S A F E T Y R E L A T E D

FARLEY NUCLEAR PLANT

SPECIFIC BACKGROUND DOCUMENT

FOR

FNP-1/2-ESP-0.2

NATURAL CIRCULATION COOLDOWN TO PREVENT REACTOR VESSEL HEAD STEAM VOIDING

PROCEDURE USAGE REQUIREMENTS PER FNP-0-AP-6	SECTIONS
Continuous Use	
Reference Use	
Information Use	**ALL**

Approved:

David L Reed (for)

Operations Manager

Date Issued: January 11, 2011

TABLE OF CONTENTS

Section: **Title**

Unit 1 ERP Step:	**Unit 2 ERP Step:**	***ERG Step No:***

ERP StepText: NATURAL CIRCULATION COOLDOWN TO PREVENT REACTOR VESSEL HEAD STEAM VOIDING

ERG StepText: *NATURAL CIRCULATION COOLDOWN*

Purpose:

Basis:

Knowledge:

References:

Justification of Differences:

1 Changed to make plant specific. Modified Title to reflect this procedure is for natural circulation cooldown without a reactor vessel void. Separate Natural Circulation cooldown procedures exist for cooldown with a void in the reactor vessel.

Section: Purpose

Unit 1 ERP Step: **Unit 2 ERP Step:** ***ERG Step No:***

ERP StepText: This procedure provides actions to perform a natural circulation RCS cooldown and depressurization to cold shutdown, with no accident in progress, under requirements that will preclude any upper head void formation and flow stagnation in an inactive loop.

ERG StepText: *This guideline provides actions to perform a natural circulation RCS cooldown and depressurization to cold shutdown, with no accident in progress, under requirements that will preclude any upper head void formation and flow stagnation in an inactive loop.*

Purpose:

Basis:

Knowledge:

References: DW-04-001

Justification of Differences:

1 Changed to make plant specific.

Section: Symptoms

Unit 1 ERP Step: **Unit 2 ERP Step:** ***ERG Step No:***

ERP StepText: This procedure is entered when it has been determined that a natural circulation cooldown is required; from the following:

ERG StepText: *This guideline is entered from:*

Purpose:

Basis:

Knowledge:

References:

Justification of Differences:

1 Changed to make plant specific.

2 Added entry from ESP-1.1 due to a potential for this transition being required following a loss of all AC power which results in SI actuation. In this case RCPs may not be able to be restarted requiring a natural circulation cooldown following SI termination.

3 Added entry from AOP-4.0 due to potential for this transition being required if RCS cooldown required after a loss of reactor coolant flow.

Section: **Procedure**

Unit 1 ERP Step: 1 CAUTION-1 **Unit 2 ERP Step:** 1 CAUTION-1 ***ERG Step No:*** *1 CAUTION-1*

ERP StepText: To ensure proper plant response, FNP-1-EEP-0, REACTOR TRIP OR SAFETY INJECTION, must be entered upon any SI actuation.

ERG StepText: *If SI actuation occurs during this guideline, E-0, REACTOR TRIP OR SAFETY INJECTION, should be performed.*

Purpose: To alert the operator that if SI occurs during this guideline he should transfer to the appropriate procedure.

Basis: When SI actuates, plant conditions exist which require actions not covered in this guideline. Therefore, a transition to E-0, REACTOR TRIP OR SAFETY INJECTION, should be made.

Knowledge: N/A

References:

Justification of Differences:

1 Changed to make plant specific.

Section: **Procedure**

Unit 1 ERP Step: 1 CAUTION-2 **Unit 2 ERP Step:** 1 CAUTION-2 ***ERG Step No:*** *1 CAUTION-2*

ERP StepText: If RCP seal cooling had previously been lost, the affected RCP should not be started prior to a status evaluation.

ERG StepText: *If RCP seal cooling had previously been lost, the affected RCP should not be started prior to a status evaluation.*

Purpose: To alert the operator that RCP seal damage may have occurred if RCP cooling had previously been lost. In that case, starting the affected RCP may further damage the seal and RCP.

Basis: The potential for degradation in RCP seal performance and seal life increases with increasing temperature above 300°F. Hence, if seal cooling is lost for a significant period of time, seal or bearing damage may occur. The potential non-uniform sealing surfaces and seal crud blockage that may exist prior to RCP start can aggravate bearing and seal damage if the RCP is started. Following restoration of seal cooling, the RCP should not be started prior to a complete RCP status evaluation in order to minimize potential RCP damage on restart. Refer to Subsection 2.1 of the background document for guideline ECA-0.0, LOSS OF ALL AC POWER, for additional information.

Knowledge:

- If RCP seal cooling is lost for only a few minutes, the inventory of cold water in the seal area should prevent excessive seal heat up. For longer periods of time, seal and bearing temperatures may increase greater than 300°F. If excessive temperatures develop, the affected RCP should not be restarted prior to a complete RCP evaluation.
- RCPs should not be started prior to a status evaluation unless an extreme (red) or severe (orange) CSF challenge is diagnosed. Under such a CSF challenge, the "rules of usage" apply and an RCP should be started if so instructed in the associated FRG. Under a CSF challenge, potential RCP damage is an acceptable consequence if RCP start is required to address a CSF challenge (e.g., to mitigate an inadequate core cooling condition). This is consistent with the intent of these FRGs which attempt to first establish support conditions to start an RCP, but then start an RCP whether or not the support conditions are established.

References:

Justification of Differences:

1 None

Section: **Procedure**

Unit 1 ERP Step: 1 NOTE-1 **Unit 2 ERP Step:** 1 NOTE-1 ***ERG Step No:*** *1 NOTE-1*

ERP StepText: Foldout page should be monitored continuously.

ERG StepText: *Foldout page should be open.*

Purpose: To remind the operator that the foldout page for ES-0.2 should be open

Basis: The foldout page provides a list of important items that should be continuously monitored. If any of the parameters exceed their limits, the appropriate operations should be initiated. Refer to the section FOLDOUT PAGE in this background document and the document FOLDOUT PAGE ITEMS in the Generic Issues section of the EXECUTIVE VOLUME for additional information on which foldout page items apply to this guideline and sample wording of those items.

Knowledge: The operator should know what items comprise each foldout page.

References:

Justification of Differences:

1 Changed to make plant specific.

2 Changed "open" to "monitored continuously". The foldout page does not open in the FNP format.

Section: **Procedure**

Unit 1 ERP Step: 1 NOTE-2 **Unit 2 ERP Step:** 1 NOTE-2 ***ERG Step No:*** *1 NOTE-2*

ERP StepText: To ensure adequate pressurizer spray, the priority for establishing RCP support conditions is 1B, 1A and then 1C.

ERG StepText: *RCPs should be run in order of priority to provide normal PRZR spray.*

Purpose: To inform the operator of a preferred order for starting RCPs

Basis: For the reference plant there are PRZR connections to one RCS hot leg via the surge line and to two RCS cold legs via the spray lines. Single pump operation in the loop that provides the best spray is preferred to obtain normal PRZR spray capability. If the RCP in the loop with the pressurizer surge line can be started, then it alone should be sufficient to provide normal pressurizer spray. However, if that RCP is unavailable, it will likely be necessary to start more than one RCP to provide normal pressurizer spray. Refer to the document RCP TRIP/RESTART in the Generic Issues section of the Executive Volume.

