minutes permits assessment and correction for minor deviations within a reasonable time.

Surveillance for heatup, cooldown, or ISLH testing may be discontinued when the definition given in the relevant plant procedure for ending the activity is satisfied.

This SR is modified by a Note that only requires this SR to be performed during system heatup, cooldown, and ISLH testing. No SR is given for criticality operations because LCO 3.4.2 contains a more restrictive requirement.

REFERENCES

1. 10 CFR 50, Appendix G.

2. ASME, Boiler and Pressure Vessel Code, Section III, Appendix G.

3. ASTM E 185-82, July 1982.

4. 10 CFR 50, Appendix H.

5. Regulatory Guide 1.99, Revision 2, May 1988.

6. ASME, Boiler and Pressure Vessel Code, Section XI, Appendix E.

7. 10 CFR 50.36, Technical Specifications, (c)(2)(ii).

For Information Only

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.12 Low Temperature Overpressure Protection (LTOP) System

BASES

BACKGROUND

The LTOP System controls RCS pressure at low temperatures so the integrity of the reactor coolant pressure boundary (RCPB) is not compromised by violating the pressure and temperature (P/T) limits of 10 CFR 50, Appendix G (Ref. 1). The reactor vessel is the limiting RCPB component for demonstrating such protection. This specification provides the maximum allowable actuation logic setpoints for the power operated relief valves (PORVs) and LCO 3.4.3, "RCS Pressure and Temperature (P/T) Limits," provides the maximum RCS pressure for the existing RCS cold leg temperature during cooldown, shutdown, and heatup to meet the Reference 1 requirements during the LTOP MODES.

The reactor vessel material is less tough at low temperatures than at normal operating temperature. As the vessel neutron exposure accumulates, the material toughness decreases and becomes less resistant to pressure stress at low temperatures (Ref. 2). RCS pressure, therefore, is maintained low at low temperatures and is increased only as temperature is increased.

The potential for vessel overpressurization is most acute when the RCS is water solid, occurring only while shutdown; a pressure fluctuation can occur more quickly than an operator can react to relieve the condition. Exceeding the RCS P/T limits by a significant amount could cause brittle cracking of the reactor vessel. LCO 3.4.3 requires administrative control of RCS pressure and temperature during heatup and cooldown to prevent exceeding the specified limits.

This LCO provides RCS overpressure protection by having a minimum coolant input capability and having adequate pressure relief capacity. Limiting coolant input capability requires all but one centrifugal charging pump or one safety injection pump incapable of injection into the RCS and isolating the accumulators. The pressure relief capacity requires either two redundant PORVs or a depressurized RCS and an RCS vent of sufficient size. One PORV or the open RCS vent is the overpressure protection device that acts to terminate an increasing pressure event.

With minimum coolant input capability, the ability to provide core coolant addition is restricted. The LCO does not require the makeup control

BACKGROUND (continued)

system deactivated or the safety injection (SI) actuation circuits blocked. Due to the lower pressures in the LTOP MODES and the expected core decay heat levels, the makeup system can provide adequate flow via the makeup control valve. If conditions require the use of more than one centrifugal charging pump for makeup in the event of loss of inventory, then pumps can be made available through manual actions.

PORV Requirements

As designed for the LTOP System, each PORV is signaled to open if the RCS pressure reaches 385 psig when the PORVS are in the "lo-press" mode of operation. If the PORVs are being used to meet the requirements of this specification, then RCS cold leg temperature is limited in accordance with the LTOP analysis. For cases where no reactor coolant pumps are in operation, this temperature limit is met by monitoring of BOTH the Wide Range Cold Leg temperatures and Residual Heat Removal Heat Exchanger discharge temperature. These temperatures are the most representative of the fluid in the reactor vessel downcomer region. The LTOP actuation logic monitors both RCS temperature and RCS pressure. The signals used to generate the pressure setpoints originate from the safety related narrow range pressure transmitters. The signals used to generate the temperature permissives originate from the wide range RTDs on cold leg C and hot leg D. Each signal is input to the appropriate NSSS protection system cabinet where it is converted to an internal signal and then input to a comparator to generate an actuation signal. If the indicated pressure meets or exceeds the bistable setpoint, a PORV is signaled to open.

This Specification presents the PORV setpoints for LTOP. Having the setpoints of both valves within the limits ensures that the Reference 1 limits will not be exceeded in any analyzed event.

When a PORV is opened in an increasing pressure transient, the release of coolant will cause the pressure increase to slow and reverse. As the PORV releases coolant, the RCS pressure decreases until a reset pressure is reached and the valve is signaled to close. The pressure continues to decrease below the reset pressure as the valve closes.

RCS Vent Requirements

Once the RCS is depressurized, a vent exposed to the containment atmosphere will maintain the RCS at containment ambient pressure in an RCS overpressure transient, if the relieving requirements of the transient do not exceed the capabilities of the vent. Thus, the vent path must be

BACKGROUND (continued)

capable of relieving the flow resulting from the limiting LTOP mass or heat input transient, and maintaining pressure below the P/T limits. The required vent capacity may be provided by one or more vent paths.

The vent path(s) must be above the level of reactor coolant, so as not to drain the RCS when open.

APPLICABLE SAFETY ANALYSES

Safety analyses (Ref. 4) demonstrate that the reactor vessel is adequately protected against exceeding the Reference 1 P/T limits. In MODES 1, 2, and 3, and in MODE 4 with RCS cold leg temperature exceeding 300°F, the pressurizer safety valves will prevent RCS pressure from exceeding the Reference 1 limits. At about 300°F and below, overpressure prevention falls to two OPERABLE PORVs or to a depressurized RCS and a sufficient sized RCS vent. Each of these means has a limited overpressure relief capability.

The actual temperature at which the pressure in the P/T limit curve falls below the pressurizer safety valve setpoint increases as the reactor vessel material toughness decreases due to neutron embrittlement. Each time the P/T curves are revised, the LTOP System must be re-evaluated to ensure its functional requirements can still be met using the PORV method or the depressurized and vented RCS condition.

Any change to the RCS must be evaluated against the Reference 4 analyses to determine the impact of the change on the LTOP acceptance limits.

Transients that are capable of overpressurizing the RCS are categorized as either mass or heat input transients, examples of which follow:

Mass Input Type Transients

a. Inadvertent safety injection; or

b. Charging/letdown flow mismatch.

Heat Input Type Transients

a. Inadvertent actuation of pressurizer heaters;

b. Loss of RHR cooling; or

APPLICABLE SAFETY ANALYSES (continued)

c. Reactor coolant pump (RCP) startup with temperature asymmetry within the RCS or between the RCS and steam generators.

The following are required during the LTOP MODES to ensure that mass and heat input transients do not occur, which either of the LTOP overpressure protection means cannot handle:

a. Rendering all but one centrifugal charging pump or one safety injection pump incapable of injection;

b. Deactivating the accumulator discharge isolation valves in their closed positions; and

c. Disallowing start of an RCP if secondary temperature is more than 50°F above primary temperature in any one loop. LCO 3.4.6, "RCS Loops—MODE 4," and LCO 3.4.7, "RCS Loops—MODE 5, Loops Filled," provide this protection.

The Reference 4 analyses demonstrate that either one PORV or the depressurized RCS and RCS vent can maintain RCS pressure below limits when only one centrifugal charging pump or one safety injection pump are actuated. Thus, the LCO allows only one centrifugal charging pump or one safety injection pump OPERABLE during the LTOP MODES. Since neither one PORV nor the RCS vent can handle the pressure transient from accumulator injection when RCS temperature is low the LCO also requires the accumulators isolation when accumulator pressure is greater than or equal to the maximum RCS pressure for the existing RCS cold leg temperature allowed in LCO 3.4.3.

The isolated accumulators must have their discharge valves closed and power removed.

Fracture mechanics analyses established the temperature of LTOP Applicability at 300°F.

The consequences of a small break loss of coolant accident (LOCA) in LTOP MODE 4 conform to 10 CFR 50.46 and 10 CFR 50, Appendix K (Refs. 5 and 6), requirements by having a maximum of one centrifugal charging pump OPERABLE and SI actuation enabled.

BASES

APPLICABLE SAFETY ANALYSES (continued)

PORV Performance

The fracture mechanics analyses show that the vessel is protected when the PORVs are set to open at or below the specified limit. The setpoints are derived by analyses that model the performance of the LTOP System, assuming the limiting LTOP transient of one centrifugal charging pump or one safety injection pump injecting into the RCS. These analyses consider pressure overshoot and undershoot beyond the PORV opening and closing, resulting from signal processing and valve stroke times. The PORV setpoints at or below the derived limit ensures the Reference 1 P/T limits will be met.

The PORV setpoints will be updated when the revised P/T limits conflict with the LTOP analysis limits. The P/T limits are periodically modified as the reactor vessel material toughness decreases due to neutron embrittlement caused by neutron irradiation. Revised limits are determined using neutron fluence projections and the results of examinations of the reactor vessel material irradiation surveillance specimens. The Bases for LCO 3.4.3, "RCS Pressure and Temperature (P/T) Limits," discuss these examinations.

The PORVs are considered active components. Thus, the failure of one PORV is assumed to represent the worst case, single active failure.

RCS Vent Performance

With the RCS depressurized, analyses show a vent size of 2.75 square inches is capable of mitigating the allowed LTOP overpressure transient. The capacity of a vent this size is greater than the flow of the limiting transient for the LTOP configuration, one centrifugal charging pump or one safety injection pump OPERABLE, maintaining RCS pressure less than the maximum pressure on the P/T limit curve.

The RCS vent size will be re-evaluated for compliance each time the P/T limit curves are revised based on the results of the vessel material surveillance.

The RCS vent is passive and is not subject to active failure.

The LTOP System satisfies Criterion 2 of 10 CFR 50.36 (Ref. 7).

BASES

LCO

This LCO requires that the LTOP System is OPERABLE. The LTOP System is OPERABLE when the minimum coolant input and pressure relief capabilities are OPERABLE. Violation of this LCO could lead to the loss of low temperature overpressure mitigation and violation of the Reference 1 limits as a result of an operational transient.

To limit the coolant input capability, the LCO permits a maximum of one centrifugal charging pump or one safety injection pump capable of injecting into the RCS and requires all accumulator discharge isolation valves closed and immobilized when accumulator pressure is greater than or equal to the maximum RCS pressure for the existing RCS cold leg temperature allowed in LCO 3.4.3.

The elements of the LCO that provide low temperature overpressure mitigation through pressure relief are:

a. Two OPERABLE PORVs (NC-32B and NC-34A); or

   A PORV is OPERABLE for LTOP when its block valve is open, its lift setpoint is set to the specified limit and testing proves its automatic ability to open at this setpoint, and motive power is available to the valve and its control circuit.

b. A depressurized RCS and an RCS vent.

   An RCS vent is OPERABLE when open with an area of ≥ 2.75 square inches.

Insert 2

Each of these methods of overpressure prevention is capable of mitigating the limiting LTOP transient.

APPLICABILITY

This LCO is applicable in MODE 4 when any RCS cold leg temperature is ≤ 300°F, in MODE 5, and in MODE 6 when the reactor vessel head is on. The pressurizer safety valves provide overpressure protection that meets the Reference 1 P/T limits above 300°F. When the reactor vessel head is off, overpressurization cannot occur.

LCO 3.4.3 provides the operational P/T limits for all MODES. LCO 3.4.10, "Pressurizer Safety Valves," requires the OPERABILITY of the pressurizer safety valves that provide overpressure protection during MODES 1, 2, and 3, and MODE 4 above 300°F.

Low temperature overpressure prevention is most critical during shutdown when the RCS is water solid, and a mass or heat input transient can cause a very rapid increase in RCS pressure when little or no time allows operator action to mitigate the event.

Insert 2:

The LCO is modified with a note that specifies that a PORV secured in the open position may be used to meet the RCS vent requirement provided that its associated block valve is open and power removed. With the PORV physically secured or locked in the open position with its associated block valve open and power removed, this vent path is passive and is not subject to active failure.

BASES

APPLICABILITY (continued)

The Applicability is modified by a Note stating that accumulator isolation is only required when the accumulator pressure is more than or at the maximum RCS pressure for the existing temperature, as allowed by the P/T limit curves. This Note permits the accumulator discharge isolation valve Surveillance to be performed only under these pressure and temperature conditions.

ACTIONS

LCO 3.0.4 is not applicable for entry into LTOP operation.

A.1, A.2.1, A.2.2.1, A.2.2.2., A.3, and A.4, A.5.1, and A.5.2

With two centrifugal charging pumps, safety injection pumps, or a combination of each, capable of injecting into the RCS, RCS overpressurization is possible.

To immediately initiate action to restore restricted coolant input capability to the RCS reflects the urgency of removing the RCS from this condition. Two pumps may be capable of injecting into the RCS provided the RHR suction relief valve is OPERABLE with the RCS cold leg temperature ≥ 167°F or > 107°F and cooldown rate limited to 20°F, or if two PORVs are secured open with the associated block valves open and power removed, or with an RCS vent of 4.5 square inches. For cases where no reactor coolant pumps are in operation, RCS cold leg temperature limits are to be met by monitoring of BOTH the WR Cold Leg temperatures and Residual Heat Removal Heat Exchanger discharge temperature. With both PORVS and block valves secured open, or with an RCS vent of 4.5 square inches, there are no credible single failures to limit the flow relief capacity. For the RHR relief valve to be OPERABLE, the RHR suction isolation valves must be open and the relief valve setpoint at 450 psig consistent with the safety analysis. The RHR suction relief valves are spring loaded, bellows type water relief valves with pressure tolerances and accumulation limits established by Section III of the American Society of Mechanical Engineers (ASME) Code (Ref. 3) for Class 2 relief valves.

>159°F (Unit 1) or > 89°F (Unit 2), or > 74°F and cooldown rate <20°F/hr (Unit 1), or > 74°F and cooldown rate <60°F/hr (Unit 2)

, or with an RCS vent of ≥2.75 square inches and two OPERABLE PORVs.

Required Action A.1 is modified by a Note that permits two centrifugal charging pumps capable of RCS injection for ≤ 15 minutes to allow for pump swaps.

B.1, C.1, and C.2

An unisolated accumulator requires isolation within 1 hour. This is only required when the accumulator pressure is at or more than the maximum

ACTIONS (continued)

RCS pressure for the existing temperature allowed by the P/T limit curves.

If isolation is needed and cannot be accomplished in 1 hour, Required Action C.1 and Required Action C.2 provide two options, either of which must be performed in the next 12 hours. By increasing the RCS temperature to > 300°F, an accumulator pressure of 639 psig cannot exceed the LTOP limits if the accumulators are fully injected. Depressurizing the accumulators below the LTOP limit also gives this protection.

