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Monticello Nuclear Generating Plant
Operated by Nuclear Management Company, LLC

June 26, 2008

L-MT-08-034
10 CFR 50.90

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555

Monticello Nuclear Generating Plant
Docket 50-263
Renewed Facility Operating License No. DPR-22

License Amendment Request: Revision to Required Actions for Specification 3.5.1, Emergency Core Cooling System

Pursuant to 10 CFR 50.90, the Nuclear Management Company, LLC (NMC) proposes to revise the Required Actions for Technical Specification 3.5.1, "Emergency Core Cooling System (ECCS) and Reactor Core Isolation Cooling (RCIC) System, ECCS - Operating," within the Monticello Nuclear Generating Plant (MNGP) Technical Specifications (TS) to more accurately reflect the assumptions of the MNGP Loss of Coolant Accident (LOCA) accident analysis. Based upon the ECCS single failure analysis for the MNGP, applying deterministic considerations and licensing precedents, it is proposed to revise the existing Conditions and Required Actions and add several new actions (and associated Completion Times) to Specification 3.5.1 to address inoperability of selected combinations of low pressure ECCS subsystems for which Required Actions are not presently specified.

Enclosure 1 provides a description of the proposed changes and includes the technical evaluation and associated no significant hazards determination and environmental evaluation. Enclosure 2 provides a marked-up copy of the TS pages showing the proposed changes. Enclosure 3 provides a copy of the associated draft marked-up TS Bases pages for information.

The NMC requests approval of the proposed license amendment by one year from the date of submittal, with an implementation period of 90 days.

The MNGP Plant Operations Review Committee has reviewed this application. In accordance with 10 CFR 50.91, a copy of this application, with enclosures, is being provided to the designated Minnesota Official.

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Summary of Commitments

This letter proposes no new commitments or revises any existing commitments.

I declare under penalty of perjury that the foregoing is true and correct.
Executed on June 26, 2008.

Timothy J. O'Connor
Site Vice President, Monticello Nuclear Generating Plant
Nuclear Management Company, LLC

Enclosures (3)

cc: Administrator, Region III, USNRC
Project Manager, Monticello, USNRC
Resident Inspector, Monticello, USNRC
Minnesota Department of Commerce

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1.0 INTRODUCTION

Pursuant to 10 CFR 50.90, the Nuclear Management Company, LLC (NMC) proposes to revise the Required Actions for Technical Specification 3.5.1, "Emergency Core Cooling System (ECCS) and Reactor Core Isolation Cooling (RCIC) System, ECCS - Operating," within the Monticello Nuclear Generating Plant (MNGP) Technical Specifications (TS) to more accurately reflect the assumptions of the MNGP Loss of Coolant Accident (LOCA) accident analysis. Based upon the ECCS single failure analysis for the MNGP, applying deterministic considerations and licensing precedents, it is proposed to revise the existing Conditions and Required Actions and to add several new actions (and associated Completion Times) to Specification 3.5.1 to address inoperability of selected combinations of low pressure ECCS subsystems for which Required Actions are not presently specified.[(1)] These Required Actions address conditions where the following combinations of low pressure ECCS injection/spray subsystems are inoperable:

1. Two entire Low Pressure Coolant Injection (LPCI) subsystems inoperable.

2. One Core Spray subsystem and one LPCI subsystem (or one or two LPCI pumps) inoperable.

3. Both Core Spray subsystems inoperable.

The General Electric SAFER/GESTR set of computer codes (Reference 1) are the evaluation model used for the MNGP licensing basis LOCA analysis. The ECCS-LOCA analysis (References 2 and 3) performed for the MNGP assumed single failures that are more limiting than those reflected within the existing MNGP TS. Therefore, the NMC proposes to revise Specification 3.5.1 to more fully reflect the assumptions of the single failure analysis, consistent with the U.S. Nuclear Regulatory Commission (NRC) approved TS for several other Boiling Water Reactors (BWRs). This approach is also consistent with the single failure assumption applied for the Pressurized Water Reactor (PWR) standard technical specification (STS) NUREGs.

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1. The proposed Conditions, Required Actions and Completion Times have been previously approved by the NRC for several other BWRs with ECCS configurations that are consistent with the MNGP ECCS configuration.

