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Michael J. Colomb
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BVY 10-071

December 21, 2010

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

SUBJECT: Technical Specifications Proposed Change No. 293
Revised Reactor Vessel Pressure-Temperature Limitation Curves
Vermont Yankee Nuclear Power Station
Docket No. 50-271
License No. DPR-28

Dear Sir or Madam:

In accordance with 10CFR50.90, Vermont Yankee (VY) is proposing an amendment to Appendix A (Technical Specifications) of the Operating License (DPR-28) for the Vermont Yankee Nuclear Power Station. The proposed changes would revise section 3.6.A "Pressure and Temperature Limitations," of the VY Technical Specifications (TS).

VY has reviewed the proposed amendment in accordance with 10CFR50.92 and concludes it does not involve a significant hazards consideration. In accordance with 10CFR50.91, a copy of this application, with attachments, is being provided to the State of Vermont, Department of Public Service.

Attachment 1 to this letter provides a detailed description and evaluation of the proposed change. Attachment 2 contains a markup of the current TS and Bases pages. Attachment 3 contains the retyped TS and Bases pages. Revised TS Bases changes are provided for information only.

There are no new regulatory commitments being made in this submittal.

VY requests review and approval of the proposed license amendment by December 31, 2011 with a 60 day implementation period from the date of approval.

In accordance with 10CFR50.91, VY is notifying the State of Vermont of this License Amendment Request by transmitting a copy of this letter to the designated State Official.

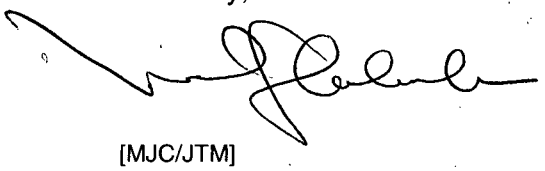
If you have any questions on this transmittal, please contact Mr. Robert Wanczyk at 802-451-3166.

A001
NRR

I declare under penalty of perjury that the foregoing is true and correct.

Executed on December 21, 2010.

Sincerely,



[MJC/JTM]

Attachments:

1. Description and Evaluation of Proposed Changes
2. Markup of the Current Technical Specification and Bases Pages
3. Retyped Technical Specification and Bases Pages

cc: Mr. William W. Dean
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Attachment 1

Vermont Yankee Nuclear Power Station

Proposed Change 293

Description and Evaluation of Proposed Changes

1. SUMMARY DESCRIPTION

1.1 PURPOSE

This Proposed Change to the licensing basis of the Vermont Yankee Nuclear Power Station (VY) revises section 3.6.A of the VY Technical Specifications (TS). The specific changes are summarized below:

1.2 DESCRIPTION OF THE PROPOSED CHANGE

VY is proposing to update the pressure and temperature (P-T) limit curves for the reactor coolant system that are required by TS 3.6.A, "Pressure and Temperature Limitations." Currently, TS Figures 3.6.1, 3.6.2 and 3.6.3 indicate validity through 4.827×10^8 megawatt-hours thermal (MWH(t)), approximately at the end of the current operating license. This proposed change updates the pressure and temperature limits for the reactor coolant system through 7.943×10^8 MWH(t), approximately the end of the prospective twenty (20) year renewed license period, depending on the plant capacity factor. The updated P-T limits are based on technical requirements and analyses that have been previously reviewed and approved by the NRC for VY (as will be explained in detail below), thus this Technical Specification change can be considered an administrative update. The set of P-T limit curves is unchanged and remains as shown in current TS Figures 3.6.1, 3.6.2 and 3.6.3.

In addition, an editorial correction is being proposed in Table 3.6.3. The data box on Figure 3.6.3 has a heading titled "All Regions" and this should be labeled "Upper Regions" as it is similarly labeled elsewhere on the figure and on Figures 3.6.1 and 3.6.2.

Also conforming changes to the TS Bases are being made and are provided for information only with this submittal.

2. DETAILED DESCRIPTION

2.1 TECHNICAL AND REGULATORY BASIS

10CFR50.60, "Acceptance criteria for fracture prevention measures for light water nuclear power reactors for normal operation," imposes the fracture toughness requirements for the reactor coolant pressure boundary set forth in Appendix G to 10CFR50. Licensees of nuclear power plants are required by Appendix G to 10CFR50, "Fracture Toughness Requirements," to develop and use P-T limits in order to provide adequate margins of safety during any condition of operation, including anticipated operational occurrences and system hydrostatic tests, to which the reactor coolant pressure boundary may be subjected over its service lifetime.

Appendix G to 10CFR50 describes the conditions that require P-T limits and provides the general bases for these limits. Operating limits based on the criteria of Appendix G, as defined by applicable regulations, codes and standards, provide reasonable assurance that non-ductile or rapidly propagating failure will not occur.

Appendix G of Section XI of the ASME Boiler and Pressure Vessel Code (the Code), (Ref. 1) forms the basis for the requirements of Appendix G to 10CFR50. The operating limits for pressure and temperature are required for three categories of operation: (1) hydrostatic pressure tests and leak tests; (2) non-nuclear heatup/cooldown and low-level physics tests; and (3) core critical operation.

Pressure-retaining components of the reactor coolant pressure boundary that are made of ferritic materials (including the pressure vessel) must meet the requirements of Appendix G of the Code, as supplemented by the additional requirements in Table 1 of Appendix G to 10CFR50 for fracture toughness during system hydrostatic tests and any condition of normal operation, including anticipated operational occurrences. In addition to beltline considerations, non-beltline discontinuities such as nozzles, penetrations and flanges may influence the construction of P-T curves.

The P-T limits are prescribed for all plant operating modes to avoid encountering pressure, temperature and temperature rate of change conditions that might cause undetected flaws to propagate and cause non-ductile failure of the reactor coolant pressure boundary. The P-T limits are acceptance limits because they preclude operation in an unanalyzed condition.

P-T limits are revised when necessary in accordance with Appendix H to 10CFR50 for changes in adjusted reference temperature for nil ductility transition (ART_{NDT}) due to neutron fluence exposure to the reactor pressure vessel material.

2.1.2 NEUTRON FLUENCE METHODOLOGY

10CFR50, Appendix G requires the prediction of the effects of neutron irradiation on vessel embrittlement by calculating the ART_{NDT} and the Charpy Upper Shelf Energy (USE). For reactor vessel beltline materials, including welds, plates and forgings, the values of ART_{NDT} must account for the effects of neutron irradiation, as part of the surveillance program of Appendix H to 10CFR50. To predict these effects, NRC Generic Letter 88-11 (Ref. 2) endorses the use of methods described in NRC Regulatory Guide 1.99, Revision 2 (Ref. 3). The fluence values calculated using the methodology described in NRC Regulatory Guide 1.190 (Ref. 4) satisfy the requirements of Appendix G to 10CFR50 and NRC Regulatory Guide 1.99.

The VY P-T limit curves utilize a fluence methodology consistent with NRC Regulatory Guide 1.190, as documented in the USNRC Safety Evaluation for License Amendment 218, dated March 29, 2004 (Ref. 5) and License Amendment 229, dated March 2, 2006 (Ref. 6). License Amendment 229 authorized plant operation at extended power uprate (EPU) conditions. This proposed change does not alter any EPU conditions.