The Completion Times are based on operating experience that these activities can be accomplished in these time periods and on engineering evaluations indicating that an event requiring LTOP is not likely in the allowed times.

D.1

In MODE 4 when any RCS cold leg temperature is ≤ 300°F, with one PORV inoperable, the PORV must be restored to OPERABLE status within a Completion Time of 7 days. Two PORVS are required to provide low temperature overpressure mitigation while withstanding a single failure of an active component.

The Completion Time considers the facts that only one of the PORVs is required to mitigate an overpressure transient and that the likelihood of an active failure of the remaining valve path during this time period is very low.

E.1 and E.2

The consequences of operational events that will overpressurize the RCS are more severe at lower temperature (Ref. 8). Thus, with one of the two PORVs inoperable in MODE 5 or in MODE 6 with the head on, all operations which could lead to a water solid pressurizer must be suspended immediately and the Completion Time to restore two valves to OPERABLE status is 24 hours.

The Completion Time represents a reasonable time to investigate and repair several types of relief valve failures without exposure to a lengthy period with only one OPERABLE PORV to protect against overpressure events.

BASES

ACTIONS (continued)

> 159 °F (Unit 1) or
> 89 °F (Unit 2).

F.1 and F.2

If the Required Actions and associated Completion Times of Condition E are not met, then alternative actions are necessary to establish the required redundancy in relief capacity. This is accomplished by verifying that the RHR relief valve is OPERABLE and the RHR suction isolation valves open and the RCS cold leg temperature > 167 °F. For cases where no reactor coolant pumps are in operation, RCS cold leg temperature limits are to be met by monitoring of BOTH the WR Cold Leg temperatures and Residual Heat Removal Heat Exchanger discharge temperature. The Completion Time of 1 hour reflects the importance of restoring the required redundancy at lower RCS temperatures.

G.1

The RCS must be depressurized and a vent must be established within 8 hours when:

a. Both required PORVs are inoperable; or

b. A Required Action and associated Completion Time of Condition C, D, E, or F is not met; or

c. The LTOP System is inoperable for any reason other than Condition A, B, C, D, E, or F.

The vent must be sized ≥ 2.75 square inches to ensure that the flow capacity is greater than that required for the worst case mass input transient reasonable during the applicable MODES. This action is needed to protect the RCPB from a low temperature overpressure event and a possible brittle failure of the reactor vessel.

The Completion Time considers the time required to place the plant in this Condition and the relatively low probability of an overpressure event during this time period due to increased operator awareness of administrative control requirements.

SURVEILLANCE REQUIREMENTS

SR 3.4.12.1 and SR 3.4.12.2

To minimize the potential for a low temperature overpressure event by limiting the mass input capability, all but one centrifugal charging pump or

SURVEILLANCE REQUIREMENTS (continued)

one safety injection pump are verified incapable of injecting into the RCS and the accumulator discharge isolation valves are verified closed and power removed.

The centrifugal charging pump and safety injection pump are rendered incapable of injecting into the RCS through removing the power from the pumps by racking the breakers out under administrative control. An alternate method of LTOP control may be employed using at least two independent means to prevent a pump start such that a single failure or single action will not result in an injection into the RCS. This may be accomplished through two valves in the discharge flow path being closed.

The Frequency of 12 hours is sufficient, considering other indications and alarms available to the operator in the control room, to verify the required status of the equipment.

SR 3.4.12.3

The RHR suction relief valve shall be demonstrated OPERABLE by verifying the RHR suction isolation valves are open and by testing it in accordance with the Inservice Testing Program. This Surveillance is only required to be performed if the RHR suction relief valve is being used to meet the Required Actions of this LCO.

The RHR suction valves are verified to be opened every 12 hours. The Frequency is considered adequate in view of other administrative controls such as valve status indications available to the operator in the control room that verify the RHR suction valves remain open.

The ASME Code, Section XI (Ref. 9), test per Inservice Testing Program verifies OPERABILITY by proving proper relief valve mechanical motion and by measuring and, if required, adjusting the lift setpoint.

SR 3.4.12.4

The RCS vent of ≥ 2.75 square inches is proven OPERABLE by verifying its open condition either:

a. Once every 12 hours for a valve that cannot be locked.

b. Once every 31 days for a valve that is locked, sealed, or secured in position. A removed pressurizer safety valve fits this category.

SURVEILLANCE REQUIREMENTS (continued)

The passive vent arrangement must only be open to be OPERABLE. This Surveillance is required to be performed if the vent is being used to satisfy the pressure relief requirements of the LCO 3.4.12b.

SR 3.4.12.5

The PORV block valve must be verified open every 72 hours to provide the flow path for each required PORV to perform its function when actuated. The valve must be remotely verified open in the main control room. This Surveillance is performed if the PORV satisfies the LCO.

The block valve is a remotely controlled, motor operated valve. The power to the valve operator is not required removed, and the manual operator is not required locked in the inactive position. Thus, the block valve can be closed in the event the PORV develops excessive leakage or does not close (sticks open) after relieving an overpressure situation.

The 72 hour Frequency is considered adequate in view of other administrative controls available to the operator in the control room, such as valve position indication, that verify that the PORV block valve remains open.

SR 3.4.12.6

Performance of a COT is required within 12 hours after decreasing RCS temperature to ≤ 300°F and every 31 days on each required PORV to verify and, as necessary, adjust its lift setpoint. The COT will verify the setpoint is within the allowed maximum limits. PORV actuation could depressurize the RCS and is not required.

The 12 hour Frequency considers the unlikelihood of a low temperature overpressure event during this time.

A Note has been added indicating that this SR is required to be met 12 hours after decreasing RCS cold leg temperature to ≤ 300°F. The test must be performed within 12 hours after entering the LTOP MODES.

SR 3.4.12.7

Performance of a CHANNEL CALIBRATION on each required PORV actuation channel is required every 18 months to adjust the whole channel so that it responds and the valve opens within the required range and accuracy to known input.

REFERENCES

1. 10 CFR 50, Appendix G.
2. Generic Letter 88-11.
3. ASME, Boiler and Pressure Vessel Code, Section III.
4. UFSAR, Section 5.2.
5. 10 CFR 50, Section 50.46.
6. 10 CFR 50, Appendix K.
7. 10 CFR 50.36, Technical Specifications, (c)(2)(ii).
8. Generic Letter 90-06.
9. ASME, Boiler and Pressure Vessel Code, Section XI.

DUKE POWER COMPANY

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ATTACHMENT 2

NEW TECHNICAL SPECIFICATION PAGES

Remove Page	Insert Page
3.3.2-12	3.3.2-12
3.4.3-1	3.4.3-1
3.4.3-3	3.4.3-3
3.4.3-4	3.4.3-4
3.4.3-5	3.4.3-5
3.4.3-6	3.4.3-6
-------	3.4.3-7
-------	3.4.3-8
3.4.12-2	3.4.12-2
3.4.12-3	3.4.12-3
3.4.12-4	3.4.12-4

Table 3.3.2-1 (page 3 of 6)
Engineered Safety Feature Actuation System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	NOMINAL TRIP SETPOINT
4. Steam Line Isolation (continued)						
(2) Negative Rate - High	3(b)(c)	3 per steam line	D	SR 3.3.2.1 SR 3.3.2.5 SR 3.3.2.8 SR 3.3.2.9	≤ 120(d) psi	100(d) psi
5. Turbine Trip and Feedwater Isolation						
a. Automatic Actuation Logic and Actuation Relays	1,2(e)	2 trains	I	SR 3.3.2.2 SR 3.3.2.4 SR 3.3.2.6	NA	NA
b. SG Water Level - High High (P-14)	1,2(e)	3 per SG	J	SR 3.3.2.1 SR 3.3.2.2 SR 3.3.2.4 SR 3.3.2.5 SR 3.3.2.6 SR 3.3.2.8 SR 3.3.2.9	≤ 85.6%	83.9%
c. Safety Injection	Refer to Function 1 (Safety Injection) for all initiation functions and requirements.					
d. T_{avg}-Low	1,2(e)	1 per loop	J	SR 3.3.2.1 SR 3.3.2.5 SR 3.3.2.8	≥ 551°F	553°F
coincident with Reactor Trip, P-4	Refer to Function 8.a (Reactor Trip, P-4) for all initiation functions and requirements.					
e. Doghouse Water Level-High High	1,2(e)	2 per train per Doghouse	L,M	SR 3.3.2.1 SR 3.3.2.7	≤13 inches	12 inches
6. Auxiliary Feedwater						
a. Automatic Actuation Logic and Actuation Relays	1,2,3	2 trains	H	SR 3.3.2.2 SR 3.3.2.4 SR 3.3.2.6	NA	NA
b. SG Water Level - Low Low	1,2,3	4 per SG	D	SR 3.3.2.1 SR 3.3.2.5 SR 3.3.2.8 SR 3.3.2.9	≥ 15%	16.7%

(continued)

(b) Except when all MSIVs are closed and de-activated.
(c) Trip function automatically blocked above P-11 (Pressurizer Pressure) interlock and may be blocked below P-11 when Steam Line Isolation on Steam Line Pressure-Low is not blocked.
(d) Time constant utilized in the rate/lag controller is ≥ 50 seconds.
(e) Except when all MFIVs, MFCVs, and associated bypass valves are closed and de-activated or isolated by a closed manual valve.

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.3 RCS Pressure and Temperature (P/T) Limits

LCO 3.4.3 RCS pressure and RCS temperature shall be limited during RCS heatup and cooldown, criticality, and inservice leak and hydrostatic testing in accordance with:

a. A maximum heatup rate as specified in Figures 3.4.3-1 through 3.4.3-4;

b. A maximum cooldown rate as specified in Figures 3.4.3-5 and 3.4.3-6; and

c. A maximum temperature change of $\leq$ 10°F in any 1 hour period during inservice leak and hydrostatic testing operations above the heatup and cooldown limit curves.

APPLICABILITY: At all times.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. ------------NOTE------------ Required Action A.2 shall be completed whenever this Condition is entered. ------------------------------- Requirements of LCO not met in MODE 1, 2, 3, or 4.	A.1 Restore parameter(s) to within limits. AND A.2 Determine RCS is acceptable for continued operation.	30 minutes 72 hours
B. Required Action and associated Completion Time of Condition A not met.	B.1 Be in MODE 3. AND B.2 Be in MODE 5 with RCS pressure < 500 psig.	6 hours 36 hours

(continued)

MATERIAL PROPERTY BASIS

LIMITING MATERIAL: LOWER SHELL LONGITUDINAL WELD SEAMS 3-442A & C
LIMITING ART VALUES AT 34 EFPY: 1/4T, 190°F
3/4T, 129°F

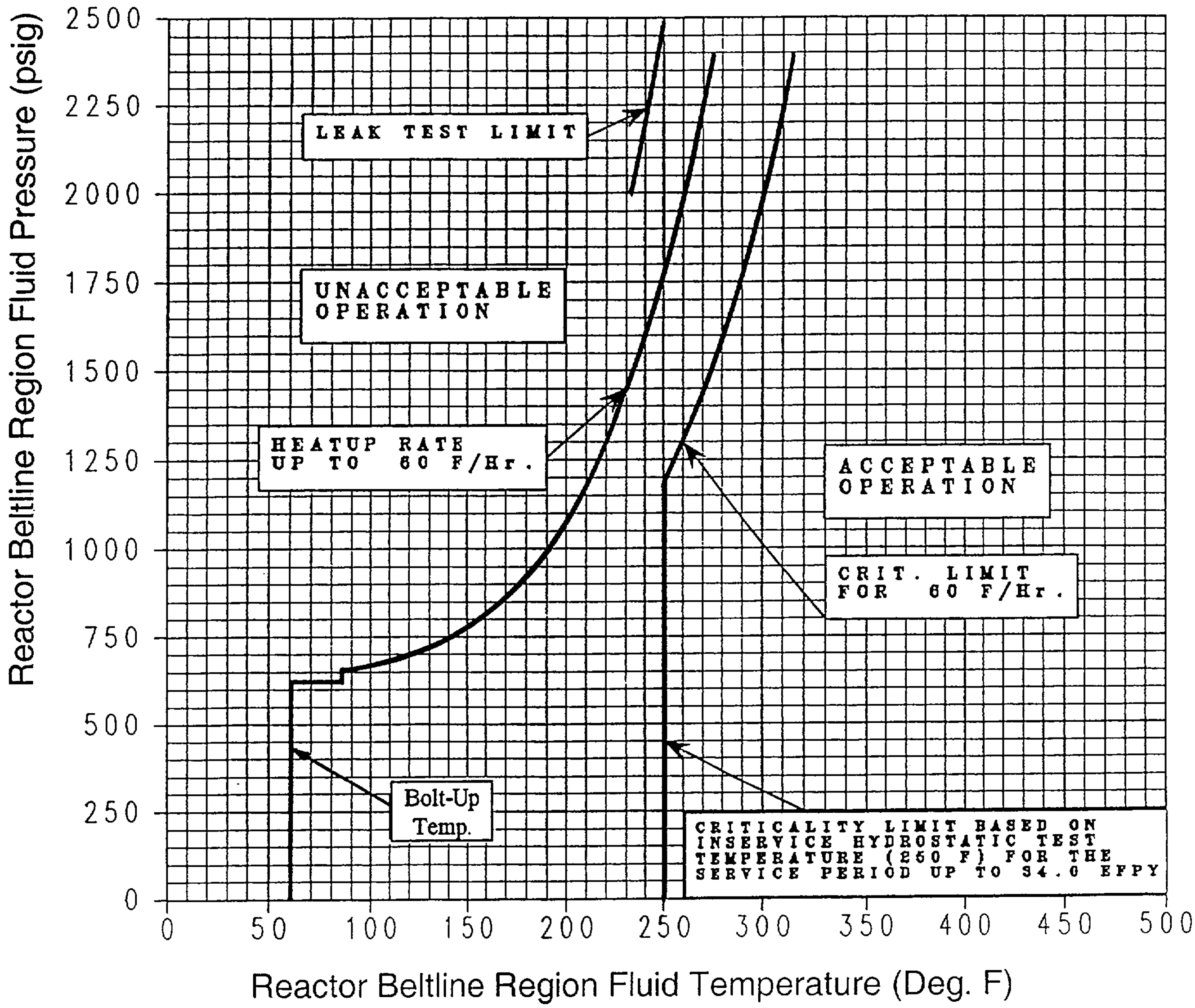

Figure 3.4.3-1

McGuire Unit 1 Reactor Coolant System Heatup Limitations (Heatup Rate of 60° F/hr) Applicable to 34 EFPY (Without Margins for Instrumentation Errors)

MATERIAL PROPERTY BASIS

LIMITING MATERIAL: LOWER SHELL LONGITUDINAL WELD SEAMS 3-442A & C
LIMITING ART VALUES AT 34 EFPY: 1/4T, 190°F
3/4T, 129°F

