Attachment 6

ENHANCED PWR Appendix G, PHASE 1 TO BE USED BY INSPECTORS AND SRAS

Shutdown Operations Significance Determination Process

1.0 Entry Conditions

Appendix G is used to assess performance deficiencies identified during refueling outages, forced outages, and maintenance outages when more than one fuel assembly is in the vessel. Appendix G covers shutdown operation- initiating when the licensee has met the entry conditions for RHR and RHR cooling has been initiated and ending when the licensee is heating up and RHR has been secured.

NOTE: if the licensee is in a refueling outage or forced outage and the plant is above RHR entry conditions, then the full power SDP tools should be used acknowledging: (1) decay heat is less compared to full power, potentially allowing for more time for operator recovery, (2) some mitigating systems may require manual operation versus automatic operation, and (3) some containment systems may not be required to be operable potentially increasing the likelihood of containment failure.

2.0 OBJECTIVE

This tool is used to ensure that a licensee's shutdown mitigation capability (equipment, instrumentation, policies, procedures, and training) is consistent with the staff's estimate of industry shutdown risk presented to the Commission in SECY 97-168 (the proposed Shutdown Rule).

This tool is also used to assess shutdown conditions that represent a loss of control. These losses of control include (1) losses of reactor coolant system (RCS) level and (2) losses of thermal margin. These conditions are considered precursors to events that could result in actual loss of the decay heat removal (DHR) function. The staff is monitoring losses of control because the staff's risk estimate of generic PWR and BWR shutdown performance indicates that, based on experience, losses of DHR are relatively infrequent.

When a licensee has a performance deficiency associated with their shutdown mitigation capability or has a loss of control, this tool is used to screen those findings for potential risk significance.

3.0 Precautions

3.1 The inspector must understand the definitions of the shutdown initiating events . These definitions can be found in Chapter 4.

3.2 The availability of standby RCS injection along with operator error drives shutdown risk. As long as standby injection is available, in most cases, standby injection buys time for other operator recovery actions such as: leak path termination and RHR recovery. If there are factors that could render the standby RCS injection unavailable such as: gas intrusion or support system unavailability, then these factors (assumptions) become risk significant and should be assessed carefully.

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4.0 Abbreviations and Definitions

4.1 Abbreviations

CETs	Core Exit Thermocouples
CD	Core Damage
High Decay Heat	Decay heat of early time window, 2 days after shutdown
Low Decay Heat	Decay heat of late time window, 12 days after shutdown
CCW	Component Cooling Water
DHR	Decay Heat Removal
ECCS	Emergency Core Cooling System
INDIC.	Indication
IMC	Inspection Manual Chapter
LOI	Loss of Reactor Inventory Initiating Event
LER	Licensee Event Report
LOOP	Loss of Offsite Power
LORHR	Loss of RHR Initiating Event
OP.	Operator
POS	Plant Operational State
PRA	Probabilistic Risk Assessment
RCS	Reactor Coolant System
RHR	Residual Heat Removal
ROP	Reactor Oversight Process
SDP	Significance Determination Process
SG	Steam Generator
SG PORV	Steam Generator Power Operated Relief Valve
SRW	Site Raw Water
SSW	Standby Service Water
TBB	Time to Boiling
TW	Time Window
TW-E	Early Time Window, before refueling operation
TW-L	Late Time Window, after refueling operation

4.2 Definitions

Phases of a Significance Determination

Phase 1 -Characterization and Initial Screening of Findings: Precise characterization of the finding and an initial screening of very low-significance findings for disposition by the licensee's corrective action program.

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Phase 3 - Risk Significance Finalization and Justification: Assessment of the risk significance by the SRAs followed by concurrence by an NRR risk analyst.

Loss of Offsite Power (LOOP) - Includes losses of offsite power which cause a loss of the RHR function..

Loss of Reactor Inventory (LOI) - Includes losses of RCS inventory that lead to a loss of the RHR function due to loss of RHR pump suction.

Loss of Level Control (LOLC) - This initiating event category includes: (1) the operator overdrains the RCS to reach midloop conditions such that the RHR function is lost, and (2) the operator fails to maintain level control while in midloop such that the RHR function is lost.

Loss of the Operating Train of RHR (LORHR) - Failures in the operating train of RHR that cause loss of the RHR function (example the operating RHR pump fails, the RHR suction valve trips shut) . This initiating event also includes failures of the RHR support systems such as CCW , SRW, vital AC and DC power.

