PSEG NUCLEAR L.L.C.
SALEM/OPERATIONS

S2.OP-AB.RHR-0002(Q) - REV. 14

LOSS OF RHR AT REDUCED INVENTORY

- Biennial Review Performed: Yes ____ No _√_
- Change Package(s) and Affected Document Number(s) incorporated into this revision:
- OTSC(s) incorporated into this Revision: None

REVISION SUMMARY

The following changes were incorporated into this revision:

- Revised curves in Attachments 2, 3 and 4 to align with Revision 0 of S-2-RC-MDC-2112, Loss of RHR During Refueling Outage. This change was incorporated to ensure technical correctness for existing plant parameters as delineated in S-2-RC-MDC-2112, and is considered editorial in nature. Due to the extent of changes in Attachments 2 through 4, revision bars were not utilized to indicate changes. **[70060456-0030]**

- Incorporated the following curves to provide guidance regarding RCS heatup following a loss of RHR after 40 days. This change was incorporated in response to operator feedback, and is considered editorial in nature as these curves were previously reviewed and approved in Rev. 11 of this procedure. Additionally, revised the 1000 day curves to indicate "100 - 1000 days" versus "0 - 1000 days". Due to the extent of changes in Attachment 2, revision bars were not utilized to indicate changes. **[70056400-0020]**

  - Attachment 2 (Page 4 of 10) - TIME TO REACH CORE BOILING AFTER LOSS OF RHR (BEFORE REFUELING 40 TO 100 DAYS)

  - Attachment 2 (Page 9 of 10) - TIME TO REACH CORE BOILING AFTER LOSS OF RHR (AFTER REFUELING 40 TO 100 DAYS)

IMPLEMENTATION REQUIREMENTS Effective Date 10/13/06

None

APPROVED: _____ 10-13-06
Operations Director - Salem **Date**

SELECTED CAS ITEMS

- IF AT ANY TIME, a complete loss of power to all vital buses occurs,
  THEN **PERFORM** Attachment 7, Steam Generator Reflux Cooling With Gravity Feed From RWST, while continuing with this procedure.

- IF the Unit is in Mode 5 OR 6,
  THEN **INITIATE** Containment Closure IAW S2.OP-AB.CONT-0001(Q), Containment Closure.

- **IF AT ANY TIME**, RWST LO level alarm actuates AND Containment Sump level is >62%,
  THEN **ALIGN** intact RHR train(s) to containment sump IAW Attachment 9, Cold Leg Recirculation.

- **IF AT ANY TIME**, Core Exit TCs are ≥200°F,
  THEN **PERFORM** the following before continuing with this procedure:

  A. **PERFORM** Attachment 5, Hot Leg Injection to cool the core.

  B. IF Core Exit TCs continue to rise,
  THEN **PERFORM** Attachment 6, Cold Leg Injection to cool the core.

- **IF AT ANY TIME**, a Charging or SI pump cannot be aligned and started to make up to the RCS,
  THEN **ESTABLISH** RWST Gravity Feed as follows:

  A. **PLACE** 2RP4 lockout switch in VALVE OPERABLE AND **OPEN** 2SJ69, RHR Suction From RWST.

  B. **CLOSE** 2SJ69 when RCS level is >97.5 ft

* Refer to EXHIBIT 1 for briefing sheet

LOSS OF RHR AT REDUCED INVENTORY

1.0 **ENTRY CONDITIONS** DATE: _____ TIME: _____

1.1 Any indication of a loss or reduction in RHR System cooling while operating with RCS aligned for operation at reduced inventory. (level ≤101 ft. elevation)

1.2 Any indication of a loss or reduction in RHR system cooling while performing Vacuum Refill of the RCS IAW S2.OP-SO.RC-0002(Q).

2.0 **IMMEDIATE ACTIONS**

2.1 None

3.0 **SUBSEQUENT ACTIONS**

___ 3.1 **INITIATE** Attachment 1, Continuous Action Summary.

NOTE

Uncontrolled RCS heatup which exceeds or rapidly approaches 200 degrees requires ECG entry AND may violate Technical Specification 3.5.3.

3.2 **CHECK** RHR cooling availability as follows:

A. Is any RHR Pump running or available?

___ YES ___ NO ——> **GO TO** Step 3.4

_____ Time

V

B. Is RCS level >97.5 foot elevation AND stable OR rising?

___ YES ___ NO ——> **GO TO** Step 3.3

_____ Time

V

___ C. **START** the available RHR Pump, if NOT running.

___ D. **ENSURE** RHR flow is between 1800 and 1900 gpm.

(step continued on next page)

SELECTED CAS ITEMS

- **IF AT ANY TIME**, a complete loss of power to all vital buses occurs,
  THEN **PERFORM** Attachment 7, Steam Generator Reflux Cooling With Gravity Feed From RWST, while continuing with this procedure.

- IF the Unit is in Mode 5 OR 6,
  THEN **INITIATE** Containment Closure IAW S2.OP-AB.CONT-0001(Q), Containment Closure.

- **IF AT ANY TIME**, RWST LO level alarm actuates AND Containment Sump level is >62%,
  THEN **ALIGN** intact RHR train(s) to containment sump IAW Attachment 9, Cold Leg Recirculation.

- **IF AT ANY TIME**, Core Exit TCs are ≥200°F,
  THEN **PERFORM** the following before continuing with this procedure:

  A. **PERFORM** Attachment 5, Hot Leg Injection to cool the core.

  B. IF Core Exit TCs continue to rise,
  THEN **PERFORM** Attachment 6, Cold Leg Injection to cool the core.

- **IF AT ANY TIME**, a Charging or SI pump cannot be aligned and started to make up to the RCS,
  THEN **ESTABLISH** RWST Gravity Feed as follows:

  A. **PLACE** 2RP4 lockout switch in VALVE OPERABLE AND **OPEN** 2SJ69, RHR Suction From RWST.

  B. **CLOSE** 2SJ69 when RCS level is >97.5 ft

* Refer to EXHIBIT 1 for briefing sheet

3.2 (continued)

___ E. RHR Pumps cavitating or gas bound:

- ♦ RHR motor amps oscillating
- ♦ RHR flow oscillating
- ♦ Report of abnormal noise or damage to both RHR Pumps
- ♦ RHR discharge pressure fluctuating
- ♦ RHR suction pressure fluctuating

___ YES ___ NO ——> **GO TO** Step 3.50

V

_____
Time

___ 3.3 **STOP** any running RHR Pumps.

___ 3.4 **ANNOUNCE** over the Containment paging system:

___ A. RHR cooling is stopped

___ B. All personnel stand clear of any RCS openings

___ C. All non-essential personnel evacuate the containment

___ 3.5 **ISOLATE** Letdown and any known drain paths:

- ♦ STOP 2 RHR Letdown Booster Pump
- ♦ Normal Letdown to CVCS
- ♦ RHR Letdown to CVCS
- ♦ Excess Letdown
- ♦ Sampling
- ♦ Terminate any known maintenance or testing in progress which could cause the loss of RCS or RHR inventory

___ 3.6 **DETERMINE** time to core boiling using:

- ♦ Attachment 2, Time to Core Boiling After Loss of RHR
- ♦ Attachment 3, Midloop Heatup Rate For Loss Of RHR Cooling

SELECTED CAS ITEMS

- **IF AT ANY TIME**, a complete loss of power to all vital buses occurs,
  THEN **PERFORM** Attachment 7, Steam Generator Reflux Cooling With Gravity Feed From RWST, while continuing with this procedure.

- IF the Unit is in Mode 5 OR 6,
  THEN **INITIATE** Containment Closure IAW S2.OP-AB.CONT-0001(Q), Containment Closure.

- **IF AT ANY TIME**, RWST LO level alarm actuates AND Containment Sump level is >62%,
  THEN **ALIGN** intact RHR train(s) to containment sump IAW Attachment 9, Cold Leg Recirculation.

- **IF AT ANY TIME**, Core Exit TCs are ≥200°F,
  THEN **PERFORM** the following before continuing with this procedure:

  A. **PERFORM** Attachment 5, Hot Leg Injection to cool the core.

  B. IF Core Exit TCs continue to rise,
  THEN **PERFORM** Attachment 6, Cold Leg Injection to cool the core.

- **IF AT ANY TIME**, a Charging or SI pump cannot be aligned and started to make up to the RCS,
  THEN **ESTABLISH** RWST Gravity Feed as follows:

  A. **PLACE** 2RP4 lockout switch in VALVE OPERABLE AND **OPEN** 2SJ69, RHR Suction From RWST.

  B. **CLOSE** 2SJ69 when RCS level is >97.5 ft

* Refer to EXHIBIT 1 for briefing sheet

3.7 Does the time to core boiling allow adequate time for normal restoration and local venting of RHR System?

___ YES ___ NO ——> **GO TO** Step 3.17

V

_____ Time

3.8 Is any RHR Pump available as indicated by ALL of the following? **[C0329]**

- ♦ Power available to at least one RHR Pump
- ♦ RHR Suction and Discharge valves open
  - ♦ 2RH1 (RHR COMMON SUCTION VALVE)
  - ♦ 2RH2 (RHR COMMON SUCTION VALVE)
  - ♦ 21RH4 (21 PUMP SUCTION VALVE)
  - ♦ 21SJ49 (21 RHR COLD LEG ISOLATION VALVE)
  - ♦ 22RH4 (22 PUMP SUCTION VALVE)
  - ♦ 22SJ49 (22 RHR COLD LEG ISOLATION VALVE)
- ♦ Component Cooling available to RHR System
- ♦ Service Water System available as heat sink

___ YES ___ NO ——> **GO TO** Step 3.30

V

_____ Time

CAUTION

Venting the RHR System may cause a reduction in RCS level requiring a larger makeup flowrate.

Any opening in the RCS boundary could result in release of high temperature fluids, radioactive water, or airborne activity to Containment.

___ 3.9 **SEND** Operators to VENT RHR Pumps and piping as follows: **[C0329]**

___ A. **RAISE** RCS level to >97.5 ft using normal charging or gravity feed.

(step continued on next page)

SELECTED CAS ITEMS

- **IF AT ANY TIME**, a complete loss of power to all vital buses occurs,
  THEN **PERFORM** Attachment 7, Steam Generator Reflux Cooling With Gravity Feed From RWST, while continuing with this procedure.

- IF the Unit is in Mode 5 OR 6,
  THEN **INITIATE** Containment Closure IAW S2.OP-AB.CONT-0001(Q), Containment Closure.

- **IF AT ANY TIME**, RWST LO level alarm actuates AND Containment Sump level is >62%,
  THEN **ALIGN** intact RHR train(s) to containment sump IAW Attachment 9, Cold Leg Recirculation.

- **IF AT ANY TIME**, Core Exit TCs are ≥200°F,
  THEN **PERFORM** the following before continuing with this procedure:

  A. **PERFORM** Attachment 5, Hot Leg Injection to cool the core.

  B. IF Core Exit TCs continue to rise,
  THEN **PERFORM** Attachment 6, Cold Leg Injection to cool the core.

- **IF AT ANY TIME**, a Charging or SI pump cannot be aligned and started to make up to the RCS,
  THEN **ESTABLISH** RWST Gravity Feed as follows:

  A. **PLACE** 2RP4 lockout switch in VALVE OPERABLE AND **OPEN** 2SJ69, RHR Suction From RWST.

  B. **CLOSE** 2SJ69 when RCS level is >97.5 ft

* Refer to EXHIBIT 1 for briefing sheet

3.9 (continued)

___ B. **OPEN** 2RH81 AND 2RH82, RHR Suction Line second high point vent, until steady stream of water flows (Mechanical Penetration area 78' elevation).

___ C. IF 2RH68 AND 2RH69, RHR Suction Line first high point vents are accessible,
THEN **OPEN** 2RH68 AND 2RH69, until steady stream of water flows (inside bioshield area inside containment).

___ D. **NOTIFY** Operator to remain in RHR Pump area until pump start is completed.

3.10 Can RCS Level be maintained >97.5 ft?

___ YES ___ NO ——> **GO TO** Step 3.30

V

Time

CAUTION

Lower flow rates when starting RHR Pumps are preferred to limit the initial sudden cooldown and to minimize level loss caused by collapsing voids.

Operating at low RHR System flowrates greatly reduces the risk of air entrainment (vortexing).

___ 3.11 **START** one RHR Pump as follows:

___ A. **CLOSE** appropriate RH18, RHR HX Flow Control Valve.

___ B. **CLOSE** 2RH20, RHR HX BYPASS CONTROL VALVE.

___ C. **RAISE** makeup flow to RCS to prevent level drop as voids collapse.

___ D. **START** the selected RHR Pump.

___ E. Slowly **OPEN** appropriate RH18 AND 2RH20 to establish RHR flow at 1800 to 1900 gpm through RHR Heat Exchanger.

SELECTED CAS ITEMS

- **IF AT ANY TIME**, a complete loss of power to all vital buses occurs,
  THEN **PERFORM** Attachment 7, Steam Generator Reflux Cooling With Gravity Feed From RWST, while continuing with this procedure.

- IF the Unit is in Mode 5 OR 6,
  THEN **INITIATE** Containment Closure IAW S2.OP-AB.CONT-0001(Q), Containment Closure.

- **IF AT ANY TIME**, RWST LO level alarm actuates AND Containment Sump level is >62%,
  THEN **ALIGN** intact RHR train(s) to containment sump IAW Attachment 9, Cold Leg Recirculation.

- **IF AT ANY TIME**, Core Exit TCs are ≥200°F,
  THEN **PERFORM** the following before continuing with this procedure:

  A. **PERFORM** Attachment 5, Hot Leg Injection to cool the core.

  B. IF Core Exit TCs continue to rise,
  THEN **PERFORM** Attachment 6, Cold Leg Injection to cool the core.

- **IF AT ANY TIME**, a Charging or SI pump cannot be aligned and started to make up to the RCS,
  THEN **ESTABLISH** RWST Gravity Feed as follows:

  A. **PLACE** 2RP4 lockout switch in VALVE OPERABLE AND **OPEN** 2SJ69, RHR Suction From RWST.

  B. **CLOSE** 2SJ69 when RCS level is >97.5 ft

* Refer to EXHIBIT 1 for briefing sheet

___ 3.12 **NOTIFY** local Operator to perform observation at RHR Pumps:

- ♦ No abnormal noise
- ♦ No seal damage
- ♦ No suction pressure oscillation

3.13 Is RHR System normal as indicated by ALL of the following?

- ♦ RCS level - greater than 97.5 ft. elevation and stable or rising
- ♦ RHR flow - stable at 1800 to 1900 gpm
- ♦ RCS temperature - stable or dropping
- ♦ Component Cooling available to RHR System
- ♦ Service Water available as heat sink
- ♦ No local indication of RHR Pump damage

___ YES ___ NO ——> **GO TO** Step 3.30

V

Time

___ 3.14 **COOLDOWN** the RCS to <140°F.

___ 3.15 **NOTIFY** the SM/CRS to refer to the following:

- ♦ Technical Specifications
- ♦ Event Classification Guide

___ 3.16 **GO TO** Section 4.0.

Time

SELECTED CAS ITEMS

- **IF AT ANY TIME**, a complete loss of power to all vital buses occurs,
  THEN **PERFORM** Attachment 7, Steam Generator Reflux Cooling With Gravity Feed From RWST, while continuing with this procedure.

- IF the Unit is in Mode 5 OR 6,
  THEN **INITIATE** Containment Closure IAW S2.OP-AB.CONT-0001(Q), Containment Closure.

- **IF AT ANY TIME**, RWST LO level alarm actuates AND Containment Sump level is >62%,
  THEN **ALIGN** intact RHR train(s) to containment sump IAW Attachment 9, Cold Leg Recirculation.

- **IF AT ANY TIME**, Core Exit TCs are ≥200°F,
  THEN **PERFORM** the following before continuing with this procedure:

  A. **PERFORM** Attachment 5, Hot Leg Injection to cool the core.

  B. IF Core Exit TCs continue to rise,
  THEN **PERFORM** Attachment 6, Cold Leg Injection to cool the core.

- **IF AT ANY TIME**, a Charging or SI pump cannot be aligned and started to make up to the RCS,
  THEN **ESTABLISH** RWST Gravity Feed as follows:

  A. **PLACE** 2RP4 lockout switch in VALVE OPERABLE AND **OPEN** 2SJ69, RHR Suction From RWST.

  B. **CLOSE** 2SJ69 when RCS level is >97.5 ft

* Refer to EXHIBIT 1 for briefing sheet

___ 3.17 **CONTINUE**

CAUTION

If adequate time is not available to completely vent entire RHR system at the high point vents and the RHR Pump and suction line are vented, the fastest way to restore RHR flow is to recover level in the RCS to ≥99 ft. AND sweep entrained air from the system by operating an RHR Pump at full flow. This method has the potential of causing pump damage OR a water hammer. If RHR venting is completed, RHR can be restarted at >98 ft.

___ 3.18 **SEND** an Operator to locally monitor RHR Pump while starting.

___ 3.19 **INITIATE** makeup to the RCS IAW Attachment 6, Cold Leg Injection.

___ 3.20 **RAISE** RCS level to >98 ft

___ 3.21 Attempt to **START** any available RHR Pump at full flow.

___ 3.22 **NOTIFY** local Operator to perform observation at RHR Pumps:

- ♦ No abnormal noise
- ♦ No seal damage
- ♦ No suction pressure oscillations

3.23 Is RHR System normal as indicated by ALL of the following?

- ♦ RHR Pumps - at least one running
- ♦ RCS level - greater than 97.5 ft. elevation and stable or rising
- ♦ RHR flow - stabilizing at between 1800 gpm and 1900 gpm
- ♦ RCS temperature - stable or dropping
- ♦ No local indication of RHR Pump damage

___ YES ___ NO ——> **GO TO** Step 3.30

V

_____
Time

___ 3.24 **ADJUST** appropriate RH18 valve to establish RHR flow between 1800 to 1900 gpm.

SELECTED CAS ITEMS

- **IF AT ANY TIME**, a complete loss of power to all vital buses occurs,
  THEN **PERFORM** Attachment 7, Steam Generator Reflux Cooling With Gravity Feed From RWST, while continuing with this procedure.

- IF the Unit is in Mode 5 OR 6,
  THEN **INITIATE** Containment Closure IAW S2.OP-AB.CONT-0001(Q), Containment Closure.

- **IF AT ANY TIME**, RWST LO level alarm actuates AND Containment Sump level is >62%,
  THEN **ALIGN** intact RHR train(s) to containment sump IAW Attachment 9, Cold Leg Recirculation.

- **IF AT ANY TIME**, Core Exit TCs are ≥200°F,
  THEN **PERFORM** the following before continuing with this procedure:

  A. **PERFORM** Attachment 5, Hot Leg Injection to cool the core.

  B. IF Core Exit TCs continue to rise,
  THEN **PERFORM** Attachment 6, Cold Leg Injection to cool the core.

- **IF AT ANY TIME**, a Charging or SI pump cannot be aligned and started to make up to the RCS,
  THEN **ESTABLISH** RWST Gravity Feed as follows:

  A. **PLACE** 2RP4 lockout switch in VALVE OPERABLE AND **OPEN** 2SJ69, RHR Suction From RWST.

  B. **CLOSE** 2SJ69 when RCS level is >97.5 ft

* Refer to EXHIBIT 1 for briefing sheet

___ 3.25 **ESTABLISH** stable or lowering Core Exit Thermocouple temperatures.

___ 3.26 **STABILIZE** RCS level at elevation 97.5 ft. or greater, as determined by the CRS.

___ 3.27 **COOLDOWN** the RCS to <140°F.

___ 3.28 **NOTIFY** the SM/CRS to refer to the following:

- Technical Specifications
- Event Classification Guide

___ 3.29 **GO TO** Section 4.0.

___ 3.30 **STOP** any running RHR Pumps. _____ Time

___ 3.31 **COMPLETE** evacuation of non-essential personnel in Containment.

CAUTION

Only Borated water should be added to the RCS to maintain adequate Shutdown Margin.

Any opening in the RCS boundary could result in release of high temperature fluids, radioactive water, or airborne activity to Containment.

Differences exist in RCS levels between active and inactive cold and hot legs during mid-loop operations. At saturated conditions, the hot and cold leg levels can vary by several feet.

___ 3.32 **INITIATE** cooldown of the Reactor Core using one of the alternate methods of decay heat removal:

- Attachment 5, Hot Leg Injection
  (Preferred method if Core Exit TCs ≥200°F)
- Attachment 6, Cold Leg Injection
  (Preferred method if Core subcooled)
- Attachment 7, Steam Generator Reflux Cooling With Gravity Feed From The RWST (This method should be use only if Hot Leg Injection or Cold Leg Injection cannot be established)

SELECTED CAS ITEMS

- **IF AT ANY TIME**, a complete loss of power to all vital buses occurs,
  THEN **PERFORM** Attachment 7, Steam Generator Reflux Cooling With Gravity Feed From RWST, while continuing with this procedure.

- IF the Unit is in Mode 5 OR 6,
  THEN **INITIATE** Containment Closure IAW S2.OP-AB.CONT-0001(Q), Containment Closure.

- **IF AT ANY TIME**, RWST LO level alarm actuates AND Containment Sump level is >62%,
  THEN **ALIGN** intact RHR train(s) to containment sump IAW Attachment 9, Cold Leg Recirculation.