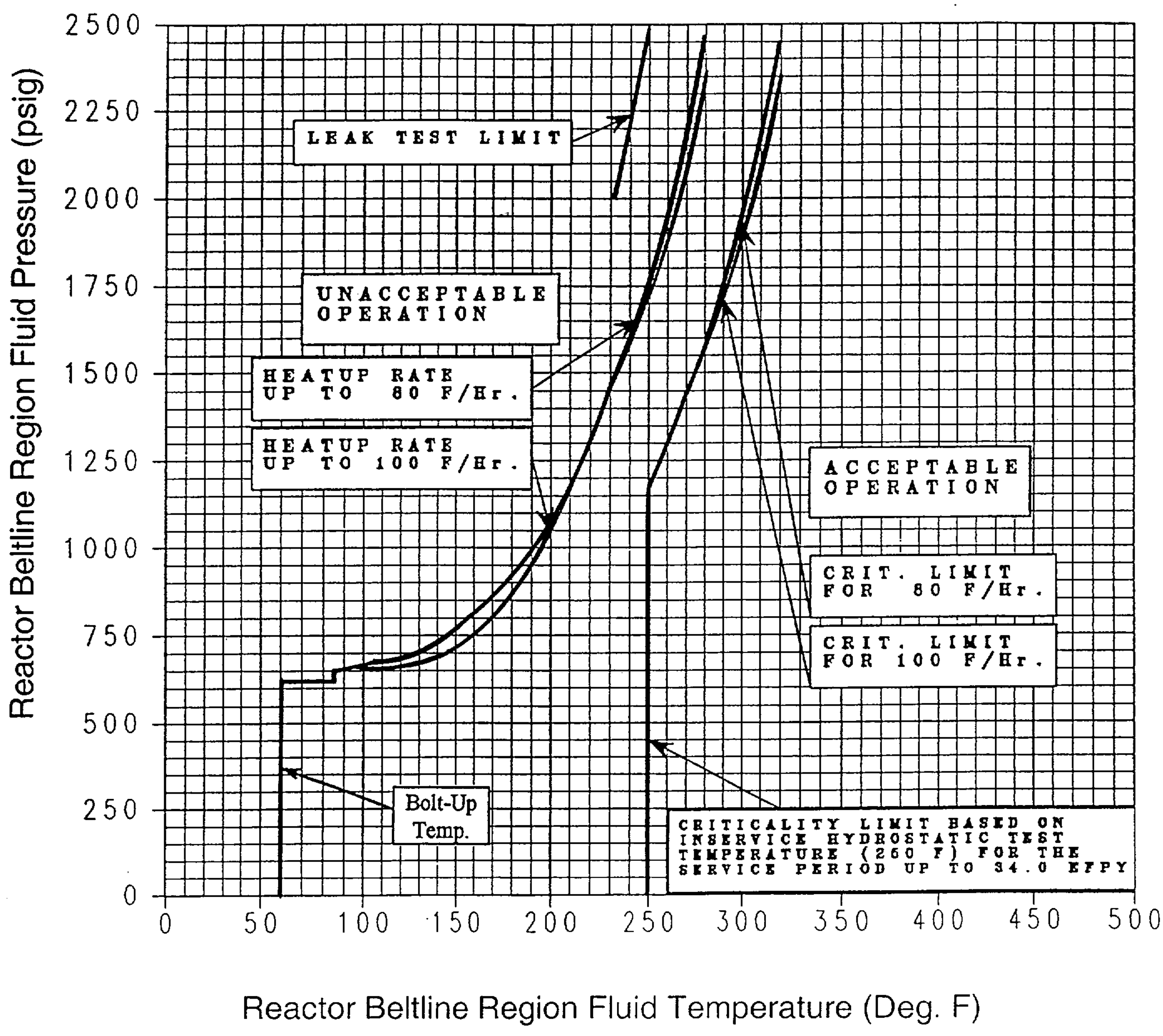

Figure 3.4.3-2

McGuire Unit 1 Reactor Coolant System Heatup Limitations (Heatup Rates of 80 and 100° F/hr) Applicable to 34 EFPY (Without Margins for Instrumentation Errors)

MATERIAL PROPERTY BASIS

LIMITING MATERIAL: LOWER SHELL FORGING 04
LIMITING ART VALUES AT 34 EFPY: 1/4T, 124.5°F
3/4T, 92.0°F

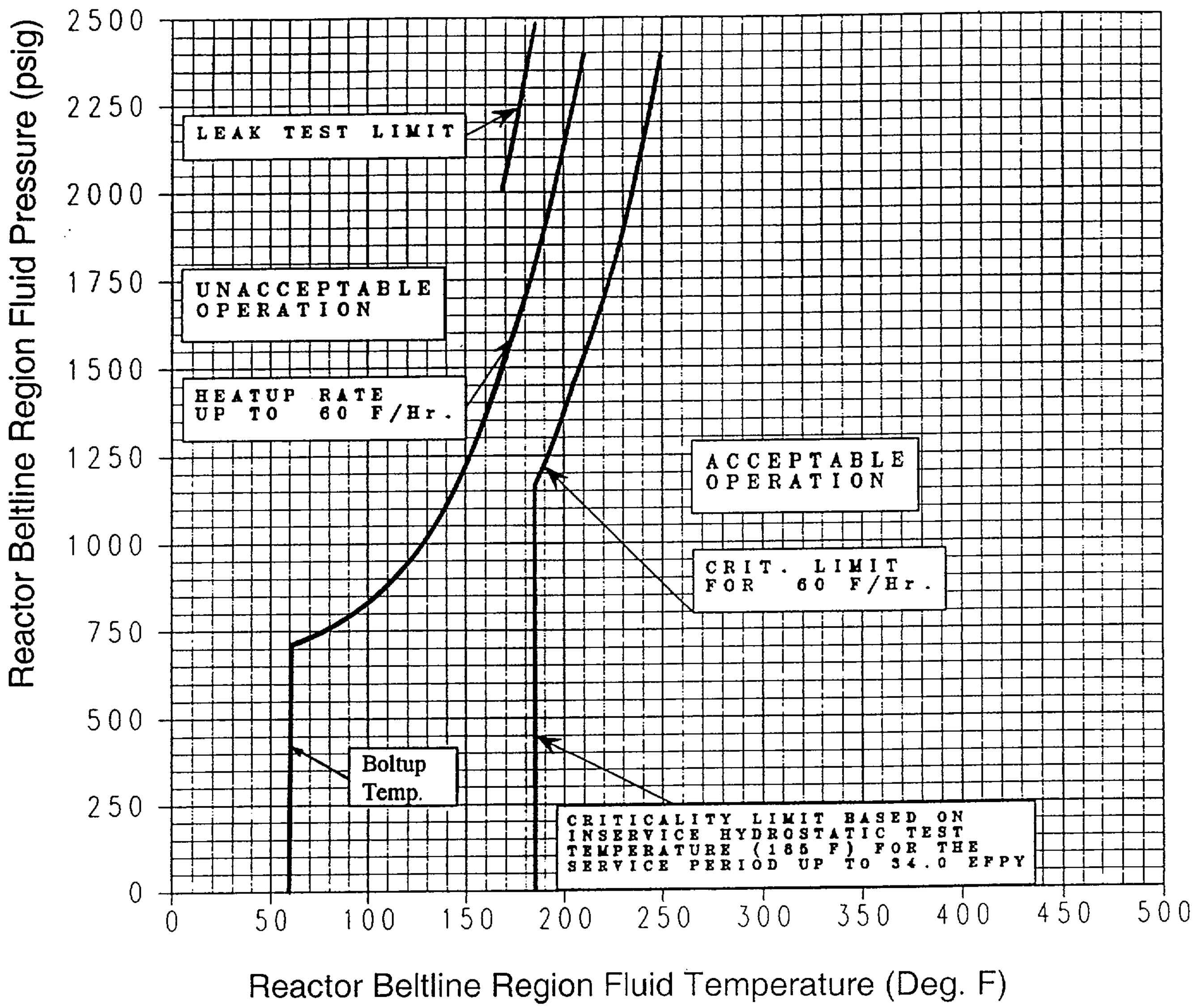

Figure 3.4.3-3

McGuire Unit 2 Reactor Coolant System Heatup Limitations (Heatup Rate of 60° F/hr) Applicable to 34 EFPY (Without Margins for Instrumentation Errors)

MATERIAL PROPERTY BASIS

LIMITING MATERIAL: LOWER SHELL FORGING 04
LIMITING ART VALUES AT 34 EFPY: 1/4T, 124.5°F
3/4T, 92.0°F

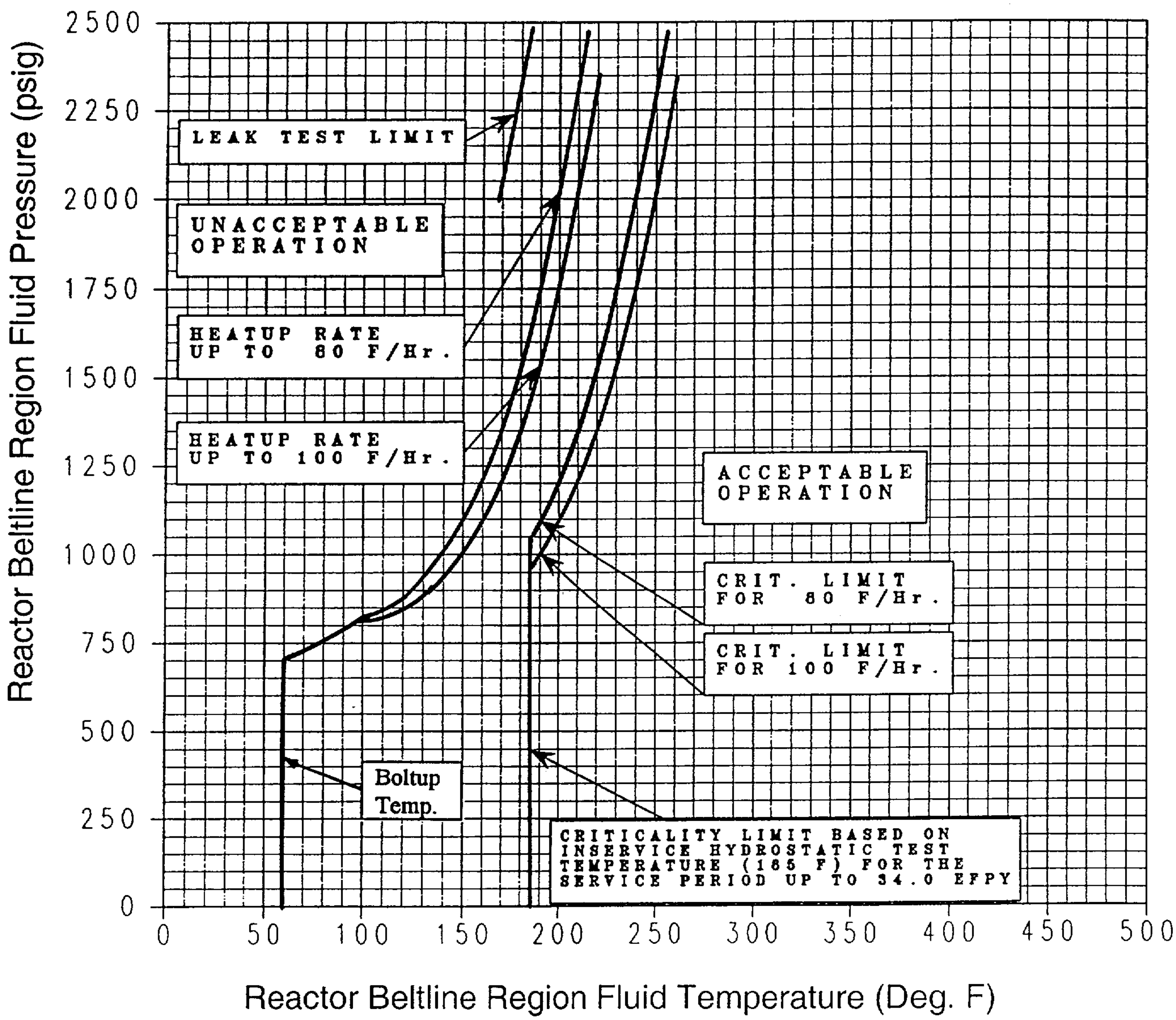

Figure 3.4.3-4

McGuire Unit 2 Reactor Coolant System Heatup Limitations (Heatup Rates of 80 and 100° F/hr) Applicable to 34 EFPY (Without Margins for Instrumentation Errors)

MATERIAL PROPERTY BASIS

LIMITING MATERIAL: LOWER SHELL LONGITUDINAL WELD SEAMS 3-442A & C
LIMITING ART VALUES AT 34 EFPY: 1/4T, 190°F
3/4T, 129°F