Knowledge: N/A

References:

Justification of Differences:

1 Changed to make plant specific.

2 Added note to flag associated step as a continuing action.

Section: **Procedure**

Unit 1 ERP Step: 1 NOTE-3 **Unit 2 ERP Step:** 1 NOTE-3 ***ERG Step No:*** *1 NOTE-3*

ERP StepText: If conditions can be *established* for starting an RCP while in this procedure, step 1 should be repeated.

ERG StepText: *If conditions can be established for starting an RCP during this guideline, Step 1 should be repeated.*

Purpose: To inform the operator that an RCP should be started whenever possible during the course of this guideline, and the guidance in Step 1 should be used.

Basis: Since forced convection cooling permits a faster plant cooldown with less potential for upper head voiding, an attempt to restart an RCP should be made when under natural circulation conditions. If the proper conditions can be established for starting an RCP, Step 1 should be repeated. Step 1 provides conditions necessary for starting an RCP and should be used when attempting a restart. This step also directs the operator to the appropriate procedure if restart is successful.

Knowledge: N/A

References:

Justification of Differences:

1 None.

Section: **Procedure**

Unit 1 ERP Step: 1 **Unit 2 ERP Step:** 1 ***ERG Step No:*** *1*

ERP StepText: Establish RCP support conditions.

ERG StepText: *Try To Restart An RCP*

Purpose: To establish forced convection cooling by starting an RCP

Basis: Cooling down under forced convection conditions allows faster plant cooldown with less potential for upper head voiding than under natural circulation conditions. This step outlines the conditions necessary for starting an RCP and thereby establishing forced convection cooling. If all seal cooling has been lost long enough that the maximum RCP seal parameters identified in the RCP Vendor Manual have been exceeded, seal injection and CCW thermal barrier cooling should not be established to the affected RCP(s). Both of these methods of seal cooling could have unintended consequences that result in additional pump damage or the failure of plant safety systems. Seal cooling should instead be restored by cooling the RCS, which will reduce the temperature of the water flowing through the pump seals.

Knowledge:

o This step is a continuous action step as indicated by NOTE preceding it. o If a pressurizer spray valve is failed open, RCP(s) previously stopped to prevent RCS depressurization should not be restarted.

o IF a DG is already operating above its continuous load rating, THEN additional manual loads should not be added. Unanticipated plant emergency conditions may dictate the need to load the emergency diesel generators above the continuous load rating limit (i.e. 2.85 MW for small DGs, 4.075 MW for large DGs). Under these circumstances, diesel generator loading may be raised not to exceed the 2000 hour load rating limit (i.e. 3.1 MW for small DGs, 4.353 MW for large DGs). Diesel loading should be reduced within the diesel generator continuous load rating limit as soon as plant conditions allow.

References:

Justification of Differences:

1 Changed to make plant specific.

2 Added RNO guidance to secure all but 1 RCP if heat up can not be stopped.

Section: **Procedure**

Unit 1 ERP Step: 2 **Unit 2 ERP Step:** 2 ***ERG Step No:*** *2,3,4*

ERP StepText: Establish adequate shutdown margin.

ERG StepText: *Borate RCS To Cold Shutdown Boron Concentration*

Purpose: To provide an RCS boron concentration in the active portions of the system which meets the required shutdown reactivity margin as stated in the plant Technical Specifications, when considered on a total plant mass basis

Basis: It is important to provide reasonable assurance that even a fairly rapid temperature drop, which results in a large outsurge of relatively dilute pressurizer liquid into the active (loop) portion of the RCS, will not cause problems with loss of core shutdown margin. Without RCP-driven pressurizer spray, no adequate means of mixing the loop coolant with pressurizer liquid exists. In addition, the upper head will not mix unless a RCP is started at a later time. Therefore, the active (loop + core) portions of the system must be over-borated to some extent to attain the required boron concentration on an overall basis. Since the typical way to determine the necessary boron addition (nomographs or boration tables) is based on normal system inventory, then determining the amount of boric acid to add will not change. However, when sampling is performed, an over-boration is expected due to mixing only in the active portions of the system.

Knowledge: Determination of RCS boron concentration required for shutdown reactivity margin on a total mass basis

References:

Justification of Differences:

1 Changed to make plant specific.

2 Since actions regarding make up control system setup and boron sampling are part of establishing the required shutdown margin, these actions were incorporated into this step.

Section: **Procedure**

Unit 1 ERP Step: **Unit 2 ERP Step:** ***ERG Step No:*** *4*

ERP StepText: N/A Step Deletion

ERG StepText: *Check VCT Makeup Control System*

Purpose: To ensure automatic makeup to the RCS at the cold shutdown boron concentration

Basis: The VCT system should be returned to AUTOMATIC makeup operation, at a boron concentration which matches that in the active portions of the RCS (not the target overall boron concentration). This boric acid/reactor makeup water blend should be reset into the flow controllers. With the system in automatic operation, the operator should verify that the normal level is being maintained in the VCT during the coolant contraction.

Knowledge: N/A

References:

Justification of Differences:

1 This action was incorporated into the step which establishes adequate shutdown margin.

Section: **Procedure**

Unit 1 ERP Step: 3 **Unit 2 ERP Step:** 3 ***ERG Step No:*** *5*

ERP StepText: Verify both CRDM CLG FANs - STARTED.

ERG StepText: *Verify All CRDM Fans - RUNNING*

Purpose: To ensure that as much heat as possible is being removed from the vessel head

Basis: The results from several tests at domestic and foreign plants indicate that the Control Rod Drive Mechanism (CRDM) cooling fans aid significantly in removing heat from the upper head area. For this reason it is necessary to have as many CRDM cooling fans in operation as possible. If the CRDM cooling fans are not in operation, subsequent RCS cooldown/depressurization instructions are affected (see Step 12). Refer to the DESCRIPTION section for a more detailed discussion of the heat removal capabilities of the CRDM cooling fans.

Knowledge: o This step is a continuous action step. o If additional CRDM fans become available after this step is encountered, they should be started to enhance cooldown of the upper head. It may be possible to satisfy the plant-specific definition of “all” CRDM fans operating by the time Step 12 is reached to allow less restrictions on the subsequent RCS cooldown and depressurization to RHR operating conditions.

References:

Justification of Differences:

1 Changed to make plant specific.

2 Deleted RNO due to the FNP definition of "verify".

Section: **Procedure**

Unit 1 ERP Step: 4 CAUTION-1 **Unit 2 ERP Step:** 4 CAUTION-1 ***ERG Step No:*** *3*

ERP StepText: RCS boron concentration must be verified to be greater than or equal to the required Cold Shutdown Boron Concentration prior to commencing a cooldown.

