3/4 LIMITING CONDITIONS FOR OPERATION AND SURVEILLANCE REQUIREMENTS

3/4.0 APPLICABILITY

LIMITING CONDITION FOR OPERATION

3.0.1 Compliance with the Limiting Conditions for Operation contained in the succeeding specifications is required during the OPERATIONAL MODES or other conditions specified therein; except that upon failure to meet the Limiting Conditions for Operation, the associated ACTION requirements shall be met.

3.0.2 Noncompliance with a specification shall exist when the requirements of the Limiting Condition for Operation and/or associated ACTION requirements are not met within the specified time intervals. If the Limiting Condition for Operation is restored prior to expiration of the specified time intervals, completion of the ACTION requirements is not required.

3.0.3 When a Limiting Condition for Operation is not met, except as provided in the associated ACTION requirements, within 1 hour, action shall be initiated to place the unit in a MODE in which the specification does not apply by placing it, as applicable, in:

1. At least HOT STANDBY within the next 6 hours, AND
~~2. At least HOT SHUTDOWN within the following 6 hours; and~~
2.3. At least COLD SHUTDOWN within the ~~subsequent 24~~ FOLLOWING 30 hours.

Where corrective measures are completed that permit operation under the ACTION requirements, ~~the ACTION~~ may be taken in accordance with the specified time limits as measured from the time of failure to meet the Limiting Condition for Operation. Exceptions to these requirements are stated in the individual specifications.

This specification is not applicable in MODE 5 or 6.

3.0.4 Entry into an OPERATIONAL MODE or other specified condition shall not be made unless the conditions of the Limiting Condition for Operation are met without reliance on provisions contained in the ACTION requirements. This provision shall not prevent passage through or to OPERATIONAL MODES as required to comply with ACTION statements. Exceptions to these requirements are stated in the individual specifications.

3/4.0 APPLICABILITY

BASES

The specifications of this section provide the general requirements applicable to each of the Limiting Conditions for Operation and Surveillance Requirements within Section 3/4.

3.0.1 This specification defines the applicability of each specification in terms of defined OPERATIONAL MODES or other specified conditions and is provided to delineate specifically when each specification is applicable.

3.0.2 This specification defines those conditions necessary to constitute compliance with the terms of an individual Limiting Condition for Operation and associated ACTION requirement.

3.0.3 This specification delineates the measures to be taken for circumstances not directly provided for in the ACTION statements and whose occurrence would violate the intent of a specification. For example, Specification 3.6.2.1 requires two containment spray systems to be OPERABLE and provides explicit ACTION requirements if one spray system is inoperable. Under the terms of Specification 3.0.3, if both of the required containment spray systems are inoperable, within 1 hour measures must be initiated to place the unit in at least HOT STANDBY within the next 6 hours, ~~in at least HOT SHUTDOWN within the following 6 hours,~~ and in COLD SHUTDOWN in the ~~subsequent 24~~ FOLLOWING 30 hours.

3.0.4 This specification provides that entry into an OPERATIONAL MODE or other specified applicability condition must be made with (a) the full complement of required systems, equipment, or components OPERABLE and (b) all other parameters as specified in the Limiting Conditions for Operation being met without regard for allowable deviations and out of service provisions contained in the ACTION statements.

The intent of this provision is to ensure that facility operation is not initiated with either required equipment or systems inoperable or other specified limits being exceeded.

Exceptions to this specification have been provided for a limited number of specifications when startup with inoperable equipment would not affect plant safety. These exceptions are stated in the ACTION statements of the appropriate specifications.

3/4 LIMITING CONDITIONS FOR OPERATION AND SURVEILLANCE REQUIREMENTS

3/4.0 APPLICABILITY

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Exceptions to this specification have been provided for a limited number of specifications when startup with inoperable equipment would not affect plant safety. These exceptions are stated in the ACTION statements of the appropriate specifications.

ENGINEERING EVALUATION REQUEST

EER NUMBER: 86-RC-118

INITIATOR/EXT/STA: Karl W. Gross/6894/6135 KWDR

PAGE 1 of 17 pgs attached

DATE: 6/10/86 | SYS: RC | CLASS [X] QR [ ] NQR | UNIT/LOCATION: 1, 2, 3

COMPONENT ID #: Overall System

REFERENCE DOCUMENTS: Technical Specifications

INITIATION

PROBLEM DESCRIPTION: The NRC has requested information regarding how fast the RCS can be cooled from 565° to 350° (Mode 3, HZP - Mode 4), with the minimum required equipment. Assume that two charging pumps are operable, no HPSI, letdown maintained at as low a level as operationally appropriate to maintain boronometer, rad mon etc. operation. Compare the system shrinkage to the net charging available. Provide copies of all calculations to document the results.