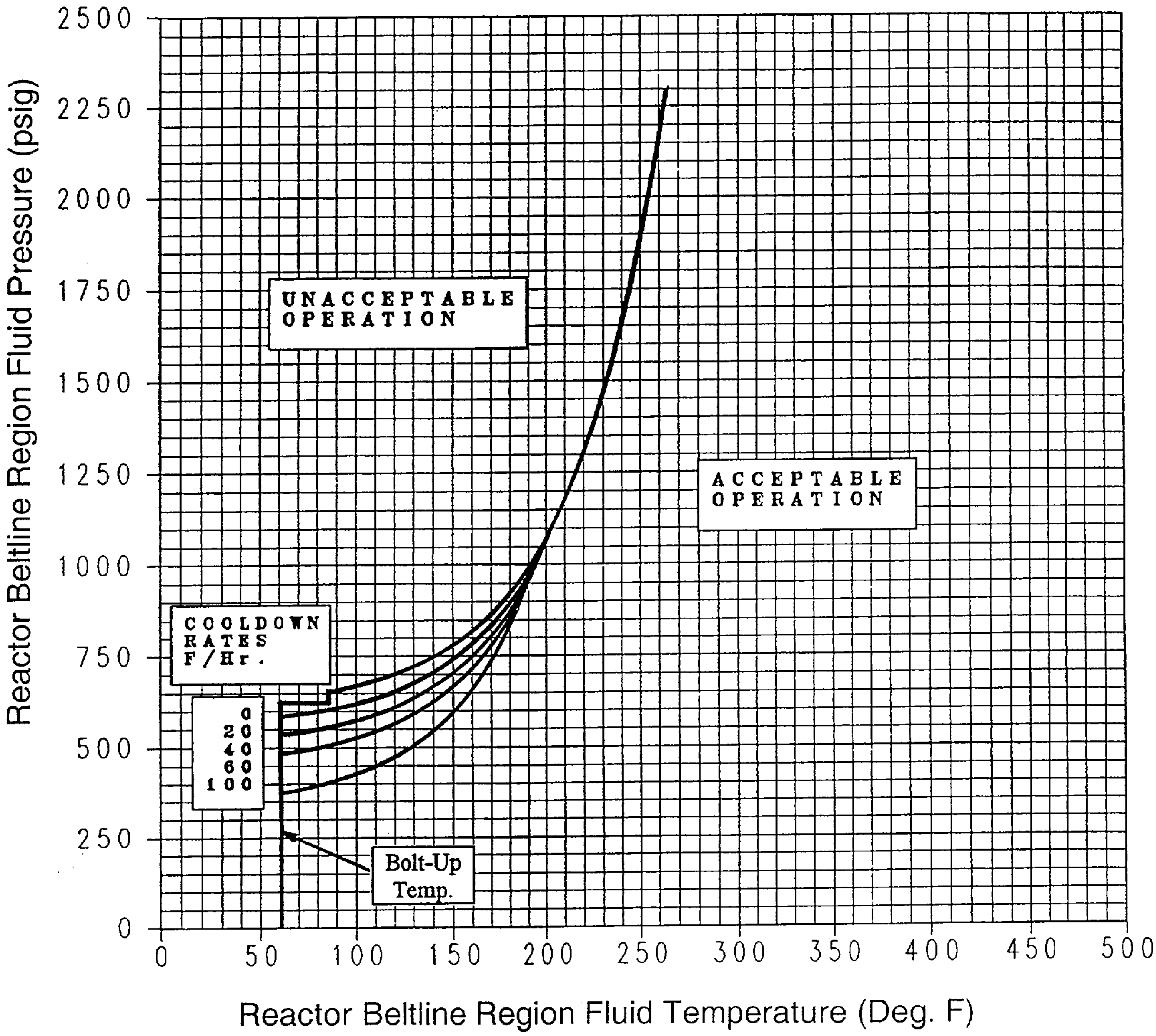

Figure 3.4.3-5

McGuire Unit 1 Reactor Coolant System Cooldown Limitations (Cooldown Rates of 0, 20, 40, 60 and 100° F/hr) Applicable to 34 EFPY (Without Margins for Instrumentation Errors)

<u>MATERIAL PROPERTY BASIS</u>

LIMITING MATERIAL: LOWER SHELL FORGING 04
LIMITING ART VALUES AT 34 EFPY: 1/4T, 124.5°F
3/4T, 92.0°F

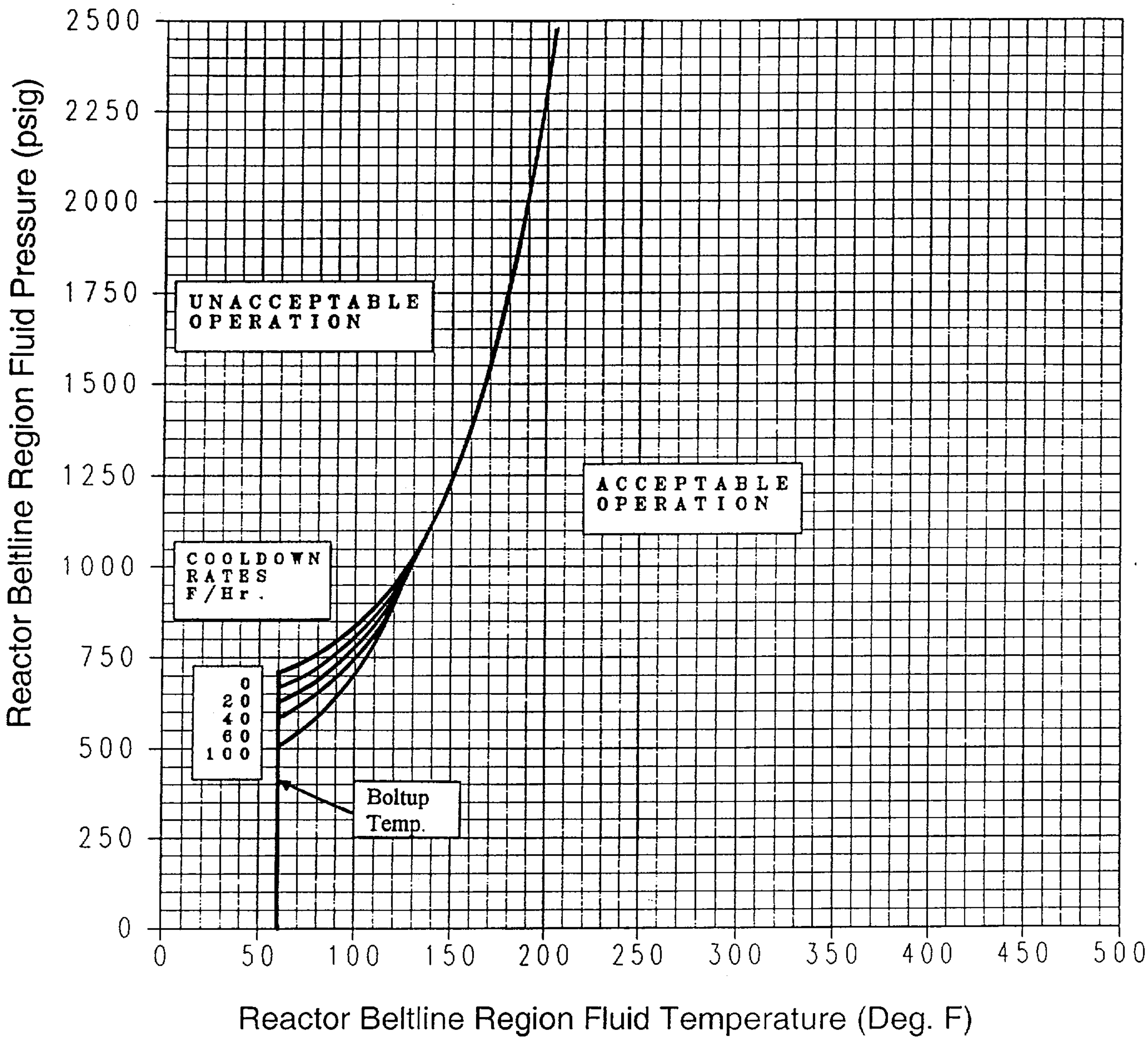

Figure 3.4.3-6

McGuire Unit 2 Reactor Coolant System Cooldown Limitations (Cooldown Rates of 0, 20, 40, 60 and 100° F/hr) Applicable to 34 EFPY (Without Margins for Instrumentation Errors)

ACTIONS

-----NOTE-----
LCO 3.0.4 is not applicable.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Two centrifugal charging pumps capable of injecting into the RCS. OR One centrifugal charging pump and one safety injection pump capable of injecting into the RCS. OR Two safety injection pumps capable of injecting into the RCS.	A.1 -----NOTE----- Two centrifugal charging pumps may be capable of injecting into the RCS during pump swap operation for ≤ 15 minutes. ----- Initiate action to verify a maximum of one centrifugal charging pump or one safety injection pump is capable of injecting into the RCS.	Immediately
	OR	
	A.2.1 Verify RHR suction relief valve is OPERABLE and the suction isolation valves are open.	Immediately
	AND	
	A.2.2.1 Verify RCS cold leg temperature > 159°F (Unit 1) or > 89°F (Unit 2).	Immediately
	OR	
	A.2.2.2 Verify RCS cold leg temperature > 74°F and cooldown rate < 20°F/hr (Unit 1), or > 74°F and cooldown rate < 60°F/hr (Unit 2).	Immediately
	OR	

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. (continued)	A.3 Verify two PORVs secured open and associated block valves open and power removed.	Immediately
	OR	
	A.4 Depressurize RCS and establish RCS vent of ≥ 4.5 square inches.	Immediately
	OR	
	A.5.1 Depressurize RCS and establish RCS vent of ≥ 2.75 square inches.	Immediately
	AND	
	A.5.2 Verify two PORVs are OPERABLE.	Immediately
B. An accumulator not isolated when the accumulator pressure is greater than or equal to the maximum RCS pressure for existing cold leg temperature allowed in Specification 3.4.3.	B.1 Isolate affected accumulator.	1 hour
C. Required Action and associated Completion Time of Condition B not met.	C.1 Increase RCS cold leg temperature to > 300°F.	12 hours
	OR	
	C.2 Depressurize affected accumulator to less than the maximum RCS pressure for existing cold leg temperature allowed by Specification 3.4.3.	12 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
D. One PORV inoperable in MODE 4.	D.1 Restore PORV to OPERABLE status.	7 days
E. One PORV inoperable in MODE 5 or 6.	E.1 Suspend all operations which could lead to a water solid pressurizer.	Immediately
	<u>AND</u>	
	E.2 Restore PORV to OPERABLE status.	24 hours
F. Required Action and associated Completion Time of Condition E not met.	F.1. Verify RCS cold leg temperature > 159°F (Unit 1) or > 89°F (Unit 2).	1 hour
	<u>AND</u>	
	F.2 Verify RHR suction relief valve is OPERABLE and the suction isolation valves are open.	1 hour
G. Two PORVs inoperable. <u>OR</u> Required Action and associated Completion Time of Condition C, D, E, or F not met. <u>OR</u> LTOP System inoperable for any reason other than Condition A, B, C, D, E, or F.	G.1 Depressurize RCS and establish RCS vent of ≥ 2.75 square inches.	8 hours

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ATTACHMENT 3

DESCRIPTION OF THE PROPOSED CHANGES AND TECHNICAL JUSTIFICATION

1.0 Background

1.1 Reactor Coolant System (RCS) Pressure and Temperature (P/T) Limits

Technical Specification (TS) Bases 3.4.3 includes the background regarding RCS P/T limits. This specification contains P/T limit curves for heatup, cooldown, inservice leak and hydrostatic testing, and data for the maximum rate of change of reactor coolant temperature. Each P/T limit curve defines an acceptable region for normal operation. Currently, McGuire Units 1 and 2 P/T limits have been evaluated for up to 16 effective full power years (EFPY). This amendment request provides Duke's justification for the new P/T limits. These changes rely in part on an alternative methodology used in determining allowable P/T limits (ASME Code Case N-640) and evaluation of the latest irradiated reactor vessel material specimens. Duke requested Westinghouse to perform reactor vessel integrity assessments and generate new P/T limit curves for Units 1 and 2. These curves have been developed and envelop operation up to 34 EFPY for both units as detailed in Westinghouse Topical Reports WCAP-15192 and WCAP-15201 (see Attachments 4 and 5).

1.2 Reactor Vessel Closure Head/Vessel Flange Requirements

10CFR50, Appendix G contains the requirement for RCS P/T limits and metal temperature of the closure head flange and vessel flange region. The P/T limits are to be determined using the methodology of ASME Section XI, Appendix G, but the flange temperature requirement is specified in 10CFR50 Appendix G Table 1. This rule states that the metal temperature of the closure flange region must exceed the material unirradiated RT_{NDT} by at least 120 $^{\circ}$F for normal operation when the pressure exceeds 20 percent of the pre-service hydrostatic test pressure, which is 621 psig for a typical PWR. This requirement was originally based on concerns about the fracture margin in the closure flange region. During the boltup process, outside surface stresses in this region typically reach over 70 percent of the steady-state stress, without being at steady-state temperature. The margin of 120 $^{\circ}$F and the pressure limitation of 20 percent of pre-service hydrostatic test pressure were developed using the K_{1A} fracture toughness, in the mid 1970s, to ensure that appropriate margins would be maintained.

1.3 RCS Low Temperature Overpressure Protection (LTOP) System

Technical Specification Bases 3.4.12 includes the background regarding the LTOP system. The LTOP pressure and temperature setpoints provide restrictions for the protection from non-ductile failure of the RCS under transient conditions. The LTOP system protects the reactor vessel from excessive pressures at low temperature condition. LTOP calculations provide inputs to or verification of the LTOP system and associated Technical Specification. Each time the P/T curves are revised, the LTOP system must be re-evaluated to ensure its functional requirement can still be met using the RCS power operated relief valve (PORV) method or the depressurized and vented RCS method.

The proposed P/T limit curves and LTOP setpoints satisfy the requirement of 10CFR50.60(a) with two exceptions. The first exception is the use of ASME Boiler and Pressure Vessel Code Case N-640. The second exception is the use of K_{1C} methodology in lieu of 10CFR50, Appendix G, Table 1 in determining the reactor vessel flange temperature requirement. The justifications for these exceptions are included in Sections 3.7 and 3.8.

1.4 ASME Code Case N-640

The startup and shutdown process for an operating nuclear plant is controlled by P/T limit curves, which are developed based on fracture mechanics analysis. These limits are developed in Appendix G of Section XI and incorporate nine numbers of safety margins, one of which is the lower bound fracture toughness curve. There are two lower bound fracture toughness curves available in Section XI, K_{1A}, which is a lower bound on all static, dynamic and arrest fracture toughness, and K_{1C}, which is a lower bound on static fracture toughness only. ASME Code Case N-640, "Alternative Reference Fracture Toughness for Development of P-T Limit Curves for Section XI, Division 1," allows the use of K_{1C} fracture toughness curve instead of K_{1A} fracture toughness curve for development of P/T limit curves. The other margins involved with the process remain unchanged.

ASME Code Case N-640 and the accompanying technical basis developed by the ASME Section XI Working Group on Operating Plant Criteria are included in Attachment 6. Duke requests exemption to use ASME Code Case N-640 pursuant to 10CFR50.60(b) and 10CFR50.12. This exemption request is provided in Section 3.7. Attachment 9 contains a list of

NRC-approved industry exemptions and amendments related to Code Case N-640 application and P/T limit changes.

2.0 Description of the Proposed Changes

TS 3.3.2 is revised to specify that the Steam Line Isolation on Steam Line Pressure Negative Rate - High may be blocked below P-11 when Steam Line Isolation on Steam Line Pressure - Low is not blocked. The current TS 3.3.2, Function 4.d.(2) incorrectly specifies that this function may be blocked below P-11 when Safety Injection Steam Line Pressure - Low is not blocked. The technical justification for this change is included in Section 3.1.

TS 3.4.3 is revised to reflect the new P/T limits which are effective to a maximum of 34 EFPY for Units 1 and 2. Figure 3.4.3-1 currently has two heatup figures, one for each unit. Figure 3.4.3-2 currently has two cooldown figures, one for each unit. Figure 3.4.3-1 will be replaced with four heatup figures (Figures 3.4.3-1 through 3.4.3-4), two for each unit. Figure 3.4.3-2 will be replaced with two cooldown figures (Figures 3.4.3-5 and 3.4.3-6), one for each unit. Limiting condition for operation (LCO) 3.4.3 is revised to refer to these new figures. The technical justification for this change is included in Section 3.2.

