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Director,
Nuclear Reactor Regulation
US Nuclear Regulatory Commission
Washington, DC 20555

DOCKET 50-255 - LICENSE DPR-20 - PALISADES PLANT -
MAIN STEAM ISOLATION VALVE SINGLE FAILURE ISSUE -
INFORMATION ON FEED AND BLEED AND EMERGENCY
OPERATING PROCEDURES

Consumers Power Company letters of May 23, 1985 and December 5, 1985 provided the results of our evaluation of Main Steam Line Break single-failure backfits. The NRC responded with a safety evaluation in their February 28, 1986 letter. The safety evaluation concluded that procedural and operator training improvements were required. Consumers Power Company letter of April 28, 1986 provided our commitments to upgrade the new Emergency Operating Procedures and provide operator training in their use to resolve the NRC concerns.

In a subsequent telephone conversation on May 15, 1986, between the NRC Palisades Project Manager and members of our staff, additional concerns related to the use of feed and bleed and the contents of the upgraded Emergency Operating Procedures (EOPs) were raised. The following discussions of the use of feed and bleed during a loss of feedwater event and contents of the EOPs address those concerns.

Feed and Bleed

The Palisades Emergency Operating Procedures make reference to the use of flow out of the Power Operated Relief Valves (PORVs) as a method of emergency core cooling. This is referred to as "once-through-cooling" or as "feed-and-bleed." The major part of the supporting analysis for feed and bleed comes from a CE Owner's Group report entitled "CE-NPSD-167, Alternatives for Decay Heat Removal in C-E Supplied Nuclear Steam Supply Systems, Task 434 Final Report."

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In the report, it was shown, for a generic CE plant (St. Lucie 2), that feed and bleed cooling could keep the reactor vessel water level from dropping very far into the core during a Total Loss of Feedwater (TLOFW) event. The analysis assumed both PORVs were opened within 20 minutes and 2 High Pressure Safety Injection (HPSI) pumps and 2 charging pumps were operating. The analysis for TLOFW also shows the steam generators go dry at 30 minutes.

The same conclusion that feed and bleed would prevent core uncovery for a loss of feedwater event was also shown in NUREG/CR-4471, "Los Alamos PWR Decay-Heat Removal Studies Summary Results and Conclusions." This study was done using Calvert Cliffs as the specific CE plant. An inspection of the plant parameters used, indicated to the authors that their results were also applicable to Palisades. The report concluded that feed and bleed prevented core uncovery if it were initiated before the steam generators dry out. The calculated steam generator dryout time was at 20.8 minutes after a loss of feedwater event. Nominal HPSI and PORV flow was assumed from two HPSI pumps and two PORVs.

The NUREG also looked at other events, one of which was a Main Steam Line Break (MSLB) concurrent with a loss of feedwater. This analysis showed that it was not necessary to open the PORVs for a "bleed" mode. In an MSLB, the depressurization from the rapid cooldown initiates SIS early in the event plus allows an amount of HPSI flow to be injected such that charging flow is sufficient to keep the core covered after the primary system repressurizes. Since the core remains covered, the PORVs are not necessary to reduce the system pressure.

Consumers Power Company intends to analyze the feed and bleed method for Palisades using the RETRAN Code. The analysis is expected to show that we can either extend the time after trip that an operator has to open the PORVs, or reduce the number of pumps necessary. This analytical gain is expected since the CE and Los Alamos analyses were done at 2700 MWt versus the 2530 MWt license limit for Palisades. Credit will be taken for increasing the HPSI pump discharge pressure by taking suction from the containment spray pump discharge. Options also exist for using three charging pumps instead of two or for maximizing letdown. Smaller analytical gains can be made since the Palisades HPSI pumps have a slightly higher pump capacity and the PORVs a slightly higher flow rate than assumed in the CE and Los Alamos analyses.

Emergency Operating Procedures Upgrade

The new Palisades Emergency Operating Procedures fall into three groups; Standard Post Trip Action Procedure, Optimal Recovery Procedures, and Functional Recovery Procedure.

The Standard Post Trip Action Procedure lists those actions to be accomplished following any reactor trip. Normal and alternate methods of accomplishing each action are provided. Success criteria are provided to assure the

operator can determine when his efforts, for listed actions, have been successful. A diagnostic flow chart is provided to assist the operator in determining which emergency procedure to enter next.

Each optimal recovery procedure lists those actions to be accomplished for a specific transient (as identified by the diagnostic flow chart of the standard post trip actions). Again, normal and alternative methods and success criteria are provided for each action. In addition, repeated checks are made on the status of each of nine safety functions. If, at any time during an optimal procedure, a safety function acceptance criteria is not satisfied, or the accident diagnosis is uncertain, the operator is directed to go to the Functional Recovery Procedure. The Functional Recovery Procedure lists those actions necessary to accomplish each safety function. Again, normal and alternate methods and success criteria are provided.

The safety functions addressed by the Functional Recovery Procedures are:

1. Reactivity Control
2. Vital Auxiliaries - Electric Power
3. PCS Inventory Control
4. PCS Pressure Control
5. Core and PCS Heat Removal
6. Containment Isolation
7. Containment Atmosphere Control
8. Vital Auxiliaries - Water
9. Vital Auxiliaries - Air

The method of accomplishing each safety function is addressed separately. Each of these sub-procedures list those actions necessary to control the particular safety function by that method and gives specific acceptance criteria for that method. If the acceptance criteria for that method cannot be met, the operator is directed to the next method of accomplishing that particular safety function. Both the safety functions and the methods of accomplishing them are prioritized.