Condition/information addressed/requested is a VALID concern.

Initiator's Supervisor: [signature] Date: 6/19/86

SUGGESTED RESOLUTION:
Calculate the system shrinkage from the steam tables and the delta T, assume that two charging pumps are operable (1 train of power available), and maintain the system within the appropriate P-T curves. Determine how long it will take to inject enough water to maintain control of the pressurizer level, and all other normal functions. This calculation will be used as a basis for requesting possible Tech. Spec. action statement changes. Provide copies of all documents.

RESOLUTION

DISPOSITION: A calculation has been performed to determine the the cooldown rate in the RCS from 565°F to 350°F under normal conditions. The calculation and associated assumptions are attached. The calculation was done analyzing each hour of the cooldown separately. The total cooldown time was determined to be 5 hours and 36 minutes The hourly maximums are:

NSSS/Burke Corp

[ ] CONTINUED ON PAGE 2

TYPE OF DISPOSITION
- [ ] REPAIR
- [ ] ACCEPT AS IS
- [ ] REWORK
- [ ] SCRAP
- [X] INFO ONLY
- [ ] OTHER _____

PROBLEM CONDITION:
- [ ] OUT OF TOLERANCE
- [ ] PERSONNEL SAFETY
- [ ] ENVIROMENTAL
- [X] N/A

MODE RESTRAINT: 8

TRANSFER TO: NA

APPROVAL

SYSTEM ENGINEER/DATE: [signature] 6/19/86

SUPERVISOR/DATE: [signature] 6-19-86

ENG. MANAGER/DATE: N/A

EER COORDINATOR/DATE (CLOSURE): [signature] 6/19/86

FOR INFORMATION ONLY

INITIATION

PROBLEM DESCRIPTION (cont'd)

See page 1

RESOLUTION

RESOLUTION (cont'd)

29°F/hr	1st hour	565-536°F
33°F/hr	2nd hour	536-503°F
36°F/hr	3rd hour	503-467°F
41°F/hr	4th hour	467-426°F
46°F/hr	5th hour	426-380°F
52°F/hr	6th hour	380-328°F

(36 minutes to go from 380°F to 350°F)

For comparison, if letdown was assumed isolated the following results:

1st hour cooldown = 565°F to 514°F ⇒ 51°F/hr.

FOR INFORMATION ONLY

ENGINEERING EVALUATION REQUEST | EER NUMBER: 1CV-96-RC-118

INITIATION

PROBLEM DESCRIPTION (cont'd) | PAGE 3 of 7

See page 1

RESOLUTION

RESOLUTION (cont'd) CALCULATION

For this analysis the following assumptions were made:
Charging Flow = 88gpm
Letdown Flow = 30gpm
Controlled Bleedoff Flow = 12gpm
Seal Injection = 26gpm
The difference between seal injection and controlled bleedoff (14gpm) is assumed to enter the RCS.
The net flow to the RCS = 88-30-12 = 46gpm
44gpm will be used to account for higher controlled bleedoff flow.
The pressurizer is at 50% level and that level is to maintained for this calculation (actually the level can go to ~20%).
Letdown flow is initially set to minimum 30gpm at the start of the cooldown.
Charging flow temperature prior to entering the regen. heat exchanger = 120°F.
The analysis accounts for system shrinkage by using the density differences at different temperatures.

ENGINEERING EVALUATION REQUEST | EER NUMBER: [illegible]-RC-118

PROBLEM DESCRIPTION (cont'd) | PAGE 4 of 7

INITIATION

See page 1

RESOLUTION

RESOLUTION (cont'd)

Net charging flow (44gpm) will expand when it enters the RCS. This expansion is accounted for in the calculation through the use of a correction factor which is the ratio of the density of water at 120°F and water at the average temperature of the RCS during each portion of the cooldown. For example, the density of water at 565°F = 44.94 lbm/ft³ and at 525°F it is 47.51 (assuming a 40°F drop in the first hour). Therefore the average density = 46.2 lbm/ft.³ The correction factor

$$= \frac{61.71 \text{ lbm/ft}^3 \text{ (density at 120°F)}}{46.2 \text{ lbm/ft}^3 \text{ (density average from 565 to 525)}} = 1.34$$