ERG StepText: *Verify Cold Shutdown RCS Boron Concentration By Sampling*

Purpose: To ensue that cold shutdown boron concentration on a total mass basis exists

Basis: The operator must determine the system boron distribution by obtaining samples from available sample points, particularly the pressurizer liquid. The pressurizer liquid boron concentration will remain at or near the original coolant boron concentration prior to the loss of forced flow event. As mixing occurs in the active portions of the RCS, the boron concentration in the loop(s) with no charging connection should rise to meet the boron concentration in the loop with the charging connection. The boron concentration in the hot legs, and in the letdown line should approach a common value as boron mixing in the active portions of the reactor coolant system proceeds. The ultimate shutdown condition of the reactor must be judged from the response of the excore nuclear instrumentation.

Knowledge: Determination of RCS boron concentration on a total mass basis utilizing RCS samples.

References:

Justification of Differences:

1 In addition to this caution which warns of the need to ensure adequate shutdown margin, boron sampling has been incorporated into the step which establishes shutdown margin.

Section: **Procedure**

Unit 1 ERP Step: 4 NOTE **Unit 2 ERP Step:** 4 NOTE ***ERG Step No:***

ERP StepText: An inactive loop is any RCS loop that is not available for cooling the RCS due to a loss of the capability to feed or steam its SG.

ERG StepText: *An inactive loop is any RCS loop that is not available for cooling the RCS due to a loss of the capability to feed or steam its SG.*

Purpose: To remind the operator of the definition of an inactive loop

Basis: An active loop is defined as one in which the SG is removing energy from the RCS; an inactive loop is one in which it is not. During a natural circulation cooldown in which one or more SGs is not participating in heat removal from the RCS because of component failure, such as loss of feedwater to the SG or loss of the ability to steam the SG, an inactive loop results.

Knowledge: If an inactive loop(s) exists, flow stagnation in the inactive loop(s) can occur, delaying or preventing cooldown of the inactive loop(s). Flow stagnation can extend the time for placing RHR in service. Therefore, it is important for the operator to understand the actions necessary to prevent stagnation from occurring and the actions necessary to restore flow in the stagnant loop.

References: DW-04-001

Justification of Differences:

1 None.

Section: **Procedure**

Unit 1 ERP Step: 4 **Unit 2 ERP Step:** 4 ***ERG Step No:*** *6*

ERP StepText: Begin RCS cooldown to cold shutdown.

ERG StepText: *Initiate RCS Cooldown To Cold Shutdown*

Purpose: To begin a controlled RCS cooldown to cold shutdown at a specified maximum rate, with preferred and alternate methods

Basis: Prior to initiating the cooldown of the RCS, a check is made to determine if an inactive loop(s) exists. An inactive loop is defined as one in which either the steam release capabilities are not available or feedwater is not available due to component failures.

If all loops are active, then steam should be released through the condenser steam dump valves. If the main condenser is not available for steam dump, the cooldown should be established by use of the steam generator power-operated relief valves, releasing steam to the atmosphere or other plant specific means. The cooldown rate should be controlled and maintained less than the plant-specific maximum cooldown rates obtained from the Appendix to this section. The cooldown rate depends upon whether the plant is a TCOLD or THOT plant (see Table A-1 in the Appendix, which defines the TCOLD and THOT plants). Steam dump must be discontinued if the actual cooldown rate exceeds these permissible values.

If one or more of the RCS loops is inactive, a more restrictive cooldown rate may be imposed to prevent flow stagnation in the inactive loop(s). The analysis performed to address stagnant loop cases is documented in WCAP-16632. Information is also provided in the "Natural Circulation Cooldown with a Stagnant Loop" section of this background document. The maximum cooldown rate is dependent on the decay heat level of the core (based on time after trip) and the elevation from the bottom of the SG plenum to the top of the U-tube bend. The maximum allowable cooldown rate decreases as the SG elevation increases. Similarly, the maximum cooldown rate decreases as the decay heat level decreases.

The maximum cooldown rate is determined from Figure ES02-1. This is a generic curve which is used to determine the maximum cooldown rate versus the active loop(s) ΔT. Note that the active loop(s) ΔT is directly proportional to the decay heat level. Each utility must develop a plant specific curve for its plant from Figure ES02-1 and this curve would be included in the plant specific EOPs. This plant specific curve can be developed by modifying Figure ES02-1 as follows: The X-axis should be the nominal or indicated ΔT (Thot - Tcold) of the active loop(s) without uncertainties. The Y-axis values are the maximum cooldown rates based on the plant specific steam generators as determined from Figures 6 through 11 of the DESCRIPTION section. A plant specific curve is then plotted similar to ES02-1.

Section: **Procedure**

Unit 1 ERP Step: 4 **Unit 2 ERP Step:** 4 ***ERG Step No:*** *6*

Basis: (cont.)

Steam release capability may not be available for an inactive loop(s). To prevent uneven RCS temperature distributions, the pressure difference between steam generators must be minimized. This ensures that decay heat removal is evenly distributed to each active coolant loop and that automatic initiation of safety injection does not occur on a high steamline delta P signal.

The MSIV on the inactive loop(s) is verified closed. The purpose of closing the MSIV is to preserve water in the inactive SG so that the actions described in the RNO for the next Step can be used to restart flow, one of which is periodically venting steam (i.e., vent steam such that the inactive SG pressure remains 100 psi above the active SG pressure). If the inactive loop(s) SG is filled or partially filled SG and its MSIV is closed, the increased inventory of the SG results in additional heat capacity that must be transferred from the secondary-to-primary side. Additionally, the rate of heat transfer from the secondary-to-primary side would be faster since the SG tubes are completely or partially covered with liquid water. The limiting cooldown rate at which flow stagnation occurs in the inactive loops will therefore be reduced since the loop temperature difference between the inactive and active loops would increase more rapidly. However, if flow stagnation occurs while at a filled or partially filled condition then the flow could easily be restarted since a substantial amount of liquid water is available to convert to steam once a relief path is established. Therefore, a natural circulation cooldown with at least one inactive SG that is full or partially full of liquid water is not a significant concern.

Active loop SG levels are maintained at the no-load level to provide a stable heat sink for the decay heat removal.

Deviation from the required cooldown rate could lead to excessive heat removal rates during the RCS cooldown or flow stagnation if there is an inactive loop(s). Since the intent of this guideline is to perform a controlled RCS cooldown and stay within Technical Specification limits, the requirement to maintain RCS temperature and pressure within these limits is explicitly emphasized in this step and subsequent steps (ERG Steps 11 and 14). Though this is not a pressurized thermal shock concern, emphasis is needed to maintain RCS temperature and pressure within certain limits. For this step and ERG Step 11, which is prior to any significant RCS depressurization, the requirement on RCS temperature and pressure is to stay within the Technical Specification limits. (Note that ERG Step 14 has additional requirements on RCS temperature and pressure.)

Knowledge: N/A

References: DW-04-001

Justification of Differences:

1 Changed to make plant specific.

Section: **Procedure**

Unit 1 ERP Step: 4.3 CAUTION-1 **Unit 2 ERP Step:** 4.3 CAUTION-1 ***ERG Step No:***

ERP StepText: SI due to steam line differential pressure may result from unbalanced heat removal from different loops.