2.0 BACKGROUND

At the MNGP, there are two independent ECCS Room Coolers (one for each low pressure ECCS division) providing cooling to the low pressure ECCS equipment. Each ECCS Room Cooler is located in the respective division's Residual Heat Removal (RHR) / Core Spray Corner Room in the Reactor Building. Each low pressure ECCS division consists of one RHR subsystem, with two RHR pumps lined up in the LPCI mode, and a Core Spray subsystem, containing one Core Spray pump.

The Emergency Service Water (ESW) System consists of two independent subsystems each taking supply from the ultimate heat sink (UHS) providing cooling water to the ECCS Room Coolers, among other loads. Condition A of Specification 3.7.2, "Emergency Service Water (ESW) System and Ultimate Heat Sink (UHS)," provides a 72 hour Completion Time for restoration to OPERABLE status when one ESW subsystem is inoperable.

<u>ECCS Room Cooler Events Resulting In Operational Challenges</u>

On July 2, 2007, during quarterly ESW pump and valve surveillance testing, a low flow condition was identified to the "A" RHR / Core Spray Pump Room resulting in inadequate flow to the Division I ECCS Room Cooler. The inoperability of the Division I ECCS Room Cooler resulted in the simultaneous inoperability of the "A" and "C" RHR pump loops (one LPCI subsystem) and the "A" Core Spray subsystem due to the inability to provide adequate room cooling. With two low pressure ECCS subsystems inoperable, Specification 3.5.1, "Emergency Core Cooling System (ECCS) and Reactor Core Isolation Cooling System (RCIC)," Action M, directed entry into Limiting Condition for Operation (LCO) 3.0.3 requiring commencement of a plant shutdown. This event was reported in Licensee Event Report (LER) 2007-04 (Reference 4).

On August 20, 2007, during Control Room panel walkdowns an Operator discovered that the indicating light for the Division II ECCS Room Cooler was not lit. It was determined that the Division II ECCS Room Cooler supply breaker would not function. On December 11, 2007, the Division I ECCS Room Cooler failed to start due to a blown fuse. Each of these room cooler inoperability events resulted in declaration of the respective division's RHR pumps (one LPCI subsystem) and associated Core Spray subsystem being declared inoperable resulting in entry into LCO 3.0.3 in accordance with TS.[2]

These events illustrate the vulnerability of the unit to a required shutdown due to the current TS requirements based on inoperability of an ECCS Room Cooler.

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2. In each of these cases, the problem was able to be resolved within the Completion Time and the unit was not taken offline. Review of the December 11, 2007, event identified that the unit was within the single failure analysis and consequently not in an unanalyzed condition.

3.0 DESCRIPTION OF THE PROPOSED CHANGES

Review of the MNGP ECCS single failure analysis indicates that one entire low pressure ECCS division was assumed inoperable as part of the MNGP ECCS LOCA analysis, although this combination of low pressure ECCS injection/spray subsystems out-of-service was not included within the Required Actions of Specification 3.5.1. An action such as this would allow maintenance and restoration of an inoperable ECCS Room Cooler, precluding the need for an unwarranted reactor shutdown with the associated risk.

The MNGP is of the BWR/3 design. Several BWRs with the same ECCS complement (BWR/3 and BWR/4 GE[3] product lines) have 72 hour Completion Times for restoration of an inoperable low pressure ECCS division. Also, the PWR STS provide a 72 hour Completion Time for the restoration of an entire ECCS train to OPERABLE status.

This allowance to have up to one division of low pressure ECCS equipment out-of-service for up to 72 hours was approved for the Duane Arnold Energy Center (DAEC) as part of their Improved STS (ITS) conversion (Reference 5). Further review identified that the Fermi TS and Limerick TS (based on the "old" STS) also include this allowance to have one division of low pressure ECCS equipment out-of-service for up to 72 hours. The DAEC, Fermi and Limerick units are of the BWR/4 design, with the same complement of ECCS systems, as the MNGP .