RCS Open - RCS vented with such that(1) SG heat removal cannot be sustained, and (2) the vent path is large enough to support feed and bleed. Examples of vent paths include: open pressurizer on to RCS

Available - A piece of equipment is considered available if it can be put into service quickly enough to meet its function need and all necessary supporting systems are functional (such as AC power, cooling water, and DC control power)

Reduced Inventory Operations - Reduced inventory operation exists whenever the reactor vessel water level is lower than 3 feet below the reactor vessel flange.

Shutdown Operations - Shutdown Operation exists during hot shutdown, cold shutdown, and refueling when more than one fuel assembly is in the reactor vessel and the decay heat removal system is in operation.

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5.0 PROCEDURE FOR SIGNIFICANCE DETERMINATION

Step 5.1 Go to the Analysis Section of each POS that the finding occurred in. Answer each question in the Analysis section to determine if the finding needs phase 3 analysis.

NOTE: IF FINDING OCCURS IN A POS, WHERE THE TIME TO RCS BOILING IS GREATER THAN 2 HOURS, USE THE REFUELING CAVITY ANALYSIS SECTION AND CHECKLIST

Step 5.2 Does the finding need phase 3 analysis?

If YES, fill out the corresponding checklist for each POS that the finding occurred in. Then give the SRAs, (1) the completed Analysis section(s), (2) a description of the finding, and (3) the completed check list(s).

IF NO, the finding screens green and should be submitted to the licensee's corrective action program plan.

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Analysis Section - HOT SHUTDOWN

Evaluate each question in order:

1. Does the finding involve non-compliance with LTOP Tech. Specs? If yes, send to SRAs for phase 3 analysis.

2. Does the finding involve non-compliance with reactivity Tech Specs? If yes, send to SRAs for phase 3 analysis.

3. Does the finding involve the pressurizer level instrumentation or the core exit thermocouples such that they are not reflective of RCS conditions? If yes, send the finding to the SRAs for phase 3 analysis.

4. Does the finding increase the likelihood of a loss of the operating train of RHR or has a loss of the operating train of RHR actually occurred? If yes, then answer all questions in this section. If no, then move on to question 5.

   4a. Can RHR be recovered within ½ time before boiling?
   4b. Is time to boiling greater than 20 minutes?
   4c. Does the licensee have SG cooling available? Are there procedures for SG cooling? Does the licensee have the capability to add inventory to allow SG cooling for 24 hours and the capability to vent steam from the SGs?
   4d. Does the licensee has at least two standby ECCS trains that are not impacted by the finding?
   4e. Can the licensee establish a RCS bleed path large enough to support Feed and Bleed (example a open PORV)?
   4f. Does the licensee have procedures for RHR system recovery?

   IF the answers to ALL of these questions are yes, then the finding may be screened green. If the finding can't be screened green, then send the finding to the SRAs for phase 3 analysis.

5. Did the finding cause a loss of RCS inventory such that :

   There was an inadvertent loss of 2 feet of RCS inventory when not in midloop?
   OR
   There was an inadvertent entry into midloop conditions?

If yes, then answer all the questions, in this section. If no, the go to question 6.

5A. Given the event, assuming the drain path could not be isolated, does the time to drain the RCS to hot leg midplane exceed one hour?
5B. If the RCS level indication a reasonable reflection of RCS level?
5C. Can the leak path be readily identified within ½ the time to drain to hotleg midplane?
5D. Can the drain path be isolated by at least one functional valves such that a train of RHR can be re-started?
5E. Does the licensee have SG cooling available? Are there procedures for SG cooling? Does the licensee have the capability to add inventory to allow SG cooling for 24 hours and the capability to vent steam from the SGs?
5F. Does the licensee has at least two standby ECCS trains that are not impacted by the finding?
5G. Can the licensee establish a bleed path large enough to support Feed and Bleed (example, open a PORV)?

IF the answers to ALL of these questions are yes, then the finding may be screened green. If the finding can't be screened green, then send the finding to the SRAs for phase 3 analysis.

6. Did this finding increase the likelihood of a LOOP? If yes, send the finding to the SRAs for phase 3 analysis.

7. Did this finding degrade the licensee's emergency AC capability? If yes, send the finding to the SRAs for phase 3 analysis.

8. Does the finding degrade the licensee's ability to use the steam generators as a decay heat removal path?. If yes, send the finding to the SRAs for phase 3 analysis.

9. Does the finding degrade the licensee's standby injection capability such that the licensee does not have at least two standby ECCS trains available for core injection? If yes, send the finding to the SRAs for phase 3 analysis.