ERG StepText: *N/A Step Addition*

Purpose:

Basis:

Knowledge:

References:

Justification of Differences:

1 Added caution to alert user for SI potential. This possibility is aggravated by the larger than normal loop temperature differentials which may occur from steam removal during natural circulation.

Section: **Procedure**

Unit 1 ERP Step: 4.3 NOTE-1 **Unit 2 ERP Step:** 4.3 NOTE-1 ***ERG Step No:***

ERP StepText: The steam dumps will be interlocked closed when RCS TAVG reaches P-12 (543°F). This interlock may be bypassed for A and E steam dumps with the STM DUMP INTERLOCK switches.

ERG StepText: *N/A Step Addition*

Purpose:

Basis:

Knowledge:

References:

Justification of Differences:

1 Added note to inform user of P-12 interlock operation.

Section: **Procedure**

Unit 1 ERP Step: 4.3 NOTE-2 **Unit 2 ERP Step:** 4.3 NOTE-2 ***ERG Step No:***

ERP StepText: Excessive opening of steam dumps can cause a high steam flow LO-LO Excessive opening of steam dumps can cause a high steam flow LO-LO TAVG main steam line isolation signal.

ERG StepText: *N/A Step Addition*

Purpose:

Basis:

Knowledge:

References:

Justification of Differences:

1 Added note to inform user of consequences of excessive opening of steam dumps.

Section: Procedure

Unit 1 ERP Step: 5 **Unit 2 ERP Step:** 5 ***ERG Step No:***

ERP StepText: Monitor For Inactive Loop(s) Stagnation Condition

ERG StepText: *Monitor For Inactive Loop(s) Stagnation Condition*

Purpose: To determine if the conditions for a stagnant loop exist, provide operator actions to prevent a stagnant loop condition from occurring, and provide operator actions to recover from a stagnant loop condition

Basis: An inactive RCS loop exists if the capability to feed the respective SG and/or the capability to release steam from the respective SG is lost due to failures. If it is desired to cooldown via natural circulation, the potential exists for the inactive loop(s) to become stagnant if the cooldown rate is excessive. As discussed in the previous Step, the maximum cooldown rate to prevent a stagnant loop from occurring may be more restrictive than the case where all loops are active.

The onset of stagnant loop conditions can be determined by monitoring the time rate of change of the inactive loop(s) hot leg temperature versus the active loop(s). The active loop hot leg temperatures will consistently decrease based on the cooldown rate. Flow stagnation in the inactive loop(s) can be diagnosed by comparing the decrease in hot leg temperature in the inactive loop(s) to the active loops. A measurable difference in the Thot temperature decrease is indicative of flow stagnation.

If symptoms of flow stagnation exist in the inactive loop(s), operator actions are necessary to restore natural circulation in the inactive loop(s). These include (1) reducing the RCS cooldown rate by a factor of two, (2), steaming the inactive loop(s) to reduce the SG pressure to within 100 psi of the active loops (by local operation of the SG PORVs, opening MSIV bypass valves, opening steam supply valves to the turbine-driven AFW pump, opening small drain lines or other plant specific means available for releasing steam), or (3) establishing blowdown from the inactive loop(s). After natural circulation flow has been restored in the inactive loop(s) as evidenced by the inactive loop(s) Thot decreasing, the cooldown rate can be gradually increased with heightened awareness of the potential for inactive loop(s) stagnation.

Knowledge:

- The operator must be able to diagnose the onset of flow stagnation when an inactive loop(s) exists.
- Although not a desired option, the plant (specifically the inactive loop(s)) can be cooled via ambient losses. This is considered a final option that can be employed should all other means of restarting the stagnant loop fail.
- The steps for recovering from a stagnant loop may need to be repeated as necessary.
- This step is a continuous action step while in this guideline.

References: DW-04-001

Justification of Differences:

1 Changed to make plant specific.

Section: **Procedure**

Unit 1 ERP Step: 6 **Unit 2 ERP Step:** 6 ***ERG Step No:*** 7

ERP StepText: Check RCS hot leg temperatures - LESS THAN 550°F.

ERG StepText: *Check RCS Hot Leg Temperatures - LESS THAN 550°F*

Purpose: To ensure a minimum RCS subcooling of 50°F during subsequent depressurization necessary to block SI circuitry

Basis: The low steamline pressure and low pressurizer pressure safety injection circuitry must be blocked during the plant cooldown and depressurization. This step and the next two steps are a group of steps for the reference plant that obtain the conditions necessary for blocking SI actuation circuits and then perform the actual blocking. These steps for blocking SI can be relocated consistent with normal cooldown procedures for each plant, since the intent is to prevent a spurious SI due to the cooldown and depressurization. Note that the Step Sequence Table in Section 4.2 shows the optimal location of these steps for the reference plant. In order to guarantee a minimum of 50°F subcooling during subsequent depressurization necessary to block SI circuitry, the RCS hot leg temperature must be less than approximately 550°F. This value of 550°F was chosen to allow for the initial RCS temperature rise within the first several minutes after the reactor coolant pumps are tripped (as is explained in the DESCRIPTION section).

Knowledge: N/A

References:

Justification of Differences:

1 Changed to make plant specific.

Section: **Procedure**

Unit 1 ERP Step: 7 **Unit 2 ERP Step:** 7 ***ERG Step No:*** *8*

ERP StepText: Reduce RCS pressure to approximately 1950 psig.

ERG StepText: *Depressurize RCS To (A.06) PSIG*

Purpose: To depressurize the RCS 50 psi below the pressure at which the SI actuation circuits can be blocked

Basis: The RCS pressure must be reduced below the pressure at which SI normally unblocks (e.g., 2000 psig) to permit the blocking of SI circuitry. A pressure of 50 psi below the pressure where SI normally unblocks is used here (e.g., 1950 psig).

The depressurization should be accomplished through the use of pressurizer auxiliary spray if letdown is available to heat the charging flow in the regenerative heat exchanger. This will minimize the thermal shock to the auxiliary spray nozzle. If letdown is not in service, then the PRZR PORV should be opened intermittently to decrease the pressurizer pressure.

Knowledge:

- Thermal shock to the spray nozzle will occur if auxiliary spray is initiated without letdown in service.
- To prevent pressurizer PORV failure, cycling of pressurizer PORVs should be minimized.
- The PRT may rupture causing abnormal containment conditions while using pressurizer PORVs.
- Reactor vessel steam voiding may occur during RCS pressure reduction. This will cause a rapid rise in pressurizer level.

References:

Justification of Differences:

1 Changed to make plant specific.

Section: **Procedure**

Unit 1 ERP Step: 7.1 CAUTION-1 **Unit 2 ERP Step:** 7.1 CAUTION-1 ***ERG Step No:***

ERP StepText: To prevent heat exchanger damage, do not attempt restoration of letdown unless the CCW miscellaneous header is aligned to an operating CCW loop.

ERG StepText: *N/A Step Addition*

Purpose:

Basis:

Knowledge:

References:

Justification of Differences:

1 Added caution to alert user to the potential for damage to the heat exchanger.

Section: **Procedure**

Unit 1 ERP Step: 8 CAUTION-1 **Unit 2 ERP Step:** 8 CAUTION-1 ***ERG Step No:*** *9 CAUTION-1*

ERP StepText: SI actuation circuits will automatically unblock if RCS average temperature rises to greater than 543°F or PRZR pressure rises to greater than 2000 psig.