During the first hour the charging pumps net flow to the RCS = 44 gal/min × 60 min/hr × 1.34 = 3537 gal/hr

In general terms makeup flow (net) =

$$\frac{44 \frac{\text{gal}}{\text{min}} \times \frac{60 \text{ min}}{\text{hr}} \times 61.71 \text{ lbm/ft}^3}{\left(\frac{1}{X}+\frac{1}{Y}\right)/2 \text{ lbm/ft}^3}$$

X = specific volume of water at the beginning of the interval.
Y = specific volume of water at the end of the interval.

FOR INFORMATION ONLY

INITIATION

PROBLEM DESCRIPTION (cont'd)

See page 1.

RESOLUTION

RESOLUTION (cont'd)

Shrinkage of the RCS (gallons) =

(Change in density of water per interval) × (Vol. of RCS − ½ Pzr Vol.) / (8.33 lbm/gal (correction for temp.))

Volume of RCS = 12,352 ft³ (Ref. EER 85-RC-118)

½ Pzr Volume = 900 ft³ (subtract; only using 50% of pzr)

Total = 11,452 ft³

$$\text{Shrinkage} = \left(\frac{1}{Y} - \frac{1}{X}\right)\left(\frac{11{,}452}{8.33}\right)\left(\frac{62.37}{\left(\frac{1}{X}+\frac{1}{Y}\right)12}\right)$$

← correction factor for temp.

8.33 lbm/gal is valid at 60°F. 62.37 = density of water at 60°F.

Shrinkage = Makeup (to ensure constant pzr level)

$$\left(\frac{1}{Y} - \frac{1}{X}\right)\left(\frac{11{,}452}{8.33}\right)\left(\frac{62.37}{\left(\frac{1}{X}+\frac{1}{Y}\right)12}\right) = (44)(60)\frac{(61.71)}{\left(\frac{1}{X}+\frac{1}{Y}/2\right)}$$

$$\frac{1}{Y} - \frac{1}{X} = \frac{8.33(44)(60)(61.71)}{11{,}452\ (62.37)} = 1.9$$

$$\frac{1}{Y} - \frac{1}{X} = 1.9$$

FOR INFORMATION ONLY

ENGINEERING EVALUATION REQUEST

EER NUMBER: 96-RC-118

INITIATION

PROBLEM DESCRIPTION (cont'd)

See page 1

RESOLUTION

RESOLUTION (cont'd)

at 565°F $x = .02225$ $\frac{1}{x} = 44.94$

$\frac{1}{y} = 1.9 + 44.94 = 46.84$

$y = .02134$ which corresponds to 536°F

$\Delta T = 565 - 536 = 29°F/hr$ for the first hour.

at 536°F $x = .02134$ $\frac{1}{x} = 46.86$

$\frac{1}{y} = 1.9 + 46.84 = \cancel{48.75}$ 48.75 Decimal.

$y = .02051$ which corresponds to 503°F

$\Delta T = 536 - 503 = 33°F/hr$ for the second hour.

at 503°F $x = .02051$ $y = (1.9 + 48.75)^{-1}$

$y = .01974$ which corresponds to 467°F

$\Delta T = 503 - 467 = 36°F/hr$ for the third hour

at 467°F $x = .01974$ $y = (1.9 + 50.6567)^{-1}$

$y = .019027$ which corresponds to 426°F

$\Delta T = 467 - 426 = 41°F/hr$ for the fourth hour.

FOR INFORMATION ONLY

ENGINEERING EVALUATION REQUEST | EER NUMBER: 86-RC-118

PROBLEM DESCRIPTION (cont'd) | PAGE 7 of 7

INITIATION

See page 1

RESOLUTION

RESOLUTION (cont'd)

at 426°F $x = .01927$ $y = (1.9 + 52.5567)^{-1}$

$y = .01836$ which corresponds to 380°F

$\Delta T = 426 - 380 = 46°F/hr$ for the fifth hour.

---

at 380°F $x = .01836$ $y = (1.9 + 54.46)^{-1} = (56.36)^{-1}$

$y = .01774$ which corresponds to 328°F

$\Delta T = 380 - 328 = 52°F/hr$ for the sixth hour.