10. Does the finding degrade the ability of containment to remain intact following a severe accident. If yes, send the finding to the SRAs for phase 3 analysis.

Check List - HOT SHUTDOWN OPERATION

I. Core Heat Removal Guidelines

A.Instrumentation

____(1)DHR heat exchanger inlet/outlet temperature and DHR flow indication in the control room with flow hi/low alarm

_____(2)2 core exit thermocouples with readout and hi alarm in the control room.

B.Training/Procedures

____ (1)Training and Procedures for normal and abnormal DHR operation. Procedure for loss of normal DHR include: prioritized alternate core cooling paths (e.g steam generator cooling, low pressure pump feed and bleed, etc.) , initial magnitude of decay heat, versus time to boiling, time to core uncovery, (NUMARC 91-06 guideline 4.1.1.1)).

____(2)Training and Procedures for DHR recovery.

C.Equipment

_____(1)Two heat removal paths consisting of any combination of RCS loops and RHR systems and necessary support systems. (WOG STS 3.4-11)

_____(2)Available equipment to support two alternate core cooling paths for at least 24 hours, steam generator cooling and feed and bleed. Minimum equipment needs include:

_____Steam generator inventory, auxiliary feed water (if needed), secondary steam relief

_____one available high pressure injection train (one operable ECCS train WOG STS 3.5-7)

_____RWST operable (WOG STS 3.5.4),

_____An RCS vent path of sufficient size to support feed and bleed (e.g. a PORV) (WOG LTOP TS 3.4.12)

_____Recirculation capability or if needed

II. Inventory Control Guidelines

A.Instrumentation

_____2 independent pressurizer level instruments with a Hi/Lo alarm or level deviation annunciator.

B.Training/Procedures

_____(1)Loss of Inventory procedures which address: source and magnitude of loss, providing sufficient makeup capability, coping with high radiation levels in containment. (NUMARC 91-06 guidelines 4.2.2.1)

_____(2)No plant configurations where a single active failure or personnel error can result in a rapid loss of RCS inventory (includes overlapping

activities, e.g. Wolf Creek drain down in 1994) (NUMARC 91-06 guideline 4.2.2 2))

C.Equipment

_____Available equipment sufficient to keep the core covered given a loss of RCS inventory. Minimum equipment needs include:

_____one available high pressure injection train (one ECCS train operable by WOG STS 3.5-7)

_____RWST operable (WOG STS 3.5.4).

III.Power Availability Guidelines

C.Equipment

_____(1)Two qualified circuits between the offsite transmission network and the onsite class 1E AC Electrical Power Distribution Systems (WOG STS 3.8.1).

_____(2)Two sources of onsite AC power sources (WOG STS 3.8.1)

_____(3)Two trains of DC electrical power subsystems (WOG STS 3.8.4)

IV.Containment Control Guidelines

A.Equipment

_____(1)Containment operable (WOG STS 3.6.1)

_____(2)Containment isolation valves operable (WOG STS 3.6.3)

_____(3)Containment Spray and Containment cooling operable (WOG STS 3.6.6)

_____(4)Containment ice beds, ice condenser doors, divider barrier integrity, containment Recirculation drains, and shield buildings operable if applicable (WOG STS 3.6.15 -19)

V.Reactivity Guidelines

_____assumes compliance with Technical Specifications

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Analysis Section - COLD SHUTDOWN RCS CLOSED

Evaluate each question in order:

1. Does the finding involve in non-compliance with LTOP Tech. Specs, if yes, send to SRAs for phase 3 analysis.

2. Does the finding involve non-compliance with reactivity Tech Specs, if yes, send to SRAs for phase 3 analysis.

3. Does the finding involve the pressurizer level instrumentation (the RCS level instrumentation while in reduced inventory operation) OR the core exit thermocouples? If yes, send the finding to the SRAs for phase 3 analysis.

4. Does the finding increase the likelihood of a loss of the operating train of RHR or has a loss of the operating train of RHR actually occurred? If yes, then answer all questions in this section. If no, then move on to question 5.

   4a. Can RHR be recovered within ½ time before boiling?
   4b. Is time to boiling greater than 20 minutes?
   4c. Does the licensee have SG cooling available? Are there procedures for SG cooling? Does the licensee have the capability to add inventory to allow SG cooling for 24 hours and the capability to vent steam from the SGs?
   4d. Does the licensee has at least two standby ECCS trains that are not impacted by the finding?
   4e. Can the licensee establish a bleed path large enough to support Feed and Bleed?