3. TECHNICAL EVALUATION

3.1 P-T LIMITATIONS

As discussed above, License Amendment No. 218 (Ref. 5) approved P-T curves for TS Figures 3.6.1, 3.6.2 and 3.6.3. The curves were based on NRC requirements delineated in Regulatory Guides 1.99 Revision 2 and 1.190 Revision 0. They were valid through 4.46×10^8 MWH(t), which represented operation to approximately the end of the current operating license at a licensed power level of 1593 MW(t).

License Amendment No 229 (Ref. 6) approved P-T curves for TS Figures 3.6.1, 3.6.2 and 3.6.3. The curves were based on NRC requirements delineated in Regulatory Guides 1.99 Revision 2 and 1.190 Revision 0. They are valid through 4.827×10^8 MWH(t), which represents operation to approximately the end of the current operating license at a licensed power level of 1912 MW(t), "EPU" conditions.

As documented in the NRC Safety Evaluation for VY Amendment 229, Section 2.1.2:

"Pressure-Temperature Limit Calculations
Section IV.A.2 of 10 CFR Part 50, Appendix G, requires that the P-T limits for operating reactors be at least as conservative as those that would be generated if the methods of calculation in the ASME Code, Section XI, Appendix G, were used to calculate the P-T limits. The rule also requires that the P-T limit calculations account for the effects of neutron irradiation on the P-T limit values for the reactor vessel beltline materials and incorporate any relevant reactor vessel surveillance capsule data that are required to be reported as part of the licensee's implementation of its 10 CFR Part 50, Appendix H, reactor vessel materials surveillance program.

Section 3.2.1 of Attachment 4 to Reference 1 indicates that the P-T limit curves contained in the TSs remain bounding for EPU conditions. The VYNPS P-T limit curves were approved in VYNPS Amendment No. 218 dated March 29, 2004. Tables 2-1 and 2-2 of Attachment 2 to the licensee's letter dated March 26, 2003 (application associated with Amendment No. 218), provided the adjusted reference temperature (ART) values for the limiting material as 57°F at 1/4T fluence (2.20×10^{17} n/cm^2) and 48°F at 3/4T fluence (1.20×10^{17} n/cm^2). Section 2.0 of Attachment 2 to the March 26, 2003, letter states that for purposes of determining the P-T curves for the vessel core region material, VYNPS has elected to maintain the more conservative ART values previously used by VYNPS (89°F at the 1/4T point and 73°F at the 3/4T point). The licensee's submittal states that, based on RG 1.99, Revision 2, lower values of ART could have been used.

The NRC staff's assessment included an independent calculation of the ART values for both the 1/4T and 3/4T locations of the VYNPS reactor vessel beltline regions based on the revised 33 EFPY neutron fluence specified in the submittal for VYNPS for EPU conditions. The staff confirmed, using the methodology of RG 1.99, Revision 2, that the limiting beltline material was the reactor vessel plate 1-14 with an ART of 58°F at the 1/4T location and 53°F at the 3/4T location. Item 13 in Table 1, "Proposed OL and TS Changes," in Attachment 1 to Reference 1, indicates the analytical methods used in the March 26, 2003, letter are unchanged; however, the peak neutron fluence increased to 3.18×10^{17} n/cm^2. The neutron fluence methodology was determined to be consistent with the guidance in RG 1.190 as discussed in the NRC's SE for Amendment No. 218. Previously, the P-T limit curves were based on a peak vessel fluence value of 1.24×10^{18} n/cm^2 resulting in the limiting material (reactor vessel plate 1-14) having an ART of 89°F at the 1/4T location and 73°F at the 3/4T location. Since the staff has confirmed that the previous ART values bound the revised ART values for EPU conditions, the staff agrees that the P-T limit curves contained in the TSs remain bounding for EPU conditions.

Conclusion
The NRC staff has reviewed the licensee's evaluation of the effects of the proposed EPU on the USE values for the reactor vessel beltline materials and P-T limits for the plant. The staff concludes that the licensee has adequately addressed changes in neutron fluence and their effects on the USE values for VYNPS reactor vessel beltline materials and the P-T limits for the plant. The staff concludes that the VYNPS beltline materials will continue to have acceptable USE, as mandated by 10 CFR Part 50, Appendix G, through the expiration of the current operation license for the facility. The NRC staff further concludes that the licensee has demonstrated the validity of the proposed P-T limits for operation under the proposed EPU conditions. Based on this, the NRC staff concludes that the proposed P-T limits will continue to meet the requirements of 10 CFR Part 50, Appendix G, and 10 CFR 50.60 and will enable the licensee to comply with draft GDC-9, 33, 34, and 35 in this respect following implementation of the proposed EPU. Therefore, the NRC staff finds the proposed EPU acceptable with respect to the proposed P-T limits."

Stated differently, License Amendment 229 demonstrated that the P-T Limit curves were appropriate at EPU conditions up to peak vessel fluence of 1.24×10^{18} n/cm^2 in the limiting

material (reactor vessel plate 1-14). (Note that all discussions concerning fluence are defined as E greater than 1MeV.)

3.2 LICENSE RENEWAL CONSIDERATIONS

VY has applied for a renewed operating license which, if approved, will allow operation for up to an additional twenty years beyond March 21, 2012. No change in any plant operating conditions or power level is associated with the renewed license application.

As documented in the USNRC Safety Evaluation for the VY License Renewal Application (LRA), the anticipated peak vessel fluence at the end of the Period of Extended Operation (PEO) will be less than the peak vessel fluence that the current P-T limit curves are based on. Specifically, the current curves are based on a peak vessel fluence of 1.24×10^{18} n/cm^2. As documented in Table 4.2-1 of the VY LRA the predicted peak vessel fluence at the end of the PEO is predicted to be 5.39×10^{17} n/cm^2. Therefore, all that is required to revise the P-T limit curves is to change the note that defines the limit of applicability.

The pertinent portion of the NRC SER for the VY LRA is presented below:

"4.2.2.2 Staff Evaluation

The staff reviewed LRA Section 4.2.2 to verify in accordance with 10 CFR 54.21(c)(1)(i), that the analyses remain valid for the period of extended operation. In its March 2003 license amendment request, VYNPS requested use of the present P-T limit curves through 32 EFPY of facility operation. This request was approved by the NRC in a license amendment dated March 29, 2004. The applicant provided a comparison of the fluence and ART values for the 32 EFPY P-T limits with the projected 54 EFPY fluence and ART values for the extended period of operation, based on the 2002 fluence analysis in LRA Table 4.2-1. The staff finds that the new projected 54 EFPY fluence and ART values are, in fact, less than the 32 EFPY fluence and ART values, on which the current technical specification (TS) P-T limits are based.