To go from 380°F to 350°F

$$\frac{1}{y} - \frac{1}{x} = 55.5864 - 54.4567 = 1.1297$$

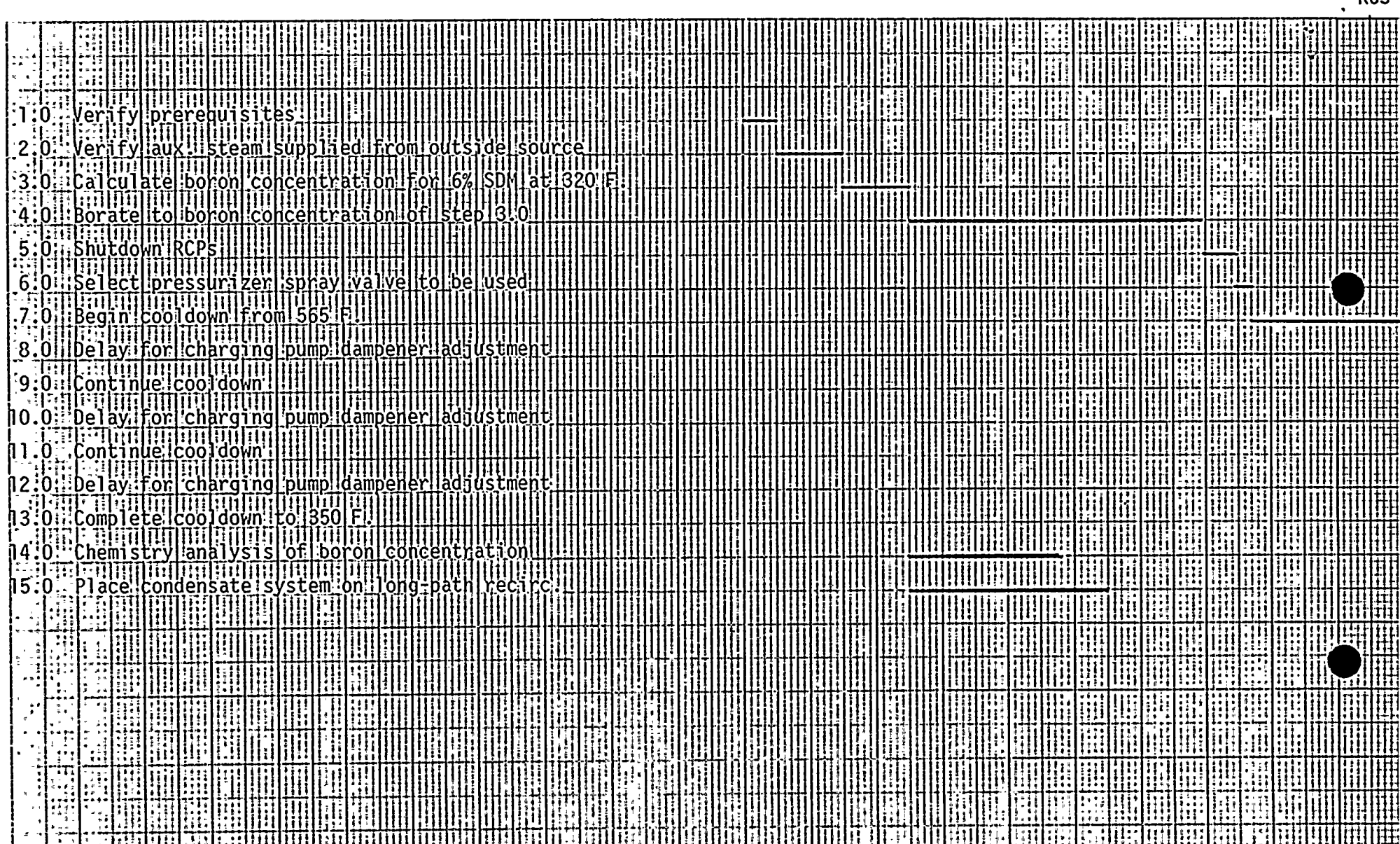
Ratio $\frac{1.1297}{1.9} = \frac{X \text{ minutes}}{60 \text{ minutes}}$ $X = 35.7$ minutes.

Therefore the cooldown from 565°F to 350°F (with the assumptions described) is 5 hours and 36 minutes.