TS 3.4.12, Required Actions A.2.2.1 and A.2.2.2 are revised to reflect the temperature and/or cooldown rate limits associated with the use of residual heat removal (RHR) suction relief valve when any combination of two centrifugal charging and safety injection pumps are capable of injecting into the core. TS 3.4.12, Required Action F.1 is revised to reflect the temperature limit associated with the use of RHR suction relief valve when the required action and associated completion time for one inoperable PORV (Condition E) are not met. Based on the LTOP calculations (References 6 and 7), the RHR suction relief valve is adequate for all steady state and heatup conditions for both units. The 100 ^{o}F/hr cooldown rate must not be used below 159 ^{o}F indicated RCS cold leg temperature for Unit 1. Cooldown rates of 20 ^{o}F/hr or less must be used between 159 ^{o}F and 74 ^{o}F indicated RCS cold leg temperature for Unit 1. The 100 ^{o}F/hr cooldown rate must not be used below 89 ^{o}F indicated RCS cold leg temperature for Unit 2. Cooldown rates of 60 ^{o}F/hr or less must be used between 89 ^{o}F and 74 ^{o}F indicated RCS cold leg temperature for Unit 2. The technical justification for these changes is included in Sections 3.4.2.4 and 3.4.3.4.

Two new Required Actions (A.5.1 and A.5.2) are proposed for TS 3.4.12. This LCO currently requires two operable PORVs (one for single failure concern) or one RCS vent of greater than or equal to 2.75 square inches for each centrifugal charging or safety injection pump capable of injecting into the RCS. Condition A is for any combination of two centrifugal charging and safety injection pumps capable of injecting into the RCS. As such, the combination of a depressurized RCS and a RCS vent of greater than or equal to 2.75 square inches and two operable PORVs is justified for the condition when any combination of two centrifugal charging and safety injection pumps are capable of injecting into the RCS. The technical justification for this change is included in Section 3.3. The RCS PORV lift setpoint and the LTOP enable temperature for both units remain unchanged based on the LTOP calculations. The technical justification for lift setpoint and enable temperature is included in Section 3.4.2.1, 3.4.2.3, 3.4.3.1, and 3.4.3.3. Even though the possibility for lifting a PORV or operating with a pressure below that required for minimum RCS pump seals is lessened with a higher PORV setpoint, the benefit is negated by slower allowable cooldown rates, as shown in Figures 1 and 2. As such, it is desirable to maintain the existing PORV setpoint instead of raising it. The RCS vent size is unchanged based on a review of the RCS vent calculation (Reference 8).

TS 3.3.2 Bases is revised to reflect the change for TS 3.3.2 described above. TS 3.4.3 Bases is revised to describe the new excore cavity dosimetry program. The reactor vessel material specimen surveillance program for McGuire Unit 2 has been completed. Similar program for McGuire Unit 1 will be completed in April 2004 when the last surveillance capsule is removed. The station will continue to monitor reactor vessel neutron fluence through a second program that employs excore cavity dosimetry to determine the reactor vessel neutron fluence through calculation-based fluence determination. This new program meets the requirements of 10CFR50 Appendix H and its calculation methodology is consistent with the recommendations of Draft Regulatory Guide 1053, "Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence, September 1999." The technical justification for this change is included in Section 3.5.

TS 3.4.12 Bases is revised to reflect the changes for TS 3.4.12 described above. Also, TS 3.4.12 LCO Bases is revised to clarify that a secured open PORV means that it is physically secured or locked open to prevent it from being

subject to active failure. This clarification is consistent with that for a RCS vent already described in the same Bases. The technical justification for this change is included in Section 3.6.

3.0 Technical Justification

3.1 Steam Line Isolation on Steam Line Pressure Negative Rate - High

The current TS 3.3.2, Function 4.d.(2), Footnote c specifies that this trip function may be blocked below P-11 when Safety Injection Steam Line Pressure - Low is not blocked. Footnote c should specify that this trip function may be blocked below P-11 when Steam Line Isolation on Steam Line Pressure - Low is not blocked. The Safety Injection on Steam Line Pressure - Low function was proposed to be deleted in TS change submittal dated October 6, 1997. The NRC approved this change by letter dated September 22, 1998 (Amendments 182/164). In the conversion from the former Technical Specifications to NUREG-1431-based Technical Specifications, submittal dated May 27, 1997, the NUREG-1431 marked-up page was incorrectly marked to reflect the proposed deletion of Safety Injection on Steam Line Pressure - Low as proposed in the October 6, 1997 submittal. See Attachment 8 for the TS and NUREG-1431 marked-up pages showing this error. TS 3.3.2 Bases is revised to reflect this change.

3.2 Pressure-Temperature Limits

3.2.1 Determination of Adjusted RT_{NDT} (ART)

The projected 34 EFPY ART values at the 1/4 thickness (1/4T) and 3/4 thickness (3/4T) locations for the beltline regions of the McGuire reactor vessels were calculated by Westinghouse. These calculations were in accordance with Regulatory Guide 1.99, Revision 2. Regulatory Guide 1.99, Revision 2 credibility criteria are applied by Westinghouse to determine the appropriate margin term. The calculations determined the ART for the various reactor vessel (RV) materials using Regulatory Guide 1.99, Revision 2, Regulatory Positions 1.1 and 2.1. The selected controlling values are those RV locations with the highest ART for 1/4T and 3/4T whether determined using Regulatory Position 1.1 or 2.1 methodology.

The calculation of the ART values for the 1/4T and 3/4T locations at 34 EFPY for Unit 1 is presented in Table 1 and Table 2 in Section 7.0. As can be seen in these tables, the limiting ART values used in the generation of the Unit 1 P/T curves are 190 °F at the 1/4T location and 129 °F at the 3/4T location. The limiting material for Unit 1 was determined to be the lower shell longitudinal weld seams 3-442A and C. The calculation of the ART values for the 1/4T and 3/4T locations at 34 EFPY for Unit 2 is presented in Table 6 and Table 7. As can be seen in these tables, the limiting ART values used in the generation of the Unit 2 P/T curves are 124.5 °F at the 1/4T location and 92 °F at the 3/4T location. The limiting material for Unit 2 was determined to be the lower shell forging 04.

Westinghouse conservatively provided 100 % of the steady-state Appendix G limits applying Code Case N-640 for both units. Since appropriate instrument error allowances are included in the operating procedures, the Technical Specification P/T limit curves do not include margins for instrument error.

3.2.2 Determination of Pressure-Temperature Limits

The proposed P/T limits for Units 1 and 2 were developed using Westinghouse computer code OPERLIM, as modified by ASME Code Case N-640 for use of the K_{1C} fracture toughness curve. The methods and criteria employed to establish operating pressure and temperature limits are described in NRC-approved Topical Report WCAP-14040-NP-A, Revision 2, "Methodology used to Develop Cold Overpressure Mitigating System Setpoints and RCS Heatup and Cooldown Limit Curves." The method of analysis consists of determining the P/T limits for the beltline region including the closure head flange region of the reactor vessel for normal heatup, normal cooldown, and inservice leak and hydrostatic test. The P/T limit curves and supporting technical basis generated by Westinghouse are included in Attachments 4 and 5.

3.2.3 Reactor Closure Head/Vessel Flange Requirement

The K_{1C} fracture toughness curve was also used to develop equivalent reactor vessel flange requirement. 10CFR50, Appendix G contains the requirement for the metal temperature of the closure head flange and vessel flange region. This rule states that the metal

temperature of the flange region must exceed the material unirradiated RT_{NDT} by at least 120 °F for normal operation when the pressure exceeds 20 % of the pre-service hydrostatic test pressure. The use of the K_{1C} curve to determine this requirement results in a revised requirement for flange region of T - RT_{NDT} = 45 °F. The technical basis for using the K_{1C} methodology for determining flange requirement is detailed in Section 3.3 of WCAP-15192 and WCAP-15201 (see Attachments 4 and 5). This revised requirement has been implemented with the P/T limit curves proposed in this amendment. Note that the flange requirement from 10CFR50, Appendix G of RT_{NDT} + 120 °F has been proposed to be eliminated in WCAP-15315 (see Attachment 7), "Reactor Closure Head/Vessel Flange Requirements Evaluation for Operating PWR and BWR Plants, October 1999."

3.3 Any Combination of Two Centrifugal and Safety Injection Pumps capable of Injecting into the RCS System

Two new Required Actions (A.5.1 and A.5.2) are proposed for TS 3.4.12. This LCO currently requires two operable PORVs (one for single failure concern) or a depressurized RCS and a RCS vent of greater than or equal to 2.75 square inches for each centrifugal charging or safety injection pump capable of injecting into the RCS. Condition A is for any combination of two centrifugal charging and safety injection pumps capable of injecting into the RCS. As such, the combination of a depressurized RCS and a RCS vent of greater than or equal to 2.75 square inches and two operable PORVs is justified for the condition when any combination of two centrifugal charging and safety injection pumps are capable of injecting into the RCS. This change is also reflected in TS 3.4.12 Bases.

3.4 LTOP Calculations

The methods involved in the LTOP calculations include:

1. Determine Pressure Overshoot

During operation at low temperatures, three bounding transients exist which will cause an increase in internal vessel pressure. These are a mass input from a safety injection pump, a mass input from a centrifugal charging pump, and a heat input from reactor coolant pump (RCP) startup with temperature asymmetry between the RCS and steam generators. The heat input transient

analysis is detailed in a calculation (Reference 9). These three transients are evaluated for 2 second PORV opening times to determine a peak pressure equal to setpoint plus overshoot.

2. Determine Uncertainties

The peak pressure is adjusted for static pressure effect, dynamic pressure effect and instrument uncertainties.

3. Verify PORV LTOP Setpoint

The adjusted peak pressure is verified acceptable by comparison to the P/T limits. The PORV actuation setpoint for LTOP is verified to be high enough to allow RCP startup and normal operations but low enough to allow operational flexibility in heatup or cooldown rate.

4. Define Heatup and Cooldown Rate Restrictions

Acceptable heatup and cooldown rates are defined to keep peak pressure for each transient below the P/T limits.

5. Determine the LTOP Enable temperature

The temperature at which the LTOP protection system must be placed in service is determined using ASME Code Case N-514 methodology which has been incorporated into Appendix G of Section XI of the ASME Code and published in the 1993 Addenda to Section XI.

6. Verification of LTOP Adequacy for Special Conditions

Additional requirements must be established for conditions where two centrifugal charging pumps, two safety injection pumps, or one centrifugal charging pump and one safety injection pump are capable of mass addition. These conditions are evaluated and all specific requirements are developed.

3.4.1 Instrument Uncertainty

Duke Energy has an engineering directive that outlines the requirements for performing instrument uncertainty and setpoint calculations. The primary purpose of this directive is to provide a consistent methodology based on standard industry practices for performing

instrument uncertainty and setpoint calculations. The calculation methodology is consistent with the intent of ISA-67.04, Part II, "Methodologies for the Determination of Setpoints for Nuclear Safety-Related Instrumentation."

In brief, the methodology conservatively accounts for the typical uncertainty terms such as reference accuracy, drift, temperature effect, calibration effects (which include measurement and test equipment uncertainty, calibration tolerance and resolution), etc. The random-independent uncertainty terms are combined via the "square-root-sum-of-the-square" (SRSS) technique, whereas the random-dependent and bias uncertainty terms are combined via a combination of SRSS and/or algebraic techniques. LTOP operating limits and parameters provided in the LTOP calculations include an allowance for instrument error and uncertainty.

3.4.2 LTOP Calculation Results - Unit 1

3.4.2.1 Verification of PORV Setpoint Adequacy for LTOP - Unit 1

Table 3 summarizes the peak vessel pressures resulting from pressure overshoots and uncertainties as computed in the LTOP calculation. As can be seen in Table 3, the safety injection pump start is the limiting transient for all conditions except when no RCP is running. In order for the 385 psig PORV setpoint to be acceptable, the peak transient pressure for each RCP operating condition must not exceed the maximum pressure established by the Appendix G limits. The peak transient pressures in this table are compared to the P/T limits (Table 4) to establish the heatup and cooldown rate operating limits under which an LTOP setpoint of 385 psig provides adequate low temperature overpressure protection.

3.4.2.2 Heatup and Cooldown Rate Restrictions - Unit 1

Figure 1 illustrates the Appendix G limits for heatup and cooldown rates along with the LTOP setpoint and highest peak pressure indicated in Table 3. From this figure, it can be seen that a cooldown rate of 100 °F/hr with beltline fluid temperature below 135 °F is insufficient to preserve Appendix G margins to brittle failure. Similar limitations exist for a cooldown rate

of 60 °F/hr below 100 °F. The maximum heatup rate of 100 °F/hr and cooldown rates of 40 °F/hr or less may be used throughout the entire operating range (above 60 °F actual, 72 °F - 74 °F indicated). Table 5 summarizes the temperature and rate restrictions for each number of operating RCPs.

3.4.2.3 Verification of LTOP Enable Temperature - Unit 1

The previous McGuire LTOP TS submittal (Reference 11) contains the technical justification for verifying that the enable temperature is adequate to provide overpressure protection. The technical justification in that submittal states that the enable temperature ensures that the Appendix G limits are protected by either the PORV setpoint or the pressurizer safety valves (PSV) setpoint. The PSVs are required to relieve pressure between 2435 psig - 2559 psig. The Appendix G steady-state pressure limit is 2,145 psig at 260 °F and 2,307 psig at 265 °F. Linear interpolation of the P/T curve for a nominal PSV lift setpoint of 2485 psig results in a corresponding temperature limit of 271 °F. Using this methodology, there will be no interruption of overpressure protection if the enable temperature is set at 271 °F (283 °F including instrument error).

An alternative method of determining enable temperature was also discussed in Branch Technical Position RSB 5-2, Revision 1. Paragraph B.2 of this branch technical position requires the LTOP system to be operable at a metal temperature of RT_{NDT} + 90 °F. For McGuire Unit 1, the limiting RT_{NDT} at 34 EFPY is 190 °F. This alternative method yields an enable temperature of 190 °F + 90 °F = 280 °F (292 °F including instrument error). Reference 11 indicates that this alternative method will be used for future revisions to the P/T limits for McGuire.

Duke proposed in a letter to NRC dated August 18, 1994, as supplemented by letters dated August 18, 1994 and September 7, 1994, to use former ASME Code Case N-514 as an alternative to Branch Technical Position RSB 5-2, Revision 1. Code Case N-514 allows establishing the LTOP enable temperature at RT_{NDT} + 50 °F for the 1/4 T location. Note that this former code case has been incorporated into Appendix G of Section XI of the ASME Code and published in the 1993 Addenda to Section XI. This proposal was accepted by the NRC based on its

letter to Duke (Reference 10). The resulting LTOP system enable temperature of 190 °F + 50 °F = 240 °F (without instrument error allowance) clearly allows a significant interruption in overpressure protection and is non-conservative. As such, this method will not be used.