ERG StepText: *SI actuation circuits will automatically unblock if PRZR pressure increases to greater than (A.07) psig.*

Purpose: To make the operator aware that SI will unblock if primary pressure increases sufficiently

Basis: The caution indicates that the automatic actuation circuit will be unblocked if PRZR pressure is increased above the pressure at which SI unblocks (e.g., 2000 psig). The manual blocking of the circuit would have to be repeated, when the permissive is energized, in order to cooldown and depressurize.

Knowledge: N/A

References:

Justification of Differences:

1 Changed to make plant specific.

2 Added information on low steam line pressure SI.

Section: Procedure

Unit 1 ERP Step: 8 **Unit 2 ERP Step:** 8 ***ERG Step No:*** *9*

ERP StepText: Block low pressurizer pressure and low steam line pressure SI actuation signals.

ERG StepText: *Block SI Actuation*

Purpose: To prevent SI actuation during subsequent depressurization

Basis: The low pressure safety injection circuitry must be blocked when RCS pressure decreases below the permissive setpoint.

Knowledge: N/A

References:

Justification of Differences:

1 Changed to make plant specific.

Section: **Procedure**

Unit 1 ERP Step: 9 **Unit 2 ERP Step:** 9 ***ERG Step No:*** *10*

ERP StepText: Maintain the following RCS conditions.

ERG StepText: *Maintain Following RCS Conditions*

Purpose: To maintain stable RCS conditions during natural circulation cooldown

Basis: At this point it must be ensured that the RCS conditions established in the previous steps are being maintained. The RCS pressure is maintained at 50 psi below the pressure at which SI unblocks during the ensuing cooldown to guard against possible void formation. In addition, the pressurizer level should be maintained within the plant-specific control band for normal cooldown. However, if voids are present in the RCS, the pressurizer will exhibit large variations in level. Therefore, the pressurizer level should be monitored during subsequent RCS cooldown and depressurization (see Step 15).

The RCS cooldown rate must be maintained at less than the plant specific rate obtained from the Appendix to this section if all RCS loops are active or in accordance with the requirements for RCS cooldown with an inactive loop(s) contained in the "Natural Circulation Cooldown with a Stagnant Loop" section of this background document. In addition, the primary system pressure and temperature are continuously monitored to ensure that the Technical Specification cooldown curve is not violated.

Figure ES02-1 is a generic curve which is used to determine the maximum cooldown rate versus the active loop(s) ΔT. Each utility must develop a plant specific curve for its plant from Figure ES02-1, and this curve would then be included in the plant specific emergency operating procedure ES-0.2. This plant specific curve can be developed by modifying Figure ES02-1 as follows: The X-axis should be the nominal or indicated ΔT (Thot - Tcold) of the active loop(s) without uncertainties. The Y-axis values are the maximum cooldown rates based on the plant specific steam generators as determined from Figures 6 through 11 of the DESCRIPTION section. A plant specific curve is then plotted similar to ES02-1.

Knowledge: N/A

References: DW-04-001

Justification of Differences:

1 Changed to make plant specific.

2 Added RNO for fourth substep to account for differences based of CRDM fan operational status.

Section: **Procedure**

Unit 1 ERP Step: 10 **Unit 2 ERP Step:** 10 ***ERG Step No:*** *11*

ERP StepText: Monitor RCS cooldown.

ERG StepText: *Monitor RCS Cooldown*

Purpose: To confirm that RCS temperatures are decreasing and RCS subcooling is increasing

Basis: The core exit thermocouples (TCs) and the reactor coolant hot leg temperatures are monitored to verify that the reactor coolant is being cooled by the discharge of steam from the steam generators at the cooldown rate previously described in ERG step 6 and the previous step. In addition, it is verified that the subcooling of the reactor coolant is increasing. This ensures that adequate core cooling is being provided. The subcooling is determined by use of wide range pressure and core exit thermocouples.

After the natural circulation cooldown has been established, the reactor coolant hot leg temperature should trend down with the decreasing steam pressure.

Knowledge: Trended readings for core exit thermocouples, loop THOT readings, and loop delta T readings should be used to monitor cooldown and subcooling with readings at 10-15 minute intervals recommended. The observed loop temperatures and temperature differences (THOT, TCOLD, delta T) can be expected to vary from loop-to-loop and may deviate at any single observation. These variations of individual readings from the nominal responses are normal, and therefore only trended values are useful for diagnosis of possible problematic conditions in natural circulation flow.

References:

Justification of Differences:

1 Changed to make plant specific.

Section: **Procedure**

Unit 1 ERP Step: 11 **Unit 2 ERP Step:** 11 ***ERG Step No:*** *12 NOTE-1*

ERP StepText: Monitor for FNP-1-ESP-0.3, NATURAL CIRCULATION COOLDOWN WITH ALLOWANCE FOR REACTOR VESSEL HEAD STEAM VOIDING (WITH RVLIS) or FNP-1-ESP-0.4, NATURAL CIRCULATION COOLDOWN WITH ALLOWANCE FOR REACTOR VESSEL HEAD STEAM VOIDING (WITHOUT RVLIS) transition criteria.

ERG StepText: *If at any time it is determined that a natural circulation cooldown and depressurization must be performed at a rate that may form a steam void in the vessel, guideline (X.03) should be used.*

Purpose: To make the operator aware that, if a rapid cooldown is required, other guidelines exist which allow for void formation and a continued cooldown/depressurization

Basis: From this point onward in ES-0.2 the operator has the option of changing guidelines if and when he determines a need to cooldown and depressurize more quickly than at the present rate. Guideline ES-0.3, NATURAL CIRCULATION COOLDOWN WITH STEAM VOID IN VESSEL (WITH RVLIS), or ES-0.4, NATURAL CIRCULATION COOLDOWN WITH STEAM VOID IN VESSEL (WITHOUT RVLIS) should be used in this case depending upon the availability of RVLIS to monitor upper head void growth.

The major factor which could require a more rapid cooldown/depressurization than guideline ES-0.2 allows is limited condensate storage. THOT plants with no CRDM fans operating and limited condensate storage are more likely to use guideline ES-0.3 or ES-0.4 for their natural circulation cooldown and depressurization since guideline ES-0.2 has more restrictive cooldown rates and is very time consuming.

Knowledge: Equipment required for long term controlled natural circulation cooldown

References:

Justification of Differences:

1 Changed to make plant specific.

2 Changed note to a step since actions are directed based on the CRDM status and to ensure proper actions are taken to mitigate the event.

Section: **Procedure**

Unit 1 ERP Step: 12 **Unit 2 ERP Step:** 12 ***ERG Step No:*** *12*

ERP StepText: Begin RCS pressure reduction.