   IF the answers to ALL of these questions are yes, then the finding may be screened green. If the finding can't be screened green, then send the finding to the SRAs for phase 3 analysis.

5. Did the finding cause a loss of RCS inventory such that :

   There was an inadvertent loss of 2 feet of RCS inventory when not in midloop?
   OR
   There was an inadvertent entry into midloop conditions?
   OR

There was an inadvertent loss of 2 inches of RCS inventory when in midloop conditions?

If yes, then answer all the questions, in this section. If no, the go to question 6.

5A. Given the event, assuming the drain path could not be isolated, does the time to drain the RCS to hot leg midplane exceed one hour?
5B. If the RCS level indication a reasonable reflection of RCS level?
5C. Can the leak path be readily identified within ½ the time to drain to hotleg midplane?
5D. Can the drain path be isolated by at least one functional valves such that a train of RHR can be re-started?
5E. Does the licensee have SG cooling available? Are there procedures for SG cooling? Does the licensee have the capability to add inventory to allow SG cooling for 24 hours and the capability to vent steam from the SGs?
5F. Does the licensee has at least two standby ECCS trains that are not impacted by the finding?
5G. Can the licensee establish a bleed path large enough to support Feed and Bleed?

IF the answers to ALL of these questions are yes, then the finding may be screened green. If the finding can't be screened green, then send the finding to the SRAs for phase 3 analysis.

6. Did this finding increase the likelihood of a LOOP? If yes, send the finding to the SRAs for phase 3 analysis.

7. Did this finding degrade the licensee's emergency AC capability? If yes, send the finding to the SRAs for phase 3 analysis.

8. Does the finding involve the licensee's ability to use the steam generators as a decay heat removal path?.

9. Does the finding degrade the licensee's standby injection capability such that the licensee does not have at least two standby ECCS trains available for core injection? If yes, send the finding to the SRAs for phase 3 analysis.

10. **Does the finding degrade the ability of containment to remain intact following a severe accident. If yes, send the finding to the SRAs for phase 3 analysis.**

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Check List - COLD SHUTDOWN, RCS CLOSED

I.Core Heat Removal Guidelines

A.Instrumentation

_____ (1)DHR heat exchanger inlet/outlet temperature and DHR flow indication in the control room with flow hi/low alarm.

_____(2)Two core exit thermocouples with control room readout and hi alarm.

B.Training/Procedures

_____(1)Procedures for normal and abnormal DHR operation. Procedure for loss of normal DHR include: prioritized alternate core cooling paths (e.g steam generator cooling, low pressure pump feed and bleed, etc.) , initial magnitude of decay heat, versus time to boiling, time to core uncovery, (NUMARC 91-06 guideline 4.1.1.1))

_____(2)Training and Procedures for DHR recovery.

C.Equipment

_____(1)one RHR loop operable and one additional RHR loop operable or the secondary side water level of at least two steam generators sufficient for DHR (includes necessary support systems (WOG STS 3.4.7)

_____(2)Available equipment to support two alternate core cooling paths for at least 24 hours, steam generator cooling and feed and bleed. Minimum equipment needs include:

____ steam generator inventory, secondary steam relief , and auxiliary feed water (if needed)

____one available high pressure injection pump train AND one other pump train capable of keeping the core covered in addition to the pumps that are part of the normal DHR system.

____ An adequate vent path to support feed and bleed (e.g. a PORV) (WOG LTOP STS 3.4.12),

____available RWST.

_____ Recirculation from emergency sump (if needed).

II.Inventory Control Guidelines

A.Instrumentation

_____2 pressurizer level instruments with hi/low alarm or level deviation in control room or 2 RCS level instruments while in reduced inventory operation (GL 88-17)

B.Training/Procedures

____(1)Loss of Inventory procedures address: source and magnitude of loss, providing sufficient makeup capability, coping with high radiation levels in containment. (NUMARC 91-06, guideline 4.2.2.1)

____(2)No plant configurations where a single active failure or personnel error can result in a rapid loss of RCS inventory, includes overlapping activities. (NUMARC 91-06, guideline 4.2.2. 2.)

C. Equipment

Available equipment sufficient to keep the core covered given a loss of RCS inventory. Minimum equipment needs include:

____one available high pressure injection pump train AND one other pump train capable of keeping the core covered in addition to the pumps that are part of the normal DHR system.