The current McGuire Unit 1 LTOP enable temperature of 300 °F bounds each of the methods discussed above, and is acceptable for operation up to 34 EFPY.

3.4.2.4 Verification of LTOP Adequacy for Special Conditions - Unit 1

It is desirable to operate with one centrifugal charging pump and one safety injection pump in service for brief periods during plant heatup (i.e., for accumulator fill and check valve testing). This has shown to be acceptable provided the RHR suction relief valve is available to provide additional relief capacity. The following description summarizes the evaluation of the adequacy of RHR suction relief in this configuration.

The peak vessel pressure with the RHR at maximum relieving capacity is approximately 560 psig. This is described in detail in LTOP calculation and includes static and dynamic pressure effects. The capacity of the RHR suction relief valve (902 gpm) alone is adequate to relieve the full flow of either the centrifugal charging pump (runout limit = 560 gpm), the safety injection pump (runout limit = 675 gpm), two centrifugal charging pumps, or two safety injection pumps. Therefore, RHR relief valve in conjunction with one assured PORV is adequate to relieve the combined flow of any combination of two centrifugal charging and safety injection pumps. The single failure criterion remains valid in that any two of the three relief valves will be adequate for LTOP. The peak pressure considering the RHR relief valve (560 psig) is somewhat higher than the PORV's (524.9 psig for 2.0 second stroke time); therefore, tighter restrictions must be placed on when the second pump may be made operational.

Additional restrictions for use of RHR suction relief valve are provided in TS 3.4.12 Required Actions A.2.2.1, A.2.2.2, and F.1:

1. From Table 4, the 10CFR50 Appendix G limit for steady-state condition and 100 °F/hr heatup rate is 621 psig (at 60 °F). Therefore, the RHR suction relief valve is adequate for all steady-state and heatup conditions.

2. From Table 4, the Appendix G allowable pressure for a 100 °F/hr cooldown is 569 psig at 145 °F (157 °F - 159 °F with instrument uncertainties). Therefore, 100°F/hr cooldown rate (maximum allowed by Technical Specification) must not be used below 159°F indicated temperature.

3. From Table 4, the Appendix G allowable pressure for a cooldown rate of 20 °F/hr is 586 psig at 60 °F (72 °F - 74 °F with instrument uncertainties). Therefore, cooldown rates of 20 °F/hr or less must be used between 159 °F and 74 °F indicated temperature.

3.4.3 LTOP Calculation Results - Unit 2

3.4.3.1 Verification of PORV Setpoint Adequacy for LTOP - Unit 2

Table 8 summarizes the peak vessel pressures resulting from pressure overshoots and uncertainties as computed in the LTOP calculation. As can be seen in Table 8, the safety injection pump start is the limiting transient for all conditions except when no RCP is running. In order for the 385 psig PORV setpoint to be acceptable, the peak transient pressure for each RCP operating condition must not exceed the maximum pressure established by the Appendix G limits. The peak transient pressures in this table are compared to the P/T limits (Table 9) to establish the heatup and cooldown rate operating limits under which an LTOP setpoint of 385 psig provides adequate low temperature overpressure protection.

3.4.3.2 Heatup and Cooldown Rate Restrictions - Unit 2

Figure 2 illustrates the Appendix G limits for heatup and cooldown rates along with the LTOP setpoint and highest peak pressure indicated in Table 8. From this figure, it can be seen that a cooldown rate of 100 °F/hr with beltline fluid temperature below 70 °F is insufficient to preserve Appendix G margins to brittle

failure. The maximum heatup rate of 100 °F/hr and cooldown rates of 60 °F/hr or less may be used throughout the entire operating range (above 60 °F actual, 72 °F - 74 °F indicated). Table 10 summarizes the temperature and rate restrictions for each number of operating RCPs.

3.4.3.3 Verification of LTOP Enable Temperature - Unit 2

The previous McGuire LTOP TS submittal (Reference 11) contains the technical justification for verifying that the enable temperature is adequate to provide overpressure protection. The technical justification in that submittal states that the enable temperature ensures that the Appendix G limits are protected by either the PORV setpoint or the pressurizer safety valves (PSV) setpoint. The PSVs are required to relieve pressure between 2435 psig - 2559 psig. The Appendix G steady-state pressure limit is 2,482 psig at 205 °F. Using this methodology, there will be no interruption of overpressure protection if the enable temperature is set at 205 °F (217 °F including instrument error).

An alternative method of determining enable temperature was discussed in Branch Technical Position RSB 5-2, Revision 1. Paragraph B.2 of this branch technical position requires the LTOP system to be operable at a metal temperature of RT_{NDT} + 90 °F. For McGuire Unit 2, the limiting RT_{NDT} at 34 EFPY is 125 °F. This alternative method yields an enable temperature of 125 °F + 90 °F = 215 °F (227 °F including instrument error). Reference 11 indicates that this alternative method will be used for future revisions to the P/T limits for McGuire.

Duke proposed in a letter to NRC dated August 18, 1994, as supplemented by letters dated August 18, 1994 and September 7, 1994, to use former ASME Code Case N-514 as an alternative to Branch Technical Position RSB 5-2, Revision 1. Code Case N-514 allows establishing the LTOP enable temperature at RT_{NDT} + 50 °F for the 1/4 T location. Note that this former code case has been incorporated into Appendix G of Section XI of the ASME Code and published in the 1993 Addenda to Section XI. This proposal was accepted by the NRC based on its letter to Duke (Reference 10). The resulting LTOP system enable temperature of 125 °F + 50 °F = 175 °F (without instrument error allowance) clearly allows a

significant interruption in overpressure protection and is non-conservative. As such, this method will not be used.

The current McGuire Unit 2 LTOP enable temperature of 300 °F bounds each of the methods discussed above, and is acceptable for operation up to 34 EFPY. Even though this temperature can be lowered for Unit 2, the desire is to keep it the same as that for Unit 1 to avoid human error.

3.4.3.4 Verification of LTOP Adequacy for Special Conditions - Unit 2

It is desirable to operate with one centrifugal charging pump and one safety injection pump in service for brief periods during plant heatup (i.e., for accumulator fill and check valve testing). This has shown to be acceptable provided the RHR suction relief valve is available to provide additional relief capacity. The following description summarizes the evaluation of the adequacy of RHR suction relief in this configuration.

The peak vessel pressure with the RHR at maximum relieving capacity is approximately 560 psig. This is described in detail in LTOP calculation and includes static and dynamic pressure effects. The capacity of the RHR suction relief valve (902 gpm) alone is adequate to relieve the full flow of either the centrifugal charging pump (runout limit = 560 gpm), the safety injection pump (runout limit = 675 gpm), two centrifugal charging pumps, or two safety injection pumps. Therefore, RHR relief valve in conjunction with one assured PORV is adequate to relieve the combined flow of any combination of two centrifugal charging and safety injection pumps. The single failure criterion remains valid in that any two of the three relief valves will be adequate for LTOP. The peak pressure considering the RHR relief valve (560 psig) is somewhat higher than the PORV's (524.9 psig for 2.0 second stroke time); therefore, tighter restrictions must be placed on when the second pump may be made operational.

Additional restrictions for use of RHR suction relief valve are provided in TS 3.4.12 Required Actions A.2.2.1, A.2.2.2, and F.1:

1. From Table 9, the 10CFR50 Appendix G limit for steady-state condition and 100 °F/hr heatup rate is 705 psig (at 60 °F). Therefore, the RHR suction relief valve is adequate for all steady-state and heatup conditions.

2. From Table 9, the Appendix G allowable pressure for a 100 °F/hr cooldown is 563 psig at 75 °F (87 °F - 89 °F with instrument uncertainties). Therefore, 100 °F/hr cooldown rate (maximum allowed by Technical Specification) must not be used below 89 °F indicated temperature.

3. From Table 9, the Appendix G allowable pressure for a cooldown rate of 60 °F/hr is 586 psig at 60 °F (72 °F - 74 °F with instrument uncertainties). Therefore, cooldown rates of 60 °F/hr or less must be used between 89 °F and 74 °F indicated temperature.

3.5 Excore Cavity Dosimetry Program

TS 3.4.3 Bases is revised to include a summary description of the new excore cavity dosimetry program. The material specimen surveillance program has been completed for McGuire Unit 2 and will be completed for McGuire Unit 1 in April 2004. McGuire will continue to monitor reactor vessel neutron fluence using the excore cavity dosimetry program. Excore cavity dosimetry was installed in each unit during EOCs 11. The new program employs excore cavity dosimetry to monitor and determine RV neutron fluence within a limited amount of uncertainty through calculation-based fluence determination. Cavity dosimetry calculations are consistent with the recommendations of Draft Regulatory Guide 1053.

Cavity dosimetry measurements are used to verify the accuracy of fluence calculations and to determine fluence uncertainty values. Dosimetry removed from the cavity will be laboratory tested to evaluate material radiation effects. Computer analyses calculate accumulated fast neutron fluence using these laboratory measurements. Westinghouse employs a calculation-based fluence analysis methodology that can be used to predict the fast neutron fluence in the RV using cavity dosimetry to benchmark the fluence predictions. The results of the fluence analysis are expected to be within 20 % or less of the measured value, consistent with the recommendations of Draft Regulatory Guide 1053.

3.6 PORV Secured in Open Position

TS 3.4.12 LCO Bases is revised to clarify that a secured open PORV means that it is physically secured or locked open. The Bases currently explains that the PORVs are active components and failure of one PORV is assumed to represent the worst case, single active failure, and that a RCS vent is passive and is not subject to active failure. Since a PORV secured in the open position can be used as a vent, as allowed by the LCO Note, this clarification is consistent with that for a RCS vent already described in the same Bases.

3.7 10CFR50.60 and 10CFR50 Appendix G Exemption Request

The following information provides the basis for the exemption request to 10CFR50.60 and 10CFR50 Appendix G for use of ASME Section XI Code Case N-640, "Alternative Fracture Toughness for Development of P-T Limit Curves for ASME Section XI, Division I." 10CFR50.60 states that alternatives to the requirements in Appendix G of this part may be used when an exemption is granted by the Commission pursuant to 10CFR50.12.

10CFR50.12 Requirements: The requested exemption to allow the use of ASME Code Case N-640 in conjunction with ASME XI, Appendix G to determine the P/T limits meets the criteria of 10CFR50.12 as discussed below. 10CFR50.12 states that the Commission may grant an exemption from requirements contained in 10CFR50 provided that:

1. The requested exemption is authorized by law:

   No law exists which precludes the activities covered by this exemption request. 10CFR50.60(b) allows the use of alternatives to 10CFR50, Appendices G and H when an exemption is granted by the Commission under 10CFR50.12.

2. The requested exemption does not present an undue risk to the public health and safety:

   The proposed P/T limits rely in part on the requested exemption. The proposed P/T limits have been developed using the K_{1C} fracture toughness curve shown on ASME XI, Appendix A, Figure A-2200-1, in lieu of the K_{1A} fracture toughness curve of ASME XI, Appendix G, Figure G-2210-1, as the lower bound for fracture toughness.

Margins that exist in the ASME XI, Appendix G P/T limit determination process are unaffected by this request.

Use of the K_{1C} curve in determining the lower bound fracture toughness in the development of P/T operating limit curves is more realistic than the assumption under the use of the K_{1A} curve. The K_{1C} curve models the slow heatup and cooldown process of a reactor coolant system, with the fastest rate allowed being 100 $^{\circ}F$ per hour. The rate of change of pressure and temperature is often constant, so the stress is essentially constant in this case. Both the heatup and cooldown and the pressure testing are essentially static processes. During development of Code Case N-640 and the accompanying Appendix G code change, the ASME Section XI, Working Group on Operating Plant Criteria (WGOPC), performed assessments of the margins inherent to K_{1A} using realistic heatup and cooldown curves. These assessments led to the conclusion that utilization of the K_{1A} curve was excessively conservative and the K_{1C} curve provided adequate margin for protection from brittle fracture (Reference 4).

The K_{1A} curve was codified in 1974. The initial K_{1A} conservatism was necessary due to limited experience and knowledge of the fracture toughness of reactor pressure vessel materials over time. The conservatism also provided margin thought to be necessary to cover uncertainties and a number of postulated but unquantified effects. Since 1974, additional knowledge has been gained from examination and testing of reactor pressure vessels that had been subject to the effects of neutron embrittlement in both an operating and test environment. The K_{1A} curve was based on 125 data points. The K_{1C} curve is based on more than 1500 data points. The additional data has significantly reduced the uncertainties associated with embrittlement effects and reduced other uncertainties. The added data ensures the K_{1C} curve adequately and statistically bounds the data. The new information indicates the lower bound on fracture toughness provided by the K_{1A} curve is extremely conservative and is well beyond the margin of safety required to protect the public health and safety from potential reactor pressure vessel failure.

3. The requested exemption will not endanger the common defense and security:

This request does not modify any physical plant architectural features, surveillance or alarm features. Therefore, the common defense and security are not endangered by this exemption request.

4. Special circumstances are present which necessitate the request for an exemption to the regulations of 10CFR50.60 and 10CFR50 Appendix G:

Pursuant to 10CFR50.12(a)(2), the NRC will consider granting an exemption to the regulations if special circumstances are present. This exemption meets the special circumstances of paragraphs:

(a)(2)(ii) - The underlying purpose of the regulation will continue to be achieved.
(a)(2)(iii) - Compliance with the regulation would result in undue hardship or other cost that are significant.
(a)(2)(v) - The exemption would provide only temporary relief from the applicable regulation and the licensee has made good faith efforts to comply with the regulations.

10CFR50.12(a)(2)(ii):

ASME Section XI, Appendix G provides the methodology for determining allowable P/T limits and is approved for that purpose by 10CFR50, Appendix G. Application of this methodology satisfies the underlying requirement for: 1) The RCS pressure boundary be operated in a regime having sufficient margin to ensure, when stressed, the vessel boundary behaves in a non-brittle manner and the probability of a rapidly propagating fracture is minimized; and 2) P/T limits provide adequate margin in consideration of uncertainties in determining the effects of irradiation on material properties.

The ASME Section XI, Appendix G methodology was conservatively developed based on the level of knowledge existing in 1974 concerning reactor pressure vessel materials and the estimated effects of irradiation. Since 1974, the level of knowledge about these topics has been greatly expanded. This increased knowledge permits relaxation of the ASME Section XI,

Appendix G requirements via application of ASME Code Case N-640 while maintaining the underlying purpose of the ASME code and the NRC regulations to ensure an acceptable margin of safety.