In its request for additional information (RAI), the staff had a number of questions concerning the applicant's TLAAs. For the P-T limits, it was unclear to the staff why the projected 54 EFPY fluence and ART values from LRA Table 4.2-1 are, in fact, less than the 32 EFPY fluence and ART values for the current TS P-T limits. Therefore, the staff requested, in RAI 4.2.2-1, that the applicant discuss the 1984 fluence analysis assumptions that resulted in conservative values for the 32 EFPY neutron fluence and ART values, taking into consideration why the 32 EFPY fluence and ART values are more conservative relative to the projected 54 EFPY fluence and ART values based on the 2002 fluence analysis.

In its response to RAI 4.2.2-1, the applicant stated that the current 32 EFPY P-T limits were originally prepared based on a 1/4 T fluence of 1.24×10^{18} n/cm^2 (E greater than 1 MeV) from the 1984 fluence analysis. This fluence value was determined to be overly conservative based on a subsequent 32 EFPY fluence calculation that generated a 1/4 T fluence value of 2.2×10^{17} n/cm^2 (E greater than 1 MeV) from the 2002 fluence analysis. However, the applicant opted not to amend the existing 32 EFPY P-T limits to incorporate the 2002 32 EFPY fluence calculation, based on time and expense associated with the TS amendment. Therefore, the conservative existing P-T limits based on the 1984 32 EFPY fluence values were retained in the TSs. Given the conservatism inherent in the 1984 32 EFPY fluence and ART values, the applicant determined that the projected 54 EFPY fluence and ART values from the 2002 fluence analysis would remain bounded by the fluence and ART values for the 32 EFPY P-T limits currently established in the VYNPS

TSs. The staff reviewed the applicant's response and finds the response acceptable since the projected 54 EFPY fluence and ART values from the 2002 fluence analysis would remain bounded by the fluence and ART values for the 32 EFPY P-T limits currently established in the VYNPS TSs. On this basis, the staff's concern described in RAI 4.2.2-1 is resolved.

In RAI 4.2.2-2, the staff requested that the applicant discuss whether the 54 EFPY P-T limit curve bases (fluence and ART values) from the 2002 fluence analysis summarized in LRA Table 4.2-1 take into consideration the VYNPS extended-power uprate (EPU) conditions. In its response to RAI 4.2.2-2, the applicant stated that the projected 54 EFPY fluence from the 2002 fluence analysis was calculated taking into consideration EPU conditions. Therefore, the 32 EFPY fluence and ART values from LRA Table 4.2-1 still bound the projected 54 EFPY fluence and ART values, including consideration of EPU conditions through the end of the period of extended operation. The staff reviewed the applicant's response and finds the response acceptable since the 32 EFPY fluence and ART values still bound the projected 54 EFPY fluence and ART values, including consideration of EPU conditions through the end of the period of extended operation. On this basis, the staff's concern described in RAI 4.2.2-2 is resolved.

The staff does not require the P-T limit curves for the extended period of operation to be submitted as part of the applicant's LRA for this TLAA. However, the staff does require NRC approval of the P-T limit curves for the extended period of operation prior to the expiration of the facility's current P-T limit curves. LRA Section 4.2.2 of VYNPS states that the P-T limit curve bases for 54 EFPY are bounded by the bases for the current P-T limit curves, and, as such, the TLAA for the P-T limits remains valid in compliance with 10 CFR 54.21(c)(1)(i). Therefore, the staff requested, in RAI 4.2.2-3, that the applicant indicate when it intends to submit P-T limit curves for NRC approval for the extended licensed period of operation (54 EFPY).

In its response to RAI 4.2.2-3, the applicant stated that it plans to submit a TS amendment requesting extension of the P-T limit curves prior to the expiration of the P-T limit curves currently established in the VYNPS TSs. The staff reviewed the applicant's response and finds the response acceptable since the applicant indicated that it plans to submit P-T limit curves for NRC approval for the extended licensed period of operation. On this basis, the staff's concern described in RAI 4.2.2-3 is resolved.

The staff finds that the applicant's plan to manage the P-T limits is acceptable because changes to the P-T limit curves will be implemented by the license amendment process (i.e., through revisions of the plant TS) and will meet the requirements of 10 CFR 50.60 and 10 CFR 50, Appendix G."

In addition, an editorial correction is being proposed in Table 3.6.3. The data box on Figure 3.6.3 has a heading titled "All Regions" and this should be labeled "Upper Regions" as it is similarly labeled elsewhere on Figure 3.6.3 and also on Figures 3.6.1 and 3.6.2.

3.3 CONCLUSION/SUMMARY

As discussed above, the NRC has previously reviewed and accepted the technical bases supporting the validity of the current Technical Specification P-T limit curves, as presented in TS Figures 3.6-1, 3.6-2 and 3.6-3, for a period beyond March 2032. The proposed changes to the P-T limit curves will extend their validity to the predicted end of the PEO. The correction of the typographical error in the data table heading of Figure 3.6.3 is administrative in nature.

In conclusion, based on the considerations discussed above, (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner; (2) such activities will be conducted in compliance with the Commission's regulations; and (3) the issuance of the requested license amendment will not be inimical to the common defense and security or to the health and safety of the public.

4. EVALUATION OF SIGNIFICANT HAZARDS CONSIDERATION

Pursuant to 10 CFR 50.92, Vermont Yankee (VY) has reviewed the proposed change and concludes that the change does not involve a significant hazards consideration since the proposed change satisfies the criteria in 10 CFR 50.92(c). These criteria require that operation of the facility in accordance with the proposed amendment would not (1) involve a significant increase in the probability or consequences of an accident previously evaluated; (2) create the possibility of a new or different kind of accident from any accident previously evaluated; or (3) involve a significant reduction in a margin of safety. The discussion below addresses each of these criteria and demonstrates that the proposed amendment does not constitute a significant hazard.

The proposed changes would revise the VY Technical Specifications (TS), Section 3.6.A, Reactor Vessel Pressure-Temperature Limitation Curves to extend the stated applicability period to account for an additional 20 years of operation. An editorial correction on the heading of a data table is also being resolved with this change.

The proposed change does not involve a significant hazards consideration because:

1. Does the proposed amendment involve a significant increase in the probability or consequences of an accident previously evaluated?

   Response: No.

   The proposed change revises the period of applicability of the P-T limits. The technical bases for the new period of applicability have been previously reviewed and approved by the NRC as discussed in the submittal. Because the applicable regulatory requirements continue to be met, the change does not significantly increase the probability of any accident previously evaluated. The proposed change provides the same assurance of RPV integrity as previously provided.

   The change will require that the reactor pressure vessel and interfacing coolant system continue to be operated within their design, operational or testing limits. Also, the change will not alter any assumptions previously made in evaluating the radiological consequences of accidents.

   Therefore, the proposed amendment does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. Does the proposed amendment create the possibility of a new or different kind of accident from any accident previously evaluated?

   Response: No.

The proposed change does not involve a modification of the design of plant structures, systems, or components. The change will not impact the manner in which the plant is operated and will not degrade the reliability of structures, systems, or components important to safety as equipment protection features will not be deleted or modified, equipment redundancy or independence will not be reduced, supporting system performance will not be affected and no severe testing of equipment will be imposed. No new failure modes or mechanisms will be introduced as a result of this proposed change.