ERG StepText: *Initiate RCS Depressurization*

Purpose: To initiate depressurization of the RCS while maintaining required subcooling

Basis: The pressurizer pressure should periodically be decreased to maintain the reactor coolant and pressurizer pressure-temperature relationship in accordance with the Technical Specifications and the figures shown in the Appendix to this section (described below). The depressurization should be accomplished using pressurizer auxiliary spray or pressurizer PORVs, depending upon whether letdown is in service. To prevent possible void formation in the upper head, the plant-specific minimum RCS subcooling based on core exit TCs, as described in the Appendix, should be maintained. With the availability of CRDM cooling fans, the total upper head cooldown rate for TCOLD plants varies from a maximum of 54°F/hr to about 45°F/hr when the upper head temperature is cooled to 350°F (34°F/hr from the natural circulation cooldown rate of 50°F/hr plus 20°F/hr from the CRDM fans when the upper head temperature is at its highest, 572°F, to 11°F/hr when the upper head temperature is 350°F). For THOT plants, the total upper head cooldown rate due to both the natural circulation cooldown rate of 25°F/hr (upper head cooldown rate of 10°F/hr) and the availability of CRDM fans (upper head cooldown rate from 21°F/hr at 600°F to 11°F/hr at 350°F) varies from 31°F/hr initially to about 21°F/hr when the upper head temperature is cooled to 350°F. With CRDM fans available, a subcooling margin of at least 50°F should be maintained for both types of plants during depressurization. Without the availability of CRDM fans, TCOLD plants must maintain a minimum subcooling of 100°F during depressurization. For THOT plants without CRDM fans available, the appropriate precautions, as outlined in Appendix, should be taken to ensure that a minimum subcooling of 200°F is maintained at all times during depressurization. However, if problems arise from a more restrictive Technical Specification limit, they will have to be resolved on a plant specific basis (e.g., lower minimum subcooling requirement will result in a longer upper head cool-off time period). See Reference 1 for more detail on the determination of these limits for natural circulation cooldown.

Knowledge: The analysis supporting the strategy in this guideline assumes either “all” or no CRDM fans are operating when RCS depressurization is initiated in this step. If some, but less than “all”, CRDM fans are operating, the conservative subcooling requirements specified in this step for no CRDM fans operating will apply throughout the remainder of this guideline. To take advantage of any intermediate combinations of operating CRDM fans and subcooling limits will require a plant-specific supporting analysis based on upper head cooldown rate.

References:

Justification of Differences:

1 Changed to make plant specific.

Section: **Procedure**

Unit 1 ERP Step: 13 **Unit 2 ERP Step:** 13 ***ERG Step No:*** *13*

ERP StepText: Continue RCS cooldown and pressure reduction.

ERG StepText: *Continue RCS Cooldown And Depressurization*

Purpose: To continue RCS cooldown and depressurization while maintaining required subcooling

Basis: The plant-specific maximum cooldown rates and minimum subcooling, as described in the Appendix to this section and in the "Natural Circulation Cooldown with a Stagnant Loop" section (for cooling down with an inactive loop(s)), should be maintained to avoid the possibility of upper head void formation and/or inactive loop(s) flow stagnation. If at any time the required subcooling cannot be maintained, the RCS depressurization should be stopped until the required subcooling is reestablished.

The figures included in the Appendix illustrate the acceptable operating region, from the pressure-temperature relationship, depending upon the type of plant (TCOLD, THOT) and availability of CRDM fans. For this step the RCS temperature and pressure should be maintained within the plant specific limitations outlined in these figures as the acceptable operating region. It should be noted that the plant-specific Technical Specification curve should be inserted in these figures to replace the typical curve shown. Since the guidelines are written on a generic basis, any problems that may arise due to a plant's more restrictive Technical Specification curve will have to be resolved on a plant specific basis.

Figure ES02-1 is a generic curve which is used to determine the maximum cooldown rate versus the active loop(s) ΔT. Each utility must develop a plant specific curve for its plant from Figure ES02-1, and this curve would then be included in the plant specific emergency operating procedure ES-0.2. This plant specific curve can be developed by modifying Figure ES02-1 as follows: The X-axis should be the nominal or indicated ΔT (Thot - Tcold) of the active loop(s) without uncertainties. The Y-axis values are the maximum cooldown rates based on the plant specific steam generators as determined from Figures 6 through 11 of the DESCRIPTION section. A plant specific curve is then plotted similar to ES02-1.

Knowledge: N/A

References: DW-04-001

Justification of Differences:

1 Changed to make plant specific.

2 Changed to include plant specific parameters.

3 Added CRDM cooling fan alignment check since this alignment effects cooldown and pressure reduction criteria.

Section: **Procedure**

Unit 1 ERP Step: 14 **Unit 2 ERP Step:** 14 ***ERG Step No:*** *14*

ERP StepText: Check no steam void in reactor vessel.

ERG StepText: *Verify Steam Void In Reactor Vessel Does Not Exist*

Purpose: To check for void formation in the reactor vessel.

Basis: If abnormal RCS conditions such as large variations in pressurizer level during normal charging or spraying operations occur, a steam void may be present in the reactor vessel upper head. To collapse the void, the RCS is re-pressurized within the plant specific limitations outlined by the figures in the Appendix to this section. These figures, which illustrate the acceptable operating region from the pressure-temperature relationship were described in Step 14.

Though the RCS cooldown can continue to RHR System entry conditions, extra care should be taken during any subsequent RCS depressurization. In order to reach RHR System entry conditions for pressure, the upper head has to be cooled sufficiently so that RCS depressurization will not cause the PRZR level to behave abnormally.

RVLIS can also be used to detect steam voiding in the upper head region. A full RVLIS upper range indication implies at least saturated conditions exist in the upper head region. If pressure is decreased and RVLIS is monitored, any void formation would be detected.

With no CRDM fans running a waiting period, during which the RCS should not be depressurized, is required to prevent upper head steam voiding.

The waiting period (indicated in the Appendix) allows the upper head to cool off to a temperature less than saturation for 400 psig before continuing with the depressurization and is dependent upon the plant's type of upper support plate (USP). These cool-off periods vary due to the differences in the USP thickness and the upper head fluid volume. Analysis for the cool-off, which takes into account the upper head fluid heat as well as the metal heat, has shown the following:

a. For inverted top hat USP plants (12-inch thick USP and 846.6 ft3 upper head volume), it takes 27 hours for the upper head to cool off to the appropriate temperature described above.

b. For top hat USP plants (5-inch thick USP and 507.8 ft3 upper head volume), it takes 8 hours for the upper head to cool off to this temperature.

c. For flat USP plants (5-inch thick USP and 580.0 ft3 upper head volume), it takes 9 hours for the upper head to cool of to this temperature.

If the RCS depressurization must continue with the possibility of a steam void in the vessel upper head, a transition to ES-0.3 or ES-0.4 should be made. These guidelines provide instructions for a natural circulation cooldown and depressurization with a steam void in the vessel (refer to Step 13-NOTE).

Section: **Procedure**

Unit 1 ERP Step: 14 **Unit 2 ERP Step:** 14 ***ERG Step No:*** *14*

Knowledge:

- Relationship between PRZR level response and depressurization using auxiliary spray or PORV
- How void formation in the vessel will affect PRZR level

References:

Justification of Differences:

1 Changed to make plant specific.

Section: **Procedure**

Unit 1 ERP Step: 15 **Unit 2 ERP Step:** 15 ***ERG Step No:*** *15*

ERP StepText: Check when to isolate SI accumulators.