The specific procedures which are most applicable to the two steam generator blowdown event are:

1) Standard Post Trip Actions
2) Excess Steam Demand Event
3) Functional Recovery Procedure
   a) Inventory Control
   b) PCS and Core Heat Removal

Draft copies of these procedures are being sent to the NRC Palisades Project Manager. A summary, in outline form, is attached which lists those specified operator actions which are most significant to the two steam generator blowdown event.

An attachment of specific instruments located outside of the containment, which can be used to confirm or back up instruments inside the containment, will be added to the following emergency operating procedures:

1) Loss of Coolant; EOP-4.0
2) Excess Steam Demand Event; EOP-6.0
3) Functional Recovery Procedure; EOP-9.0

This list of instruments has not been completed due to the major effort of implementing the new Emergency Operating Procedures. The list will be completed and incorporated into the first revision of the procedures.

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Attachment

ATTACHMENT

Consumers Power Company
Palisades Plant
Docket 50-255

SUMMARY OF PROCEDURE GUIDANCE

August 1, 1986

4 Pages

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SUMMARY OF PROCEDURE GUIDANCE

I. ASSUMED INITIATING EVENT

A. Main Steam Line Break Inside Containment; Plant at Power

B. Reactor Trip

C. MSIV on Opposite SG Fails to Close

II. IMMEDIATE OPERATOR ACTIONS

A. Standard Post Trip Actions (EOP-1.0)

1. Manually Trip Reactor.

2. Trip Main Feed Pumps.

3. Start AFW Pump.

4. Verify Reactor Shutdown.

5. Verify Vital Auxiliaries Available.

   a. AC Power
   b. Service and Component Cooling Water
   c. Instrument Air

6. Verify PCS Level and Pressure Control.

   a. Abnormal indications here imply that more than an uncomplicated trip has occurred.

7. Verify PCS and Core Heat Removal.

   a. Abnormal indications here indicate more than an uncomplicated trip.

8. Verify MSIV's, Feedwater Regulation Valves and Bypasses are Shut.

9. Verify Containment Isolation.

10. Verify Containment Air Cooler and Spray Operation.

11. Diagnostic Chart refers operator to use Excess Steam Demand Procedure or Functional Recovery Procedure.

III. SUBSEQUENT OPERATOR ACTIONS

A. Excess Steam Demand Event (EOP-6.0)

1. Verify Standard Post Trip Actions have been performed.

2. Caution Note:

   a. If degraded containment conditions exist, the operator should not rely on any single instrument. Alternate instrumentation should be used to confirm trending of PCS conditions.

   b. A reference to an attachment which lists available alternative instruments will be added to this caution note.

3. Initiate Periodic Checks of each Safety Function.

   a. Failure to satisfy any safety function success criterion will suggest, but not require, transferring to the Functional Recovery Procedure depending upon the specific safety function(s) in jeopardy (part of safety function hierarchy/operator training).

4. If the event diagnosis is uncertain, Functional Recovery Procedure (EOP-9) is entered.

5. Check MSIV's are shut.

6. Ensure AFW flow to both SGs.

7. Ensure safety injection equipment is operating.

8. Isolate most affected steam generator.

9. Verify AFW flow to unisolated steam generator.

10. Check for indications of SG tube rupture.

11. Verify Containment Air Cooler and Spray Operation.

12. Cool down and initiate Shutdown Cooling.

B. Functional Recovery Procedure (EOP-9.0)

1. Verify Standard Post Trip Actions have been performed.

2. Identify safety functions which do not meet acceptance criteria.

3. Identify resources available to fulfill these (jeopardized) safety functions.

4. Implement specified actions for highest priority jeopardized safety function.

   a. Each safety function success path includes directions on when to direct attention to next jeopardized safety function.

5. Continue periodic checks on each safety function.

6. When all safety functions success criteria are satisfied, implement "Functional Recovery Long Term Actions."

IV. EXAMPLE OF SAFETY FUNCTION SUCCESS PATHS (HEAT REMOVAL)

A. Steam Generator Heat Sink - Natural Circulation (HR-2).

1. Borate PCS to maintain shutdown margin.

2. If, at any time, SG cooling is lost (both levels below -84% and/or pressurizer pressure increases rapidly), go to "once-through-cooling; HR-4."

3. If PCS Pressure drops to 1605, verify SIAS and go to "SG Heat Sink and Safety Injection; HR-3."

   a. At this point following a two SG blowdown, the operator would transfer to success path HR-3 if he had not previously gone to path HR-4.

B. Steam Generator Heat Sink and Safety Injection (HR-3).

1. Verify Safety Injection Equipment Operation.

2. If, at any time, SG cooling is lost, go to "once-through-cooling; HR-4."

3. Available Steaming Paths listed in order of preference:

   a. Turbine bypass to condenser.

   b. Atmospheric Dump Valves.

   c. Hogging Air Ejector.

   d. Turbine driven AFW pump.

4. Isolate the most affected steam generator.

5. Check for Steam Generator Tube Rupture.

6. Verify AFW to unisolated steam generator.

7. If AFW is unavailable, use the main feedwater/condensate system to feed the SG.

8. If SG cooling is lost, go to "once-through-cooling; HR-4.

9. Go to "Shutdown Cooling; HR-5."