During the MNGP ITS conversion, the MNGP requested to change the TS to allow the combination of two full LPCI subsystems to be inoperable. That request was not included in the approved ITS amendment as it was considered by the NRC as a Beyond-Scope Change. It was indicated that this change could be submitted later as a separate technical change. This proposed change has been previously approved by the NRC for Dresden Units 2 and 3 and Quad Cities 1 and 2. Each of these units is of the BWR/3 design, with the same complement of ECCS systems as the MNGP.

Also, it was recognized during review of the MNGP ECCS single failure analysis that adding a new Condition F to provide a 72 hour Completion Time when both Core Spray subsystems are inoperable was worthwhile. This allowance was approved for the DAEC as part of the ITS conversion.

These actions with 72 hour Completion Times have been previously approved by the NRC for plants with the same complement of ECCS systems as the MNGP, are within the constraints of the MNGP ECCS single failure analysis, are standard for the PWRs, and hence are conservative and have been previously demonstrated acceptable. Based upon the single failure analysis associated with the MNGP LOCA analysis, it is proposed to revise and add the following Required Actions (and associated Completion Times) to Specification 3.5.1, "Emergency Core Cooling System, ECCS - Operating" to more fully reflect the Conditions (assumptions) of the ECCS analysis and design basis.

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3. Section 5.2 discusses the pertinent ECCS characteristics that apply to the BWR/3 and BWR/4 GE product lines.

ENCLOSURE 1

The following changes are proposed:

- Revise existing Condition D to apply to two entire LPCI subsystems being inoperable. Currently, the Condition applies when two LPCI subsystems are inoperable due to inoperable injection paths.
- Add a new Condition E to provide a 72 hour Completion Time when one Core Spray subsystem and one LPCI subsystem (or one or two LPCI pump(s) (may be in the same LPCI or opposite LPCI subsystems)) are inoperable.
- Add a new Condition F to provide a 72 hour Completion Time when both Core Spray subsystems are inoperable.
- Re-designate the Conditions and Required Actions (starting at existing letter E) to reflect the insertion of new Conditions E and F. Note that there are no changes to the technical content of the actions, only the letter of the designators are being revised to reflect the insertions.

The major revised actions / changes to the applicable portions of the Specification 3.5.1 Actions table are shown below.[4] The table also provides a reference to other BWR's NRC approved TS which contain the same Conditions, Required Actions and Completion Times.

Action

CONDITION	REQUIRED ACTION		COMPLETION TIME	OTHER BWR's TS
D. Two LPCI subsystems inoperable ~~due to inoperable injection paths~~ for reasons other than Condition C or Condition H.	D.1	Restore one LPCI ~~injection path~~ subsystem to OPERABLE status.	72 hours	Quad Cities Unit 1 & 2 Dresden Units 2 & 3

4. Additions are shown by dotted underlining or revision bars, and deletions by strikeout.

CONDITION	REQUIRED ACTION		COMPLETION TIME	OTHER BWR's TS
E. One Core Spray subsystem inoperable. AND One LPCI subsystem inoperable.	E.1 OR E.2	Restore Core Spray subsystem to OPERABLE status. Restore LPCI subsystem to OPERABLE status.	72 hours 72 hours	Limerick Unit 1, Fermi Unit 2 Duane Arnold
OR One or two LPCI pump(s) inoperable.	OR E.3	Restore LPCI pump(s) to OPERABLE status.		Duane Arnold
F. Both Core Spray subsystems inoperable.	F.1	Restore one Core Spray subsystem to OPERABLE status.	72 hours	Duane Arnold,
G. Required Action and associated Completion Time of Condition A, B, C, ~~or~~ D, E or F not met.	G.1 AND G.2	Be in MODE 3. Be in MODE 4.	12 hours 36 hours	(MNGP Existing)

Changes to the remaining Conditions and Required Actions reflect insertion of the new conditions (see mark-up). A full mark-up of the proposed changes to the Conditions, Required Actions and Completion Times table for Specification 3.5.1 is provided in Enclosure 2. Enclosure 3 provides a copy of the associated draft TS Bases pages. The Bases changes will be issued in accordance with Specification 5.5.9, "Technical Specification TS Bases Control Program," following approval of this LAR.