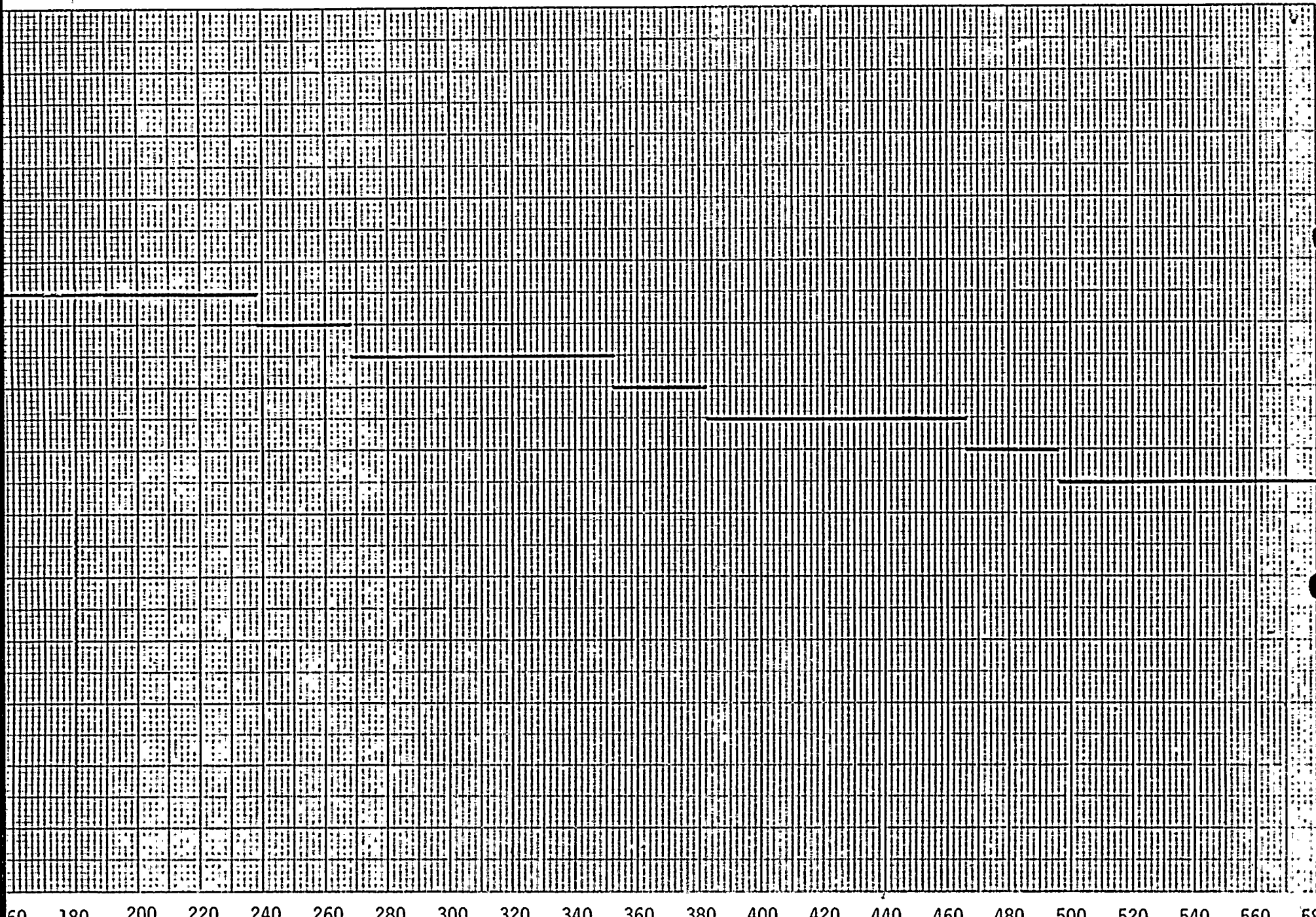
Calculation performed by JJ Conyras 6/19/86

Calculation reviewed by MO Lowlyfes 6/19/86

FOR INFORMATION ONLY


1.0 Verify prerequisites
2.0 Verify aux. steam supplied from outside source
3.0 Calculate boron concentration for 6% SDM at 320 F.
4.0 Borate to boron concentration of step 3.0
5.0 Shutdown RCPs
6.0 Select pressurizer spray valve to be used
7.0 Begin cooldown from 565 F.
8.0 Delay for charging pump dampener adjustment
9.0 Continue cooldown
10.0 Delay for charging pump dampener adjustment
11.0 Continue cooldown
12.0 Delay for charging pump dampener adjustment
13.0 Complete cooldown to 350 F.
14.0 Chemistry analysis of boron concentration
15.0 Place condensate system on long-path recirc.
0
20
40
60
80
100
120
140
160
180

RCS COOLDOWN TIMELINE



Assumptions:

RCS Conditions: Temperature - NOT
Pressure - NOP
Mode 3
4 RCP's running

CH Conditions: 2 Charging Pumps available - discharge pulsation dampeners set @1500 psig.