- **IF AT ANY TIME**, Core Exit TCs are ≥200°F,
  THEN **PERFORM** the following before continuing with this procedure:

  A. **PERFORM** Attachment 5, Hot Leg Injection to cool the core.

  B. IF Core Exit TCs continue to rise,
  THEN **PERFORM** Attachment 6, Cold Leg Injection to cool the core.

- **IF AT ANY TIME**, a Charging or SI pump cannot be aligned and started to make up to the RCS,
  THEN **ESTABLISH** RWST Gravity Feed as follows:

  A. **PLACE** 2RP4 lockout switch in VALVE OPERABLE AND **OPEN** 2SJ69, RHR Suction From RWST.

  B. **CLOSE** 2SJ69 when RCS level is >97.5 ft

* Refer to EXHIBIT 1 for briefing sheet

___ 3.33 **NOTIFY** the SM/CRS to refer to the following:

- ♦ Technical Specifications
- ♦ Event Classification Guide

3.34 Is there indication of RCS leakage as indicated by any of the following? **[C0354]**

- ♦ Level rise in the RWST **[C0631]**
- ♦ Level drop in RCS prior to initiation of alternate decay heat removal methods
- ♦ Greater Containment Sump pumping frequency
- ♦ RHR SUMP OVRFLO alarms:
  - ♦ OHA C-26
  - ♦ OHA C-34
- ♦ RHR MIDLOOP SYS TRBL OHA D-47
- ♦ Reduced Inventory Instrumentation indicating RCS level drop (RVLIS or Mid-Loop, if in service).

___ YES ___ NO ——> **GO TO** Step 3.50

|
V

Time _____

___ 3.35 **ISOLATE** RHR as follows: **[C0354]**

___ A. **ENERGIZE** AND **CLOSE** RHR Common Suction Valves:

___ 1.0 2RH2 **[C0658]**

___ 2.0 2RH1

___ B. **PLACE** 2RP4 lockout switch for RHR Discharge to Cold Leg Valves in VALVE OPERABLE and CLOSE:

- ♦ 21SJ49
- ♦ 22SJ49

___ C. **SEND** an Operator to ensure 2RH21 is fully closed and locked. **[C0631]**

SELECTED CAS ITEMS

- **IF AT ANY TIME**, a complete loss of power to all vital buses occurs,
  THEN **PERFORM** Attachment 7, Steam Generator Reflux Cooling With Gravity Feed From RWST, while continuing with this procedure.

- IF the Unit is in Mode 5 OR 6,
  THEN **INITIATE** Containment Closure IAW S2.OP-AB.CONT-0001(Q), Containment Closure.

- **IF AT ANY TIME**, RWST LO level alarm actuates AND Containment Sump level is >62%,
  THEN **ALIGN** intact RHR train(s) to containment sump IAW Attachment 9, Cold Leg Recirculation.

- **IF AT ANY TIME**, Core Exit TCs are ≥200°F,
  THEN **PERFORM** the following before continuing with this procedure:

  A. **PERFORM** Attachment 5, Hot Leg Injection to cool the core.

  B. IF Core Exit TCs continue to rise,
  THEN **PERFORM** Attachment 6, Cold Leg Injection to cool the core.

- **IF AT ANY TIME**, a Charging or SI pump cannot be aligned and started to make up to the RCS,
  THEN **ESTABLISH** RWST Gravity Feed as follows:

  A. **PLACE** 2RP4 lockout switch in VALVE OPERABLE AND **OPEN** 2SJ69, RHR Suction From RWST.

  B. **CLOSE** 2SJ69 when RCS level is >97.5 ft

* Refer to EXHIBIT 1 for briefing sheet

3.36 Has the isolation of RHR stopped the leak in RCS as indicated by ANY of the following?

- ♦ RCS level (Tygon hose) rising at a faster rate
- ♦ Reactor Vessel Level rising at a faster rate
- ♦ Containment or RHR sumps pumping less frequently

___ YES ___ NO ——> **GO TO** Step 3.44

Time

V

___ 3.37 **SEND** Operators to locate AND **ISOLATE** the leak from RHR System.

NOTE

Isolating the leak from the RCS and the other train of RHR will allow placing one train of RHR back in service.

3.38 Is either train of RHR available for Shutdown Cooling?

___ NO ___ YES ——> **GO TO** Step 3.41

Time

V

___ 3.39 **CONTINUE** decay heat removal using alternate methods until RHR System is repaired and restored to service.

___ 3.40 **GO TO** Section 4.0.

Time

___ 3.41 **PLACE** the INTACT train of RHR in operation IAW S2.OP-SO.RHR-0001(Q), Initiating RHR.

___ 3.42 **SECURE** alternate decay heat removal method selected IAW Attachment in effect.

___ 3.43 **GO TO** Section 4.0.

Time

SELECTED CAS ITEMS

- **IF AT ANY TIME**, a complete loss of power to all vital buses occurs,
  THEN **PERFORM** Attachment 7, Steam Generator Reflux Cooling With Gravity Feed From RWST, while continuing with this procedure.

- IF the Unit is in Mode 5 OR 6,
  THEN **INITIATE** Containment Closure IAW S2.OP-AB.CONT-0001(Q), Containment Closure.

- **IF AT ANY TIME**, RWST LO level alarm actuates AND Containment Sump level is >62%,
  THEN **ALIGN** intact RHR train(s) to containment sump IAW Attachment 9, Cold Leg Recirculation.

- **IF AT ANY TIME**, Core Exit TCs are ≥200°F,
  THEN **PERFORM** the following before continuing with this procedure:

  A. **PERFORM** Attachment 5, Hot Leg Injection to cool the core.

  B. IF Core Exit TCs continue to rise,
  THEN **PERFORM** Attachment 6, Cold Leg Injection to cool the core.

- **IF AT ANY TIME**, a Charging or SI pump cannot be aligned and started to make up to the RCS,
  THEN **ESTABLISH** RWST Gravity Feed as follows:

  A. **PLACE** 2RP4 lockout switch in VALVE OPERABLE AND **OPEN** 2SJ69, RHR Suction From RWST.

  B. **CLOSE** 2SJ69 when RCS level is >97.5 ft

* Refer to EXHIBIT 1 for briefing sheet

___ 3.44 **SEND** Operators to perform the following steps concurrently:

CAUTION

Venting the RHR System may cause a reduction in RCS level requiring a larger makeup flowrate.

Any opening in the RCS boundary could result in release of high temperature fluids, radioactive water, or airborne activity to Containment.

___ A. **LOCATE** AND **ISOLATE** the leak, paying particular attention to locations of known maintenance or testing activities.

___ B. **VENT** RHR Pumps and piping as follows: **[C0329]**

___ 1. **ENERGIZE** AND **OPEN** RHR Common Suction Valves.

- 2RH1
- 2RH2

___ 2. **ENSURE** makeup is initiated to the RCS IAW step 3.32 (Attachment 5, 6, or 7).

___ 3. **RAISE** RCS level to >97.5 ft

___ 4. **OPEN** 2RH81 AND 2RH82, RHR Suction Line second high point vent, until steady stream of water flows (mechanical penetration area 78' elevation).

___ 5. IF 2RH68 AND 2RH69, RHR Suction Line first high point vents are accessible,
THEN **OPEN** 2RH68 AND 2RH69, until steady stream of water flows (inside bioshield area inside containment).

___ 6. **DE-ENERGIZE** RHR Common Suction Valves.

- 2RH1
- 2RH2

___ 7. **NOTIFY** Operator to remain in RHR Pump area until pump start completed.

SELECTED CAS ITEMS

- **IF AT ANY TIME**, a complete loss of power to all vital buses occurs,
  THEN **PERFORM** Attachment 7, Steam Generator Reflux Cooling With Gravity Feed From RWST, while continuing with this procedure.

- IF the Unit is in Mode 5 OR 6,
  THEN **INITIATE** Containment Closure IAW S2.OP-AB.CONT-0001(Q), Containment Closure.

- **IF AT ANY TIME**, RWST LO level alarm actuates AND Containment Sump level is >62%,
  THEN **ALIGN** intact RHR train(s) to containment sump IAW Attachment 9, Cold Leg Recirculation.

- **IF AT ANY TIME**, Core Exit TCs are ≥200°F,
  THEN **PERFORM** the following before continuing with this procedure:

  A. **PERFORM** Attachment 5, Hot Leg Injection to cool the core.

  B. IF Core Exit TCs continue to rise,
  THEN **PERFORM** Attachment 6, Cold Leg Injection to cool the core.

- **IF AT ANY TIME**, a Charging or SI pump cannot be aligned and started to make up to the RCS,
  THEN **ESTABLISH** RWST Gravity Feed as follows:

  A. **PLACE** 2RP4 lockout switch in VALVE OPERABLE AND **OPEN** 2SJ69, RHR Suction From RWST.

  B. **CLOSE** 2SJ69 when RCS level is >97.5 ft

* Refer to EXHIBIT 1 for briefing sheet

___ 3.45 When the leakage from the RCS is stopped, **RESTORE** RHR as follows:

___ A. **ESTABLISH** RCS level ≥97.5 ft.

CAUTION

Lower flow rates when starting RHR Pumps are preferable to limit the initial sudden cooldown and to minimize level loss caused by collapsing voids.

Operating at low RHR System flowrates during mid-loop conditions greatly reduces the risk of air entrainment (vortexing).

___ B. **OPEN** 21SJ49 AND 22SJ49, RHR DISCHARGE TO COLD LEG VALVES.

___ C. **START** one RHR Pump as follows:

___ 1. **CLOSE** applicable RH18, RHR HX FLOW CONTROL VALVE.

___ 2. **CLOSE** 2RH20, RHR HX BYPASS CONTROL VALVE.

___ 3. **ENSURE** applicable RH29, is in AUTO.

___ 4. **RAISE** makeup flow to RCS to prevent level drop as voids collapse.

___ 5. **START** the selected RHR Pump.

___ 6. Slowly **OPEN** appropriate RH18 AND 2RH20, to establish RHR flow between 1800 to 1900 gpm.

___ 7. **ESTABLISH** stable or lowering Core Exit Thermocouple temperatures.

___ D. **NOTIFY** local Operator to perform observation at RHR Pumps:

- ♦ No abnormal noise
- ♦ No seal damage
- ♦ No suction pressure oscillations

(step continued on next page)

SELECTED CAS ITEMS

- **IF AT ANY TIME**, a complete loss of power to all vital buses occurs,
  THEN **PERFORM** Attachment 7, Steam Generator Reflux Cooling With Gravity Feed From RWST, while continuing with this procedure.

- IF the Unit is in Mode 5 OR 6,
  THEN **INITIATE** Containment Closure IAW S2.OP-AB.CONT-0001(Q), Containment Closure.

- **IF AT ANY TIME**, RWST LO level alarm actuates AND Containment Sump level is >62%,
  THEN **ALIGN** intact RHR train(s) to containment sump IAW Attachment 9, Cold Leg Recirculation.

- **IF AT ANY TIME**, Core Exit TCs are ≥200°F,
  THEN **PERFORM** the following before continuing with this procedure:

  A. **PERFORM** Attachment 5, Hot Leg Injection to cool the core.

  B. IF Core Exit TCs continue to rise,
  THEN **PERFORM** Attachment 6, Cold Leg Injection to cool the core.

- **IF AT ANY TIME**, a Charging or SI pump cannot be aligned and started to make up to the RCS,
  THEN **ESTABLISH** RWST Gravity Feed as follows:

  A. **PLACE** 2RP4 lockout switch in VALVE OPERABLE AND **OPEN** 2SJ69, RHR Suction From RWST.

  B. **CLOSE** 2SJ69 when RCS level is >97.5 ft

* Refer to EXHIBIT 1 for briefing sheet

3.45 (continued)

E. Is RHR System normal as indicated by ALL of the following?

- ♦ RCS level - stable or rising
- ♦ RHR flow - stable at 1800 to 1900 gpm
- ♦ RCS temperature - stable or lowering
- ♦ Component Cooling - available to RHR System
- ♦ Service Water - available as heat sink
- ♦ No local indication of RHR Pump damage

___ NO ___ YES ——> **GO TO** Step 3.47

Time

V

___ 3.46 **RETURN TO** Step 3.1 for symptom rediagnosis or as directed by the CRS.

___ 3.47 **COOLDOWN** the RCS to <140°F.

___ 3.48 **SECURE** alternate decay heat removal method selected IAW Attachment in effect.

___ 3.49 **GO TO** Section 4.0.

Time

3.50 Is a heat sink available for Residual Heat Removal?

- ♦ Component Cooling to RHR System
- ♦ Service Water to Component Cooling System

___ YES ___ NO ——> **GO TO** Step 3.58

Time

V

SELECTED CAS ITEMS

- **IF AT ANY TIME**, a complete loss of power to all vital buses occurs,
  THEN **PERFORM** Attachment 7, Steam Generator Reflux Cooling With Gravity Feed From RWST, while continuing with this procedure.

- IF the Unit is in Mode 5 OR 6,
  THEN **INITIATE** Containment Closure IAW S2.OP-AB.CONT-0001(Q), Containment Closure.

- **IF AT ANY TIME**, RWST LO level alarm actuates AND Containment Sump level is >62%,
  THEN **ALIGN** intact RHR train(s) to containment sump IAW Attachment 9, Cold Leg Recirculation.

- **IF AT ANY TIME**, Core Exit TCs are ≥200°F,
  THEN **PERFORM** the following before continuing with this procedure:

  A. **PERFORM** Attachment 5, Hot Leg Injection to cool the core.

  B. IF Core Exit TCs continue to rise,
  THEN **PERFORM** Attachment 6, Cold Leg Injection to cool the core.

- **IF AT ANY TIME**, a Charging or SI pump cannot be aligned and started to make up to the RCS,
  THEN **ESTABLISH** RWST Gravity Feed as follows:

  A. **PLACE** 2RP4 lockout switch in VALVE OPERABLE AND **OPEN** 2SJ69, RHR Suction From RWST.

  B. **CLOSE** 2SJ69 when RCS level is >97.5 ft

* Refer to EXHIBIT 1 for briefing sheet

3.51 Is RHR flow stable?

___ NO ___ YES ——> **GO TO** Step 3.70

V

_____
Time

___ 3.52 **ATTEMPT** to stabilize RHR flow between 1800 to 1900 gpm using appropriate RH18 valve:

- 21RH18, RHR HX Flow Control Valve for 21 RHR PUMP
- 22RH18, RHR HX Flow Control Valve for 22 RHR PUMP

___ 3.53 IF RHR flow and RCS temperature can NOT be stabilized, THEN:

___ A. **CLOSE** appropriate RH18, RHR HX Flow Control Valve, on standby RHR Pump.

___ B. **STOP** the running RHR Pump.

___ C. **START** the standby RHR Pump.

___ D. Slowly **OPEN** appropriate RH18 to establish RHR flow between 1800 to 1900 gpm.

___ E. **ESTABLISH** stable or lowering Core Exit Thermocouple temperatures.

___ F. **ADJUST** Component Cooling flow to RHR Heat Exchangers between 4000 and 4200 gpm.

___ G. **SEND** an Operator to perform local observations at RHR Pumps:

- No abnormal noise
- No seal damage
- No suction pressure oscillations

SELECTED CAS ITEMS

- **IF AT ANY TIME**, a complete loss of power to all vital buses occurs,
  THEN **PERFORM** Attachment 7, Steam Generator Reflux Cooling With Gravity Feed From RWST, while continuing with this procedure.

- IF the Unit is in Mode 5 OR 6,
  THEN **INITIATE** Containment Closure IAW S2.OP-AB.CONT-0001(Q), Containment Closure.

- **IF AT ANY TIME**, RWST LO level alarm actuates AND Containment Sump level is >62%,
  THEN **ALIGN** intact RHR train(s) to containment sump IAW Attachment 9, Cold Leg Recirculation.

- **IF AT ANY TIME**, Core Exit TCs are ≥200°F,
  THEN **PERFORM** the following before continuing with this procedure:

  A. **PERFORM** Attachment 5, Hot Leg Injection to cool the core.

  B. IF Core Exit TCs continue to rise,
  THEN **PERFORM** Attachment 6, Cold Leg Injection to cool the core.

- **IF AT ANY TIME**, a Charging or SI pump cannot be aligned and started to make up to the RCS,
  THEN **ESTABLISH** RWST Gravity Feed as follows:

  A. **PLACE** 2RP4 lockout switch in VALVE OPERABLE AND **OPEN** 2SJ69, RHR Suction From RWST.

  B. **CLOSE** 2SJ69 when RCS level is >97.5 ft

* Refer to EXHIBIT 1 for briefing sheet

3.54 Is RHR System normal as indicated by ALL of the following?

- ♦ RHR Pumps - at least one running
- ♦ RCS level - stable or rising
- ♦ RHR flow - stable at 1800 to 1900 gpm
- ♦ RCS temperature - stable or lowering
- ♦ No local indication of RHR Pump damage

___ YES ___ NO ——> **GO TO** Step 3.58

V

Time

___ 3.55 **COOLDOWN** the RCS to <140°F.

___ 3.56 **NOTIFY** the SM/CRS to refer to the following:

- ♦ Technical Specifications
- ♦ Event Classification Guide

___ 3.57 **GO TO** Section 4.0.

Time

___ 3.58 **STOP** any running RHR Pumps.

___ 3.59 **ISOLATE** Letdown and any known drain paths:

- ♦ STOP 2 RHR Letdown Booster Pump
- ♦ Normal Letdown to CVCS
- ♦ RHR Letdown to CVCS
- ♦ Excess Letdown
- ♦ Sampling activities
- ♦ Any known maintenance or testing in progress at or near loop centerline elevation

___ 3.60 **DETERMINE** time to core boiling using:

- ♦ Attachment 2, Time to Core Boiling After Loss of RHR
- ♦ Attachment 3, Midloop Heatup Rate For Loss Of RHR Cooling

SELECTED CAS ITEMS

- **IF AT ANY TIME**, a complete loss of power to all vital buses occurs,
  THEN **PERFORM** Attachment 7, Steam Generator Reflux Cooling With Gravity Feed From RWST, while continuing with this procedure.

- IF the Unit is in Mode 5 OR 6,
  THEN **INITIATE** Containment Closure IAW S2.OP-AB.CONT-0001(Q), Containment Closure.

- **IF AT ANY TIME**, RWST LO level alarm actuates AND Containment Sump level is >62%,
  THEN **ALIGN** intact RHR train(s) to containment sump IAW Attachment 9, Cold Leg Recirculation.

- **IF AT ANY TIME**, Core Exit TCs are ≥200°F,
  THEN **PERFORM** the following before continuing with this procedure:

  A. **PERFORM** Attachment 5, Hot Leg Injection to cool the core.

  B. IF Core Exit TCs continue to rise,
  THEN **PERFORM** Attachment 6, Cold Leg Injection to cool the core.

- **IF AT ANY TIME**, a Charging or SI pump cannot be aligned and started to make up to the RCS,
  THEN **ESTABLISH** RWST Gravity Feed as follows:

  A. **PLACE** 2RP4 lockout switch in VALVE OPERABLE AND **OPEN** 2SJ69, RHR Suction From RWST.

  B. **CLOSE** 2SJ69 when RCS level is >97.5 ft

* Refer to EXHIBIT 1 for briefing sheet

___ 3.61 **EVACUATE** non-essential personnel in Containment.

___ 3.62 **CONTINUE.**

CAUTION

Only Borated water should be added to the RCS to maintain adequate Shutdown Margin.

Any opening in the RCS boundary could result in release of high temperature fluids, radioactive water, or airborne activity to Containment.

Differences exist in RCS levels between active and inactive cold and hot legs during mid-loop operations. At saturated conditions, the hot and cold leg levels can vary by several feet.

___ 3.63 **INITIATE** cooldown of the Reactor Core using one of the alternate methods of decay heat removal:

- Attachment 5, Hot Leg Injection
  (Preferred method if Core Exit TCs ≥200°F)
- Attachment 6, Cold Leg Injection
  (Preferred method if core subcooled)
- Attachment 7, Steam Generator Reflux Cooling With Gravity Feed From The RWST (This method should be use only if Hot Leg Injection or Cold Leg Injection cannot be established)

3.64 Is Component Cooling System available to RHR as indicated by the following?

- 21 RHR Heat Exchanger flow
- 22 RHR Heat Exchanger flow
- 21 RHR Pump Cooling flow (RHR PUMP CCW FLOW LO alarm clear, on 2CC1)
- 22 RHR Pump Cooling flow (RHR PUMP CCW FLOW LO alarm clear, on 2CC1)

___ NO ___ YES ——> **GO TO** Step 3.67

V

Time

SELECTED CAS ITEMS

- **IF AT ANY TIME**, a complete loss of power to all vital buses occurs,
  THEN **PERFORM** Attachment 7, Steam Generator Reflux Cooling With Gravity Feed From RWST, while continuing with this procedure.

- IF the Unit is in Mode 5 OR 6,
  THEN **INITIATE** Containment Closure IAW S2.OP-AB.CONT-0001(Q), Containment Closure.

- **IF AT ANY TIME**, RWST LO level alarm actuates AND Containment Sump level is >62%,
  THEN **ALIGN** intact RHR train(s) to containment sump IAW Attachment 9, Cold Leg Recirculation.

- **IF AT ANY TIME**, Core Exit TCs are ≥200°F,
  THEN **PERFORM** the following before continuing with this procedure:

  A. **PERFORM** Attachment 5, Hot Leg Injection to cool the core.

  B. IF Core Exit TCs continue to rise,
  THEN **PERFORM** Attachment 6, Cold Leg Injection to cool the core.

- **IF AT ANY TIME**, a Charging or SI pump cannot be aligned and started to make up to the RCS,
  THEN **ESTABLISH** RWST Gravity Feed as follows:

  A. **PLACE** 2RP4 lockout switch in VALVE OPERABLE AND **OPEN** 2SJ69, RHR Suction From RWST.

  B. **CLOSE** 2SJ69 when RCS level is >97.5 ft

* Refer to EXHIBIT 1 for briefing sheet

___ 3.65 **INITIATE** S2.OP-AB.CC-0001(Q), Component Cooling Abnormality.

___ 3.66 When Component Cooling is restored to RHR,

___ A. **ADJUST** Component Cooling flow to RHR components IAW S2.OP-SO.CC-0001(Q), Component Cooling System Normal Operation.