Therefore, the proposed change does not create the possibility of a new or different kind of accident from any accident previously evaluated.

3. Does the proposed amendment involve a significant reduction in a margin of safety?

Response: No.

Appendix G to 10CFR50 describes the conditions that require pressure-temperature (P-T) limits and provides the general bases for these limits. Operating limits based on the criteria of Appendix G, as defined by applicable regulations, codes and standards, provide reasonable assurance that non-ductile or rapidly propagating failure will not occur. The P-T limits are prescribed for all plant modes to avoid encountering pressure, temperature and temperature rate of change conditions that might cause undetected flaws to propagate and cause non-ductile failure of the reactor coolant pressure boundary. Calculation of P-T limits in accordance with the criteria of Appendix G to 10CFR50 and applicable regulatory requirements ensures that adequate margins of safety are maintained and there is no significant reduction in a margin of safety.

The proposed change does not alter the manner in which safety limits, limiting safety system settings, or limiting conditions for operation are determined. There is no change or impact on any safety analysis assumption or in any other parameter affecting the course of an accident analysis supporting the basis of any Technical Specification. The proposed change does not involve any increase in calculated off-site dose consequences.

Therefore, operation of VY in accordance with the proposed amendment will not involve a significant reduction in a margin to safety.

On the basis of the above, VY has determined that operation of the facility in accordance with the proposed change does not involve a significant hazards consideration as defined in 10CFR50.92(c), in that it: (1) does not involve a significant increase in the probability or consequences of an accident previously evaluated; (2) does not create the possibility of a new or different kind of accident from any accident previously evaluated; and (3) does not involve a significant reduction in a margin of safety.

5. ENVIRONMENTAL CONSIDERATIONS

This amendment request meets the eligibility criteria for categorical exclusion from environmental review set forth in 10 CFR 51.22(c)(9) as follows:

(i) The amendment involves no significant hazards determination.

As described in Section 4 of this evaluation, the proposed change involves no significant hazards consideration.

(ii) There is no significant change in the types or significant increase in the amounts of any effluent that may be released offsite.

The proposed amendment does not involve any physical alterations to the plant configuration that could lead to a change in the type or amount of effluent release offsite.

(iii) There is no significant increase in individual or cumulative occupational radiation exposure.

The proposed amendment does not involve a significant increase in individual or cumulative occupational radiation exposure.

Based on the above, VY concludes that the proposed change meets the eligibility criteria for categorical exclusion as set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of this amendment.

6. REFERENCES

1) American Society of Mechanical Engineers, Boiler and Pressure Vessel Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," Appendix G, 1995 Edition, including Summer 1996 Addenda
2) NRC Generic Letter 88-11, "NRC Position on Radiation Embrittlement of Reactor Pressure Vessel Materials and its Impact on Plant Operations," July 12, 1988
3) NRC Regulatory Guide 1.99, "Radiation Embrittlement of Reactor Vessel Materials, Revision 2," April 8, 2002
4) NRC Regulatory Guide 1.190, "Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence," March 2001
5) Letter, USNRC to Entergy Nuclear Operations, "Vermont Yankee Nuclear Power Station – Issuance of Amendment Re: Reactor Pressure Vessel Fracture Toughness and Material Surveillance Requirements (TAC Nos. MB8119 and MB8379)," dated March 29, 2004.
6) Letter, USNRC to Entergy Nuclear Operations, "Vermont Yankee Nuclear Power Station – Issuance of Amendment Re: Extended Power Uprate (TAC Nos. MC0761)", dated March 2, 2006.

Attachment 2

Vermont Yankee Nuclear Power Station

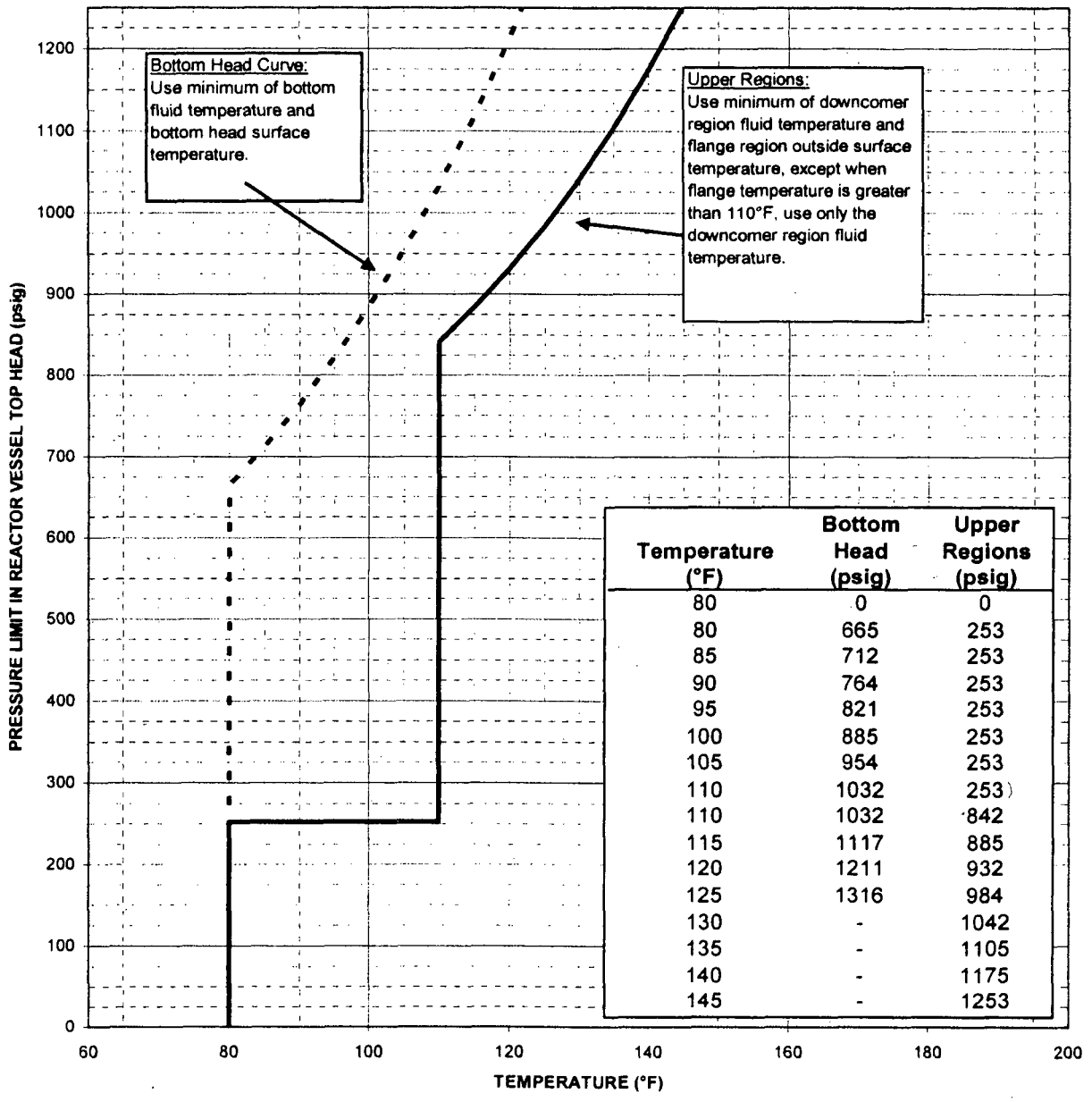
Proposed Change 293

Markup of the Current Technical Specifications and Bases Pages

Figure 3.6.1

Reactor Vessel Pressure-Temperature Limitations
Hydrostatic Pressure and Leak Tests, Core Not Critical