III.Power Availability Guidelines

A.Procedures/Training

_____(1)Control over switch yard and transformer yard activities. (NUMARC 91-06 guideline 4.3.2.1)

_____(2)Work activities do not have significant potential to affect existing operable power supplies (NUMARC 91-06 guidelines 4.3.1.2)

B.Equipment

_____(1)3 sources of AC power including: 1 offsite and 1 onsite source.

_____(2)Necessary DC and AC vital bus electrical power distribution subsystems to support the equipment needed to meet the core heat removal and inventory control safety function guidelines.

IV.Containment Control Guidelines

A.Procedures/Training

_____Procedures and training to close containment before core uncovery commensurate with plant conditions (should consider unavailability of AC power and environmental conditions in containment) following a loss of RHR AND a loss of RCS inventory. (NUMARC 91-06 guideline 4.5.1))

B.Equipment

_____Containment penetrations (including temporary) have a differential pressure equal to the ultimate pressure capability of containment or would be expected to remain intact following a severe accident .

V.Reactivity Guidelines

_____assumes compliance with Technical Specifications Reactivity Guidelines

Analysis Section- COLD SHUTDOWN & REFUELING, RCS OPEN (RCS level < 23' above vessel flange)

Evaluate each question in order:

1. Does the finding involve in non-compliance with LTOP Tech. Specs, if yes, send to SRAs for phase 3 analysis?

2. Does the finding involve non-compliance with reactivity Tech Specs, if yes, send to SRAs for phase 3 analysis?

3. Does the finding involve the the RCS level instrumentation or the core exit thermocouples? If yes, send the finding to the SRAs for phase 3 analysis.

4. Did the finding cause a loss of the operating train of RHR? If yes, send the finding to the SRAs for phase 3 analysis.

5. Did the finding increase the likelihood of a loss of the operating train of RHR? If yes, then answer all questions in this section. If no, then move on to question 6.

   5a. Is the time to RHR loss given no successful operation action greater than one hour?
   5b. Are there trouble alarms present for finding such as CCW low flow alarms?
   5c. Is time to boiling greater than 60 minutes?
   4c. Does the licensee has at least two standby ECCS trains that are not impacted by the finding?
   4e. Can the licensee easily fill the RCS and vent the RHR pumps if RHR is lost? For example, does the RHR pump suction piping have any high elevation points that could trap non-condensibles?
   4F. Does the licensee have procedures and equipment necessary to provide makeup to the RWST?

I IF the answers to ALL of these questions are yes, then the finding may be screened green. If the finding can't be screened green, then send the finding to the SRAs for phase 3 analysis.

5. Did the finding cause a loss of RCS inventory such that :

There was an inadvertent loss of 2 feet of RCS inventory when not in midloop?
OR
There was an inadvertent entry into midloop conditions?
OR
There was an inadvertent loss of 2 inches of RCS inventory when in midloop conditions

If yes, then answer all the questions, in this section. If no, the go to question 6.

6A. Given the event, assuming the drain path could not be isolated, does the time to drain the RCS such that RHR would be lost exceed one hour?
6B. If the RCS level indication a reasonable reflection of RCS level?
6C. Can the leak path be readily identified within ½ the time to drain to hotleg midplane?
6D. Can the drain path be isolated by at least one functional valves such that a train of RHR can be re-started?
6E. Does the licensee has at least two standby ECCS trains that are not impacted by the finding?
6F. Does the licensee have procedures and equipment necessary to provide makeup to the RWST?

IF the answers to ALL of these questions are yes, then the finding may be screened green. If the finding can't be screened green, then send the finding to the SRAs for phase 3 analysis.

6. If nozzle dams are installed, is there an adequate vent path such that loss of a nozzle dam following a postulated RCS re-pressurization is prevented?

7. Did this finding increase the likelihood of a LOOP? If yes, send the finding to the SRAs for phase 3 analysis.

8. Did this finding degrade the licensee's emergency AC capability? If yes, send the finding to the SRAs for phase 3 analysis.

9. Does the finding degrade the licensee's standby injection capability such that the licensee does not have at least two standby ECCS trains available for core injection? If yes, send the finding to the SRAs for phase 3 analysis.