___ B. **RETURN** RHR to service IAW S2.OP-SO.RHR-0001(Q), Initiating RHR.

3.67 Is Service Water available as an ultimate heat sink for RHR cooling?

___ NO ___ YES ——> **GO TO** Step 3.70

V

Time

___ 3.68 **INITIATE** S2.OP-AB.SW-0001(Q), Loss of Service Water Header Pressure.

___ 3.69 When Service Water is restored:

___ A. **RETURN** RHR to normal operation IAW S2.OP-SO.RHR-0001(Q), Initiating RHR.

___ B. **PERFORM** Attachment 8, Step 8.0, Alternate Cooling Water to return components to normal.

3.70 Is RHR System normal as indicated by ALL of the following?

- ♦ RHR Pumps - at least one running
- ♦ RCS level - greater than 97.5 ft. and stable or rising
- ♦ RHR flow - stable at 1800 to 1900 gpm
- ♦ RCS temperature - stable or lowering

___ NO ___ YES ——> **GO TO** Step 3.72

V

Time

___ 3.71 **RETURN TO** Step 3.1 for symptom rediagnosis OR as directed by the CRS.

SELECTED CAS ITEMS

- **IF AT ANY TIME**, a complete loss of power to all vital buses occurs,
  THEN **PERFORM** Attachment 7, Steam Generator Reflux Cooling With Gravity Feed From RWST, while continuing with this procedure.

- IF the Unit is in Mode 5 OR 6,
  THEN **INITIATE** Containment Closure IAW S2.OP-AB.CONT-0001(Q), Containment Closure.

- **IF AT ANY TIME**, RWST LO level alarm actuates AND Containment Sump level is >62%,
  THEN **ALIGN** intact RHR train(s) to containment sump IAW Attachment 9, Cold Leg Recirculation.

- **IF AT ANY TIME**, Core Exit TCs are ≥200°F,
  THEN **PERFORM** the following before continuing with this procedure:

  A. **PERFORM** Attachment 5, Hot Leg Injection to cool the core.

  B. IF Core Exit TCs continue to rise,
  THEN **PERFORM** Attachment 6, Cold Leg Injection to cool the core.

- **IF AT ANY TIME**, a Charging or SI pump cannot be aligned and started to make up to the RCS,
  THEN **ESTABLISH** RWST Gravity Feed as follows:

  A. **PLACE** 2RP4 lockout switch in VALVE OPERABLE AND **OPEN** 2SJ69, RHR Suction From RWST.

  B. **CLOSE** 2SJ69 when RCS level is >97.5 ft

* Refer to EXHIBIT 1 for briefing sheet

___ 3.72 **NOTIFY** the SM/CRS to refer to the following:

- ♦ Technical Specifications
- ♦ Event Classification Guide

4.0 COMPLETION AND REVIEW

___ 4.1 **COMPLETE** Attachment 10, Sections 1.0 and 2.0, AND **FORWARD** this procedure to SM/CRS for review and approval.

___ 4.2 SM/CRS **PERFORM** the following:

___ A. **REVIEW** this procedure with Attachments 1 and 5 through 10 for completeness and accuracy.

___ B. **COMPLETE** Attachment 10, Section 3.0.

___ C. **FORWARD** completed procedure to Operations Staff.

END OF PROCEDURE

ATTACHMENT 1
(Page 1 of 1)

CONTINUOUS ACTION SUMMARY

CAUTION

Changes in RCS pressure or voiding in the Reactor Core may result in inaccuracies in RCS level indication.

___ 1.0 **IF AT ANY TIME**, a complete loss of power to all vital buses occurs,
THEN **PERFORM** Attachment 7, Steam Generator Reflux Cooling With Gravity Feed From RWST, while continuing with this procedure.

___ 2.0 **IF AT ANY TIME** the Unit is in Mode 5 OR 6, **[C0330]**
THEN **INITIATE** Containment Closure IAW S2.OP-AB.CONT-0001(Q), Containment Closure.

___ 3.0 **IF AT ANY TIME**, the loss of RHR cooling is due to a complete loss of Service Water or Component Cooling as a heat sink,
THEN **ALIGN** alternate water sources IAW Attachment 8, Alternate Cooling Water, while continuing with this procedure.

___ 4.0 **IF AT ANY TIME**, RWST LO Level Alarm actuates AND Containment Sump level is >62%,
THEN **ALIGN** intact RHR train(s) to containment sump IAW Attachment 9, Cold Leg Recirculation.

___ 5.0 **IF AT ANY TIME**, Core Exit TCs are ≥200°F,
THEN **PERFORM** the following before continuing with this procedure:

___ A. **PERFORM** Attachment 5, Hot Leg Injection to cool the core.

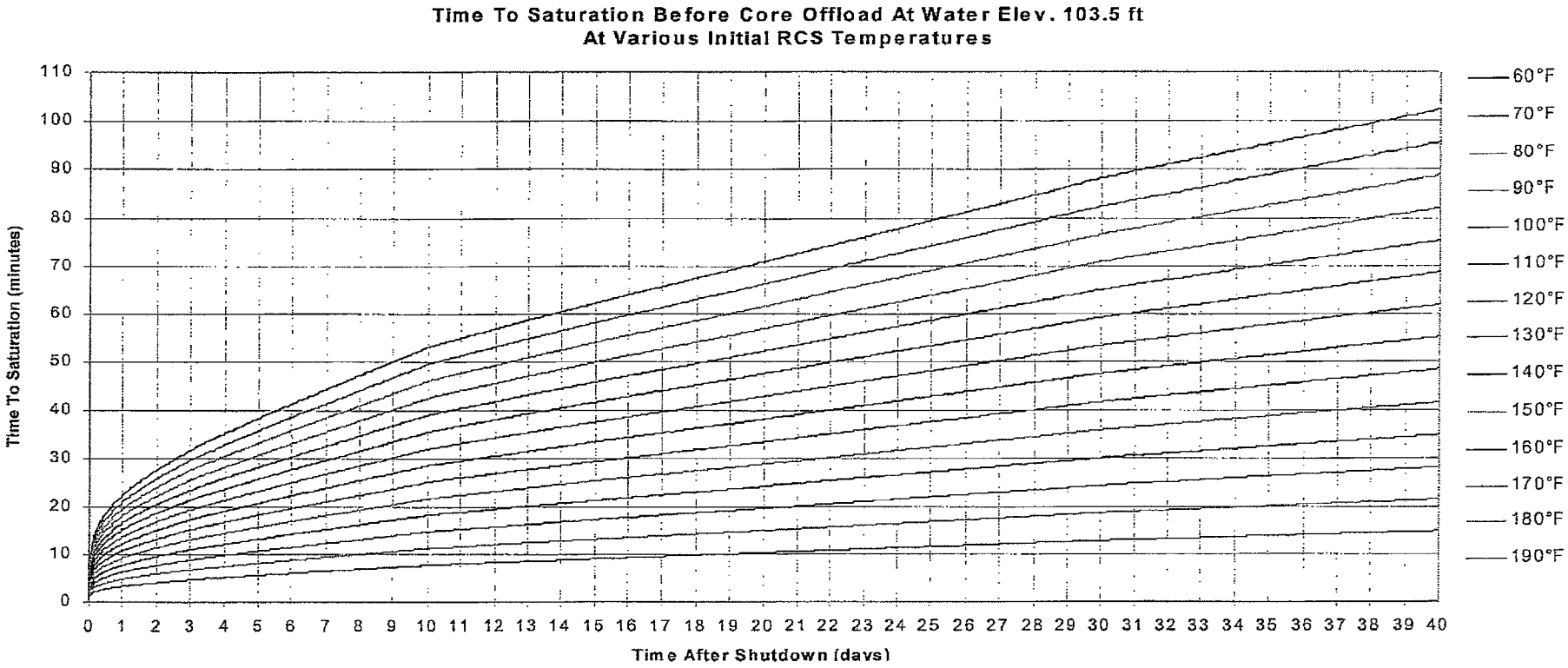
___ B. IF Core Exit TCs continue to rise,
THEN **PERFORM** Attachment 6, Cold Leg Injection to cool the core.

___ 6.0 **IF AT ANY TIME**, a Charging or SI pump cannot be aligned and started to make up to the RCS,
THEN **ESTABLISH** RWST Gravity Feed as follows:

___ A. **PLACE** 2RP4 lockout switch in VALVE OPERABLE and OPEN 2SJ69, RHR Suction From RWST.

___ B. **CLOSE** 2SJ69 when RCS level is >97.5 ft.

ATTACHMENT 2
(Page 1 of 10)

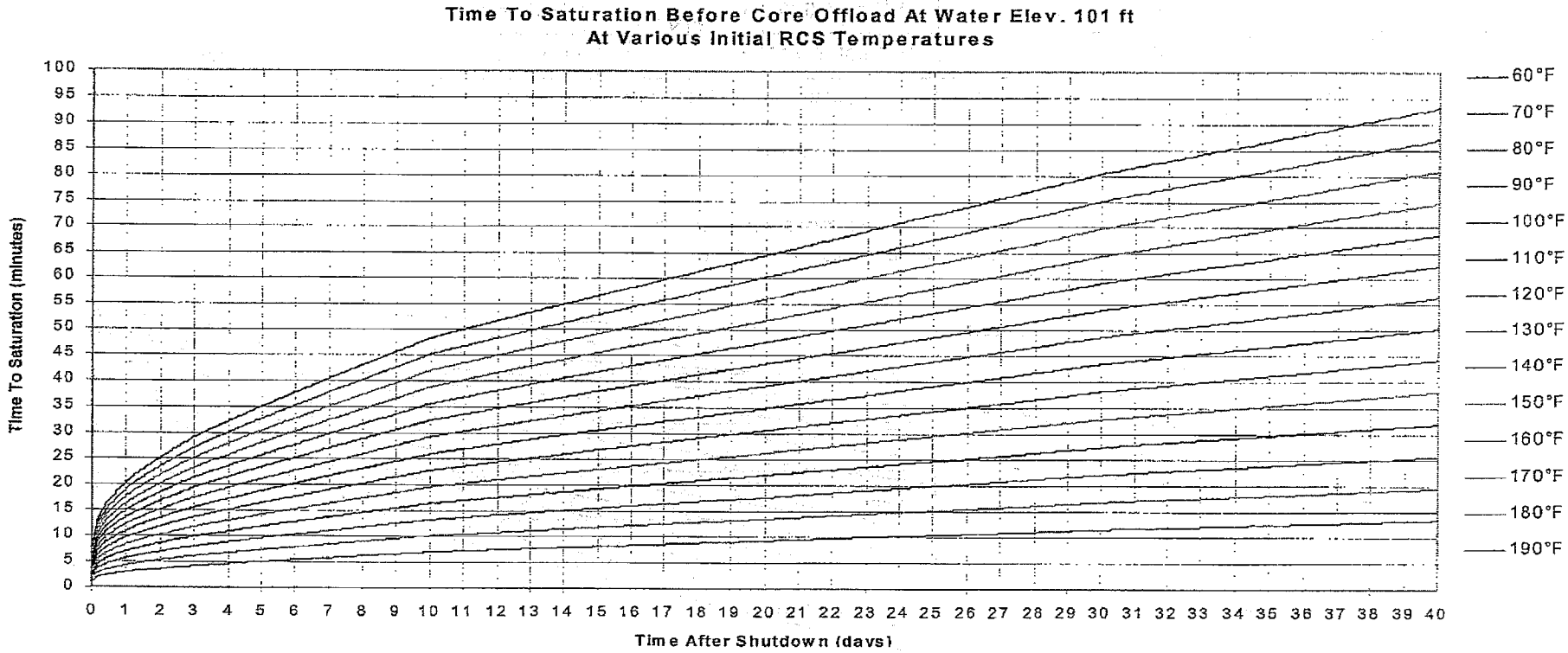


NOTE

Use the highest reading Core Exit Thermocouple OR Hot Leg Temperature to determine the starting temperature for the Reference Core

CORE	T/C OR HOT LEG	D12	T31 / 21 HOT LEG	K12	T22 / 22 HOT LEG	J1	T46 / 23 HOT LEG	H4	T14 / 21 HOT LEG
	COMPUTER POINT		T0031A / T0419A		T0022A / T0439A		T0046A / T0459A		T0014A / T0479A

ATTACHMENT 2
(Page 2 of 10)

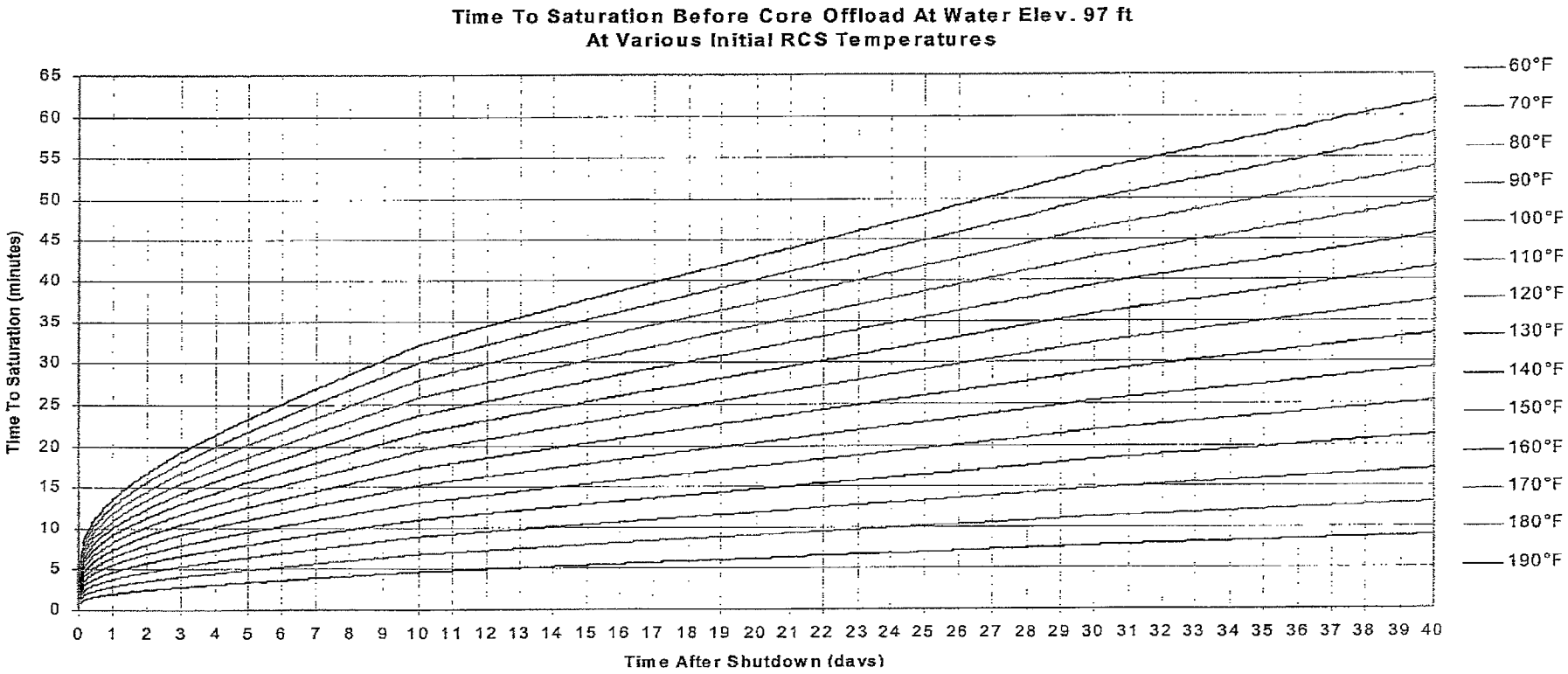


NOTE

Use the highest reading Core Exit Thermocouple OR Hot Leg Temperature to determine the starting temperature for the Reference Core

CORE	T/C OR HOT LEG	D12	T31 / 21 HOT LEG	K12	T22 / 22 HOT LEG	J1	T46 / 23 HOT LEG	H4	T14 / 21 HOT LEG
	COMPUTER POINT		T0031A / T0419A		T0022A / T0439A		T0046A / T0459A		T0014A / T0479A

ATTACHMENT 2
(Page 3 of 10)



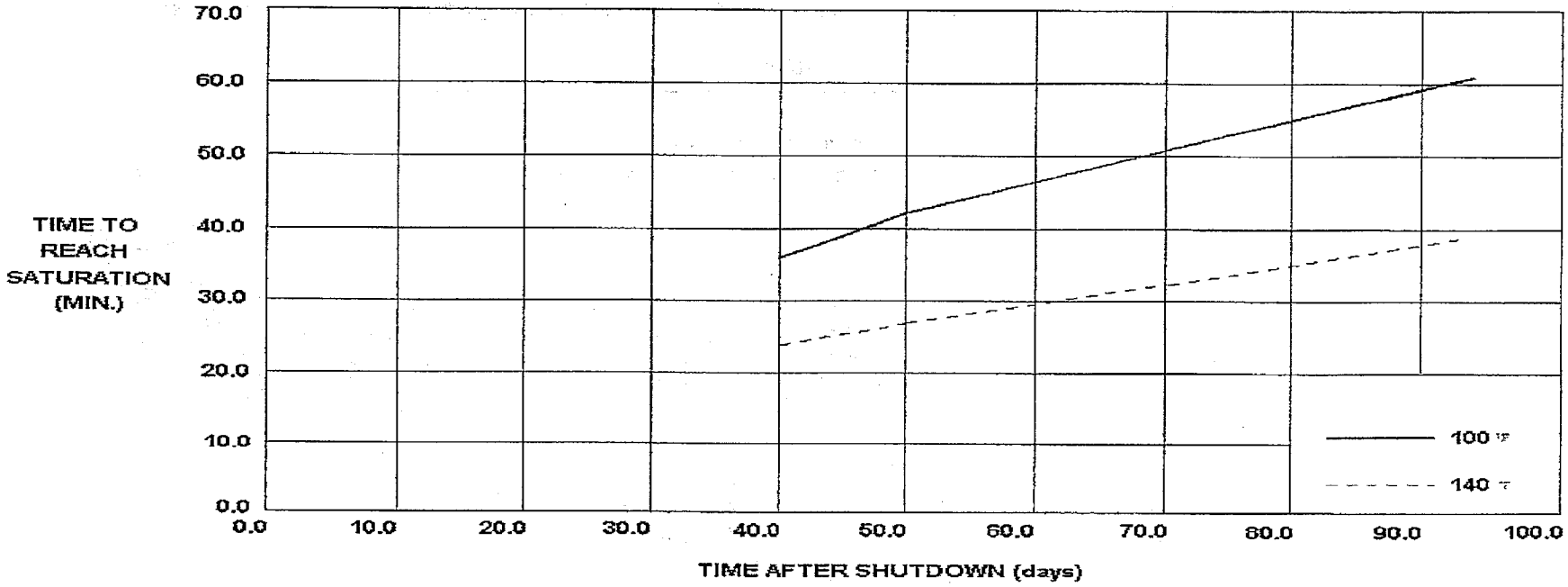
NOTE

Use the highest reading Core Exit Thermocouple OR Hot Leg Temperature to determine the starting temperature for the Reference Core

CORE	T/C OR HOT LEG	D12	T31 / 21 HOT LEG	K12	T22 / 22 HOT LEG	J1	T46 / 23 HOT LEG	H4	T14 / 21 HOT LEG
	COMPUTER POINT		T0031A / T0419A		T0022A / T0439A		T0046A / T0459A		T0014A / T0479A

ATTACHMENT 2
(Page 4 of 10)

TIME TO REACH CORE BOILING AFTER LOSS OF RHR
(BEFORE REFUELING - 40 to 100 Days)