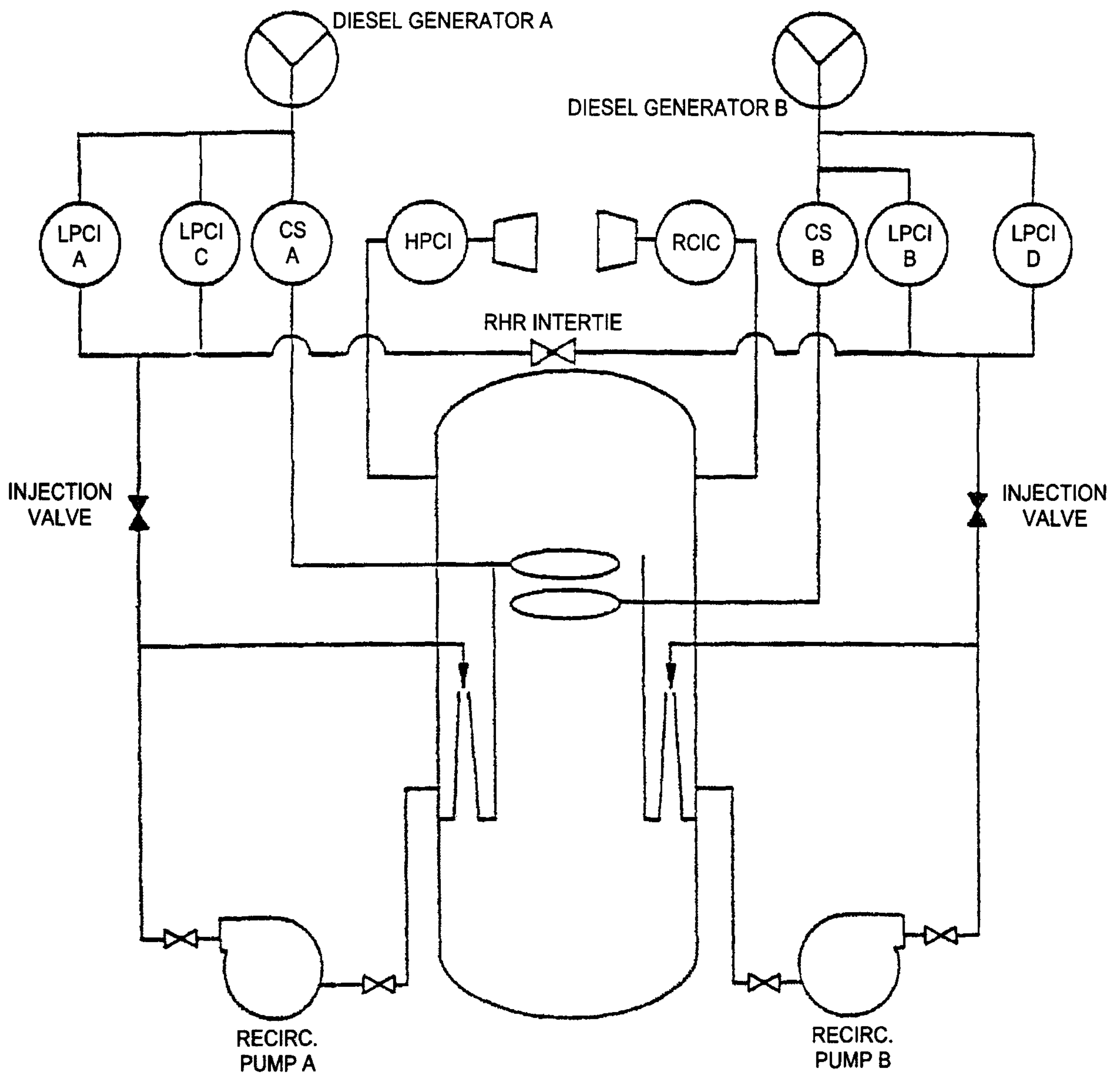
4.0 DESCRIPTION OF THE EMERGENCY CORE COOLING SYSTEM

The MNGP emergency core cooling system network consists of the following:

- High Pressure Coolant Injection (HPCI),
- Automatic Depressurization System (ADS),
- Core Spray (CS), and
- Low Pressure Coolant Injection (LPCI), (an operating mode of RHR).