10. **Does the finding degrade the ability of containment to remain intact following a severe accident? If yes, send the finding to the SRAs for phase 3 analysis.**

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Check List - COLD SHUTDOWN & REFUELING, RCS OPEN (RCS level < 23' above flange)

I.Core Heat Removal Guidelines

A.Instrumentation

_____(1)DHR heat exchanger inlet/outlet temperature, DHR flow indication with hi/low flow alarm, and DHR pump motor current with alarm. (GL 88-17)

_____(2)At least two core exit thermocouples with control room readout and hi alarm until must be removed for preparations for vessel head removal (GL 88-17).

B.Training/Procedures

_____(1)Procedures for normal and abnormal DHR operation. Procedure for loss of normal DHR include: alternate core cooling paths (e.g feed and bleed), initial magnitude of decay heat, versus time to boiling, time to core uncovery, initial RCS condition (e.g. filled, mid-loop, etc.), RCS configuration (open/closed, nozzle dams installed or loop isolation valves closed, etc.) (NUMARC 91-06 guideline 4.1.1.1)

_____(2)Training and Procedures for DHR recovery.

C.Equipment

_____(1)Both trains of DHR operable with necessary support systems. (STS)

_____(2)Available equipment to support feed and bleed for at least 24 hours. Minimum equipment needs include:

_____One high pressure injection pump train AND one other pump train capable of keeping the core covered in addition to the pumps that are part of the normal DHR system (GL 88-17)

_____An adequate vent path that can (1) support feed and bleed and (2) prevent loss of a nozzle dam during RCS re-pressurization following a postulated loss of DHR (e.g. pressurizer manway). (GL 88-17),

_____Available RWST (GL 88-17)

_____Recirculation capability from sump (if needed).

II. Inventory Control Guidelines

A.Instrumentation

_____(1)2 sources of pressurizer level instrumentation with hi/low alarm or level deviation in control room when inventory in pressurizer.

_____(2)Two sources of level continuous level instrumentation with pressurizer empty. Monitoring performed by an operator in the control room or from a location other than the control room with a provision for providing immediate water level values to an operator in the control room if significant changes occur. (GL 88-17)

B.Procedures/Training

_____(1)Outage schedule minimizes the overall time that the plant is in a

reduced inventory condition (NUMARC 91-06 guideline 4.2.1.3)

_____(2)Outage schedule delays to the extent practical going to reduced inventory conditions when decay heat load is high. (NUMARC 91-06 guideline 4.2.1.2)

_____(3)Training, procedures and administrative controls implemented to avoid operations that could lead to perturbations in RCS level control or DHR flow (GL 88-17, NUMARC 91-06 guideline 4.2.1.4)

_____(4)Loss of Inventory procedures address: source and magnitude of loss, providing sufficient makeup capability, coping with high radiation levels in containment. (NUMARC 91-06 guideline 4.2.2.1)

_____(5)Drain down is controlled; inventory balances performed and appropriate action taken on level deviation.

C.Equipment

_____(1)At least, one large hot leg vent established and maintained prior to opening an RCS cold leg penetration. (GL 88-17)

_____(2)Equipment sufficient to keep the core covered given a loss of RCS inventory. Minimum equipment needs include: one high pressure injection pump train (after breaker racked -in) AND one other pump capable of keeping the core covered in addition to the pumps that are part of the normal DHR system. (GL 88-17).

III.Power Availability Guidelines

A.Procedures/Training/Administrative Controls

_____(1)Work activities do not have significant potential to affect existing operable power supplies (NUMARC 91-06 guidelines 4.3.1.2)

_____(2)Control over switch yard and transformer yard activities. (NUMARC 91-06 guideline 4.3.2.1)

B.Equipment

_____(1)3 sources of AC power including: 1 offsite and 1 onsite source.

_____(2)Necessary DC and AC vital bus electrical power distribution subsystems to support the equipment needed to meet the core heat removal and inventory control safety function guidelines.

IV.Containment Control Guidelines

A.Procedures/Training

_____(1)Procedures and training to close containment prior to core boiling if the RCS is open. (NUMARC 91-06 guideline 4.2.5 and GL 88-17

_____(2)Procedures and training to close containment before core uncovery commensurate with plant conditions if the RCS is closed (should consider unavailability of AC power and environmental conditions in containment) following a loss of RHR AND a loss of RCS inventory. (NUMARC 91-06 guideline 4.5.1))

B.Equipment

_____Containment penetrations (including temporary) have a differential pressure equal to the ultimate pressure or would be expected to remain intact following a severe accident. (GL 88-17)

V.Reactivity Guidelines

_____(assumes compliance with Technical Specifications)

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Analysis Section - REFUELING CAVITY FLOODED

Evaluate each question in order:

1. Does the finding increase the likelihood of a LOOP AND failure of the refueling cavity seal following a loss of offsite power? If yes, send to SRAs for phase 3 analysis.