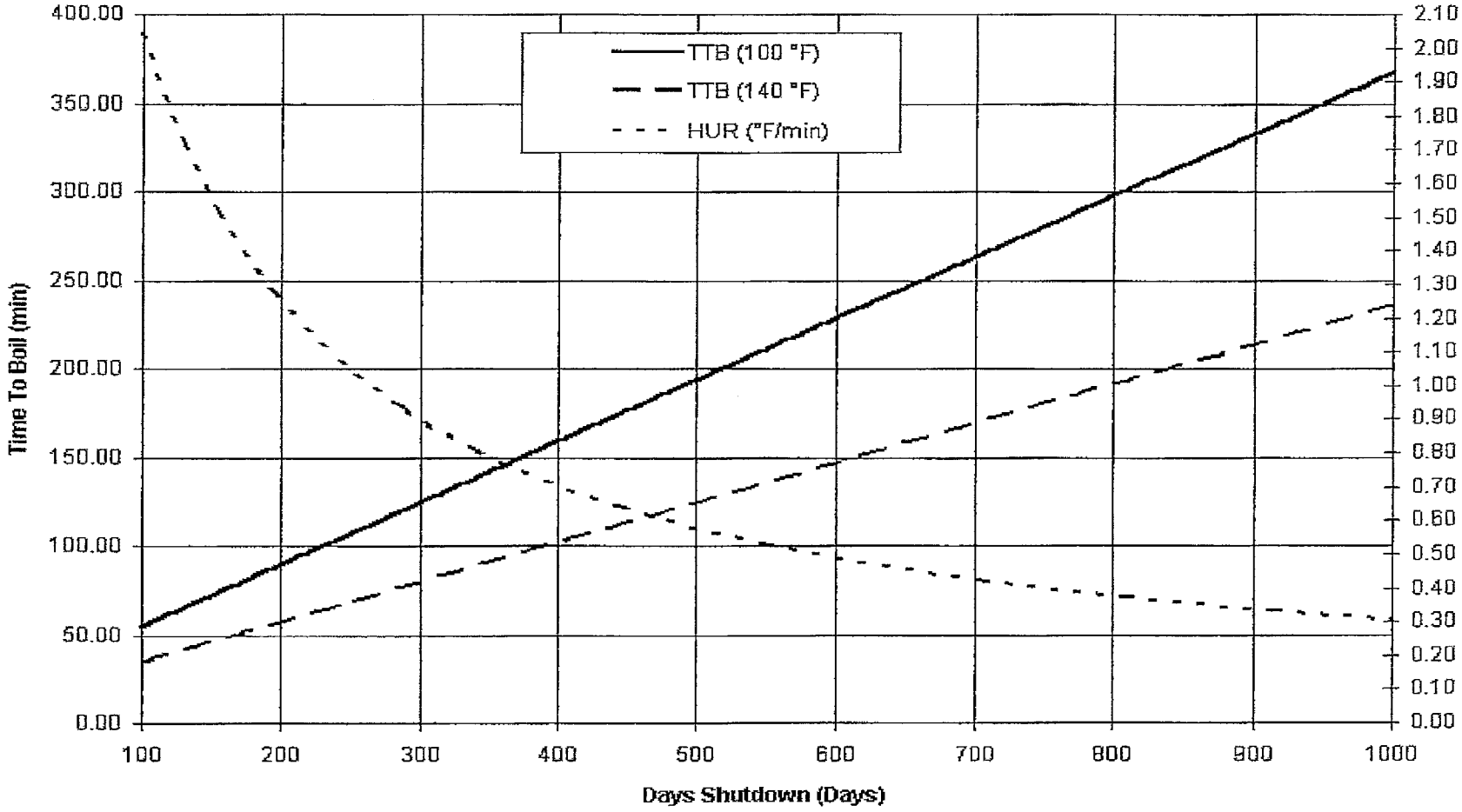


NOTE

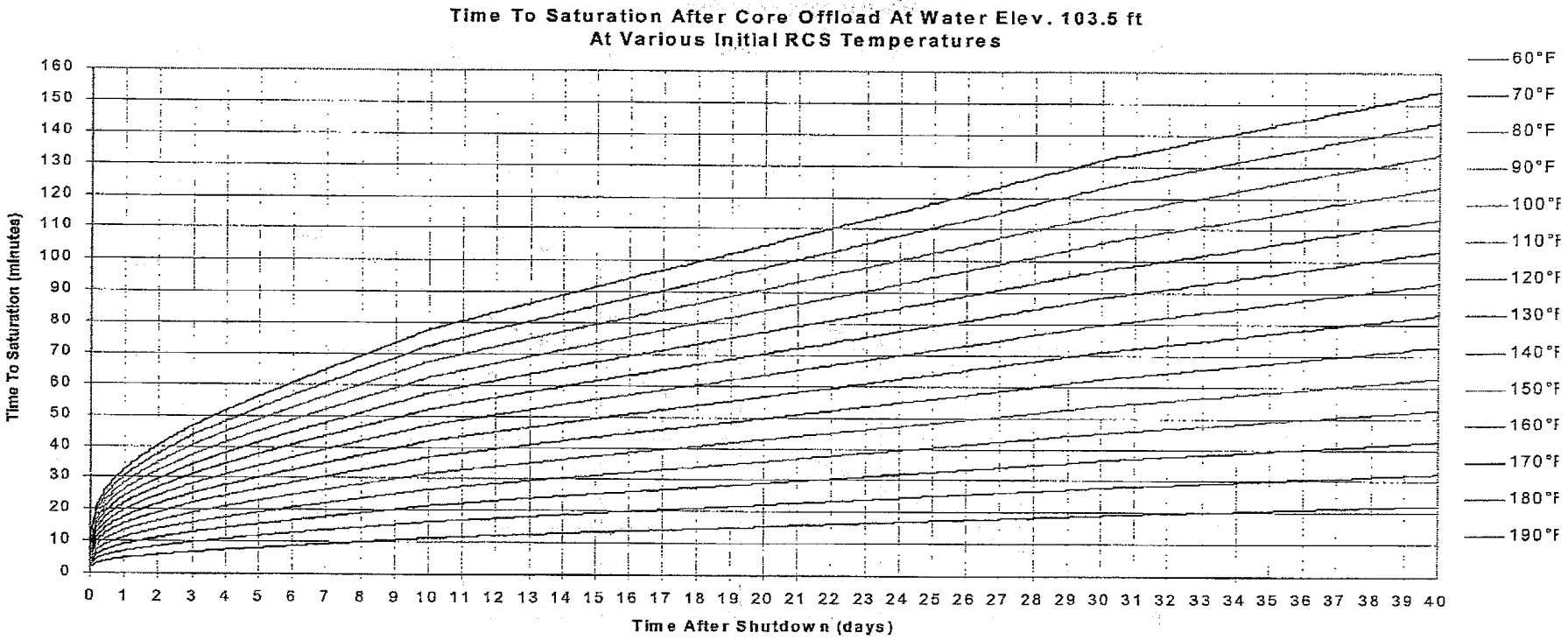
Use the highest reading Core Exit Thermocouple OR Hot Leg Temperature to determine the starting temperature for the Reference Core

CORE	T/C OR HOT LEG	D12	T31 / 21 HOT LEG	K12	T22 / 22 HOT LEG	J1	T46 / 23 HOT LEG	H4	T14 / 21 HOT LEG
	COMPUTER POINT		T0031A / T0419A		T0022A / T0439A		T0046A / T0459A		T0014A / T0479A

ATTACHMENT 2
(Page 5 of 10)
TIME TO REACH CORE BOILING AFTER LOSS OF RHR
(BEFORE REFUELING - 100 to 1000 Days)



ATTACHMENT 2
(Page 6 of 10)

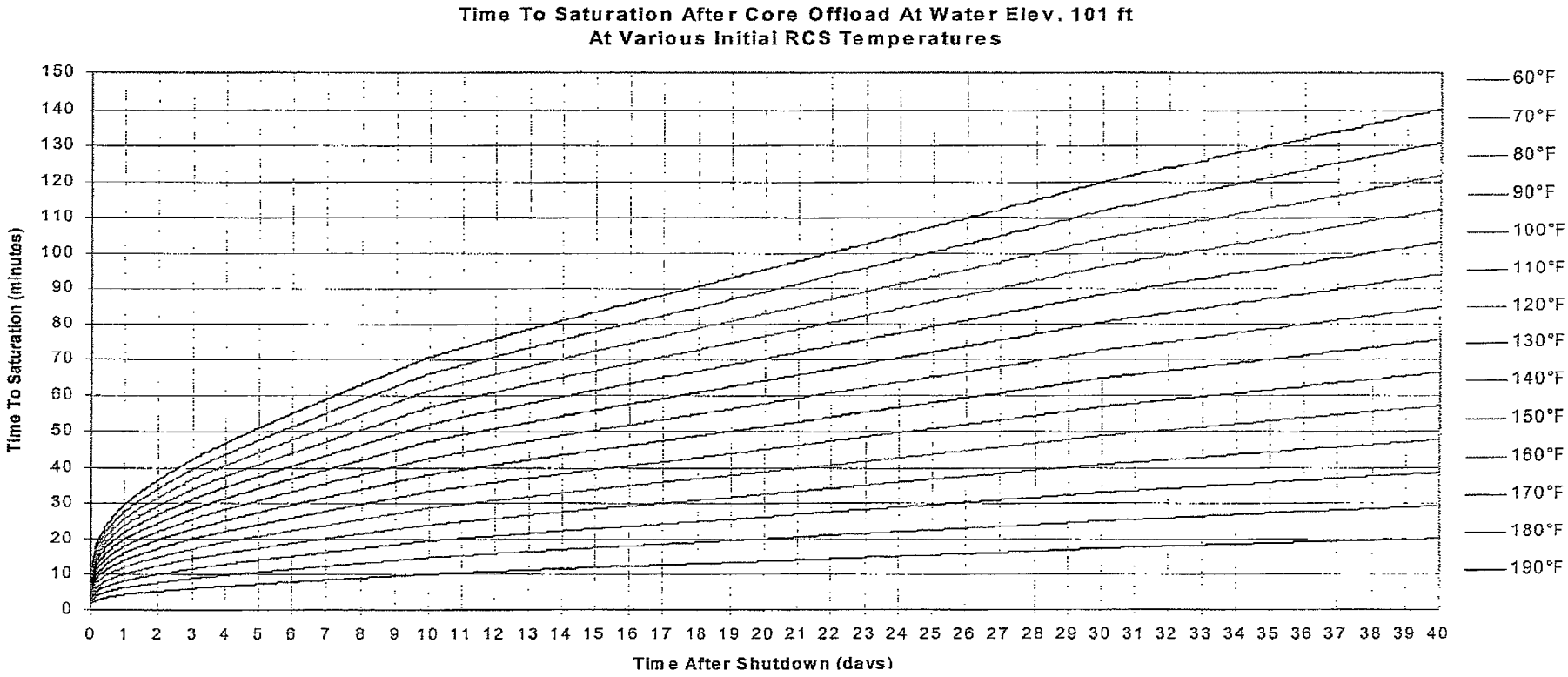


NOTE

Use the highest reading Core Exit Thermocouple OR Hot Leg Temperature to determine the starting temperature for the Reference Core

CORE	T/C OR HOT LEG	D12	T31 / 21 HOT LEG	K12	T22 / 22 HOT LEG	J1	T46 / 23 HOT LEG	H4	T14 / 21 HOT LEG
	COMPUTER POINT		T0031A / T0419A		T0022A / T0439A		T0046A / T0459A		T0014A / T0479A

ATTACHMENT 2
(Page 7 of 10)

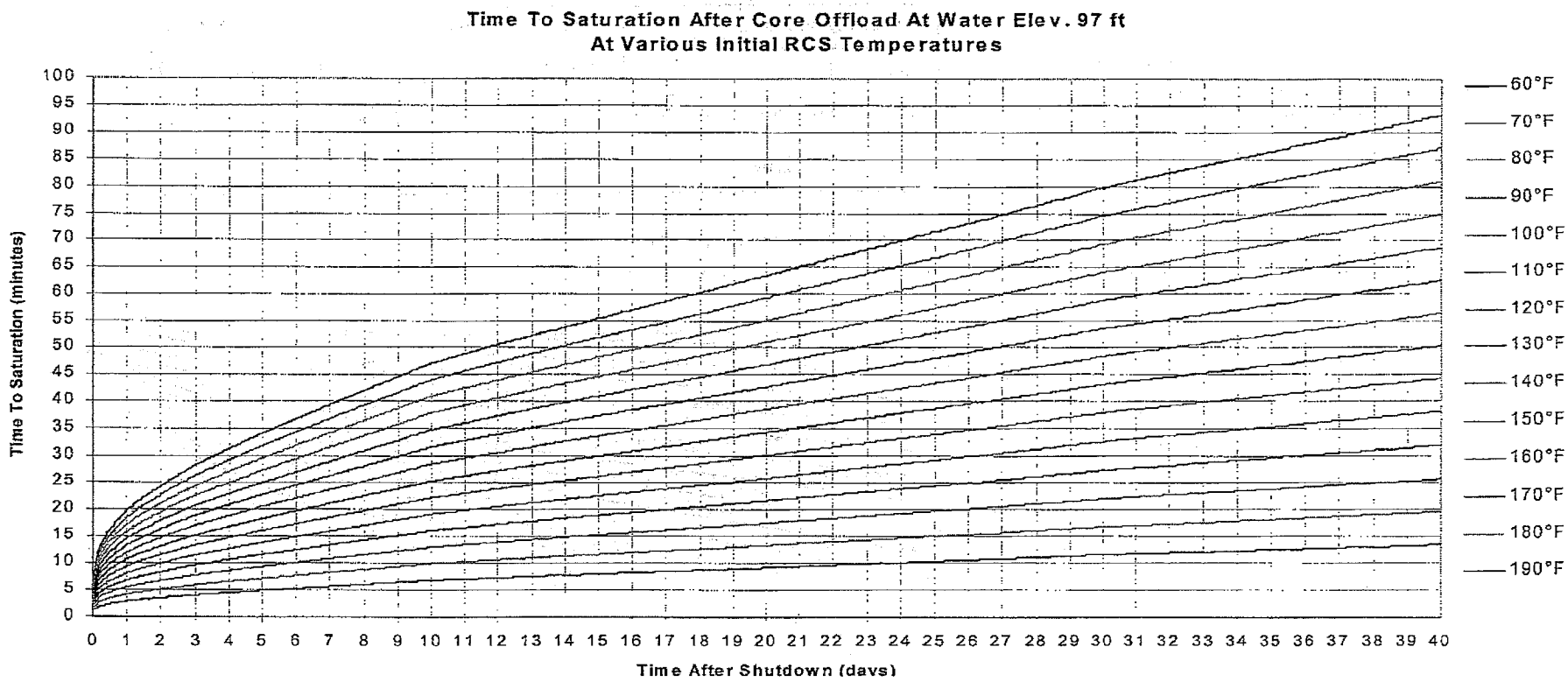


NOTE

Use the highest reading Core Exit Thermocouple OR Hot Leg Temperature to determine the starting temperature for the Reference Core

CORE	T/C OR HOT LEG	D12	T31 / 21 HOT LEG	K12	T22 / 22 HOT LEG	J1	T46 / 23 HOT LEG	H4	T14 / 21 HOT LEG
	COMPUTER POINT		T0031A / T0419A		T0022A / T0439A		T0046A / T0459A		T0014A / T0479A

ATTACHMENT 2
(Page 8 of 10)



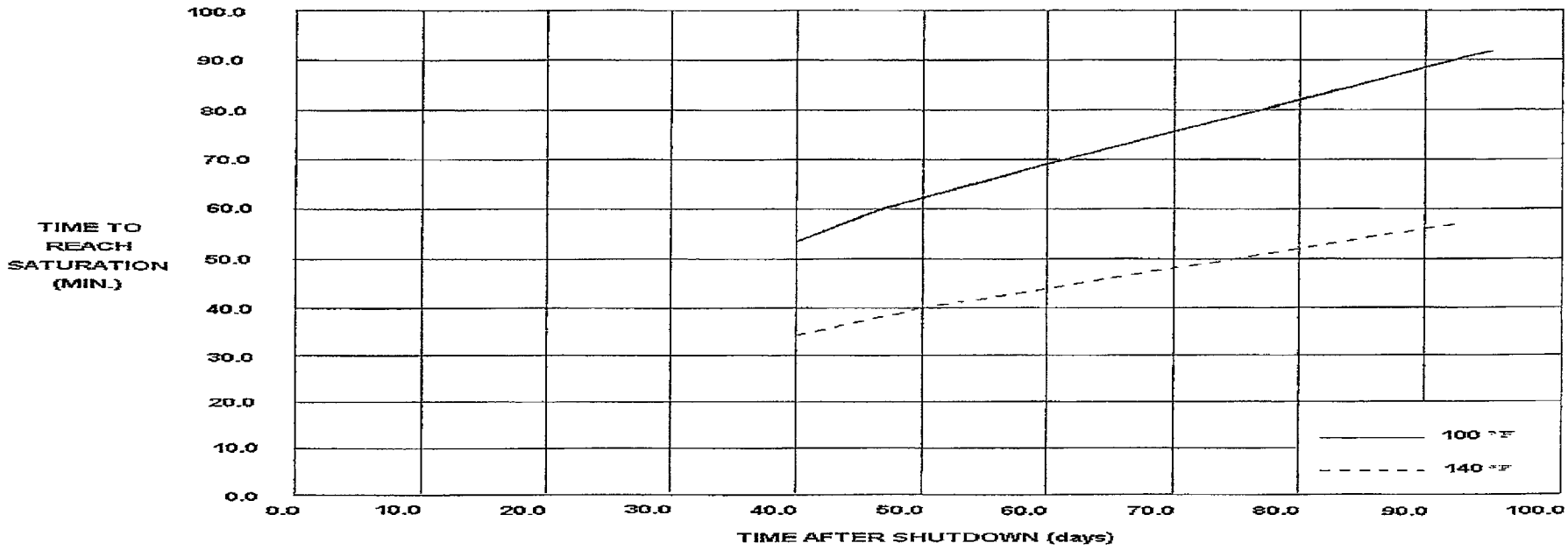
NOTE

Use the highest reading Core Exit Thermocouple OR Hot Leg Temperature to determine the starting temperature for the Reference Core

CORE	T/C OR HOT LEG	D12	T31 / 21 HOT LEG	K12	T22 / 22 HOT LEG	J1	T46 / 23 HOT LEG	H4	T14 / 21 HOT LEG
	COMPUTER POINT		T0031A / T0419A		T0022A / T0439A		T0046A / T0459A		T0014A / T0479A

ATTACHMENT 2
(Page 9 of 10)

TIME TO REACH CORE BOILING AFTER LOSS OF RHR
(AFTER REFUELING - 40 to 100 Days)



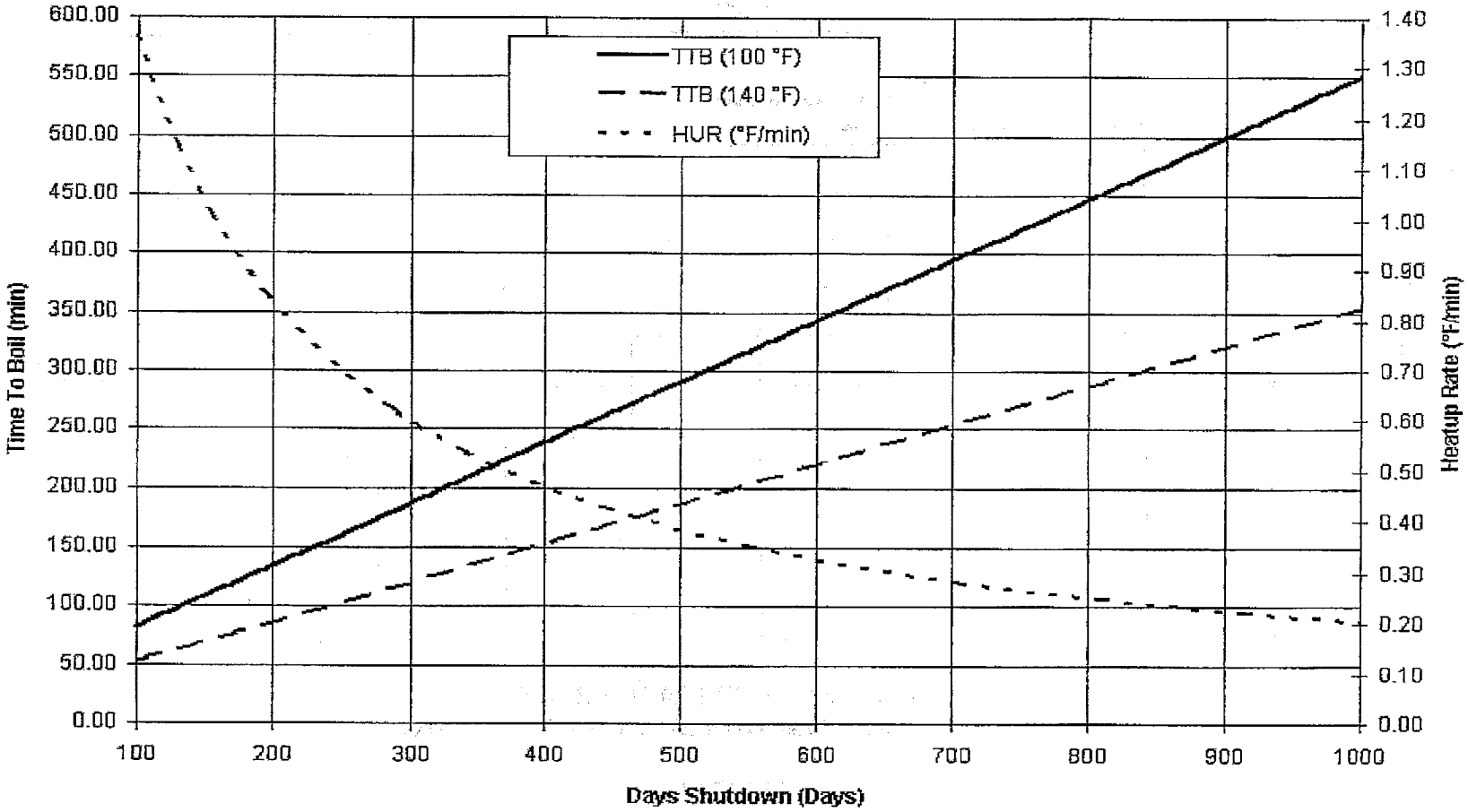
NOTE

Use the highest reading Core Exit Thermocouple OR Hot Leg Temperature to determine the starting temperature for the Reference Core

CORE	T/C OR HOT LEG	D12	T31 / 21 HOT LEG	K12	T22 / 22 HOT LEG	J1	T46 / 23 HOT LEG	H4	T14 / 21 HOT LEG
	COMPUTER POINT		T0031A / T0419A		T0022A / T0439A		T0046A / T0459A		T0014A / T0479A