40°F/hr Heatup/Cooldown Limit
Valid Through ~~4.827E8~~ 7.943 MWH(t)



Temperature (°F)	Bottom Head (psig)	Upper Regions (psig)
80	0	0
80	665	253
85	712	253
90	764	253
95	821	253
100	885	253
105	954	253
110	1032	253
110	1032	842
115	1117	885
120	1211	932
125	1316	984
130	-	1042
135	-	1105
140	-	1175
145	-	1253

Figure 3.6.2

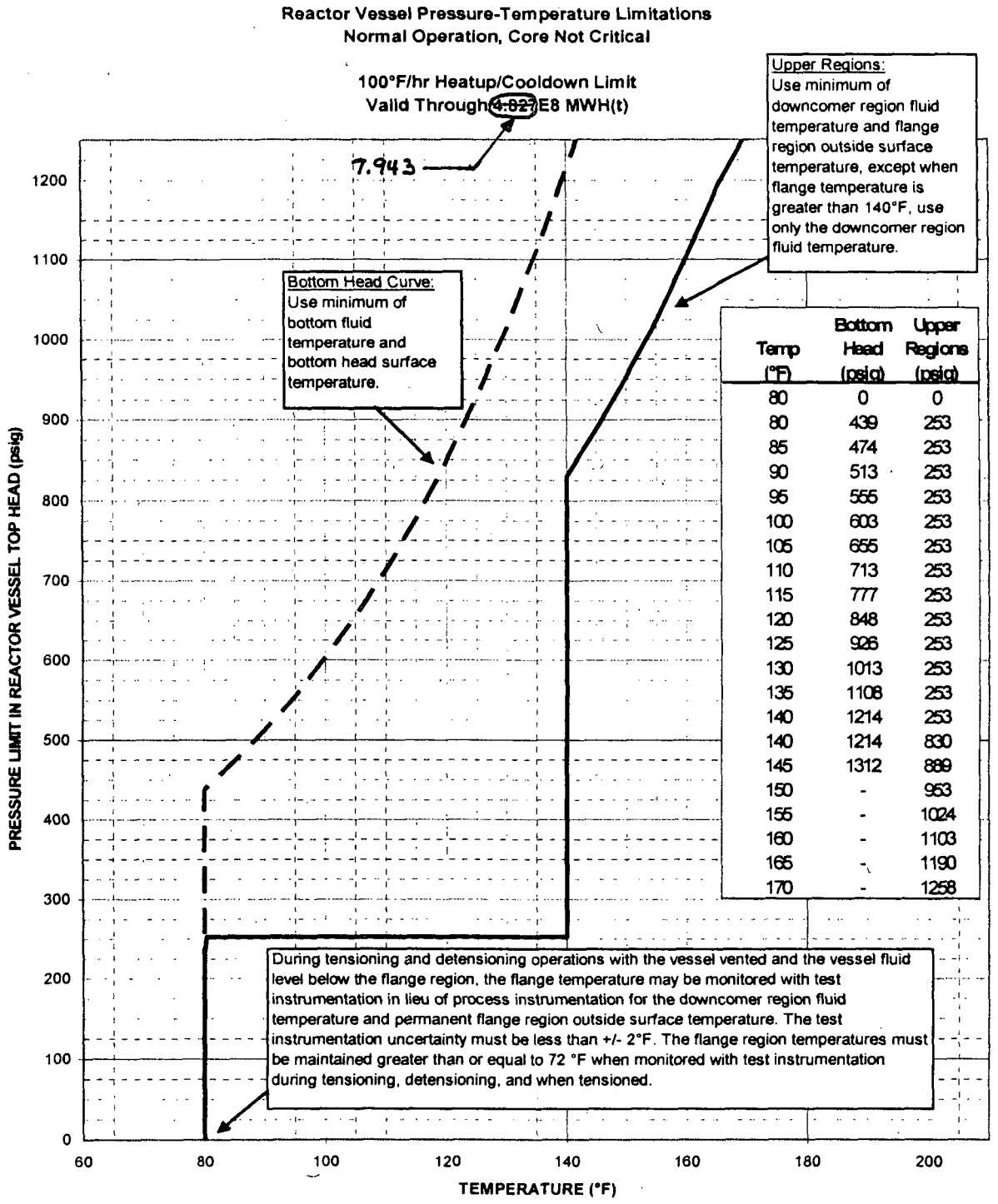

Reactor Vessel Pressure-Temperature Limitations
Normal Operation, Core Not Critical
100°F/hr Heatup/Cooldown Limit
Valid Through ~~4.82~~ 7.943 E8 MWH(t)
Upper Regions:
Use minimum of downcomer region fluid temperature and flange region outside surface temperature, except when flange temperature is greater than 140°F, use only the downcomer region fluid temperature.
Bottom Head Curve:
Use minimum of bottom fluid temperature and bottom head surface temperature.
Temp (°F) | Bottom Head (psig) | Upper Regions (psig)
80 | 0 | 0
80 | 439 | 253
85 | 474 | 253
90 | 513 | 253
95 | 555 | 253
100 | 603 | 253
105 | 655 | 253
110 | 713 | 253
115 | 777 | 253
120 | 848 | 253
125 | 926 | 253
130 | 1013 | 253
135 | 1108 | 253
140 | 1214 | 253
140 | 1214 | 830
145 | 1312 | 889
150 | - | 953
155 | - | 1024
160 | - | 1103
165 | - | 1190
170 | - | 1258
During tensioning and detensioning operations with the vessel vented and the vessel fluid level below the flange region, the flange temperature may be monitored with test instrumentation in lieu of process instrumentation for the downcomer region fluid temperature and permanent flange region outside surface temperature. The test instrumentation uncertainty must be less than +/- 2°F. The flange region temperatures must be maintained greater than or equal to 72 °F when monitored with test instrumentation during tensioning, detensioning, and when tensioned.
PRESSURE LIMIT IN REACTOR VESSEL TOP HEAD (psig)
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
60
80
100
120
140
160
180
200
TEMPERATURE (°F)