ERG StepText: *Check If SI System Should Be Locked Out*

Purpose: To determine if appropriate plant conditions exist for locking out SI

Basis: The safety injection accumulator isolation valves should be closed (by whatever plant specific means necessary) and their power supplies locked out to prevent the dumping of the accumulator borated water into the RCS when RCS pressure drops below accumulator pressure. The high-head safety injection pumps and non-operating charging/SI pump should be locked out to prevent any spurious starting. The pressure and temperature criteria from the appropriate Technical Specifications for the plant should be used to lock out SI.

Knowledge: N/A

References:

Justification of Differences:

1 Changed to make plant specific.

2 Step modified to reflect step specifically applies to accumulators only at FNP.

Section: **Procedure**

Unit 1 ERP Step: 16 **Unit 2 ERP Step:** 16 ***ERG Step No:*** *16*

ERP StepText: Maintain letdown flow.

ERG StepText: *Maintain Letdown Flow*

Purpose: To maintain required letdown flow so RCS inventory remains constant.

Basis: As reactor coolant pressure decreases, the delta P across the letdown orifice will drop and result in decreased letdown flow. Action should be taken to increase letdown flow to maintain a constant RCS inventory.

Knowledge: N/A

References:

Justification of Differences:

1 Changed to make plant specific.

Section: **Procedure**

Unit 1 ERP Step: 17 **Unit 2 ERP Step:** 17 ***ERG Step No:*** *17*

ERP StepText: Maintain seal injection flow to each RCP - 6-13 gpm.

ERG StepText: *Maintain Required RCP Seal Injection Flow*

Purpose: To control the amount of RCP seal injection flow within specified limits

Basis: Reactor coolant pump seal injection flow will vary as RCS cooldown/ depressurization continues. The hand controlled throttle valve in the charging line (or other plant specific valves) should be adjusted as necessary to maintain the seal injection flow within the required limits for RCP support.

Knowledge: If all seal cooling has been lost long enough that the maximum RCP seal parameters identified in the RCP Vendor Manual have been exceeded, seal injection and CCW thermal barrier cooling should not be established to the affected RCP(s). Both of these methods of seal cooling could have unintended consequences that result in additional pump damage or the failure of plant safety systems. Seal cooling should instead be restored by cooling the RCS, which will reduce the temperature of the water flowing through the pump seals.

References:

Justification of Differences:

1 Changed to make plant specific.

Section: **Procedure**

Unit 1 ERP Step: 18 **Unit 2 ERP Step:** 18 ***ERG Step No:*** *18*

ERP StepText: Check if RHR system can be placed in service.

ERG StepText: *Check If RHR System Can Be Placed In Service*

Purpose: To check required conditions and then place RHR System in service.

Basis: The RHR System is designed to operate below specific RCS pressure and temperature conditions. If previous actions to establish conditions were not complete, this step directs the operator to return to those steps for completion of the actions. The RHR System is placed in service according to plant specific procedure when required conditions are established.

Knowledge: N/A

References:

Justification of Differences:

1 Changed to make plant specific.

NATURAL CIRCULATION COOLDOWN TO PREVENT REACTOR VESSEL HEAD STEAM VOIDING
Plant Specific Background Information

Section: **Procedure**

Unit 1 ERP Step: 19 **Unit 2 ERP Step:** 19 ***ERG Step No:*** *19*

ERP StepText: Continue RCS cooldown to cold shutdown with RHR.

ERG StepText: *Continue RCS Cooldown To Cold Shutdown*

Purpose: To use RHR System to cool the RCS to cold shutdown conditions

Basis: The RCS must be cooled down to less than 200°F to attain cold shutdown. The RHR System is used to achieve this temperature in the RCS.

Knowledge: N/A

References:

Justification of Differences:

1 Changed to make plant specific.

Section: **Procedure**

Unit 1 ERP Step: 20 CAUTION-1 **Unit 2 ERP Step:** 20 CAUTION-1 ***ERG Step No:*** *20 CAUTION-1*

ERP StepText: Depressurizing the RCS before the entire RCS is less than 200°F may result in void formation in the RCS.

ERG StepText: *Depressurizing the RCS before the entire RCS is less than 200°F may result in void formation in the RCS.*

Purpose: To warn the operator that depressurizing the RCS before the entire RCS is less than 200°F could allow voids to form.

Basis: The caution warns that depressurizing the RCS before the entire RCS (including the upper head region and steam generator U-tubes) is less than 200°F could result in void formation. Therefore, while using the RHR System to cool down the RCS, steps to cool down the inactive portions of the RCS should also be performed.

Knowledge: N/A

References:

Justification of Differences:

1 None

Section: **Procedure**

Unit 1 ERP Step: 20 **Unit 2 ERP Step:** 20 ***ERG Step No:*** *20*

ERP StepText: Continue cooldown of inactive portion of RCS.

ERG StepText: *Continue Cooldown Of Inactive Portion Of RCS*

Purpose: To ensure that heat is being removed from the vessel head and SG U-tubes so potential void formation during depressurization is minimized.

Basis: The total core flow during RHR System operation is approximately 2 percent of full flow. The RHR System flow is even less than the natural circulation flow, and the upper head will, therefore, remain relatively stagnant compared to the rest of the RCS (i.e., the RHR System will force minimal cooling flow into the upper head). Two options are then available: 1) run CRDM fans during RHR system operation to cool the upper head, or 2) without CRDM fans running, wait for the upper head to cool by conduction before depressurizing the RCS with the RHR system in service. For the second option, plants with inverted top hat upper support plates (USP), should wait 3.7 days (88 hours) to allow the upper head region to cool off to 200°F. For top hat USP plants and flat USP plants, the waiting periods are 1.1 days (27 hours) and 1.2 days (29 hours), respectively.

When the plant is being cooled by the RHR System, the injection from the RHR System is into the cold legs and the return line to the RHR System is from the hot leg. Thus the steam generators are not being cooled by the RHR System. Steam dump should, therefore, be used to cool the steam generators from 350°F to less than or equal to 212°F. The steam dumping from all steam generators must be continued until they have stopped steaming. This will reduce the potential for steam bubble formation in the steam generator U-tubes upon depressurization of the RCS.

Knowledge: It is important to keep SG chemistry within the required specifications throughout the final cooldown/depressurization to cold shutdown. The operator should be aware that chemistry requirements must be met at all times.

References:

Justification of Differences:

1 Added attachment to provide detailed instructions on verification of 4160 V busses energized.

2 Added RCS pressure control band.

3 Changed to make plant specific.

Section: **Procedure**

Unit 1 ERP Step: 21 **Unit 2 ERP Step:** 21 ***ERG Step No:*** *21*

ERP StepText: Check if RCS depressurization is permitted.

ERG StepText: *Determine If RCS Depressurization Is Permitted*

Purpose: To ensure that the entire RCS is below 200°F before final depressurization.