10CFR50.12(a)(2)(iii):

The RCS P/T operating window is defined by the P/T limit curve developed in accordance with the ASME Section XI, Appendix G methodology and the minimum P/T curve for pump operation. Continued operation of McGuire with these P/T curves without the relief provided by ASME Code Case N-640 would unnecessarily restrict the operating window that results from these operating P/T limits. This constitutes an unnecessary burden that can be alleviated by the application of Code Case N-640 in the development of the proposed P/T curves. Implementation of the proposed P/T curves as allowed by ASME Code Case N-640 does not significantly reduce the margin of safety.

10CFR50.12(a)(2)(v):

The exemption provides relief from the applicable regulation and McGuire has made a good faith effort to comply with the regulation. We request the exemption be granted based on the methodology given in Code Case N-640 (Attachment 6).

10CFR50.60 and 10CFR50 Appendix G, Conclusion for Exemption Acceptability:

Compliance with the specified requirements of 10CFR50.60 and 10CFR50 Appendix G would result in hardship and unusual difficulty without a compensating increase in the level of quality and safety. ASME Code Case N-640 allows a reduction in the fracture toughness lower bound used by ASME Section XI, Appendix G in the determination of RCS P/T limits. This proposed alternative is acceptable because it reduces the excess conservatism in the current Appendix G. The safety margin that exists with the revised methodology is still very large. Restrictions on allowable operating conditions and equipment operability requirements are established to ensure RCS pressure and temperature be within the heatup and cooldown rate dependent P/T limits specified in TS 3.4.3. Therefore, this exemption does not present an undue risk to the public health and safety.

3.8 Reactor Vessel Flange Requirement Relaxation Exemption Request

The following information provides the basis for the exemption request to 10CFR50.60 and 10CFR50 Appendix G for use of the K_{1C} fracture toughness curve to develop the temperature requirement for the reactor vessel flange region, in lieu of the limit currently specified in 10CFR50, Appendix G, Table 1.

10CFR50.12 Requirements: The requested exemption to allow the use of the K_{1C} methodology to determine the flange requirement meets the criteria of 10CFR50.12 as discussed below. 10CFR50.12 states that the Commission may grant an exemption from requirements contained in 10CFR50 provided that:

1. The requested exemption is authorized by law:

   No law exists which precludes the activities covered by this exemption request. 10CFR50.60(b) allows the use of alternatives to 10CFR50, Appendices G and H when an exemption is granted by the Commission pursuant to 10CFR50.12.

2. The requested exemption does not present an undue risk to the public health and safety:

   The proposed flange requirement relies on the requested exemption. The proposed flange requirement has been developed using the K_{1C} methodology in lieu of the limit specified in 10CFR50, Appendix G, Table 1. Use of the K_{1C} methodology in determining the flange requirement is more appropriate than the limit specified in 10CFR50, Appendix G, Table 1 because the same methodology is applied in ASME Code Case N-640 for determining the P/T limit curves. This table specifies that the metal temperature of the flange region must exceed the material unirradiated RT_{NDT} by at least 120 ^{o}F for normal operation when the pressure exceeds 20 percent of the pre-service hydrostatic test pressure, which is 621 psig for a typical PWR. This requirement was developed using the K_{1A} fracture toughness, in the mid 1970s, to ensure that appropriate margins would be maintained.

   Improved knowledge of fracture toughness and other issues which affect the integrity of the reactor vessel have led to the recent change to allow the use of K_{1C}

curve, as contained in ASME Code Case N-640, in the development of P/T curves. The existing Appendix G flange requirement presents operating flexibility problems for a typical PWR operating with an associated heatup curve. The heatup curve using the K_{1C} methodology provides a much higher allowable pressure through the entire range of temperatures. This benefit is negated at temperatures below RT_{NDT} + 120 °F because of the flange requirement. The use of the K_{1C} curve to determine the flange requirement results in a revised requirement of RT_{NDT} + 45 °F at pressures exceeding 20 percent of the pre-service hydrostatic test pressure.

The new requirement allows the relaxation of the operating P/T window at low temperature region. Continued operation of McGuire with these P/T limit curves without this relief would unnecessarily restrict the operating window at low temperature region that results from these operating P/T limits. WCAP-15315 (see Attachment 7) proposes elimination of 10CFR50, Appendix G, Table 1 requirement of RT_{NDT} + 120 °F for the flange region. In this WCAP, it is demonstrated that the application of the K_{1C} fracture toughness curve and detailed analysis of the stresses that are actually experienced by the flange region justify the elimination of this requirement.

3. The requested exemption will not endanger the common defense and security:

   This request does not modify any physical plant architectural features, surveillance or alarm features. Therefore, the common defense and security are not endangered by this exemption request.

4. Special circumstances are present which necessitate the request for an exemption to the regulations of 10CFR50.60 and 10CFR50 Appendix G:

   Pursuant to 10CFR50.12(a)(2), the NRC will consider granting an exemption to the regulations if special circumstances are present. This exemption meets the special circumstances of paragraphs:

   (a)(2)(ii) - The underlying purpose of the regulation will continue to be achieved.
   (a)(2)(iii) - Compliance with the regulation would result in undue hardship or other cost that are significant.

(a)(2)(v) - The exemption provides only temporary relief from the applicable regulation and the licensee has made good faith efforts to comply with the regulations.

10CFR50.12(a)(2)(ii):

10CFR50, Appendix G, Table 1 provides the limit for the metal temperature of the flange region. Application of this limit satisfied the concerns about the fracture margin in the closure flange region. During the boltup process, outside surface stresses in this region typically reach over 70 percent of the steady state stress, without being at steady state temperature. The margin of 120 ^{o}F was to ensure that appropriate margins would be maintained. This limit was developed in the mid 1970s using the K_{1A} methodology. Since the mid-1970s, the level of knowledge about the fracture toughness topics has been greatly expanded. This increased knowledge permits the relaxation of the methodology used in determining the P/T limit curves and flange requirement via application of the K_{1C} methodology while maintaining the underlying purpose of the ASME code and the NRC regulations to ensure an acceptable margin of safety.

10CFR50.12(a)(2)(iii):

The flange temperature limit is defined in 10CFR50, Appendix G, Table 1. Operation of McGuire without the relief for the flange requirement would unnecessarily restrict the P/T operating window in low temperature region. This constitutes an unnecessary burden that can be alleviated by the application of the K_{1C} methodology in the development of the proposed flange requirement. Implementation of the proposed flange requirement does not significantly reduce the margin of safety. The safety margin that exists with the K_{1C} methodology is still very large.

10CFR50.12(a)(2)(v):

The exemption provides relief from the applicable regulation and McGuire has made a good faith effort to comply with the regulation. We request the exemption be granted based on the methodology given in Code Case N-640 and WCAP-15315 (Attachments 4 and 7).

Flange Requirement, Conclusion for Exemption Acceptability:

Compliance with the specified requirements of 10CFR50.60 and 10CFR50 Appendix G would result in hardship and unusual difficulty without a compensating increase in the level of quality and safety. The K_{1C} methodology results in the relaxation of the flange requirement. This results in the relaxation of the P/T operating window in the low temperature region. This proposed alternative is acceptable because the K_{1C} methodology maintains an acceptable margin of safety while allowing more operational flexibility. The approach is justified by consideration of the application of the same methodology in Code Case N-640 for determining the P/T curves. Therefore, this exemption does not present an undue risk to the health and safety of the public.

4.0 UFSAR Revision

The proposed changes affect the UFSAR. Appropriate UFSAR changes will be made in accordance with 10CFR50.71(e).

5.0 Conclusion

The proposed changes to the P/T limits and LTOP satisfy the underlying purposes of 10CFR50 Appendix G, Appendix H, and Technical Specifications. ASME Code Case N-640 allows a reduction in the fracture toughness lower bound used by ASME Section XI, Appendix G in the determination of RCS P/T limits. The methodology associated with Code Case N-640 results in the relaxation of the P/T limits including the flange temperature requirement. This methodology is acceptable because it reduces the excess conservatism in the current Appendix G. The safety margin that exists with the revised methodology is still very large. The development of the P/T curves is performed in accordance with NRC-approved methodologies. The LTOP changes are performed in accordance with approved procedures under Duke QA program. Duke Energy concludes that the proposed changes conform to the underlying purpose of NRC's regulations and maintain the safe operation of the units.

6.0 References

1. WCAP-15192, McGuire Unit 1 Heatup and Cooldown Limit Curves for Normal Operation, E. Terek, May 1999.

2. WCAP-15201, McGuire Unit 2 Heatup and Cooldown Curves for Normal Operation Using Code Case N-640, T.J. Laubham, June 1999.

3. WCAP-15315, Reactor Vessel Closure Head/Vessel Flange Requirements Evaluation for Operating PWR and BWR Plants, Warren Bamford, K. Robert Hsu, and Joseph F. Patsche, October 1999.

4. ASME Code Case N-640, Alternative Reference Fracture Toughness for Development of P-T Limit Curves for Section XI, Division 1, February 26, 1999 and accompanying technical basis by Warren Bamford and Bruce Bishop of Westinghouse Electric Company.

5. Former ASME Code Case N-514, Low Temperature Overpressure Protection, Section XI, Division 1.

6. MCC-1223.03-00-0005, McGuire Nuclear Station Unit 1 Pressurizer Power Operated Relief Valve Setpoint Determination for the LTOP System, K. Pitser, April 27, 2000.

7. MCC-1223.03-00-0033, McGuire Nuclear Station Unit 2 Pressurizer Power Operated Relief Valve Setpoint Determination for the LTOP System, K. Pitser, April 27, 2000.

8. MCC-1223.03-00-0037, McGuire Nuclear Station Units 1 and 2 RCS Vent Area for TS 3.4.9.3, J. Byrd, jr., March 24, 1994.

9. MCC-1552.08-00-0305, Rev 0, Replacement Steam Generator LTOP Heat Input Transient, T. Yadon, January 28, 2000.

10. Letter from H. N. Berkow, United States Nuclear Regulatory Commission, to T. C. McMeekin, McGuire Site VP dated September 30, 1994. Subject: Exemption from Requirements of 10CFR50.60, Acceptance Criteria for Fracture Prevention for Light Water Nuclear Power Reactors for Normal Operation - McGuire Nuclear Station Units 1 and 2.

11. Letter from T. C. McMeekin, McGuire Site VP to United States Nuclear Regulatory Commission dated March 29, 1995. Subject: McGuire Nuclear Station Units 1 and 2, Technical Specification (TS) 3.4.9.3 Amendment, Heat Up and Cool Down Curves and Low Temperature Overpressure Protection (LTOP).

12. Oconee Nuclear Station Technical Specification Change Submittal dated May 11, 1999, Proposed Revision to Technical Specification Pressure-Temperature Operating Curves.

13. Letter from D. E. LaBarge, United States Nuclear Regulatory Commission, to W. R. McCollum, Jr., Oconee Site VP dated July 23, 1999. Subject: Environmental Assessment and Finding of No Significant Impact for an Exemption from the Requirements of 10CFR Part 50, Section 50.60 and Appendix G - Oconee Nuclear Station Units 1, 2 and 3.

14. NRC Safety Evaluation Report dated October 1, 1999, Oconee Nuclear Station Pressure-Temperature Operating Curves.

7.0 Tables and Figures

Table 1
(Unit 1)
Calculation of the ART Values for the 1/4T Location @ 34 EFPY

Material	RG 1.99 R2 Method	CF (°F)	FF	IRT_{NDT}[(a)]	ΔRT_{NDT}[(c)]	Margin	ART[(b)]
Intermediate Shell Plate B5012-1	Position 1.1	74.2	1.04	34	77.2	34	145
	Position 2.1	62.7	1.04	34	65.2	17[(e)]	116
Intermediate Shell Plate B5012-2	Position 1.1	100.3	1.04	0	104.3	34	138
Intermediate Shell Plate B5012 -3	Position 1.1	74.9	1.04	-13	77.9	34	99
Lower Shell Plate B5013-1	Position 1.1	99.1	1.04	0	103.1	34	137
Lower Shell Plate B5013-2	Position 1.1	65.0	1.04	30	67.6	34	132
Lower Shell Plate B5013 -3	Position 1.1	65.0	1.04	15	67.6	34	117
Intermediate Shell Longitudinal Weld Seam 2-442A (0° Azimuth)	Position 1.1	201.3	0.91	-50	183.2	56	189
	Position 2.1	157.2	0.91	-50	143.1	28[(e)]	121
Intermediate Shell Longitudinal Weld Seam 2-442B & C (120° & 240° Azimuth)	Position 1.1	201.3	1.01	-50	203.3	56	209
	Position 2.1	157.2	1.01	-50	158.8	28[(e)]	137
Intermediate to Lower Shell Circumferential Weld Seam 9-442	Position 1.1	37.5	1.04	-70	39.0	39.0	8
Lower Shell Longitudinal Weld Seams 3-442A & C (60°& 300° Azimuth)	Position 1.1	208.2	1.01	-50	210.3	56	216
	Position 2.1	210.0[(d)]	1.01	-50	212.1	28	190
Lower Shell Longitudinal Weld Seam 3-442B (180° Azimuth)	Position 1.1	208.2	0.91	-50	189.5	56	196
	Position 2.1	210.0[(d)]	0.91	-50	191.1	28	169

Notes:

(a) Initial RT_{NDT} values are measured values
(b) ART = Initial RT_{NDT} + ΔRT_{NDT} + Margin (°F)
(c) ΔRT_{NDT} = CF * FF
(d) Based on Diablo Canyon Unit 2 surveillance capsule data
(e) The McGuire Surveillance Data is credible

Table 2

(Unit 1)

Calculation of the ART Values for the 3/4T Location @ 34 EFPY

Material	RG 1.99 R2 Method	CF (°F)	FF	IRT_{NDT}(a)	ΔRT_{NDT}(c)	Margin	ART(b)
Intermediate Shell Plate B5012-1	Position 1.1	74.2	0.76	34	56.4	34	124
	Position 2.1	62.7	0.76	34	47.7	17(e)	99
Intermediate Shell Plate B5012-2	Position 1.1	100.3	0.76	0	76.2	34	110
Intermediate Shell Plate B5012 -3	Position 1.1	74.9	0.76	-13	56.9	34	78
Lower Shell Plate B5013-1	Position 1.1	99.1	0.76	0	75.3	34	109
Lower Shell Plate B5013-2	Position 1.1	65.0	0.76	30	49.4	34	113
Lower Shell Plate B5013 -3	Position 1.1	65.0	0.76	15	49.4	34	98
Intermediate Shell Longitudinal Weld Seam 2-442A (0° Azimuth)	Position 1.1	201.3	0.63	-50	126.8	56	133
	Position 2.1	157.2	0.63	-50	99.0	28(e)	77
Intermediate Shell Longitudinal Weld Seam 2-442B & C (120° & 240° Azimuth)	Position 1.1	201.3	0.72	-50	144.9	56	151
	Position 2.1	157.2	0.72	-50	113.2	28(e)	91
Intermediate to Lower Shell Circumferential Weld Seam 9-442	Position 1.1	37.5	0.76	-70	28.5	28.5	-13
Lower Shell Longitudinal Weld Seams 3-442A & C (60°& 300° Azimuth)	Position 1.1	208.2	0.72	-50	149.9	56	156
	Position 2.1	210.0(d)	0.72	-50	151.2	28	129
Lower Shell Longitudinal Weld Seam 3-442B (180° Azimuth)	Position 1.1	208.2	0.63	-50	131.2	56	137
	Position 2.1	210.0(d)	0.63	-50	132.3	28	110