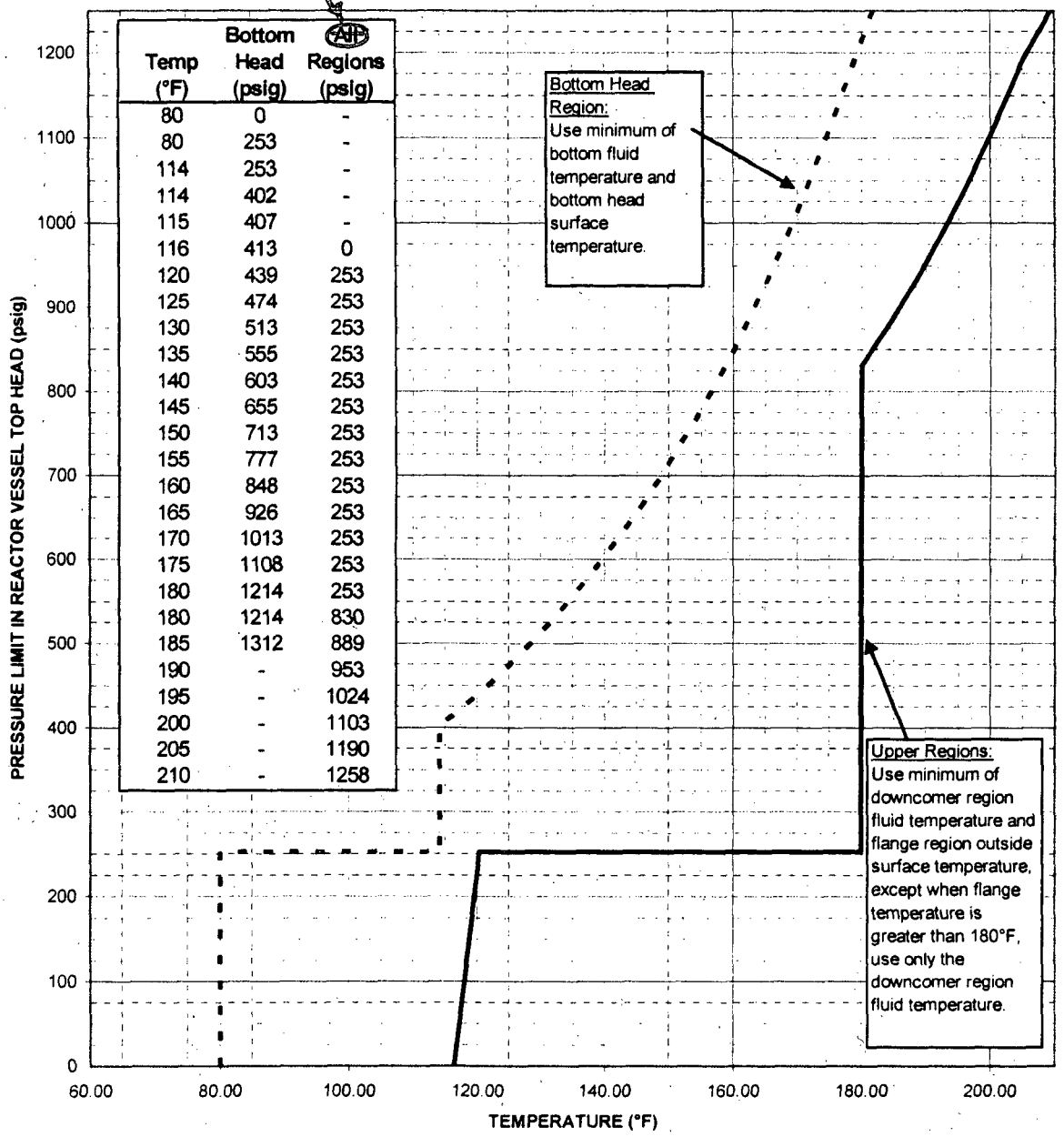
Figure 3.6.3

Reactor Vessel Pressure-Temperature Limitations
Normal Operation, Core Critical

100°F/hr Heatup/Cooldown Limit
If Pressure < 253 psig, Water Level must be within
Normal Range for Power Operation
Valid Through ~~4.82~~ 7.943 E8 MWH(t)

UPPER

Temp (°F)	Bottom Head (psig)	All Regions (psig)
80	0	-
80	253	-
114	253	-
114	402	-
115	407	-
116	413	0
120	439	253
125	474	253
130	513	253
135	555	253
140	603	253
145	655	253
150	713	253
155	777	253
160	848	253
165	926	253
170	1013	253
175	1108	253
180	1214	253
180	1214	830
185	1312	889
190	-	953
195	-	1024
200	-	1103
205	-	1190
210	-	1258



BASES:

3.6 and 4.6 REACTOR COOLANT SYSTEM

A. Pressure and Temperature Limitations

All components in the Reactor Coolant System are designed to withstand the effects of cyclic loads due to system temperature and pressure changes. These cyclic loads are introduced by normal load transients, reactor trips, and startup and shutdown operations. The various categories of load cycles used for design purposes are provided in Section 4.2 of the FSAR. During startup and shutdown, the rates of temperature and pressure changes are limited so that the maximum specified heatup and cooldown rates are consistent with the design assumptions and satisfy the stress limits for cyclic operation.

The Pressure/Temperature (P/T) curves included as Figures 3.6.1, 3.6.2, and 3.6.3 were developed using 10CFR50 Appendix G, 1995 ASME Code, Section XI, Appendix G (including the Summer 1996 Addenda), and ASME Code Case N-640. These three curves provide P/T limit requirements for Pressure Test, Core Not Critical, and Core Critical. The P/T curves are not derived from Design Basis Accident analysis. They are prescribed to avoid encountering pressure, temperature or temperature rate of change conditions that might cause undetected flaws to propagate and cause nonductile failure of the reactor pressure boundary, a condition that is unanalyzed.

During heating events, the thermal gradients in the reactor vessel wall produce thermal stresses that vary from compressive at the inner wall to tensile at the outer wall. During cooling events the thermal stresses vary from tensile at the inner wall to compressive at the outer wall. The thermally induced tensile stresses are additive to the pressure induced tensile stresses. In the flange region, bolt preload has a significant affect on stress in the flange and adjacent plates. Therefore heating/cooling events and bolt preload are used in the determination of the pressure-temperature limitations for the vessel.

The guidance of Branch Technical Position - MTEB 5-2, material drop weight, and Charpy impact test results were used to determine a reference nil-ductility temperature (RT_{NDT}) for all pressure boundary components. For the plates and welds adjacent to the core, fast neutron (E > 1 Mev) irradiation will cause an increase in the RT_{NDT}. For these plates and welds an adjusted RT_{NDT} (ART_{NDT}) of 89°F and 73°F (¼ and ¾ thickness locations) was conservatively used in development of these curves for core region components. Based upon plate and weld chemistry, initial RT_{NDT} values, predicted peak fast neutron fluence (~~3.19~~ 5.16 x 10^{17} n/cm^2 at the reactor vessel inside surface) for a gross power generation of ~~4.827~~ 7.943 x 10^8 MWH(t), these core region ART_{NDT} values conservatively bound the guidance of Regulatory Guide 1.99, Revision 2.

There were five regions of the reactor pressure vessel (RPV) that were evaluated in the development of the P/T Limit curves: (1) the reactor vessel beltline region, (2) the bottom head region, (3) the feedwater nozzle, (4) the recirculation inlet nozzle, and (5) the upper vessel flange region. These regions will bound all other regions in the vessel with respect to considerations for brittle fracture.