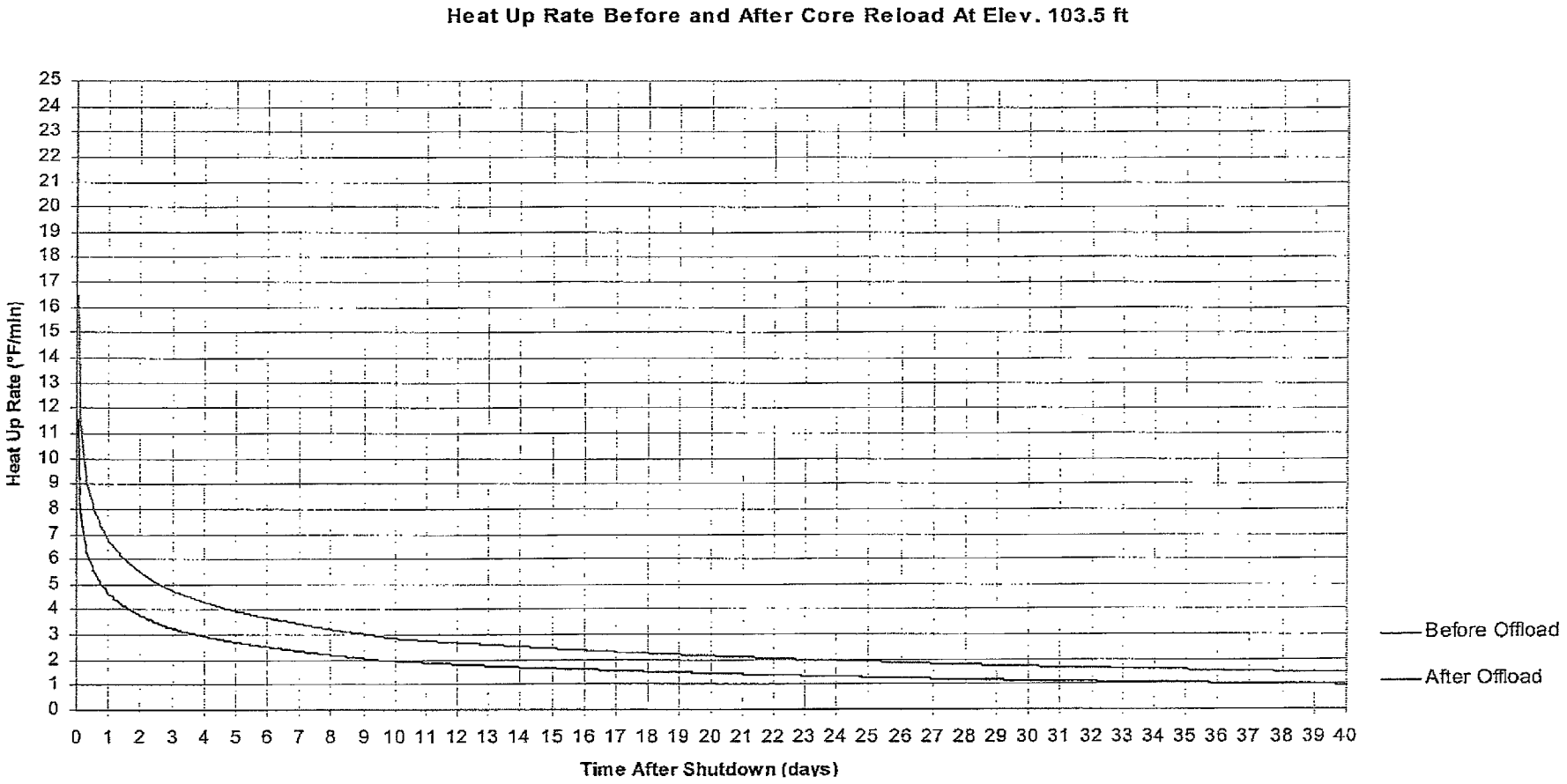
ATTACHMENT 2
(Page 10 of 10)

TIME TO REACH CORE BOILING AFTER LOSS OF RHR
(AFTER REFUELING - 100 to 1000 Days)



ATTACHMENT 3
(Page 1 of 3)

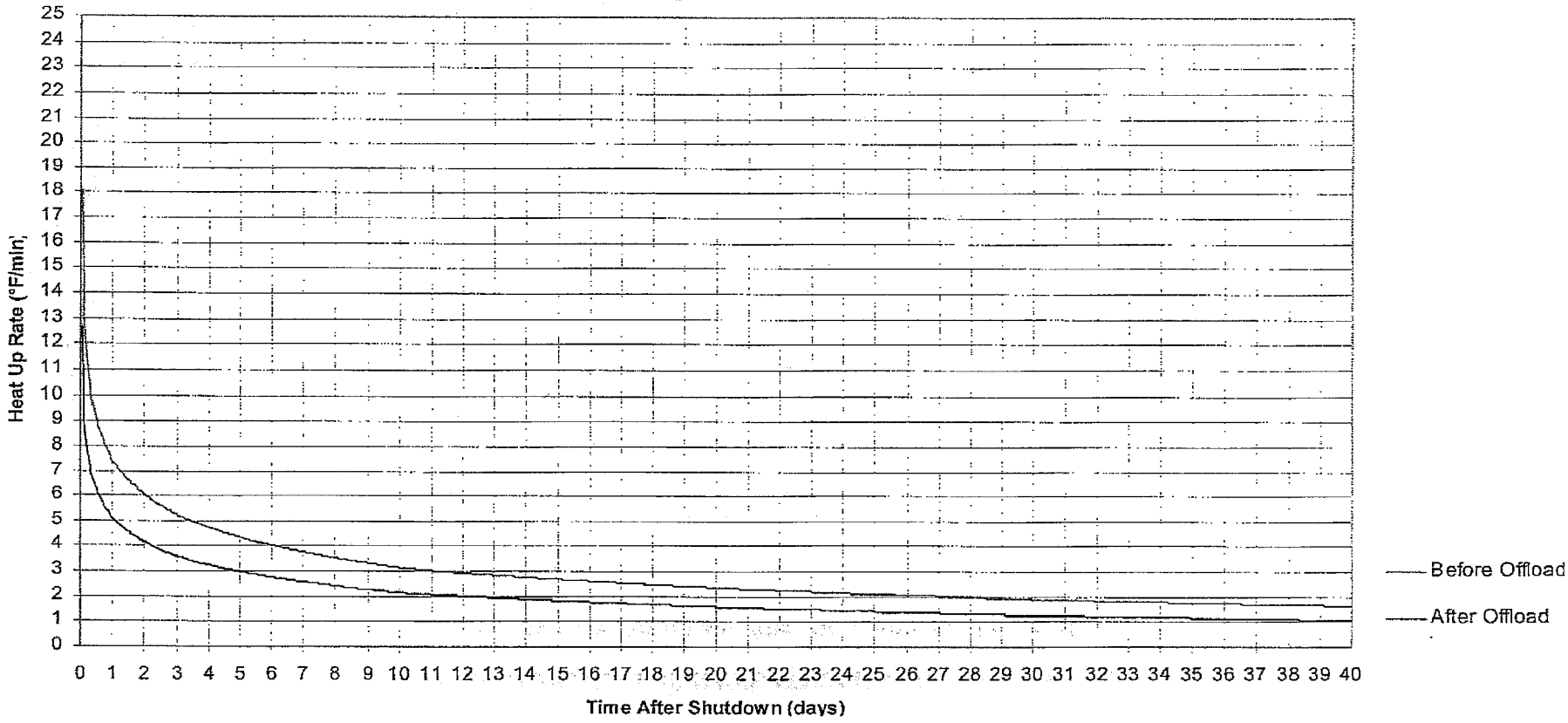
MIDLOOP HEATUP RATE FOR LOSS OF RHR COOLING



ATTACHMENT 3
(Page 2 of 3)

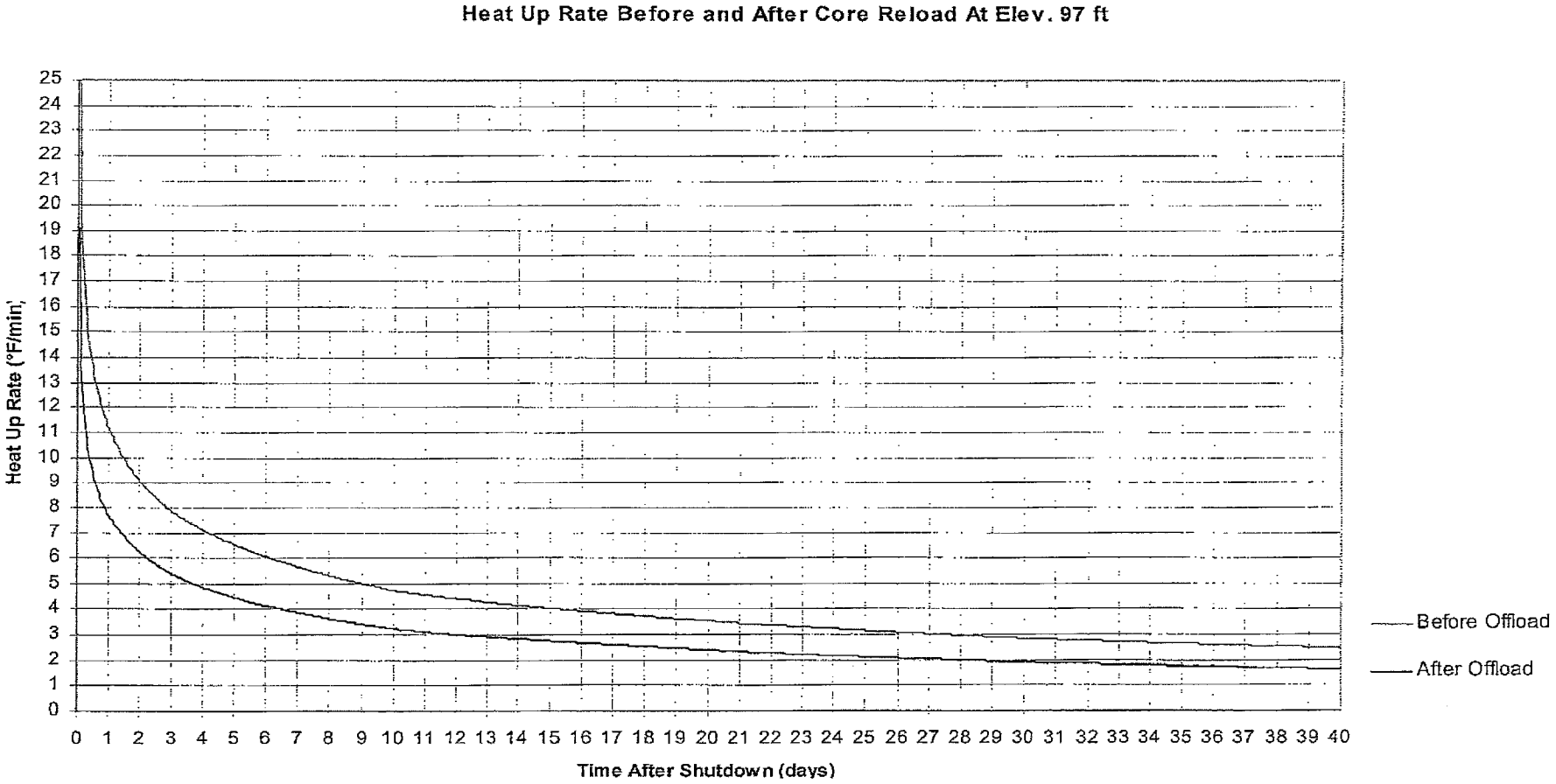
MIDLOOP HEATUP RATE FOR LOSS OF RHR COOLING

Heat Up Rate Before and After Core Reload At Elev. 101 ft



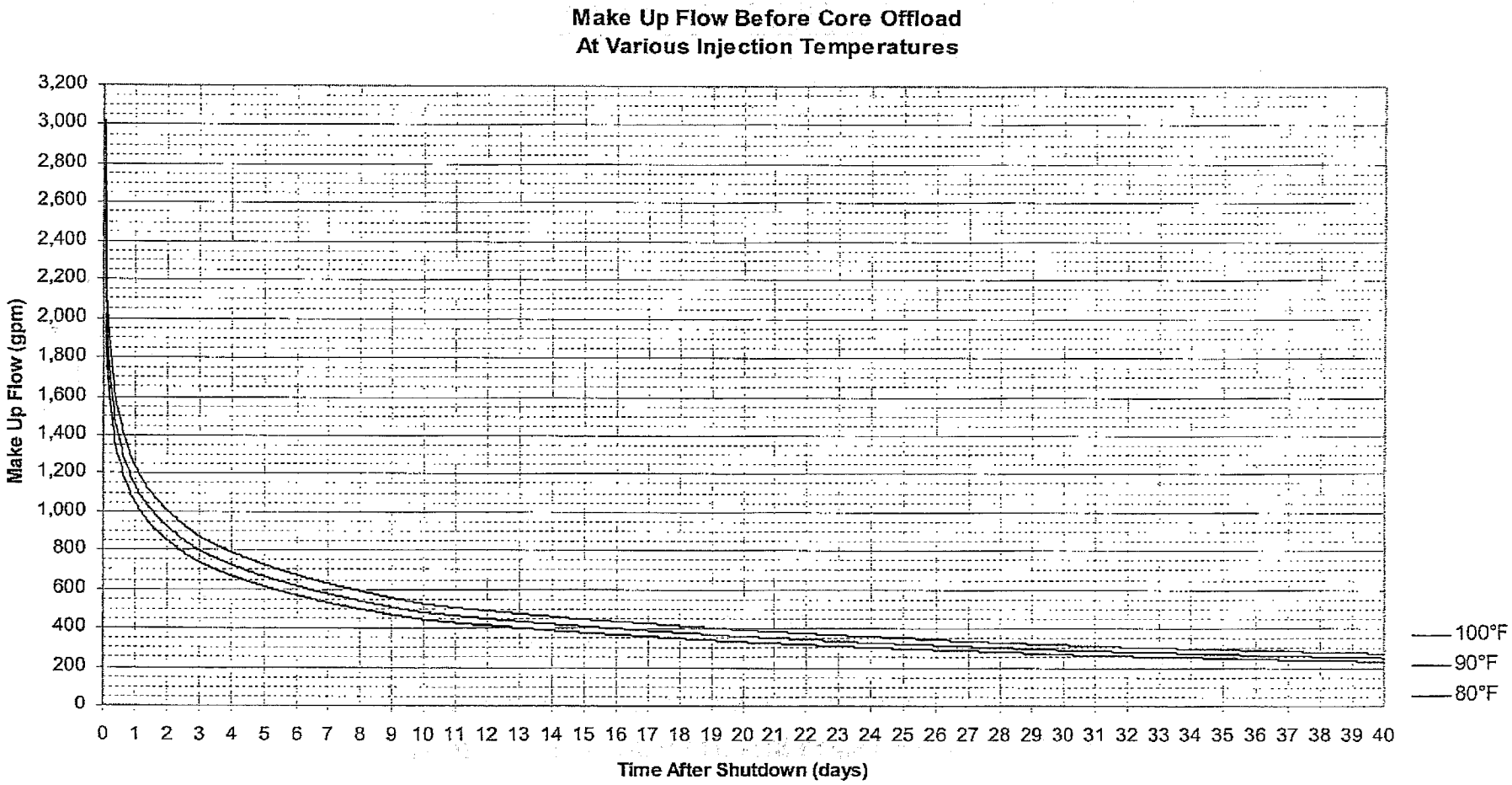
ATTACHMENT 3
(Page 3 of 3)

MIDLOOP HEATUP RATE FOR LOSS OF RHR COOLING



ATTACHMENT 4
(Page 1 of 2)

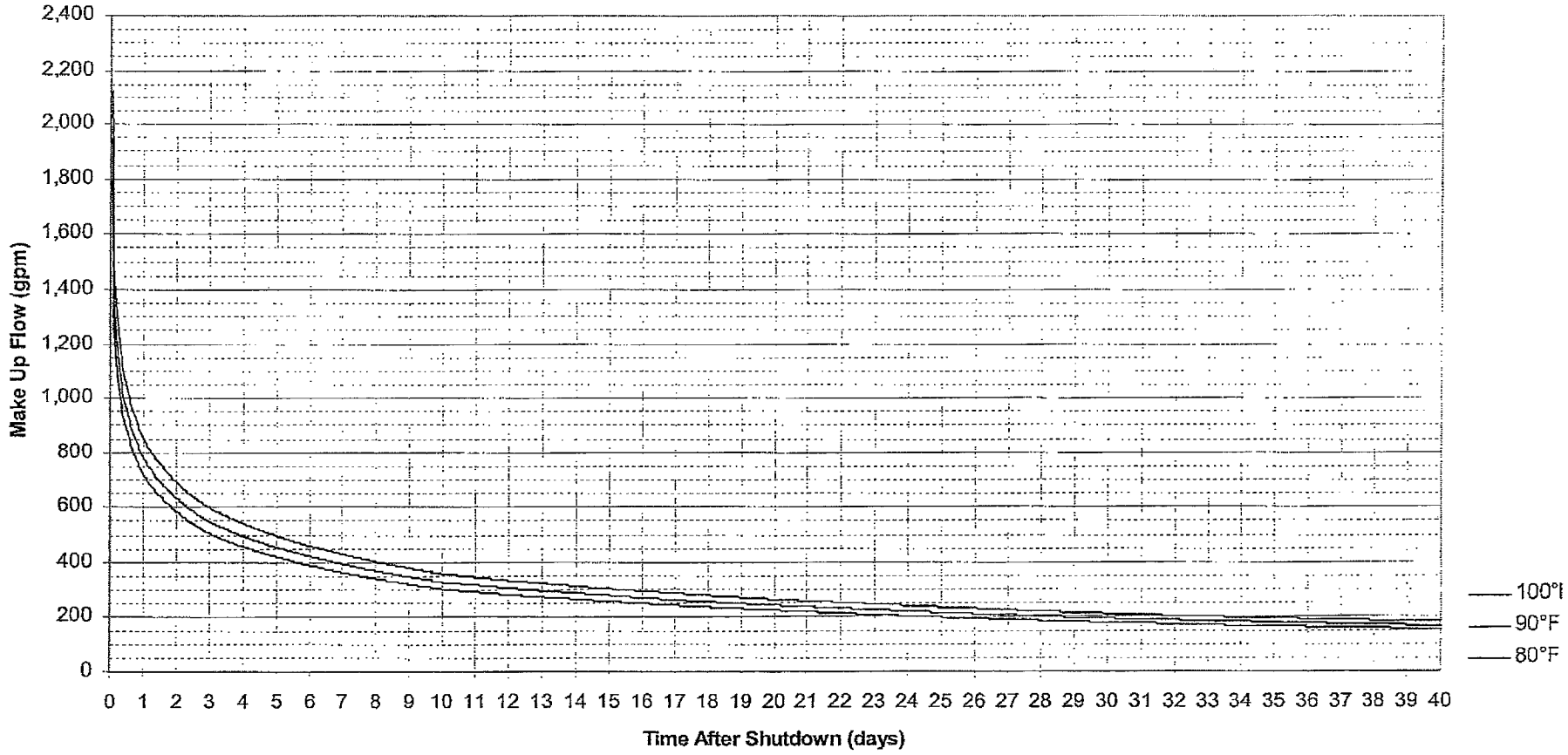
MAKEUP RATE REQUIRED TO REFILL RCS AFTER LOSS OF RHR



ATTACHMENT 4
(Page 2 of 2)

MAKEUP RATE REQUIRED TO REFILL RCS AFTER LOSS OF RHR

Make Up Flow After Core Offload
At Various Injection Temperatures



ATTACHMENT 5
(Page 1 of 3)

HOT LEG INJECTION

[C0354]

CAUTION

Only Borated water should be added to the RCS to maintain adequate Shutdown Margin.

Any opening in the RCS boundary could result in release of high temperature fluids, radioactive water, or airborne activity to Containment.

Differences exist in RCS levels between active and inactive cold and hot legs during mid-loop operations. At saturated conditions, the hot and cold leg levels can vary by several feet.

Pressurizer level may not increase as anticipated with hot leg injection if a S/G manway is open or if a cold leg opening exists.

Uncontrolled RCS heatup which exceeds or rapidly approaches 200 degrees requires ECG entry AND may violate Technical Specification 3.5.3.

___ 1.0 **MAKEUP** to the RCS as follows:

___ A. **ENSURE** OPEN 2SJ30, Suction from RWST.

___ B. IF BOTH Safety Injection Pumps are tagged,
THEN send an Operator to **RELEASE** breaker for one Safety Injection Pump.

___ C. **PLACE** the SJ40 lockout switch on 2RP4 in VALVE OPERABLE for the Pump released AND **OPEN** the appropriate SJ40 valve, Safety Injection Header Stop Valve.

___ D. IF 2PS1 or 2PS3 is open,
THEN **CLOSE** 2PS1 and 2PS3.

CAUTION

When the 2PS59 is the vent path, maximum flow of <300 gpm is required when steam generator nozzle dams are installed. This may be controlled by throttling the pump discharge valve.

___ E. **START** the selected Safety Injection Pump.

(step continued on next page)

ATTACHMENT 5
(Page 2 of 3)

HOT LEG INJECTION

1.0 (continued)

___ F. IF the Reactor is Shutdown for ≤5 days (Decay heat is ≥13 MWt), THEN **START** one Charging Pump IAW Attachment 6, Steps 1.C through 1.C.6.

___ G. **CONTINUE** feeding RCS at maximum rate until one of the following occurs:

___ 1. RHR is restored.

___ 2. Flow from any RCS opening is adequate to result in dropping Core Exit Thermocouple temperatures.

___ H. When any of the above conditions are satisfied, **CONTROL** injection flow by locally throttling the appropriate SJ35, SI Pump Disch Valve, to minimize flow to Containment while maintaining Core Exit Thermocouples stable or lowering (SI Pump room, 84' elevation).

___ I. IF Core Exit Thermocouples are NOT available, THEN **MAINTAIN** injection flow determined in Attachment 4, Makeup Rate Required To Refill RCS After Loss Of RHR.