Notes:

(a) Initial RT_{NDT} values are measured values
(b) ART = Initial RT_{NDT} + ΔRT_{NDT} + Margin (°F)
(c) ΔRT_{NDT} = CF * FF
(d) Based on Diablo Canyon Unit 2 surveillance capsule data
(e) The McGuire Surveillance Data is credible

Table 3
(Unit 1)

Peak Reactor Coolant System Pressure

Transient Description	Nominal PORV Setpoint (psig)	Pressure Overshoot (psi)	Dynamic Pressure Effects (psi)	Static Pressure Effects (psi)	Instrument Error (psi)	Peak Pressure (psig)
Safety Injection with....						
0 RCP's in Operation	380	*51.3*	*0.1*	4.7	30	**466.1**
1-2 RCP's in Operation	380	*51.3*	*15.9*	4.7	30	**481.9**
3 RCP's in Operation	380	*51.3*	*34.0*	4.7	30	**500.0**
4 RCP's in Operation	380	*51.3*	*58.9*	4.7	30	**524.9**
Charging/Letdown Mismatch with....						
0 RCP's in Operation	380	*45.6*	*1*	4.7	30	*461.3*
1-2 RCP's in Operation	380	*45.6*	*15.9*	4.7	30	*476.2*
3 RCP's in Operation	380	*45.6*	*34.0*	4.7	30	*494.3*
4 RCP's in Operation	380	*45.6*	*58.9*	4.7	30	*519.2*
Heat Input (Primary - Secondary Temp Mismatch) with...						
0 RCP's in Operation AND						
Tave of 60 - 100°F	From Heat Input Transient Analysis					*468.3*
Tave to 100 - 180°F						*522.5*
Tave to 180 - 250°F						*514.9*
1-4 RCP's in Operation	***Transient not credible with an NC pump initially running.***					-

Table 4
(Unit 1)

Heatup and Cooldown limits from WCAP-15192

RV Beltline Region Temperature (°F)		RV Beltline Region Pressure Limit per WCAP -15192 (psig)					
Actual	Indicated (w / 12°F Margin)	Steady state	Cooldown @ 20 F/Hr	Cooldown @ 40 F/hr	Cooldown @ 60F/hr	Cooldown @ 100F/hr	Heatup @ 100F/hr
60	72	0	0	0	0	0	0
60	72	621	586	535	484	377	621
65	77	621	589	539	487	381	621
70	82	621	592	542	491	385	621
75	87	621	596	546	495	390	621
80	92	621	600	550	500	395	621
85	97	654	605	555	505	401	621
90	102	658	610	561	511	408	654
95	107	664	616	567	517	416	658
100	112	670	622	574	525	425	659
105	117	676	629	581	533	435	659
110	122	684	637	590	542	446	659
115	127	692	646	599	552	458	659
120	132	701	655	610	564	472	659
125	137	711	666	621	576	487	660
130	142	721	678	634	590	504	663
135	147	733	691	648	606	524	668
140	152	747	705	664	624	545	676
145	157	761	721	682	643	569	686
150	162	778	739	701	664	595	698
155	167	795	759	723	688	625	713
160	172	815	780	747	715	657	731
165	177	837	804	773	744	694	751
170	182	861	831	803	777	734	774
175	187	888	860	835	813	779	801

Table 5

(Unit 1)

Reactor Coolant System Heatup and Cooldown Limits

Number of RCP's Running	RCS Temperature Range			
	Without Margin	OAC Points*	Chart Recorder**	Heat-up Limit
0 to 4	> 60°F	> 72°F	> 74°F	100 °F / hr
				Cooldown Limit
0	> 135°F 135 - 100 100 - 60	> 147 147 - 112 112 - 72	> 149 149 - 114 114 - 74	100 °F / hr 60 °F / hr 40 °F / hr
1 - 2	> 125°F 125 - 60	> 137 137 - 72	> 139 139 - 74	100 °F / hr 60 °F / hr
3	> 130°F 130 - 80 80 - 60	> 142 142 - 92 92 - 72	> 144 144 - 94 94 - 74	100 °F / hr 60 °F / hr 40 °F / hr
4	> 140°F 140 - 100 100 - 60	> 152 152 - 112 112 - 72	> 154 154 - 114 114 - 74	100 °F / hr 60 °F / hr 40 °F / hr

** RCS WR T-cold: A1061, A1067, A1073, A1079; ND Hx Outlet: A0832, A0838*

*** Chart Recorder NCCR5860, NCCR5910, NDCR5060, NDCR5070*

Table 6
(Unit 2)

Calculation of the ART Values for the 1/4T Location @ 34 EFPY

Material	RG 1.99, R2 Method	CF (°F)	FF	ΔRT_{NDT} (°F)	Margin (°F)	IRT_{NDT} (1) (°F)	ART (2) (°F)
Intermediate Shell Forging 05 (Heat 526840)	Position 1.1	117.2	1.041	122.0	34	-4	152.0
	Position 2.1	84.9	1.041	88.4	17	-4	101.4
Circumferential Weld Seam W05	Position 1.1	52.7	1.041	54.9	54.9	-68	41.8
	Position 2.1	31.9	1.041	33.2	28	-68	-6.8
Lower Shell Forging 04 (Heat 411337/11)	Position 1.1	115.8	1.041	120.5	34	-30	124.5

Notes:

(1) Initial RT_{NDT} values measured values.

(2) ART = Initial RT_{NDT} + ΔRT_{NDT} + Margin (°F)

Table 7

(Unit 2)

Calculation of the ART Values for the 3/4T Location @ 34 EFPY

Material	RG 1.99, R2 Method	CF (°F)	FF	ΔRT_{NDT} (°F)	Margin (°F)	IRT_{NDT} (1) (°F)	ART (2) (°F)
Intermediate Shell Forging 05	Position 1.1	117.2	0.760	89.1	34	-4	119.1
(Heat 526840)	Position 2.1	84.9	0.760	64.5	17	-4	77.5
Circumferential Weld Seam W05	Position 1.1	52.7	0.760	40.1	40.1	-68	12.2
	Position 2.1	31.9	0.760	24.2	24.2	-68	-19.6
Lower Shell Forging 04 (Heat 411337/11)	Position 1.1	115.8	0.760	88.0	34	-30	92.0

Notes:

(1) Initial RT_{NDT} values measured values.

(2) ART = Initial RT_{NDT} + ΔRT_{NDT} + Margin (°F)

Table 8
(Unit 2)

Peak Reactor Coolant System Pressure

Transient Description	Nominal PORV Setpoint (psig)	Pressure Overshoot (psi)	Dynamic Pressure Effects (psi)	Static Pressure Effects (psi)	Instrument Error (psi)	Peak Pressure (psig)
Safety Injection with....						
0 RCP's in Operation	380	***51.3***	***0.1***	4.7	30	**466.1**
1-2 RCP's in Operation	380	***51.3***	***15.9***	4.7	30	**481.9**
3 RCP's in Operation	380	***51.3***	***34.0***	4.7	30	**500.0**
4 RCP's in Operation	380	***51.3***	***58.9***	4.7	30	**524.9**
Charging/Letdown Mismatch with....						
0 RCP's in Operation	380	***45.6***	***1***	4.7	30	***461.3***
1-2 RCP's in Operation	380	***45.6***	***15.9***	4.7	30	***476.2***
3 RCP's in Operation	380	***45.6***	***34.0***	4.7	30	***494.3***
4 RCP's in Operation	380	***45.6***	***58.9***	4.7	30	***519.2***
Heat Input (Primary - Secondary Temp Mismatch) with...						
0 RCP's in Operation AND						
Tave of 60 - 100°F	From Heat Input Transient Analysis					***468.3***
Tave to 100 - 180°F						***522.5***
Tave to 180 - 250°F						***514.9***
1-4 RCP's in Operation	***Transient not credible with an NC pump initially running.***					**-**

Table 9
(Unit 2)

Heatup and Cooldown limits from WCAP-15201

RV Beltline Region Temperature (°F)		RV Beltline Region Pressure Limit per WCAP -15201 (psig)						
Actual	Indicated (w / 12°F Margin)	Steady state	Cooldown @ 20 F/Hr	Cooldown @ 40 F/hr	Cooldown @ 60F/hr	Cooldown @ 100F/hr	Heatup @ 60F/hr	Heatup @ 100F/hr
60	72	0	0	0	0	0	0	0
60	72	705	666	626	586	[illegible]	705	705
65	77	716	678	639	600	[illegible]	716	716
70	82	728	691	653	616	542	716	716
75	87	741	705	669	633	563	716	716
80	92	756	721	686	652	586	716	716
85	97	772	738	705	673	611	772	772
90	102	790	758	726	696	639	790	790
95	107	810	780	750	722	671	810	810
100	112	832	803	776	751	706	832	815
105	117	856	830	805	782	745	856	816
110	122	883	859	837	818	788	883	821
115	127	913	892	873	857	835	910	830
120	132	945	927	912	900	888	938	843
125	137	981	967	956	948	947	972	860
130	142	1021	1011	1004	1001	1012	1010	880

Table 10
(Unit 2)

Reactor Coolant System Heatup and Cooldown Limits

Number of RCP's Running	RCS Temperature Range			Heat-up Limit
	Without Margin	OAC Points*	Chart Recorder**	Max Rate
0 to 4	> 60°F	> 72°F	> 74°F	100 °F / hr

Number of RCP's Running	RCS Temperature Range			Cooldown Limit
	Without Margin	OAC Points*	Chart Recorder**	Max Rate
0	> 70°F 70 - 60	> 82 82 - 72	> 84 84 - 74	100 °F / hr 60 °F / hr
1 - 3	> 60°F	> 72	> 74	100 °F / hr
4	> 70°F 70 - 60	> 82 82 - 72	> 84 84 - 74	100 °F / hr 60 °F / hr

** RCS WR T-cold: A1061, A1067, A1073, A1079; ND Hx Outlet: A0832, A0838*

*** Chart Recorder NCCR5860, NCCR5910, NDCR5060, NDCR5070*

Figure 1
(Unit 1)

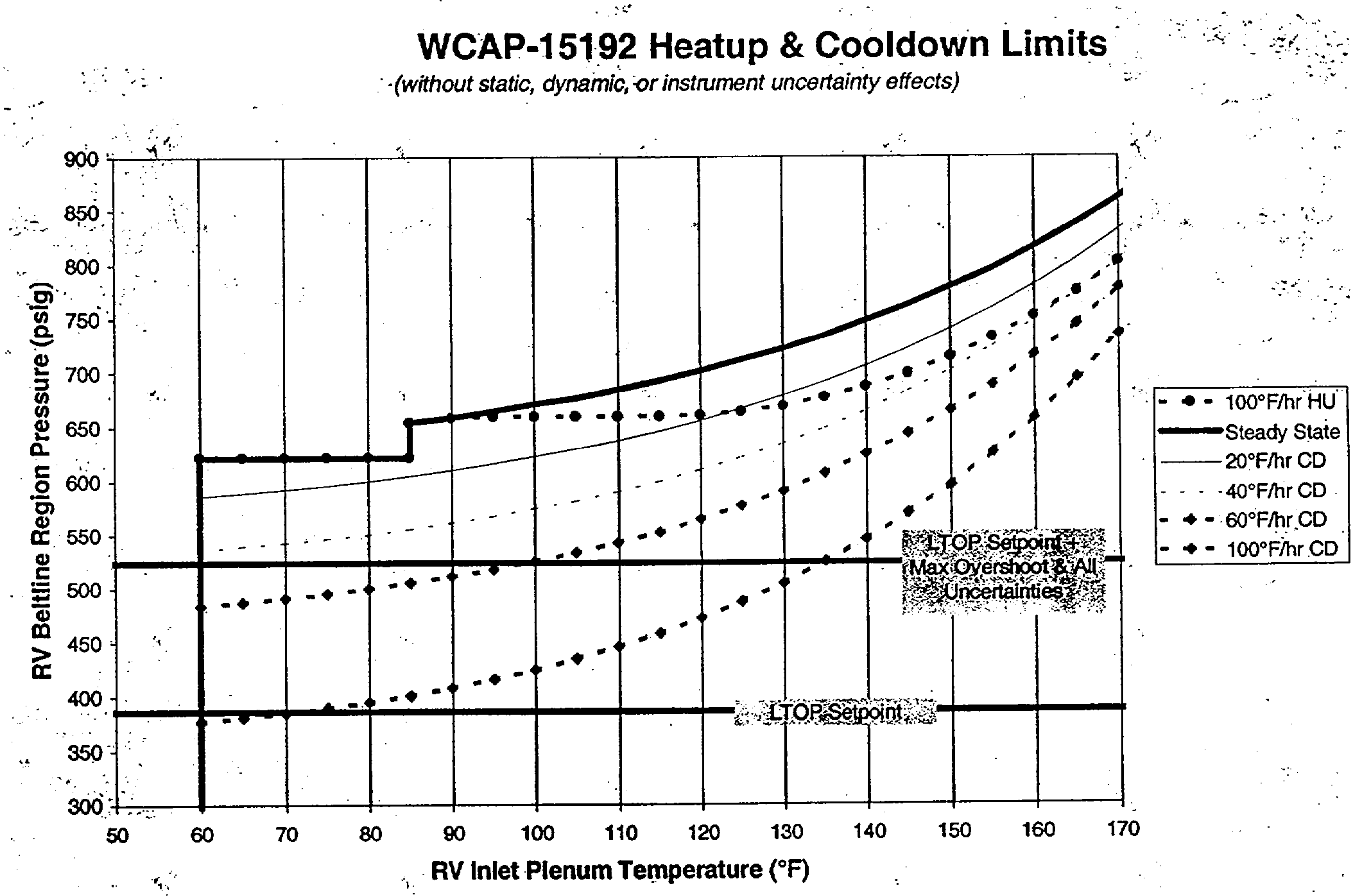

Figure 2

(Unit 2)