Two lines are shown on each P/T limit figure. The dashed line is the Bottom Head Curve. This is applicable to the bottom head area only and includes the bottom head knuckle plates and dollar plates. Based on bottom head fluid temperature and bottom head surface temperature, the reactor pressure shall be maintained below the dashed line at all times.

Attachment 3

Vermont Yankee Nuclear Power Station

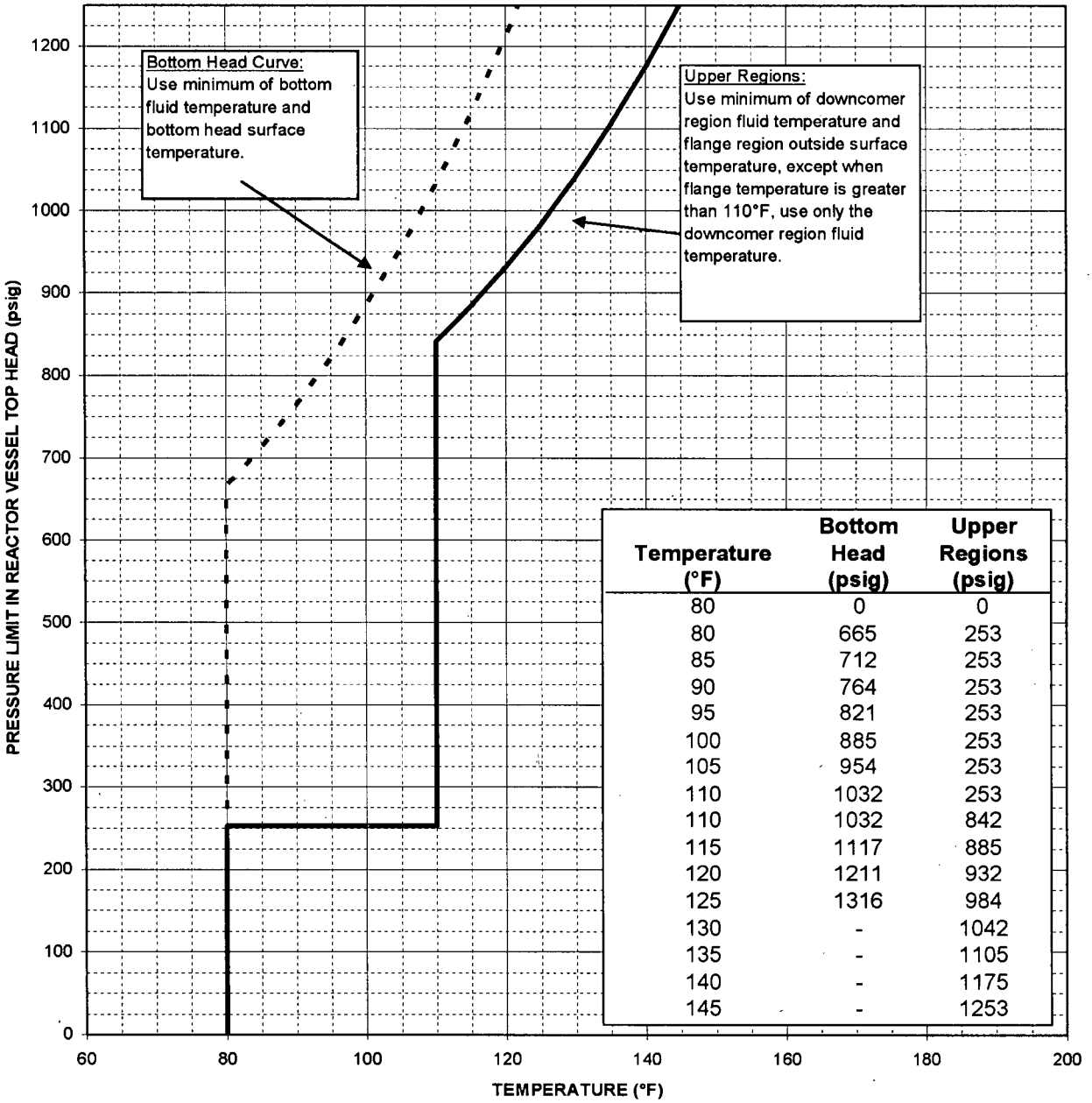
Proposed Change 293

Retyped Technical Specification and Bases Pages

Figure 3.6.1

Reactor Vessel Pressure-Temperature Limitations
Hydrostatic Pressure and Leak Tests, Core Not Critical

40°F/hr Heatup/Cooldown Limit
Valid Through 7.943'E8 MWH(t)