___ 2.0 **INFORM** Containment personnel that high temperature fluids, contamination, and airborne activity will exist at any RCS openings.

___ 3.0 **START** all available CFCUs in slow speed to minimize Containment pressure rise.

___ 4.0 **ALIGN** Bleed path by performing one of the following:

___ A. **VERIFY** a 0.5 sq. ft or greater hot leg vent path exists:

- ♦ All Pressurizer Safety Valves removed

  OR

- ♦ Pressurizer Manway removed

  OR

- ♦ Vent path determined by System Engineer

OR

___ B. **OPEN** the following valves:

- ♦ 2PR1, Pressurizer PORV, and 2PR6, Block Valve for 2PR1
- ♦ 2PR2, Pressurizer PORV, and 2PR7, Block Valve for 2PR2
- ♦ 2RC40 through 2RC43, Reactor Head Vent Solenoid Valves **[C0329]**

ATTACHMENT 5
(Page 3 of 3)

HOT LEG INJECTION

___ 5.0 **CONTROL** Safety Injection Pump flow rate to maintain Core Exit Thermocouple temperature stable or dropping by locally throttling the appropriate SJ35, SI Pump Disch valve.

___ 6.0 **MAINTAIN** feed and bleed of the RCS until RHR is restored or other methods of decay heat removal are utilized.

___ 7.0 When RHR becomes available, **RETURN** RHR to service IAW S2.OP-SO.RHR-0001(Q), Initiating RHR.

___ 8.0 When RHR is restored, **REMOVE** Hot Leg Injection from service as follows:

___ A. **STOP** any running Safety Injection Pumps.

___ B. **CLOSE** 21SJ40 AND 22SJ40, Safety Injection Header Stop Valves for Hot Leg Injection.

___ C. **CLOSE** 2SJ30, Suction From RWST.

___ D. Fully **OPEN** 21SJ35 AND 22SJ35, if throttled.

___ E. IF the Reactor is Shutdown for ≤5 days (Decay heat is ≥13 MWt), AND Charging Pump was placed in service IAW Attachment 6, THEN **REMOVE** Charging Pump from Cold Leg Injection IAW Attachment 6, Steps 8.B through 8.B.6.

___ 9.0 **CLOSE** Reactor Head Vent Solenoid Valves:

- ♦ 2RC40
- ♦ 2RC41
- ♦ 2RC42
- ♦ 2RC43

ATTACHMENT 6
(Page 1 of 5)

COLD LEG INJECTION

[C0354]

CAUTION

Only Borated water should be added to the RCS to maintain adequate Shutdown Margin.

Any opening in the RCS boundary could result in release of high temperature fluids, radioactive water, or airborne activity to Containment.

Differences exist in RCS levels between active and inactive cold and hot legs during mid-loop operations. At saturated conditions, the hot and cold leg levels can vary by several feet.

Pressurizer level may not increase as anticipated with hot leg injection if a S/G manway is open or if a cold leg opening exists.

Uncontrolled RCS heatup which exceeds or rapidly approaches 200 degrees requires ECG entry AND may violate Technical Specification 3.5.3.

___ 1.0 **MAKEUP** to the RCS as follows:

___ A. IF the Reactor is Shutdown for ≤5 days (Decay heat is ≥13 MWt), THEN:

___ 1. **START** one Charging Pump IAW step 1.C,

AND

___ 2. **START** one Safety Injection Pump IAW step 1.D

___ B. IF the Reactor is Shutdown for >5 days (Decay heat is <13 MWt), AND Charging Pumps are NOT available, THEN **GO TO** Step 1.D.

___ C. **ALIGN** feed path to the RCS from Charging Pumps:

___ 1. **OPEN** RWST outlet to Charging Pumps:

- ♦ 2SJ1
- ♦ 2SJ2

___ 2. **CLOSE** VCT outlet to Charging Pumps:

- ♦ 2CV40
- ♦ 2CV41

(continued on next page)

ATTACHMENT 6
(Page 2 of 5)

COLD LEG INJECTION

1.C (Continued)

___ 3. IF both Centrifugal Charging Pumps are tagged,
THEN **SEND** an Operator to release breaker for one Centrifugal Charging Pump.

___ 4. **ALIGN** the following valves in the Cold Leg Injection flow path:

- **OPEN** 2SJ4, BIT Inlet
- **OPEN** 2SJ5, BIT Inlet
- **OPEN** 2SJ12, BIT Outlet
- **OPEN** 2SJ13, BIT Outlet
- **CLOSE** 2CV68, Normal Charging Valve Chg Hdr Mot Oper Valve
- **CLOSE** 2CV69, Normal Charging Valve Chg Hdr Mot Oper Valve
- **CLOSE** 2CV139, Charging Pump Miniflow (Prevent VCT overfill)
- **CLOSE** 2CV140, Charging Pump Miniflow (Prevent VCT overfill)

___ 5. IF 2PS1 or 2PS3 is open,
THEN **CLOSE** 2PS1 and 2PS3.

CAUTION

When the 2PS59 is the vent path, maximum flow of <300 gpm is required when steam generator nozzle dams are installed. This may be controlled by throttling the pump discharge valve.

___ 6. **START** associated Charging Pump and feed at maximum rate.

___ 7. IF the Reactor is Shutdown for >5 days (Decay heat is <13 MWt),
AND a second pump is NOT required,
THEN **GO TO** Step 2.0.

ATTACHMENT 6
(Page 3 of 5)

COLD LEG INJECTION

___ D. **ALIGN** feed path to the RCS from SI pumps:

___ 1. **PLACE** 2RP4 lockout switch in VALVE OPERABLE AND **OPEN** 2SJ30, RWST to SI pump stop valve.

___ 2. IF BOTH Safety Injection pumps are tagged,
THEN **SEND** operator to release breaker for ONE Safety Injection pump.

___ 3. **OPEN** the appropriate SJ134, SI pump header to cold leg injection.

___ 4. **PLACE** 2RP4 lockout switch in VALVE OPERABLE AND **OPEN** 2SJ135, SI pumps to Cold Leg Injection.

___ 5. IF 2PS1 or 2PS3 is open,
THEN **CLOSE** 2PS1 and 2PS3.

CAUTION

When the PS59 is the vent path, maximum flow of <300 gpm is required when steam generator nozzle dams are installed. This may be controlled by throttling the pump discharge valve.

___ 6. **START** the selected Safety Injection pump.

___ 2.0 **CONTINUE** makeup to the RCS as follows:

___ A. **CONTINUE** feeding RCS at maximum rate until one of the following occurs:

___ 1. RHR is restored.

___ 2. Pressurizer level reaches or exceeds 50% cold calibration.

___ 3. Flow from any RCS opening is adequate to result in dropping Core Exit Thermocouple temperatures.

___ B. When any of the above conditions are satisfied, **CONTROL** injection flow by normal charging OR locally throttling appropriate SJ35, SI pump discharge valve, for SI pumps. This will minimize flow to Containment while maintaining Core Exit Thermocouples stable or dropping.

___ C. IF Core Exit Thermocouples are NOT available,
THEN **MAINTAIN** injection flow determined in Attachment 4, Makeup Rate Required To Refill RCS After Loss Of RHR.

ATTACHMENT 6
(Page 4 of 5)

COLD LEG INJECTION

___ 3.0 **INFORM** Containment personnel to evacuate or that high temperature fluids, contamination, and airborne activity will exist at any RCS openings.

___ 4.0 **START** all available CFCUs in slow speed to minimize Containment pressure rise.

___ 5.0 **ALIGN** a Bleed path by performing one of the following:

___ A. **VERIFY** a hot leg vent path exists: (equivalent to a 0.5 sq. ft or greater)

- ♦ All Pressurizer Safety Valves removed

  OR

- ♦ Pressurizer Manway removed

  OR

- ♦ Vent path determined by System Engineer

OR

B. **OPEN** the following valves:

- ♦ 2PR1, Pressurizer PORV, and 2PR6, Block Valve for 2PR1
- ♦ 2PR2, Pressurizer PORV, and 2PR7, Block Valve for 2PR2
- ♦ 2RC40 through 2RC43, Reactor Head Vent Solenoid Valves **[C0329]**

___ 6.0 **MAINTAIN** feed and bleed of the RCS until RHR is restored OR other methods of decay heat removal are utilized.

___ 7.0 When RHR becomes available, **RETURN** RHR to service IAW S2.OP-SO.RHR-0001(Q), Initiating RHR.

___ 8.0 When RHR is restored, **REMOVE** Cold Leg Injection from service as follows:

___ A. IF Safety Injection pumps are running,
THEN **STOP** Safety Injection flow as follows:

___ 1. **STOP** any running Safety Injection pump.

___ 2. **CLOSE** 2SJ135, SI pump to cold leg injection.

___ 3. **CLOSE** the open SJ134, SI pump header to cold leg injection.

___ 4. Fully **OPEN** 21SJ35 AND 22SJ35,if throttled.

(continued on next page)

ATTACHMENT 6
(Page 5 of 5)

COLD LEG INJECTION

8.0 (continued)

___ B. IF Charging Pumps are running,
THEN **STOP** charging flow as follows:

___ 1. **STOP** any running Charging Pumps.

___ 2. **OPEN** the Charging Pump Miniflow Valves:

- 2CV139
- 2CV140

___ 3. **CLOSE** Charging Header Stop Valves for Cold Leg Injection:

- 2SJ4, BIT Inlet
- 2SJ5, BIT Inlet
- 2SJ13, BIT Outlet
- 2SJ12, BIT Outlet

___ 4. **OPEN** VCT Outlet to Charging Pumps:

- 2CV40
- 2CV41

___ 5. **CLOSE** RWST Outlet to Charging Pumps:

- 2SJ1
- 2SJ2

___ 6. **OPEN** Chg Hdr Mot Oper Stop Valves

- 2CV68
- 2CV69

___ 9.0 **CLOSE** Reactor Head Vent Solenoid Valves:

- 2RC40
- 2RC41
- 2RC42
- 2RC43

ATTACHMENT 7
(Page 1 of 4)

STEAM GENERATOR REFLUX COOLING WITH GRAVITY FEED FROM THE RWST

NOTE

Gravity feed of the RCS from the RWST is available in the event power is lost to all emergency buses with the RCS at or near atmospheric pressure.

To maintain RCS pressure low enough for gravity feed from RWST, at least two Steam Generators must be available as heat sinks using reflux cooling.

CAUTION

Only Borated water should be added to the RCS to maintain adequate Shutdown Margin.

Any opening in the RCS boundary could result in release of high temperature fluids, radioactive water, or airborne activity to Containment.

Differences exist in RCS levels between active and inactive cold and hot legs during mid-loop operations. At saturated conditions, the hot and cold leg levels can vary by several feet.

___ 1.0 **ALIGN** the RWST to gravity feed the RCS using one of the following methods:

___ A. RWST To RHR Suction (Preferred)

___ 1. **PLACE** 2RP4 lockout switch for 2SJ69, RHR Suction From RWST in VALVE OPERABLE.

___ 2. **OPEN** 2SJ69, RHR Suction From RWST.

___ 3. **CLOSE** 2RH1 OR 2RH2, RHR COMMON SUCTION VALVE

___ 4. **THROTTLE** RH18 valve to control flow to the RCS.

OR

___ B. RWST To Hot Leg

___ 1. **OPEN** 2RH21, RHR To RWST Stop Valve.

___ 2. **PLACE** 2RP4 lockout switch for 2RH26 Hot Leg Injection in VALVE OPERABLE

(step continued on next page)

ATTACHMENT 7
(Page 2 of 4)

STEAM GENERATOR REFLUX COOLING WITH GRAVITY FEED FROM THE RWST

1.0.B (continued)

___ 3. **OPEN** 2RH26, Hot Leg Injection Valve

___ 4. **THROTTLE** 2RH21 to control flow to the RCS.

OR

___ C. RWST To Cold Leg

___ 1. **OPEN** 2RH21, RHR To RWST Stop Valve.

___ 2. **OPEN** 21RH19 AND 22RH19, RHR Heat Exchanger Discharge Cross-Connect Valves.

___ 3. **PLACE** 2RP4 lockout switches for 21SJ49 AND 22SJ49, RHR Discharge to Cold Legs in VALVE OPERABLE.

___ 4. **OPEN** 21SJ49 AND 22SJ49, RHR Discharge to Cold Legs.

___ 2.0 **ALIGN** at least two Steam Generators for heat sink using reflux cooling. Steam Generators are available if the following conditions are satisfied:

- Steam Generator nozzle dams not installed
- Steam Generator contains water or can be filled
- Primary and secondary manways and handholes installed

___ 3.0 **FEED** available Steam Generators to maintain wide range level >77% IAW one of the following, as applicable:

___ - S2.OP-SO.AF-0001(Q), Auxiliary Feedwater System Operation

___ - S2.OP-SO.CN-0001(Q), Condensate System Operation

___ 4.0 **CONTINUE** feeding RCS until one of the following occurs:

___ A. RHR is restored.

___ B. Pressurizer level reaches or exceeds 50% cold calibration.

ATTACHMENT 7
(Page 3 of 4)

STEAM GENERATOR REFLUX COOLING WITH GRAVITY FEED FROM THE RWST

___ 5.0 **REMOVE** decay heat by performing one of the following:

- ♦ **OPERATE** the appropriate MS10s to maintain Core Exit Thermocouples stable or dropping.

  OR

- ♦ **DRAIN** the Steam Generators as required to maintain level <95% wide range.

___ 6.0 **NOTIFY** non-essential personnel in Containment to evacuate.

___ 7.0 **INFORM** Containment personnel that any RCS opening could result in release of high temperature fluids, radioactive water, and airborne activity.

___ 8.0 **START** all available CFCUs in low speed to minimize Containment pressure rise.

___ 9.0 **OPEN** Reactor Head Vent Solenoid Valves. **[C0329]**

- ♦ 2RC40
- ♦ 2RC41
- ♦ 2RC42
- ♦ 2RC43

___ 10.0 **MAINTAIN** reflux cooling of the RCS until RHR is restored or other methods of decay heat removal are utilized.

___ 11.0 When RHR becomes available, **RETURN** RHR to service IAW S2.OP-SO.RHR-0001(Q), Initiating RHR.

ATTACHMENT 7
(Page 4 of 4)

STEAM GENERATOR REFLUX COOLING WITH GRAVITY FEED FROM THE RWST

___ 12.0 When RHR is restored, **SECURE** Gravity Feed Path as follows:

___ A. **CLOSE** 2SJ69, RHR Suction From RWST.

___ B. IF aligned for gravity feed,
THEN **CLOSE** the following valves:

- ♦ 2RH21, RHR to RWST Stop Valve
- ♦ 2RH26, Hot Leg Isolation Valve

___ 13.0 **CLOSE** Reactor Head Vent Solenoid Valves.

- ♦ 2RC40
- ♦ 2RC41
- ♦ 2RC42
- ♦ 2RC43

___ 14.0 **RESTORE** Steam Generator level to the level required by the SM/CRS AND **INITIATE** shutdown of Steam Generator Feed System and Steam Generator Blowdown System IAW appropriate procedures.

♦ Auxiliary Feedwater System	S2.OP-SO.AF-0001(Q)
♦ Condensate System	S2.OP-SO.CN-0001(Q)
♦ Blowdown System	S2.OP-SO.GBD-0002(Q)

___ 15.0 **VERIFY** the MS10s are in the required position for current plant conditions.

ATTACHMENT 8
(Page 1 of 6)

ALTERNATE COOLING WATER

___ 1.0 Prior to aligning the alternate cooling water supply, **STOP** the affected pump normally cooled by Service Water.

NOTE

DM cooling supply hoses are to be furnished with double check valves. DM cooling discharge hoses are to be directed to the closest available floor drain and securely fastened to prevent hoses from coming dislodged from the drain.

___ 2.0 **INSTALL** Demineralized Water supply hoses with double check valves between the applicable DR Header Connection Valves:

Component	Connected From	Connected To	Initials
21 RHR PUMP MECH SEAL HEAT EXCH SUPPLY HOSE	2DR47	21CC22	
21 RHR PUMP MECH SEAL HEAT EXCH DISCHARGE HOSE	21CC220	Floor Drain	
22 RHR PUMP MECH SEAL HEAT EXCH SUPPLY HOSE	2DR48	22CC22	
22 RHR PUMP MECH SEAL HEAT EXCH DISCHARGE HOSE	22CC220	Floor Drain	
21 & 22 CHG PUMPS MECH SEAL HX & GLAND COOLER SUPPLY HOSE	2DR39	2CC106	
21 CHG PUMP MECH SEAL HX & GLAND COOLER DISCHARGE HOSE	2CC239	Floor Drain	
22 CHG PUMP MECH SEAL HX & GLAND COOLER DISCHARGE HOSE	2CC231	Floor Drain	
22 CHG PUMP LUBE OIL COOLER & GEAR OIL COOLER SUPPLY HOSE	2DR38	2SW201	
22 CHG PUMP LUBE OIL COOLER & GEAR OIL COOLER DISCHARGE HOSE	22SW961	Floor Drain	
22 SAFETY INJECTION PUMP LUBE OIL COOLER SUPPLY HOSE	2DR36	2SW165	
22 SAFETY INJECTION PUMP LUBE OIL COOLER DISCHARGE HOSE	2SW166	Floor Drain	

ATTACHMENT 8
(Page 2 of 6)

ALTERNATE COOLING WATER

Component	Connected From	Connected To	Initials
21 CHG PUMP LUBE OIL COOLER & GEAR OIL COOLER SUPPLY HOSE	21DR38	2SW187	
21 CHG PUMP LUBE OIL COOLER & GEAR OIL COOLER DISCHARGE HOSE	21SW952	Floor Drain	
21 SAFETY INJECTION PUMP LUBE OIL COOLER SUPPLY HOSE	2DR36	2SW171	
21 SAFETY INJECTION PUMP LUBE OIL COOLER DISCHARGE HOSE	2SW172	Floor Drain	

___ 3.0 **CROSS-TIE** the Component Cooling System Header to supply 21 and 22 Charging Pump Seal Water Heat Exchanger by removing the lock and opening 2CC318, CC Cross-Tie Valve.

ATTACHMENT 8
(Page 3 of 6)

ALTERNATE COOLING WATER

___ 4.0 **REPOSITION** valves from the normal cooling position to the alternate cooling position as shown:

COMPONENT	NORMAL COOLING POSITION	ALTERNATE COOLING POSITION
21 Charging Pump Lube Oil Cooler & Gear Oil Cooler		
2DR38, DR Header Hose Conn	Closed	Open
21SW956, SW Inlet Valve	Locked Open	Closed
21SW955, SW Outlet Valve	Locked Open	Closed
2SW187, SW Inlet Drain	Closed	Open
21SW952, SW Outlet Drain	Closed	Open
22 Charging Pump Lube Oil Cooler & Gear Oil Cooler		
2DR38, DR Header Hose Conn	Closed	Open
22SW960, SW Inlet Valve	Locked Open	Closed
22SW959, SW Outlet Valve	Locked Open	Closed
2SW201, SW Inlet Drain	Closed	Open
22SW961, SW Outlet Drain	Closed	Open
21 Safety Injection Pump Lube Oil Cooler		
2DR36, Comp Clng @ SFTY INJ Flush Conn	Closed	Open
2SW160, Inlet to Cooler	Locked Open	Closed
2SW174, Outlet form Cooler	Open	Closed
2SW171, Inlet Drain	Closed	Open
2SW172, Outlet Vent	Closed	Open
2SW513, Inlet To Rm Cooler	Open	Closed

ATTACHMENT 8
(Page 4 of 6)

ALTERNATE COOLING WATER

COMPONENT	NORMAL COOLING POSITION	ALTERNATE COOLING POSITION
22 Safety Injection Pump Lube Oil Cooler		
2DR36, DM Supply Valve	Closed	Open
2SW162, Inlet to Cooler	Locked Open	Closed
2SW181, Outlet form Cooler	Open	Closed
2SW165, Inlet Drain	Closed	Open
2SW166, Outlet Vent	Closed	Open
21 RHR Pump Mechanical Seal Heat Exchanger		
2DR47, DR Supply Valve	Closed	Open
21CC21, CC Inlet Valve	Open	Closed
21CC23, CC Outlet Valve	Open	Closed
21CC22, CC Inlet Drain	Closed	Open
21CC220, CC Outlet Drain	Closed	Open
22 RHR Pump Mechanical Seal Heat Exchanger		
2DR48, DR Supply Valve	Closed	Open
22CC21, CC Inlet Valve	Open	Closed
22CC23, CC Outlet Valve	Open	Closed
22CC22, CC Inlet Drain	Closed	Open
22CC220, CC Outlet Drain	Closed	Open

ATTACHMENT 8
(Page 5 of 6)

ALTERNATE COOLING WATER

COMPONENT	NORMAL COOLING POSITION	ALTERNATE COOLING POSITION
21 Charging Pump Mechanical Seal Heat Exchanger & Gland Cooler		
2DR39, Cont Spray SV	Closed	Open
2CC318, CC Cross-tie Valve	Locked Closed	Open
2CC105, CC Inlet Valve	Open	Open
2CC107, CC Outlet Valve	Open	Closed
2CC97, CC Inlet Valve	Open	Closed
2CC214, CC Header Outlet	Open	Closed
2CC106, CC Inlet Drain	Closed	Open
2CC239, CC Outlet Drain	Closed	Open
22 Charging Pump Mechanical Seal Heat Exchanger & Gland Cooler		
2DR39, Cont Spray SV	Closed	Open
2CC318, CC Cross-tie Valve	Locked Closed	Open
2CC319, CC Inlet Valve	Open	Closed
2CC103, CC Outlet Valve	Open	Closed
2CC97, CC Inlet Valve	Open	Closed
2CC105, CC Inlet Valve	Open	Open
2CC107, CC Outlet Valve	Open	Closed
2CC214, CC Header Outlet	Open	Closed
2CC106, CC Inlet Drain	Closed	Open
2CC231, CC Outlet Drain	Closed	Open

ATTACHMENT 8
(Page 6 of 6)

ALTERNATE COOLING WATER

___ 5.0 **INSTALL** AND **OPERATE** fans in the following pump rooms for additional cooling as required:

PUMP ROOM	NUMBER OF FANS REQUIRED
Component Cooling Water Pump	2
Residual Heat Removal Pumps	2
Containment Spray Pumps	1
Safety Injection Pumps	1
Charging Pumps	1
Spent Fuel Pool Cooling Pumps	1

___ 6.0 **CLOSE** the following balancing dampers between the Auxiliary Building Ventilation System and the RHR area and 21 & 22 Sump Tank Pumps.