Basis: As long as the entire RCS is below 200°F, depressurization to atmospheric pressure will not cause any void formation in the system. With CRDM fans running, the upper head should be cooled to below 200°F. Without CRDM fans, waiting the length of time discussed in the BASIS section of step 21 should allow a water-solid upper head to cool down below 200°F. Other methods can be used to help determine upper head fluid temperature. If upper head TCs are available, they can give a good indication of upper head fluid temperature. A full RVLIS vessel indication will imply at least saturated conditions (temperature based on system pressure, corrected for differences between measurement point and the vessel head). Any PRZR level increase and/or RVLIS indication less than full, following an RCS depressurization at this time, would indicate that the upper head fluid temperature is not below 200°F, and the RCS should be repressurized to collapse the void. In this case, when it is appropriate to depressurize would be determined by trial and error. The method for determining SG U-tube temperature conditions consists of steaming the SGs until they stop steaming. This then implies that no delta T exists and the primary/secondary temperature are approximately equal.

Knowledge: Determination of upper head and SG U-tube temperatures from direct or indirect means (upper head TCs, RVLIS, steam pressure, etc.)

References:

Justification of Differences:

1 Changed to make plant specific.

Section: **Procedure**

Unit 1 ERP Step: 21.1 NOTE-1 **Unit 2 ERP Step:** 21.1 NOTE-1 ***ERG Step No:***

ERP StepText: FNP-1-SOP-68.0, INADEQUATE CORE COOLING MONITORING SYSTEM provides detailed operating instructions for the core exit T/C monitor.

ERG StepText: *N/A Step Addition*

Purpose:

Basis:

Knowledge:

References:

Justification of Differences:

1 Added note to inform user of location of guidance for operation of CETC monitor

Section: **Continuous Action Summary**

Unit 1 ERP Step:	**Unit 2 ERP Step:**	***ERG Step No:***

ERP StepText: Continuing action summary pages

ERG StepText: *N/A Step Addition*

Purpose:

Basis:

Knowledge:

References:

Justification of Differences:

1 The Continuous Action Summary was added to aide the operator in addressing actions which are of a continuing nature. This page can be removed from the procedure and used as a reminder of on going actions during the event.

Section: **Figure 1**

Unit 1 ERP Step: **Unit 2 ERP Step:** ***ERG Step No:***

ERP StepText: Figure 1 - NUMBER 1 SEAL OPERATING RANGE

ERG StepText: *N/A Step Addition*

Purpose:

Basis:

Knowledge:

References: Westinghouse product update number s-009

Justification of Differences:

1 Added figure to provide additional operator guidance. Obtained from Westinghouse product update number s-009.

Section: **Figure 2**

Unit 1 ERP Step: **Unit 2 ERP Step:** ***ERG Step No:***

ERP StepText: Figure 2 - RCS PRESSURE - TEMPERATURE OPERATING LIMITS

ERG StepText: *N/A Step Addition*

Purpose:

Basis:

Knowledge:

References:

Justification of Differences:

1 Added figure to provide additional operator guidance. Obtained from UOP-1.1.

Section: **Figure 3**

Unit 1 ERP Step: **Unit 2 ERP Step:** ***ERG Step No:***

ERP StepText: Figure 3 - COOLDOWN LIMITS TO AVOID UPPER HEAD VOID FORMATION WITH BOTH CRDM FANS

ERG StepText: *N/A Step Addition*

Purpose:

Basis:

Knowledge:

References:

Justification of Differences:

1 Added Figure three to provide RCS pressure and temperature restrictions from the setpoint document.

Section: **Figure 4**

Unit 1 ERP Step: **Unit 2 ERP Step:** ***ERG Step No:***

ERP StepText: Figure 4 - COOLDOWN LIMITS TO AVOID UPPER HEAD VOID FORMATION WITHOUT CRDM FANS

ERG StepText: *N/A Step Addition*

Purpose:

Basis:

Knowledge:

References:

Justification of Differences:

1 Added Figure four to provide pressure and temperature restrictions from the setpoint document.

Section: **Figure 5**

Unit 1 ERP Step: **Unit 2 ERP Step:** ***ERG Step No:***

ERP StepText: Figure 4 - MAXIMUM COOLDOWN RATE VERSUS ΔT

ERG StepText: *N/A Step Addition*

Purpose:

Basis:

Knowledge:

References: DW-04-001

Justification of Differences:

1 Added Figure 5 per DW-04-001.

Section: **Attachment 1**

Unit 1 ERP Step: **Unit 2 ERP Step:** ***ERG Step No:***

ERP StepText: Attachment 1 - ACCUMULATOR MOV DISCONNECTS (POWER RESTORATION)

ERG StepText: *N/A Step Addition*

Purpose:

Basis:

Knowledge:

References:

Justification of Differences:

1 Added attachment to provide detailed guidance for the restoration of power to the accumulator discharge valves.

Section: Attachment 2

Unit 1 ERP Step: **Unit 2 ERP Step:** ***ERG Step No:***

ERP StepText: Attachment 2 - ACCUMULATOR MOV DISCONNECT (POWER REMOVAL)

ERG StepText: *N/A Step Addition*

Purpose:

Basis:

Knowledge:

References:

Justification of Differences:

1 Added attachment to provide detailed guidance for the removal of power to the accumulator discharge valves.

Section: **Attachment 3**

Unit 1 ERP Step:	**Unit 2 ERP Step:**	***ERG Step No:***

ERP StepText: Attachment 3 - CALCULATION FOR ADEQUATE AVAILABLE CST INVENTORY

ERG StepText: *N/A Step Addition*

Purpose:

Basis:

Knowledge:

References:

Justification of Differences:

1 Added Attachment to provide guidance for crew to decide when transition is appropriate based on CST inventory.

Section: FOLDOUT Page

Unit 1 ERP Step: 1 **Unit 2 ERP Step:** 1 ***ERG Step No:***

ERP StepText: Monitor SI criteria.

ERG StepText: *SI ACTUATION CRITERIA*

Purpose:

Basis: Although the criteria are identical to the ones found in the SI Reinitiation criteria, the actions are different. The operator is instructed to actuate safety injection rather than start SI pumps as necessary. The criteria selected for SI actuation are either loss of RCS subcooling or the inability to maintain pressurizer level with charging. Each of these limits indicate that control of the plant is lost and that SI actuation is necessary.

Knowledge:

References:

Justification of Differences:

1 Changed to make plant specific.

2 Changed to dual column format IAW Writer's Guide.

Section: FOLDOUT Page

Unit 1 ERP Step: 2 **Unit 2 ERP Step:** 2 ***ERG Step No:***

ERP StepText: Monitor switchover criteria.

ERG StepText: *AFW SUPPLY SWITCHOVER CRITERION*

Purpose:

Basis: This criterion is on the FOLDOUT PAGE to remind the operator that the supply of water from the condensate storage tank to the suction of the AFW pumps is limited and, if it is depleted, an alternate suction supply of water to the AFW pumps is necessary.

Knowledge:

References:

Justification of Differences:

1 Changed to make plant specific.

2 Changed to dual column format IAW Writer's Guide.