2. Does the finding increase the likelihood of EDG failure AND failure of the refueling cavity seal given a loss of emergency AC power? If yes, then send the finding to the SRAs for phase 3 analysis.

3. Did the finding cause a loss of RCS inventory such that 2 feet of RCS inventory was lost? If yes, then answer all the questions, in this section.

- **3A. Given the event, assuming the drain path could not be isolated, does the time to drain the RCS to hot leg midplane exceed one hour?**
- **3B. If the RCS level indication a reasonable reflection of RCS level?**
- **3C. Can the leak path be readily identified within ½ the time to drain to hotleg midplane?**
- **3D. Can the drain path be isolated by at least one functional valves such that a train of RHR can be re-started**

I IF the answers to ALL of these questions are yes, then the finding may be screened green. If the finding can't be screened green, then send the finding to the SRAs for phase 3 analysis.

4. Did the finding increase the likelihood of freeze seal or refueling cavity seal failure? If yes, then send the finding to the SRAs for phase 3 analysis.

Check List - REFUELING CAVITY FLOODED

I.Core Heat Removal Guidelines

A.Instrumentation
_____(1)DHR heat exchanger inlet/outlet temperature and DHR flow indication in the control room with flow hi/low alarm.
_____(2)Two sources of vessel temperature instrumentation (as soon as practical during vessel head re-installation).
B.Procedures/Training
_____(1)Procedures for normal and abnormal DHR operation. Procedure for loss of normal DHR include: alternate core cooling paths (e.g feed and bleed, use of fuel storage pool cooling), initial magnitude of decay heat, versus time to boiling, time to core uncovery, initial RCS condition (NUMARC 91-06 guideline 4.1.1.1))
_____(2)Procedures for RHR recovery.
C.Equipment
_____(1)At least one RHR loop shall be operable and in operation with support systems (WOG STS 3.9.8.1 or applicable RHR TS)
II.Inventory Control Guidelines
A.Instrumentation
_____Two sources of level instrumentation system with low level setpoint alarm with level < 23 ' above reactor vessel flange. One source of level instrumentation with refueling cavity flooded.
B.Procedures/Training/Administrative Controls
_____(1)Preventive maintenance/inspection or post-installation testing performed on reactor cavity seals prior to filling the reactor cavity to preclude potential seal failure. (NUMARC 91-06 guideline 4.2.5.1)
_____(2)Verify procedures for reactor cavity seal failure or loss of cavity inventory (NUMARC 91-06 guideline 4.2.5.2)
_____(3)Loss of Inventory procedures address: source and magnitude of loss, providing sufficient makeup capability, coping with high radiation levels in containment. (NUMARC 91-06 4.2.2.1).
_____(4)Freeze seals used in locations that can impact RCS inventory are continuously monitored. Procedures and contingency plans are established in the event of freeze seal failure. (NUMARC 4.2.2.6)
C.Equipment
_____Equipment necessary for makeup to the refueling cavity
III.Power Availability Guidelines
_____TS for AC and DC power are being met.
IV.Containment Control Guidelines
_____TS for core alterations are being met, if applicable. Containment closure should be addressed in contingency plans and/or in procedures.

V.Reactivity Guidelines
_____TS are being met.

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7.0 BASIS

For each POS defined in the checklist, there is a set of equipment, instrumentation, policies, and procedures that the staff expects the licensee to maintain during shutdown. This checklist is grouped by the five shutdown safety functions identified by NUMARC 91-06: decay heat removal, inventory control, power availability, reactivity control, and containment. As a plant enters into the different POSs, the inspector uses a different checklist. The inspector should check to ensure that each item on the checklist is being met. If an item is not being met, the inspector should review the section labeled, "Analysis Section" to see if the finding needs to be quantitatively assessed (phase 3 analysis). These conditions vary with plant configuration and time to boiling. Findings not requiring quantitative assessment, may be screened "green" and forwarded to the licensee's corrective action program.

The risk estimates used to produce the following tables recognize that certain plant configurations have inherently higher risks than others. For higher risk evolutions, the tables have more guidelines for each safety function. For example, based on past reviews of PWR shutdown PRAs, the staff has identified a step increase in risk that occurs when the RCS boundary is breached and the steam generators cannot be used for DHR. A second step increase in risk occurs when mid-loop conditions are reached. During midloop conditions, the likelihood that DHR can be lost due to poor RCS level control or poor DHR flow control increases. The staff has also identified the step increased in risk during cold shutdown in BWRs. This increase in risk occurs because technical specifications allow for more equipment to be inoperable in cold shutdown than in a hot shutdown. Also, the technical specifications allow the SRVs to be inoperable which are needed to provide an alternate decay heat removal path and pressure control if the DHR system is lost.