___ A. 2VHE728 (Elev 55 RHR Valve Rm)

___ B. 2VHE731 (Aux Bldg - Sump Tk Rm)

___ 7.0 **RETURN** to Step 3.1 in body of procedure to remove decay heat until Service Water is restored.

___ 8.0 When Service Water is restored:

___ A. **REPOSITION** valves on components aligned for alternate cooling to the normal cooling position.

___ B. **REMOVE** alternate cooling and drain hoses installed for alternate cooling and return to storage.

___ C. **REMOVE** portable fans installed in pump rooms and return to storage.

___ D. **RETURN** Auxiliary Building Ventilation System balancing dampers to normal position.

ATTACHMENT 9
(Page 1 of 2)

COLD LEG RECIRCULATION

[C0354]

___ 1.0 **VERIFY** Containment Sump level >62% at all times while on Cold Leg Recirculation. (adequate water supply for Cold Leg Recirculation)

___ 2.0 **ENSURE** CLOSE 2RH21, RHR to RWST Stop Valve.

___ 3.0 **ENSURE** CLOSE 2RH26, HOT LEG Injection Valve.

___ 4.0 **ALIGN** intact RHR train to Containment Sump as follows:

___ A. IF RHR Pump(s) are running,
THEN **STOP** RHR Pumps.

___ B. **PLACE** 2RP4 lockout switch for 2SJ69, RHR Suction From RWST in VALVE OPERABLE

___ C. **CLOSE** 2SJ69, RHR Suction From RWST

___ D. **CLOSE** RHR Pump Suction Valves:

- 21RH4
- 22RH4

___ E. **ENSURE** CLOSED 2RH1 AND 2RH2

___ F. **OPEN** SJ44, CONT SUMP SUCT VALVE, on intact RHR train.

___ G. **PLACE** 2RP4 lockout switch for SJ49, RHR Discharge to Cold Legs, on intact RHR train in VALVE OPERABLE.

___ H. **OPEN** SJ49, RHR Discharge to Cold Legs, on intact RHR train.

___ I. **OPEN** RH18, RHR HX Flow Control Valve, on intact RHR train.

___ J. **START** intact RHR Pump(s).

___ K. **OPEN** the CC16 to the RHR Heat Exchange for the RHR Pump(s) placed in service.

___ L. **ENSURE** at least two CC Pumps are in service.

(step continued on next page)

ATTACHMENT 9
(Page 2 of 2)

COLD LEG RECIRCULATION

4.0 (continued)

___ M. IF Hot Leg Injection is in service,
THEN:

___ 1. **STOP** any running Safety Injection Pumps.

___ 2. **CLOSE** Safety Injection Header Stop Valves for Hot Leg Injection:

- 21SJ40
- 22SJ40

___ N. IF Cold Leg Injection is in service,
THEN:

___ 1. **STOP** any running Charging Pumps.

___ 2. **CLOSE** Charging Header Stop Valves for Cold Leg Injection:

- 2SJ4, Inlet to BIT
- 2SJ5, Inlet to BIT
- 2SJ12, BIT Outlet
- 2SJ13, BIT Outlet

___ 5.0 **THROTTLE** RH18 on intact RHR train to control RCS Temperature.

___ 6.0 **CONTINUE** Cold Leg Recirculation Cooling until RHR is restored or other methods of decay heat removal are utilized.

ATTACHMENT 10
(Page 1 of 2)

COMPLETION SIGN-OFF SHEET

1.0 **COMMENTS**:

(Include procedure deficiencies and corrective actions. Attach additional pages as necessary.)

ATTACHMENT 10
(Page 2 of 2)

COMPLETION SIGN-OFF SHEET

2.0 **SIGNATURES**:

Print	Initials	Signature	Date

3.0 **SM/CRS FINAL REVIEW AND APPROVAL:**

This procedure with Attachments 1 - 10 is reviewed for completeness and accuracy. Entry conditions and all deficiencies, including corrective actions, are clearly recorded in the COMMENTS Section above.

Signature: _____ Date: _____
SM/CRS

EXHIBIT 1
(Page 1 of 1)

BRIEFING SHEET

NOTE

The following items are a list of potential topics which should be covered during the briefing at SM.CRS discretion.

1. **SAFETY**

   - If sending Operators to inspect for suspected leaks, **OBTAIN** radiation Protection support, due to possible elevated radiation levels.

2. **TECHNICAL SPECIFICATIONS and ECGs**

   REFER to TS 3.9.8.1, 3.9.8.2 & 3.4.1.4.

3. **PARAMETERS TO BE MONITORED**

   - RHR flow, RWST level, and CETs
   - Containment and Auxiliary Building radiation levels

4. **SOURCES OF LEAKAGE**

   - Particular attention should be given to components which have on-going maintenance activities or have been recently operated, tagged for maintenance or had valve alignments performed.

5. **CONTINGENCIES**

   - Brief most likely success path to restore core cooling. (Consider Attachment 24, Time to Reach Core Boiling).
   - Restoration of normal RHR cooling.
   - No power available - Attachment 7, Steam Generator Reflux Cooling with Gravity Feed from the RWST.
   - If CETs >200°F - Attachment 5, Hot Leg Injection.
   - If CETs <200°F - Attachment 6, Cold Leg Injection.
   - Reactor Head removed - Attachment 11, Cooling the RCS with the Spent Fuel Pool.
   - If the RWST level drops to 15.2' cold leg recirculation will be aligned IAW Attachment 9, Cold Leg Recirculation. (At saturation conditions, hot and cold leg levels can vary by several feet).

LOSS OF RHR AT REDUCED INVENTORY
TECHNICAL BASES DOCUMENT

1.0 REFERENCES

1.1 Technical Documents

A. Salem Generating Station Updated Final Safety Analysis Report:
   1. Section 5, Chapter 5.5, Component and Subsystem Design
   2. Section 6, Chapter 6.3, Emergency Core Cooling Systems
   3. Section 7, Chapter 7.4, Systems Required for Safe Shutdown
   4. Section 15, Chapter 15.1, Condition I Faults, Normal Operation and Operational Transients
   5. Section 15, Chapter 15.2, Condition II Faults, Faults of Moderate Frequency
   6. Section 15, Chapter 15.3, Condition III Faults, Infrequent Faults
   7. Section 15, Chapter 15.4, Condition IV Faults, Limiting Faults

B. Salem Generating Station Technical Specifications Unit 2:
   1. 3.4.1.4, Reactor Coolant System
   2. 3.5.3, ECCS Subsystems - Tavg <350°F
   3. 3.9.8.1, Refueling Operations-Coolant Circulation

C. Configuration Baseline Documentation:
   1. DE-CB.RHR-0030(Q), Configuration Baseline Documentation for Residual Heat Removal System

D. Technical/Engineering Letters:
   1. Salem Generating Station Licensee Event Reports:
      a. NSO LER-83-066, Closure of 2RH1
      b. NSO LER 89-019-00, Nitrogen Injection Into RCS Causes Gas Binding of RHR Pumps
      c. NSO LER-89-021, Overpressurization of RHR Piping
      d. NSO LER-89-022, RHR Cold Leg Discharge Valves Not Meeting Single-Failure Criteria
   2. NSO NLR-189215-01, NRC Corrective Action Plan for Loss of RHR at Salem 1 per inspection 50-272/89-17 **[C0329]**
   3. NRC Inspection Report 50-272/89-17, Loss of RHR Event on May 20, 1989
   4. Letter from L.K. MILLER, General Manager-Salem Operations, to all station employees, dated May 22, 1989
   5. Letter from J.M. Zupko, Jr., General Manager QA and Nuclear Safety Review: Special Investigation into the Loss Of RHR Event of May 20, 1989, to Vice President and Chief Nuclear Officer
   6. Supervisory Letter SL-37, Salem Primary Systems Loss of Decay Heat Removal, from General Manager to all Supervisors, dated April 2, 1990
   7. S-C-RHR-MEE-0390, 12-21-89, RHR Venting and Addition of New Vent Valves on RHR Suction Piping

(continued on next page)

1.1.D (Continued)

8. WCAP-11916, 7-88, Loss of RHR Cooling While the RCS is Partially Filled
9. PSE-86-532, Westinghouse letter to PSE&G, ECCS Performance During Mode 4 Operation, April 9, 1986
10. Calculation SC-WD-001-01, Containment Sump setpoint for alarm and indication change to 62%

E. Event Classification Guide, Section 4, Loss of Decay Heat Removal
F. Salem Generating Station Technical Department Safety Evaluation, S-C-R200-MSE-0738-1, Mid-Loop Operation, 10/10/88
G. Engineering Calculation S-C-RHR-NDC1619, Time To Boil Curve Extension For Loss Of Residual Heat Removal
H. Westinghouse Salem RCS Pressurization studies for shutdown configuration with the PS25 spray line valve bonnet removed as a vent path.(PSBP324187)
I. DCP 80010288, 1.4% Core Thermal Power Uprate of Salem Generating Station Unit 2
J. S-C-RC-MEE-1614, RCS Reduced Level Condition and Required Vent Path
K. S-C-RC-MDC-1911, Analysis of RSC Fill and Vent Piping Modification
L. S-2-RHR-MDC-2074, Time to Boil Reactor Vessel with a Loss of RHR

1.2 **Procedures**

A. S2.OP-SO.AF-0001(Q), Auxiliary Feedwater System Operation
B. S2.OP-SO.CC-0001(Q), Component Cooling System Normal Operation
C. S2.OP-SO.CN-0001(Q), Placing Feed and Condensate Systems in Operation
D. S2.OP-SO.GBD-0001(Q), Steam Generator Operation - Normal Operation
E. S2.OP-SO.RC-0001(Q), Reactor Coolant Pump Operation
F. S2.OP-SO.RC-0006(Q), Draining the Reactor Coolant System
G. S2.OP-SO.RHR-0001(Q), Initiating RHR
H. S2.OP-SO.SF-0002(Q), Spent Fuel Cooling Operation
I. S2.OP-SO.SF-0003(Q), Filling the Reactor Refueling Cavity
J. S2.OP-SO.SF-0005(Q), Refueling Water Purification Operation
K. S2.OP-AB.CONT-0001(Q), Containment Closure
L. S2.OP-AB.CC-0001(Q), Component Cooling Abnormality
M. S2.OP-AB.RCS-0001(Q), Small RCS Leak
N. S2.OP-AB.RHR-0001(Q), Loss of RHR
O. SC.MD-FR.CAN-0001(Q), Outage Equipment Hatch Installation, Removal, and Seal Replacement
P. 2-EOP-LOCA-3, Transfer to Cold Leg Recirculation

1.3 **Drawings**

A. 205332, No. 2 Unit Residual Heat Removal P&ID
B. 205331, No. 2 Unit Component Cooling P&ID
C. 205333, No. 2 Unit Spent Fuel Cooling P&ID

1.4 **Conformance Documents**

A. C0329, NLR-189215-01, Task 4, add steps to restore RHR to operability in AOP
B. C0329, NLR-189215-01, Task 5, recommend use of additional vent paths in AOP
C. C0329, NLR-189215-01, Task 6, revise AOP for additional vent paths
D. C0329, NLR-189215-01, Task 7, required reference to this letter in AOP references
E. C0330, NRC GL 88-17-F1, Task 5, develop procedures for Containment Closure
F. C0354, Westsalepse-86-532, ECCS Performance During Mode 4 Operations, Shutdown LOCA
G. C0631, INPO OE 7261, Reactor Coolant System Draindown At Wolf Creek

1.5 **Industry Concerns**

A. NRC Generic Letter 87-12, Loss of Decay Heat Removal
B. NRC Generic Letter 88-17, Loss of Decay Heat Removal
C. NUREG 1269, Loss of Residual Heat Removal System Diablo Canyon Unit 2
D. NUREG 1410, Loss of Vital AC Power and the Residual Heat Removal System During Mid-Loop Operations at Vogtle Unit 1 on March 20, 1990
E. NRC Bulletin 80-12, Decay Heat Removal System Inoperability
F. NRC INFO 87-23, Loss of Decay Heat Removal Function at PWRs With Partially Drained Reactor Coolant Systems
G. Westinghouse Owners Group Abnormal Response Guideline (WOG-ARG-1), Loss of RHR While Operating at Mid-Loop Conditions, Rev.1, June 6, 1996
H. INPO SOER 85-4, Loss or Degradation of RHR Capability in PWRs
I. INPO-SOER 88-3 Losses of RHR With Reduced Reactor Vessel Water Level at PWRs
J. NRC INFO 89-67, Loss of Residual Heat Removal Caused by Accumulator Nitrogen Injection
K. NSAC-52, Residual Heat Removal Experience Review and Safety Analysis, Pressurized Water Reactors, January 1983

2.0 DISCUSSION

2.1 This procedure provides the direction necessary for shutdown plant mid-loop operation with RHR System malfunctions. It is the intent of this discussion to provide the reasoning behind the logic and flowpath of the procedure. It is not intended to provide additional direction to the procedure. The Westinghouse Owners Group Abnormal Response Guideline, ARG-1, is used as the basis for step actions and sequence throughout this procedure.

Salem Generating Station management has taken several steps to minimize the potential and mitigate the effects of loss of RHR during mid-loop conditions, including:

- An adequate RCS hot leg vent path is provided:
  - 0.5 SQ. FT opening (Pressurizer Manway or all Pressurizer Safety Valves removed with PORVs blocked open and PRT rupture disc removed)

    OR

  - Vent Path specified by Systems Engineer
- Inner Containment Equipment Hatch is installed using all bolts with no air gap OR the Outage Equipment Hatch (OEH) is installed in the closed position IAW SC.MD-FR.CAN-0001(Q), Outage Equipment Hatch Installation, Removal, and Seal Replacement.
- No. 21 or 22 Safety Injection Pump and associated Hot Leg Injection flow path is available.
- No. 21 or 22 Charging Pump and associated Cold Leg Injection flow path is available.
- Hot side Steam Generator manways are removed first and installed last.
- Cold side Steam Generator nozzle dams are installed first and removed last.
- 2RH1 and 2RH2, RHR Suction Isolation Valves, are opened and de-energized.

2.2 Entry Conditions - Entry conditions are based on the Operator recognizing a malfunction in the RHR System.

The symptoms available to the Operator are as follows:

- Indications of RHR Pump Trip
- 2CC1 Alarm DISCHARGE HIGH PRESSURE
- Unexpected lowering in RCS level with RHR in service as indicated by Overhead Alarm indicating <97 ft. 6 inches:
  - OHA-D47, RHR MIDLOOP SYS TRBL
- Unexpected lowering in Reactor Vessel level as indicated on Reduced Inventory Instrumentation (RVLIS and Mid-Loop).
- Unexpected rise in RCS temperature indicated by Plant Computer Alarms indicating >140°F:
  - T0014A, Reactor Core location H4
  - T0022A, Reactor Core location K12
  - T0031A, Reactor Core location D12
  - T0046A, Reactor Core location J1
- RHR sump alarms:
  - OHA-C26, 21 RHR SUMP OVRFLO
  - OHA-C34, 22 RHR SUMP OVRFLO
- Indication of RHR Pumps cavitating or gas bound:
  - Flow oscillations
  - Motor amps fluctuating
  - Excessive pump noise
  - RHR discharge pressure fluctuating
- Frequent operation of Reactor Coolant Drain Tank Pumps
- Unexpected lowering in VCT level as indicated on Plant Computer points L0112A or L0114A

2.3 Immediate actions - None

2.4 Subsequent actions -

Step 3.1 initiates Attachment 1, Continuous Action Summary, which contains guidance for the duration of the procedure.

Step 3.2 determines if RHR Pumps should be stopped to prevent damage to the preferred system for decay heat removal. Low RCS level can result in air entrainment of the RHR pumps resulting in cavitation (vortexing) which will result in RHR Pump damage. If an RHR system or pump abnormality is identified, the operating pump is stopped to prevent pump damage. RCS letdown and drain paths are isolated to maintain RCS inventory. Time to boil is checked to verify adequate time for venting RHR System pumps for restarting to restore cooling. If adequate time exists for venting, system cooling requirements are checked to be satisfied and the RHR System is vented.

If RHR Pumps are operating and RCS level is adequate, the Operator is directed to Step 3.50 to verify an adequate heat sink exists. Corrective actions are provided to restore Component Cooling and Service Water, as applicable.

Step 3.52 attempts to stabilize RHR flow at a reduced flow rate. Operating at a reduced flow rate while the RCS is in mid-loop conditions greatly reduces the possibility of air entrainment in the RHR System due to vortexing at the RHR suction. In the event vortexing initiates while raising RHR flow, rapid reduction in flowrate may stop the air ingestion and pump cavitation. This phenomena has been extensively studied in the industry and is continuously reinforced in licensed Operator requalification training. If this action results in stabilizing RHR flow, adjustments are made to maintain RCS temperature <140°F and the procedure is exited.

If RHR Pumps are stopped in Step 3.3 due to inadequate RCS level or indications of Pump Cavitation, steps are taken to immediately establish conditions for restart of RHR Pumps. All known drain paths from the RCS are closed to eliminate any further loss of RCS inventory.

The time available to the Operator before core boiling occurs is determined in Attachment 2, Time to Core Boiling After Loss of RHR or Attachment 3, Midloop Heatup Rate For Loss Of RHR Cooling. If the time is determined to be sufficient for normal restoration and local venting, the RHR Pumps are vented. This decision will require calculation of time necessary to dispatch Operators for Containment entry if none are already in Containment. Also, an estimate of time required to vent the RHR System is determined and is part of this decision. Normal venting and startup of RHR pumps is accomplished by first throttling down on RHR discharge flow control valves and raising RCS makeup rate. This is done to minimize effects of sudden cooldown of the RCS and collapsing of any voids as flow is restored.

If these actions are not performed, the possibility exists that RCS level could drop rapidly resulting in a loss of Net Positive Suction Head to the RHR Pumps and a repeated loss of cooling flow. Once operating, the RHR Pump is checked to ensure continued operation is possible and no damage has occurred because of the transient. All of the above actions are performed any time RHR restoration is attempted in this procedure.

If the CRS determines that a rapid restoration of RHR flow is necessary in Step 3.17, RCS level is brought above the minimum operating level for RHR Pumps and an RHR pump is started at a high flow rate to sweep entrained air from the system, as discussed in detail in ARG-1.

Pump and System parameters are closely monitored after this starting sequence to verify acceptable operation of the system and that decay heat removal has been restored. When the necessary conditions have been satisfied, the procedure is exited.

If decay heat removal is not yet established at this point in the procedure, Step 3.30 stops any running RHR Pumps to preclude further damage to these components, checked at Step 3.13. In Step 3.62, Containment Closure and protection of personnel is addressed since the potential for high temperature fluids and fission product release exists if the Core should uncover. Flow of primary coolant from any openings in the RCS is expected and will be highly contaminated and may result in airborne activity.

Steps 3.32, direct the Operator to initiate alternate decay heat removal methods provided in Attachments 5 through 7, allowing the method selected to best suit plant conditions. These attachments are described in detail below. The event is classified IAW the Emergency Plan and appropriate Technical Specifications are entered in Step 3.33.

Stability of RCS level is checked in Step 3.34 to determine if a loss of inventory is occurring. If an RCS leak is indicated, subsequent steps isolate the RHR System since this is the most likely location of RCS boundary failure when operating in this configuration. RH21 is checked to be sure fully closed and locked. If not fully closed, leakage to the RWST may experienced, as at Wolf Creek plant. If the loss of inventory is stopped by isolating RHR, the location of the leak inside the RHR boundary is determined and, if possible, an intact train of RHR is returned to service. If RHR is completely unavailable, alternate decay heat removal is continued until necessary repairs can be completed.

If the leak is determined to be outside RHR boundary, Operators are dispatched to locate and isolate the leak. When conditions permit, RHR is restored as described above, and the procedure is exited.

ATTACHMENT 1 - CONTINUOUS ACTION SUMMARY

IF AT ANY TIME statements which are in effect for the duration of the procedure performance. The Operator is notified that if power is lost to all RHR pumps and makeup sources, gravity feed to the RCS from the RWST is available. If the loss of RHR cooling is due to a loss of heat sink, the Operator is directed to perform Attachment 8 to align alternate cooling water sources to components required for normal and alternate decay heat removal methods.

ATTACHMENT 2 - TIME TO BOIL CURVES

Attachment 2 is a series of curves depicting the time available before saturation temperature is reached in the Reactor core. Two groups of curves are provided in Attachment 2. Three curves each for prior to refueling and after refueling. Each group of curves includes time frames from 1 to 1000 days. An RCS level of 101' elevation is selected since any volume of water in the Pressurizer will not provide any additional time to boiling in the actual core regions. Any volume of water in the Pressurizer is important in time to core uncovery, but not in time to core boiling. Hot Leg Temperature may be used in place of CETs when CETs are not available (i.e. Reactor Head removed, CETs disconnected etc.).