Feed Conditions: S/G's being fed from Aux. Feedwater Pumps.

CD Conditions: Normal Condensate lineup with two condensate pumps running.

The problem is to perform a plant cooldown from Mode 3 (approx. 565^{0}F) to Mode 4 (approx. 350^{0}F) within the 7 hours directed by 3.0.3 of Tech. Specs. A step-by-step (cookbook) type of cooldown will be given first as an example and then a more practicle type of cooldown will be given as an example.

1.0 4XOP-XZZ10, HOT STANDBY TO COLD SHUTDOWN MODE 3 TO MODE 5

SECTION 4.0
STEP #
4.2 PREREQUISITES

4.2.1 Verify RCS temperature is less than 564^{0}F and is being maintained by SBCS of ADV's.

4.2.2 Verify S/G levels are being maintained with Main or Aux Feed.

4.2.3 Verify Pressurizer level control is Auto and approx. 50%.

4.2.4 Verify either 4XRO-XZZ01, Reactor Trip Recovery or 4XOP-XZZ08, Reactor Shutdown procedure has been performed.

4.2.5 Verify CPC's bypassed.

4.2.6 Verify trip switchgear breakers open unless used for testing.

The preceeding prerequistie steps basically do not take up much time . Therefore, *10* minutes are alloted to complete these steps.

4.2.7 Verify Aux. Steam is being supplied from an outside source. (i.e., from the other unit(s) or from the Aux. Boilers).

4.2.8 Notify Chemistry to sample the RCS to determine the need for degassing.

Step 4.2.8 does not delay the cooldown. However, step 4.2.7 requires approx. *20* minutes to perform. This assumes that the other unit(s) are available. If the Aux. Boilers are required to be started, then an additional 30 minutes should be added to the time necessary to get Aux. Steam on an outside source.

4.3 Instructions

4.3.1 De-gas the RCS if desired. **This step takes approximately 48 hours and can be done concurrently with the cooldown.**

4.3.2 Calculate the boron concentration necessary for 6% shutdown margin for RCS temperature of approx. 320^{0}F. **This step takes approximately *20* minutes to complete.**

4.3.3 Commence borating the RCS to the boron concentration determined in step 4.3.2. **This step takes approximately *89* minutes to complete.**

4.3.4 Chemistry analysis of boron concentration. **This step takes approximately *45* minutes to complete.**

4.3.5 Start using or continue using Aux. Feedwater Pumps to maintain S/G level. **Aux. Feed is assumed to be in service. Therefore, no time is used on this step.**

4.3.6 Shutdown Main Feedwater Pumps. **Main Feed Pumps assumed to be shutdown. Therefore, no time is used on this step.**

4.3.7 Notify Chemistry about placing Feedwater and Condensate on long-path recirc. **This step uses no time.**

4.3.8 Place Condensate system on long-path recirc. **This step takes approximately *60* minutes to complete.**

4.3.9 through 4.3.13 These steps pertain to adjusting the Charging Pump Pulsation Dampeners. These will be addressed later.

4.3.14 Shutdown the RCP's. This step takes approximately *10* minutes to complete.

4.3.15 Select the pressurizer spray valve to be used. This step takes approximately *5* minutes to complete.

4.3.16 Notify RP if atmospheric dumps are to be used for the cooldown. This step uses no time.

4.3.17 Establish a cooldown rate. This step begins the actual cooldown.

Using a step-by-step method in following this procedure, it takes approximately *4 hours and 19 minutes* to begin the cooldown. This, combined with the amount of time required to actually perform the cooldown, precludes complying with 3.0.3 of Tech. Specs.

As mentioned earlier, the Charging Pump Pulsation dampeners have to be adjusted during a cooldown/depressurization. This extends the time required to get to the cooldown step an additional *30* minutes. Also, these adjustments extend the overall cooldown time by an additional *90 to 120* minutes.