In addition to ensuring that the licensees maintain a mitigation capability during shutdown, as part of the Significance Determination Process, the staff is also monitoring conditions that represent a loss of control. These event are considered precursors to events that result in an actual loss DHR. The staff is monitoring losses of control because the voluntary action case for the proposed Shutdown Rule assumed that, based on experience, losses of DHR are relatively infrequent. In Step 4.1.1, conditions that meet a loss of control are listed. If these conditions occur, then the finding is referred to the Analysis section for each POS lists to determine if quantitative assessment is needed.

Finding Requiring Quantitative Assessment

Findings that need quantitative assessment should be forwarded to the Region SRA for analysis in Headquarters. To start the assessment, the PRA analyst in Headquarters and the SRA need the completed checklists for the outage and a complete description of the finding.

Background

In SECY 97-168, the staff requested the Commission to approve the publication of a proposed rule for comment that would cover shutdown and low power operation at nuclear power plants. The proposed rule was applicable during cold shutdown and refueling operation as defined in Technical Specifications. This rule would have required licensees to establish and implement procedures for training, quality assurance, and corrective actions to ensure that the safety functions of: decay heat removal, inventory control, and pressure control are maintained and monitored. The proposed rule also required the licensees to provide a mitigation capability. The mitigation capability would include the necessary equipment to maintain the reactor in a safe condition in the event of the loss of the operating decay heat removal system. .A quantitative regulatory analysis using PRA techniques was performed for SECY 97-168 to evaluate the benefit of the proposed rule. Core damage frequencies were developed for three cases of shutdown operation at PWRs and BWRs: the base case, the voluntary case, and the rule case.

The base case represented the level of protection provided strictly by legally enforceable requirements, i.e., current regulations, technical specifications, licensee conditions and orders. It did not credit any measure that was voluntary or that could be unilaterally changed by the licensee, such as licensee commitments made in response to generic letters and bulletins. The base case was used to assess the benefit of the proposed new rule.

The voluntary case represented the level of protection for plants operated with a reasonable implementation of voluntary measures, based on guidance from NUMARC 91-06 and GL 88-17. (NUMARC 91-06 provides guidance on improving outage management and GL 88-17 provides recommendations concerning the ability of a licensee to mitigate a potential loss of DHR during reduced inventory operations at PWRs). The voluntary action case also credited equipment assumed operable according to Technical Specifications. The rule case represents the level of protection provided by all plants complying with the requirements of the proposed rule. For both PWRs and BWRs, two voluntary action cases were performed using different interpretation of NUMARC 91-06 and GL 88-17. The higher CDF voluntary case represents a minimal implementation of both guidance documents. The lower CDF voluntary case represents an in-depth implementation of both guidance documents. The Regulatory analysis reported core damage frequencies (per reactor year) on the order of E-2 per year and E-3 per year for PWRs and BWRs respectively for the base case. The core damage frequencies (per reactor year) estimated for the voluntary action cases ranged from 8E-5 to 2E-6 per year for PWRs and from 1E-5 to 6E-7 for BWRS.

Based on staff review of the base case, voluntary action cases, and the rule case, the staff reported in SECY 97-168 that: (1) the existing level of safety at shutdown is largely

dependent upon measures that are not traceable to specific underlying regulations, and that could, therefore, be withdrawn by licensees without prior staff approval (2) little reduction of risk is achieved by the rule for the licensee who has adopted effective voluntary practices that reduce risk for shutdown operation.

In response to SECY 97-168, the Staff Requirements Memorandum (SRM) did not authorize the staff to issue the rule. As documented in the Federal Register (dated February 4, 1999, vol. 64, no. 23), the Commission did not believe that the proposed shutdown rule was needed given the staff's estimate of current industry performance. However, as directed in the SRM, the Commission "expects the staff to continue to monitor licensee performance, through inspections and other means, in the area of shutdown operations to ensure that the current level of safety is maintained." In addition, in the Federal Register (dated February 4, 1999, vol. 64, no. 23), it states, "the Commission will continue to monitor industry performance and may take further action if any adverse trends are identified."

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