ATTACHMENT 3 - MIDLOOP HEATUP RATE FOR LOSS OF RHR COOLING

Attachment 3 provides the heatup rate expected for a loss of RHR at midloop so that a conservative calculation of time to core boiling can be made in the event the RCS is at some initial temperature other than that depicted in the curves of Attachment 2.

ATTACHMENT 4 - MAKEUP RATE REQUIRED TO REFILL RCS AFTER LOSS OF RHR

Attachment 4 is a curve depicting the makeup flow rate required to adequately cool the Reactor core and refill the RCS after a loss of RHR. This is the flowrate necessary to result in a lowering Core Exit Thermocouple temperature in a feed and bleed scenario. Two curves are provided: 0 to 40 days after shutdown for before core offload and after core offload. Also attached to the bases document are two figures and a table to help with an expanded flow rate needed to suppress boiling. These figures provide direction for decay heat rates up to 20 days, boil-off flows, and flow rates to prevent boiling. The decay heat level chart, from figures PSE-90-557, may not be read with sufficient accuracy to determine the decay heat rates used in the Salem analysis. Therefore, the table on page 9 contains a summary of the decay heat rates prior to refueling, the corresponding boil-off rates at atmospheric pressure, and (for comparison) the flow rates needed to prevent boiling at atmospheric pressure. The decay heat rates are based on the ANS-5.1-1979 decay heat standard (including 2-sigma uncertainty) and were actually taken from Appendix A in NSAC-195L (Reference 12), a shutdown safety study performed for Diablo Canyon.

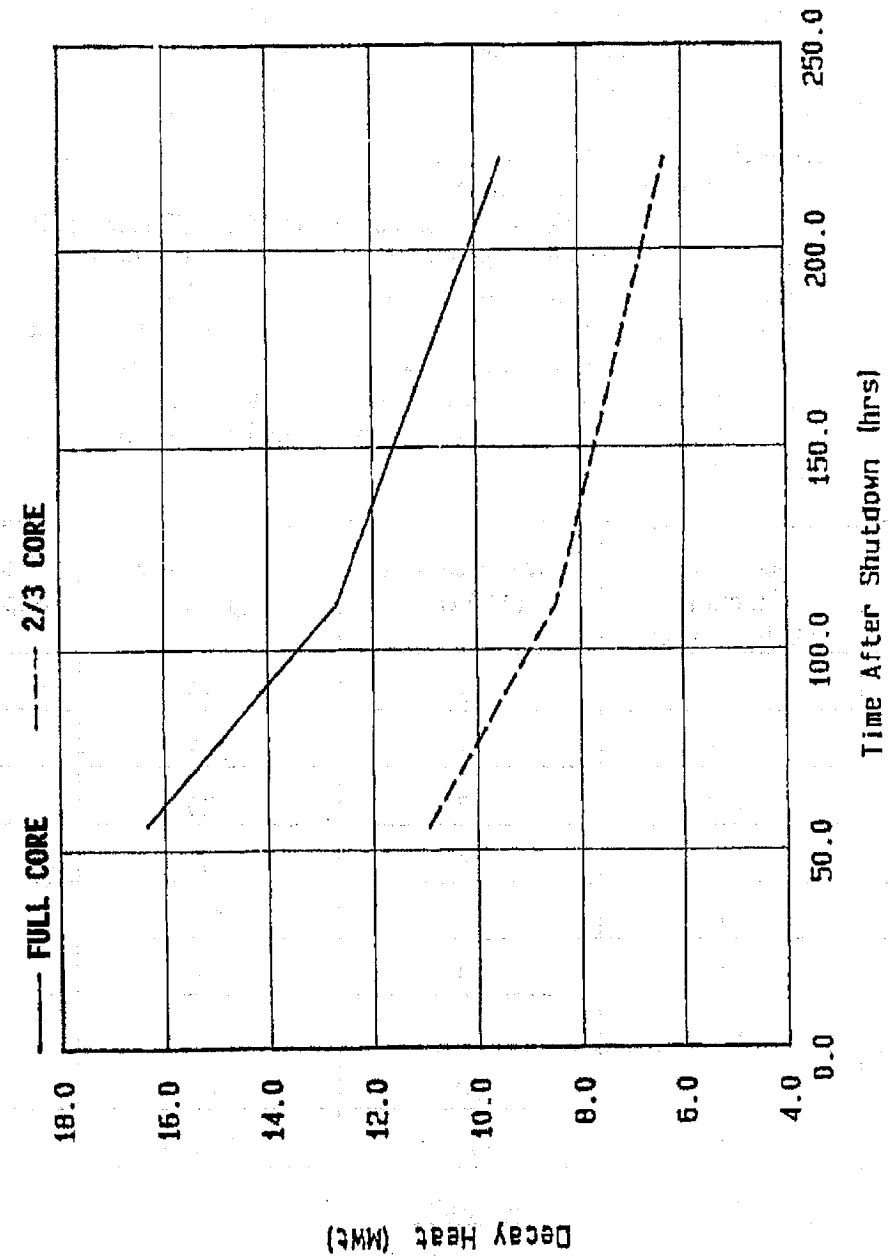
ATTACHMENT 4 - MAKEUP RATE REQUIRED TO REFILL RCS AFTER LOSS OF RHR (continued).

These decay heat values compare closely with those of Figures 1 and 2 in PSE-90-557. The flow rates required to prevent boiling (at 212°F) are based on an RWST temperature of 80°F (e.g., see Section 2 in Reference 13). They assume "zero-spill" prior to being heated in the core. Attachment 4 uses a makeup flow rate that is approximately three times the boil-off flow, a rate that is still regarded as reasonable if boiling is an acceptable consequence for RHR recovery. For personnel safety and for level inaccuracy concerns, a higher flow rate, i.e., one to prevent boiling, is considered. Note that most differential pressures as well as ultra-sonic level indications are inaccurate once the RCS starts to boil (the ultra-sonic system requires a defined surface in the hot leg to reflect the sound wave). Therefore, the flow rates are shown expanded in this document to give the operator some additional information of the flow rates needed to suppress boiling. The operator has the added information to add inventory whenever the RWST inventory is high (e.g., above 50%). Flow is then reduced to match boil-off. An RWST level as low as 25% would be justified in view of the factor of seven difference between the flow rates.

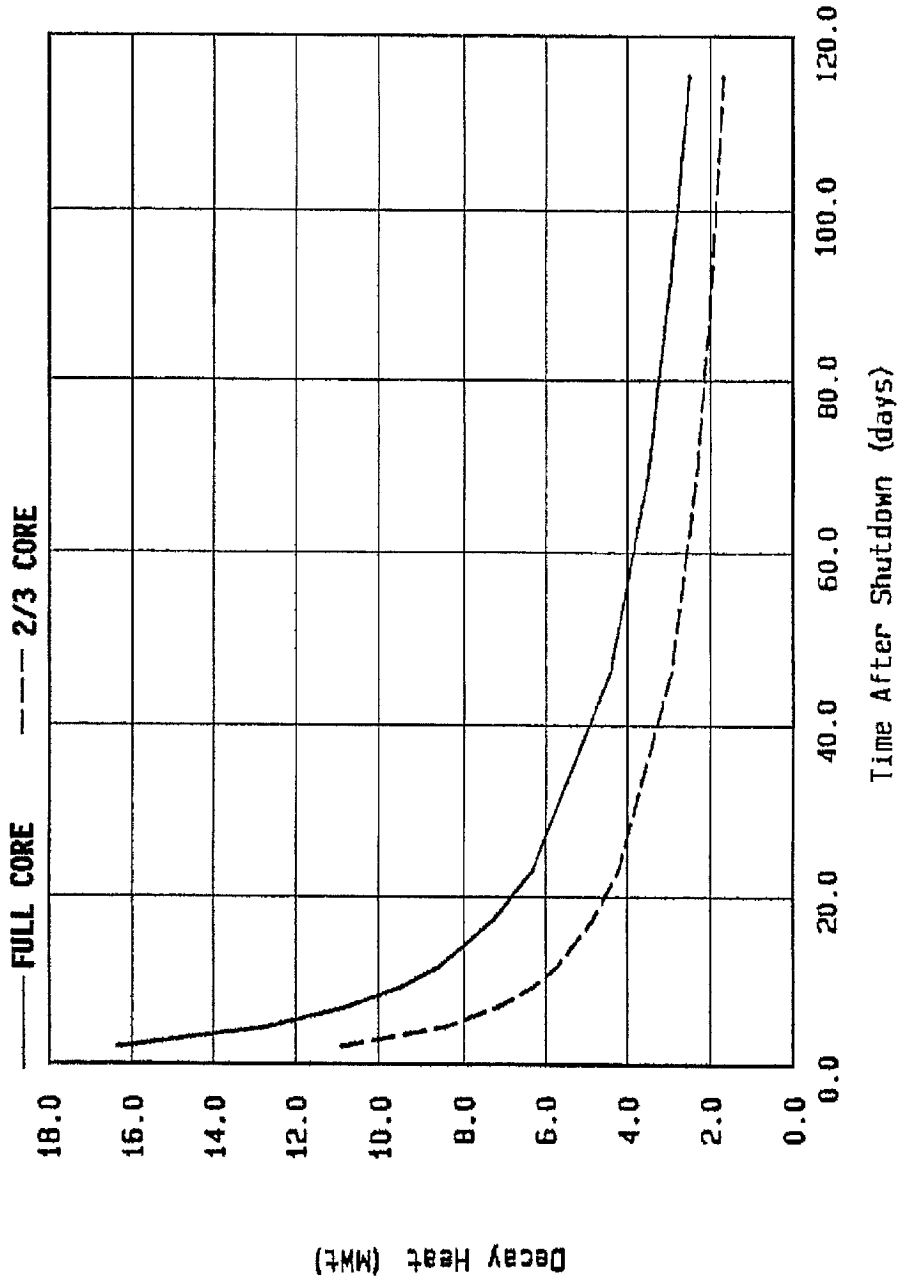
Days After SHUTDOWN	Decay heat Fraction (% Full Power)	Decay Heat Rate (MWt) *	Boil-off Rate (gpm) *	Flow Rate to Supress Boiling (gpm) *
1.16	.602	21	149	1067
2.00	.505	18	125	894
2.31	.483	17	120	856
3.47	.419	15	104	742
4.00	.396	14	98	702
4.63	.377	13	93	668
7.00	.320	11	79	567
9.26	.283	10	70	501
10.0	.276	9.5 (6.4)	68 (45)	489 (326)
11.57	.258	8.9 (6.0)	64 (43)	457 (305)
14.0	.239	8.3 (5.5)	59 (39)	424 (283)
17.35	.216	7.5 (5.0)	53 (36)	383 (255)
21.0	.199	6.9 (4.6)	49 (33)	353 (235)

* Post-refueling values shown in parentheses are based on 2/3 of the pre-refueling values.

ATTACHMENT 4 - MAKEUP RATE REQUIRED TO REFILL RCS AFTER LOSS OF RHR (continued).



ATTACHMENT 4 - MAKEUP RATE REQUIRED TO REFILL RCS AFTER LOSS OF RHR (continued).



ATTACHMENT 5 - HOT LEG INJECTION

Hot Leg Injection is the preferred method of restoring RCS inventory lost due to leakage, as it ensures flow through the core when RCS temperature is greater than 200°F.

Openings in any RCS Hot Leg will provide an adequate vent path to prevent pressurization of the RCS which could inhibit flow to the core. If a hot leg vent path does not already exist, Pressurizer PORVs are opened to provide the desired bleed path.
Decay heat removal is accomplished by Feed and Bleed of the RCS: Borated water is pumped into the RCS using a Safety Injection Pump aligned to RCS hot legs, taking suction from the RWST. Design minimum flow of the Safety Injection Pump is 400 gpm. If the 2PS59 is the vent path and the S/G nozzle dams are installed, the flow is limited to <300 gpm, sufficient to suppress boiling and not over-pressurize the system. If decay heat is greater than 13MWt, a Charging pump is started IAW attachment 6. Under these conditions two pumps will be required to suppress boiling. Maximum flow to the RCS is maintained until one of the following conditions is satisfied:

1) RHR is restored

2) Flow from RCS opening is adequate to result in a lowering Core Exit Thermocouple temperatures

The bases of these conditions is as follows:

RHR restored. Once RHR is restored, normal shutdown operation is resumed and this procedure is exited.
Consistent with Westinghouse Owners Group ARG-1, the SI pumps are operated long term until RHR can be restored. Hot leg injection is performed once core exit temperatures reach 200°F to allow feed and bleed alternate cooling of the RCS. The boil off will maintain Core Exit temperatures at saturation temperature for RCS pressure, anticipated to be at or near atmospheric.
Flow from RCS openings is adequate to result in a lowering Core Exit Thermocouple temperatures. This determines that decay heat removal is adequate and core will remain covered.
In the event Core Exit Thermocouples are not available, injection flow is maintained IAW Attachment 3, Makeup Rate Required to Refill RCS After Loss of RHR. To avoid frequent starting and stopping of Safety Injection Pumps, the appropriate SJ35 valve is throttled to obtain the flow rates addressed above. Minimum flow recirculation is maintained at all times to the Safety Injection Pumps, therefore throttling discharge flow is acceptable and within UFSAR analysis. Heat is removed from the Containment by operation of all available Containment Fan Cooling Units (CFCUs) in slow speed, which is the UFSAR analyzed accident configuration, which also insures Containment or RCS pressure rises are minimized.

ATTACHMENT 5 - HOT LEG INJECTION (continued)

RCS feed flow is adjusted to exceed boil off rate or to stabilize level while maintaining Core Exit Thermocouples stable or lowering. A bleed path is aligned from the Pressurizer to the PRT, and ultimately to the Containment Sump. The Reactor Head is vented to remove any bubble which may have formed, and to provide additional vent path. Attempts to correct primary system leakage continue and when accomplished, RHR is restored and the procedure is exited.

ATTACHMENT 6 - COLD LEG INJECTION

Cold Leg Injection is the preferred method of restoring RCS inventory lost due to leakage, when RCS temperature is less than 200°F. Decay heat removal is accomplished by feed and bleed of the RCS. Borated water is charged into the RCS using a Charging Pump aligned to RCS cold legs taking suction from the RWST. If any opening exists in any RCS Cold Leg, flow may not reach the Reactor Core unless Cold Leg Injection is initiated before any RCS pressurization due to boiling occurs.

Failure of a Steam Generator Nozzle Dam or removal of a Cold Leg Steam Generator Manway, with no Hot Leg vent path on the same loop could result in core uncovery within several minutes after boiling starts due to Hot Leg pressurization. As a result of these concerns, Salem Generating Station has incorporated several practices to minimize the possibility of this event occurring:

A) Hot side Steam Generator Manways are removed first and installed last.

B) Cold side Steam Generator Manways are installed first and removed last.

These precautions ensure if Cold Leg Injection is required, a Cold Leg opening does not exist without an adequate Hot Leg vent path on the same loop. Maximum makeup flow is maintained as described in the bases for Hot Leg Injection. The design minimum flowrate of the Charging Pumps is 460 gpm, well above the flow required to remove core heat in the conditions addressed in this procedure. If the 2PS59 is the vent path and the S/G nozzle dams are installed, the flow is limited to <300 gpm, sufficient to suppress boiling and not over-pressurize the system. If decay heat is greater than 13 MWt, a Safety Injection Pump is placed in service. Under these conditions two pumps will be required to suppress boiling.
Heat is removed from the Containment by operation of all available CFCUs in slow speed (UFSAR analyzed) which also ensures Containment or RCS pressure rises are minimized. RCS feed flow is adjusted to exceed boil off rate or to stabilize level while maintaining Core Exit Thermocouples stable or lowering. A Bleed path is aligned from the Pressurizer to the PRT and ultimately to the Containment Sump. The Reactor Head is vented to remove any bubble which may have formed and to provide an additional vent path. Attempts to correct primary system leakage continue and when accomplished, RHR is restored and the procedure is exited.

ATTACHMENT 7 - COOLING THE RCS WITH STEAM GENERATORS

In the event the RCS is at or near atmospheric pressure, the RWST is available to provide a borated water source to the RCS. This method is of particular importance when electrical power is not available for other methods of decay heat removal. Westinghouse Owners Group analysis has shown that the phenomena known as reflux cooling will adequately remove decay heat if at least two Steam Generators are available as a secondary heat sink. RCS pressure at or near atmospheric is most conducive to the initiation of this phenomena.

Steam in the RCS piping will condense in the relatively cold Steam Generator tubes and "fall back" to the loops and flow to the Reactor Core due to density differences. As temperature rises, RCS pressure rises also, but it has been found through analysis that pressures up to the 20 psig range tend to improve this phenomena once established at lower pressures. Once the secondary side of the Steam Generators reach saturation, continued heat removal can be accomplished by feed and bleed or steaming of the Steam Generator. Feedwater is provided to the Steam Generators for decay heat removal by the Condensate System or the Auxiliary Feedwater System.

Heat removal from the Steam Generators is accomplished by operation of the Main Steam Power Relief Valves (MS10s), or by feed and bleed of the Steam Generator secondary side while maintaining wide range level in the 77% to 95% range. This range was selected based on the following:

1. Wide range level is accurate at low RCS temperatures (Cold Calibrated)

2. 77% WR is equivalent to approximately 5% narrow range which ensures Steam Generator tubes remain covered providing the maximum heat transfer rate from the RCS

3. 95% is selected as the maximum to provide the Operator with an adequate operating margin without going "off-scale high" or passing water through MS10s or to the Main Steam piping.

Heat removal from the Containment is especially critical in this decay heat removal mode since any excessive pressure rise with any openings in the RCS pressure boundary could disrupt flow from the RWST, and reduce heat transfer to the secondary water in the Steam Generators. A more complete explanation of this phenomena can be found in the Westinghouse Owners Group Abnormal Response Guideline. Heat is removed from the Containment by operation of all available CFCUs in slow speed (UFSAR analyzed) which also insures Containment or RCS pressure rises are minimized.

ATTACHMENT 7 - COOLING THE RCS WITH STEAM GENERATORS (continued)

In the event the RCS is filled as a result of alternate decay heat removal injection, cooldown by steaming the Steam Generators will stop any heatup of the RCS. If RCS pressure is adequate to satisfy RCP seal differential pressure requirements, RCPs are operated IAW the normal Operating Procedure. If a natural circulation cooldown is required, the Operator is provided with parameters to maintain to ensure natural circulation heat removal is occurring.
Once decay heat removal from the RCS is stabilized, Operators are dispatched to locate and isolate the source of RCS leakage. When leak isolation is completed, RHR is restored and the procedure is exited.

ATTACHMENT 8 - ALTERNATE COOLING WATER

This attachment is provided to direct the Operator to align alternate cooling water to pumps and components used throughout this procedure. Failure to do so can lead to failure of components necessary for alternate decay heat removal. If the failure is a loss of Service Water, decay heat is transferred to Component Cooling and then to the Spent Fuel Pool since CC temperature will eventually exceed SFP temperature on extended loss of RHR casualties. Loss of Component Cooling will require initiating one of the specified means of alternate decay heat removal.Since alternate cooling water cannot be provided to Safety Injection Pump Seal Water Heat Exchangers when BOTH trains of CC are lost, decay heat removal by cold leg injection or Steam Generators would be preferred in this very unique case. Additional cooling to the pumps is provided by placing fans in the rooms and operating the fans for circulation of air in each area.

ATTACHMENT 9 - COLD LEG RECIRCULATION

This attachment provides direction for alignment of RHR pump suction to Containment Sump as described in 2-EOP-LOCA-3, Transfer to Cold Leg Recirculation.

As discussed in Westinghouse background documents, this provides long term decay heat removal. This attachment is referred to in the other attachments when RWST LO Level Alarm actuates (15.24 ft) and Containment Sump level reaches 62%. This has been determined to be the level necessary to provide adequate Net Positive Suction Head for RHR Pumps taking a suction on the Containment Sump.

For this worst case loss of RHR scenario, the following comparison of step sequence is made with ARG-1:

ARG-1 SEQUENCE	SALEM SEQUENCE	Step No.
1. CHECK IF RHR PUMPS SHOULD BE STOPPED	1	3.2
2. ISOLATE LETDOWN AND DRAINS	2	3.5, 3.59
3. DETERMINE TIME TO CORE BOILING	3	3.6, 3.60
4. PROTECT CONTAINMENT PERSONNEL	4	3.4, 3.63
5. ESTABLISH CONTAINMENT CLOSURE	5	Attachment 1 Step 2.0
6. START CFCUs	6	Attachment 5 Step 3 Attachment 6 Step 4 Attachment 7 Step 8
7. Check CETs <200°F	7	Attachment 5 Attachment 6
8. CHECK RCS LEVEL	8	3.2.B, 3.34
9. REFILL RCS	9	3.9.A, 3.19
10. GO TO Step 12	N/A	N/A
11. REFILL RCS TO ≥ MID-LOOP	11	3.9.A, 3.20, 3.44.B.3, 3.45.A
12. IDENTIFY AND ISOLATE LEAK	12	3.44
13. DETERMINE IF SEC HEAT SINK REQUIRED	13	Attachment 7
14. VENT RHR	14	3.9, 3.44.B
15. ESTABLISH RHR INITIAL CONDITIONS	15	3.11, 3.45
16. RESTORE RHR FLOW	16	3.11.E, 3.45.C
17. CHECK IF MAKEUP SHOULD BE REDUCED	17	3.48
18. CHECK RCS <140°F	18	3.14, 3.27, 3.47
19. EXIT PROCEDURE	19	3.16, 3.29, 3.40, 3.43, 3.49, 3.57

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