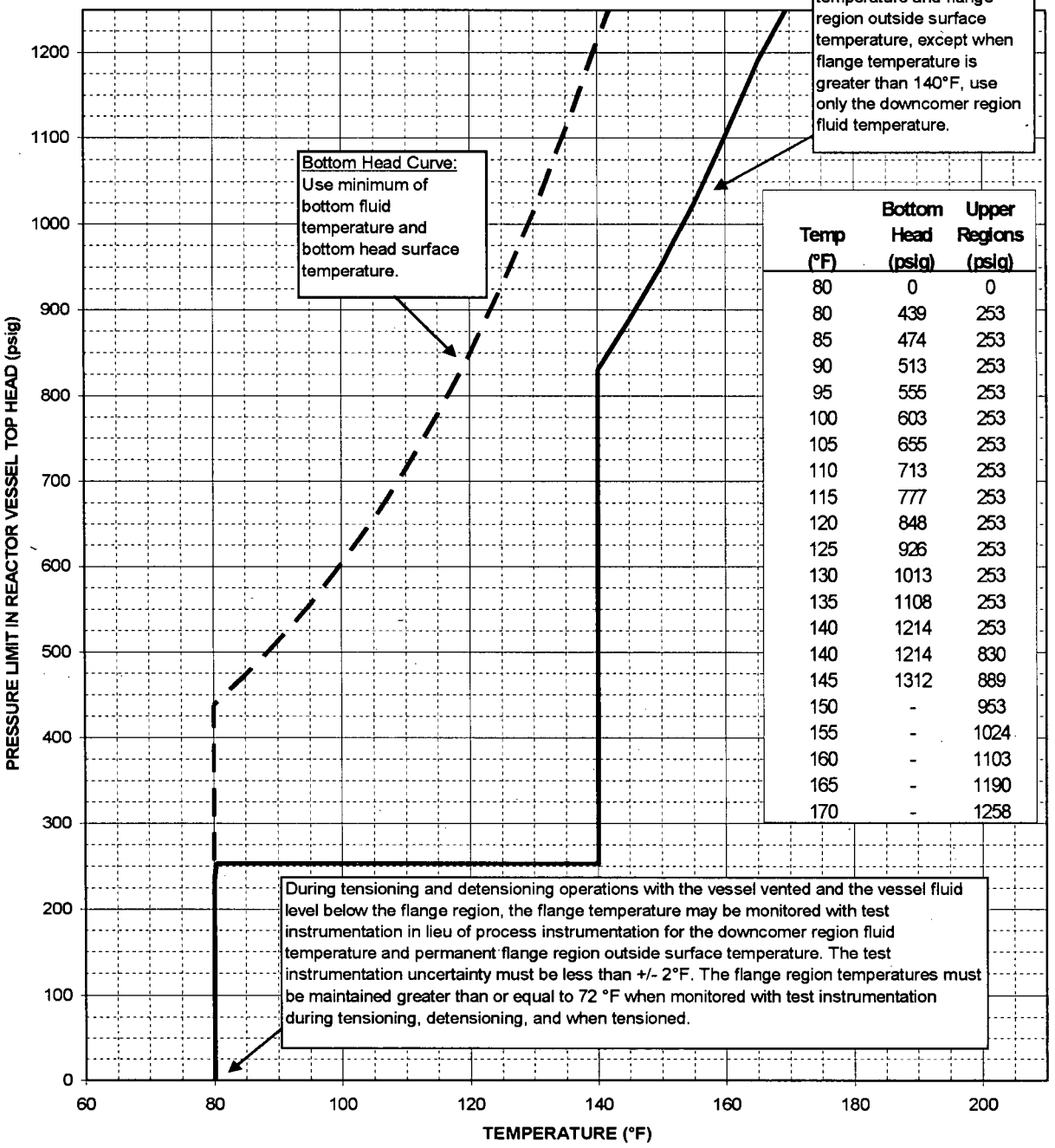


Temperature (°F)	Bottom Head (psig)	Upper Regions (psig)
80	0	0
80	665	253
85	712	253
90	764	253
95	821	253
100	885	253
105	954	253
110	1032	253
110	1032	842
115	1117	885
120	1211	932
125	1316	984
130	-	1042
135	-	1105
140	-	1175
145	-	1253

Figure 3.6.2

Reactor Vessel Pressure-Temperature Limitations
Normal Operation, Core Not Critical

100°F/hr Heatup/Cooldown Limit
Valid Through 7.943 E8 MWH(t)



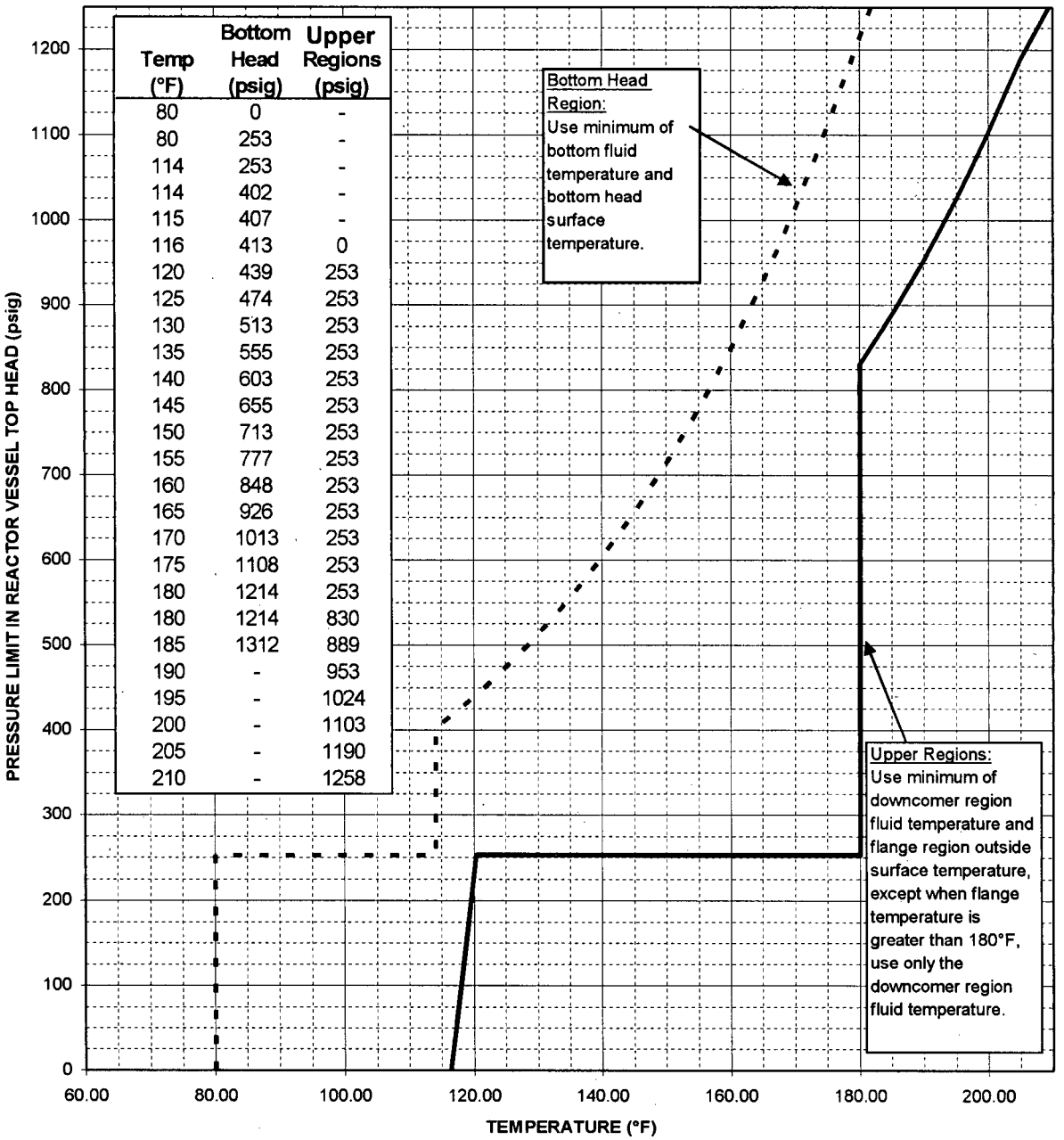
Temp (°F)	Bottom Head (psig)	Upper Regions (psig)
80	0	0
80	439	253
85	474	253
90	513	253
95	555	253
100	603	253
105	655	253
110	713	253
115	777	253
120	848	253
125	926	253
130	1013	253
135	1108	253
140	1214	253
140	1214	830
145	1312	889
150	-	953
155	-	1024
160	-	1103
165	-	1190
170	-	1258

Figure 3.6.3

Reactor Vessel Pressure-Temperature Limitations
Normal Operation, Core Critical

100°F/hr Heatup/Cooldown Limit
If Pressure < 253 psig, Water Level must be within
Normal Range for Power Operation
Valid Through 7.943 E8 MWH(t)

Temp (°F)	Bottom Head (psig)	Upper Regions (psig)
80	0	-
80	253	-
114	253	-
114	402	-
115	407	-
116	413	0
120	439	253
125	474	253
130	513	253
135	555	253
140	603	253
145	655	253
150	713	253
155	777	253
160	848	253
165	926	253
170	1013	253
175	1108	253
180	1214	253
180	1214	830
185	1312	889
190	-	953
195	-	1024
200	-	1103
205	-	1190
210	-	1258



BASES:

3.6 and 4.6 REACTOR COOLANT SYSTEM

A. Pressure and Temperature Limitations

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