(The other operating modes of RHR include shutdown cooling, containment spray and suppression pool cooling, and supplemental fuel pool cooling.)

The ECCS subsystems are designed to limit clad temperature over the complete spectrum of possible break sizes in the nuclear system process barrier, including the design basis break. The design basis break is defined as the complete and sudden circumferential rupture of the largest pipe connected to the reactor vessel (i.e., one of the recirculation loop pipelines) with displacement of the ends so that blowdown occurs from both ends. A simplified diagram showing the Monticello ECCS flow paths[5] is provided below.



5. The Reactor Core Isolation Cooling (RCIC) System flowpath is also shown, but it is not a credited ECCS.

High Pressure Coolant Injection

The High Pressure Coolant Injection (HPCI) System consists of a steam driven turbine pump unit, piping, and valves to provide steam to the turbine, as well as piping and valves to transfer water from the suction source to the core via the feedwater system line, where the coolant is distributed within the reactor pressure vessel (RPV) through the feedwater sparger. Pump suction for HPCI is normally aligned to the condensate storage tanks (CSTs) to minimize injection of suppression pool water into the RPV. However, if the water level in the CSTs are low, or if the suppression pool level is high, an automatic transfer to the suppression pool water source ensures a water supply for continuous operation of the HPCI System. The steam supply to the HPCI turbine is piped from a main steam line upstream of the associated inboard main steam isolation valve. The HPCI System is designed to provide core cooling for a wide range of reactor pressures (150 psig to 1120 psig). Exhaust steam from the HPCI turbine is discharged to the suppression pool.

Automatic Depressurization System

The Automatic Depressurization System (ADS) consists of three of the eight safety/relief valves (S/RVs). It is designed to provide depressurization of the reactor coolant system (RCS) during a small break LOCA if HPCI fails or is unable to maintain required water level in the RPV. ADS operation reduces the RPV pressure to within the operating pressure range of the low pressure ECCS subsystems (CS and LPCI), so that these subsystems can provide coolant inventory makeup.

Core Spray

Two independent loops are provided as a part of the Core Spray (CS) System. Each loop consists of one 100 percent-capacity centrifugal pump driven by an electric motor, a spray sparger in the reactor vessel above the core, piping and valves to convey water from the suppression pool to the sparger, and the associated controls and instrumentation.

In the case of low-low water level in the reactor vessel plus low reactor vessel pressure, or high pressure in the drywell, or low-low reactor water level sustained for 20 minutes, the CS System, when reactor vessel pressure is low enough, automatically sprays water onto the top of the fuel assemblies at a sufficient flow rate to cool the core and limit fuel cladding temperature. (LPCI starts from the same signals and operates independently to achieve the same objective by flooding the reactor vessel). The CS System can provide protection to the core for the largest break in the reactor pressure boundary (the double-ended recirculation line break). The CS System, after ADS has operated to lower reactor vessel pressure provides coolant to the core for small breaks in the reactor pressure boundary for which the control rod drive water pumps, RCIC, and HPCI are all unable to maintain the reactor vessel water level.

<u>Low Pressure Coolant Injection</u>

Low Pressure Coolant Injection (LPCI) is an operating mode of RHR. There are two LPCI subsystems, each consisting of two motor driven pumps, piping and valves that transfer water from the suppression pool to the reactor vessel through the corresponding recirculation loop. LPCI operates to restore and maintain the coolant inventory in the reactor vessel after a loss-of-coolant accident so that the core is sufficiently cooled to preclude fuel clad temperatures in excess of 2200°F and subsequent energy release due to a metal-water reaction. The LPCI subsystem operates in conjunction with HPCI, ADS, and the CS System to achieve this goal.

HPCI is a high-head system and pumps water into the reactor vessel when the nuclear system is at high pressure. If HPCI fails to maintain the required level of water in the reactor vessel, the automatic depressurization feature of the Nuclear System Pressure Relief System functions to reduce nuclear system pressure so that LPCI operates to inject water into the pressure vessel. LPCI is a low-head, high-flow subsystem. All these operations are carried out automatically. LPCI is designed to reflood the reactor vessel to at least two-thirds core height and to maintain this level. After the core has been flooded to this height, the capacity of one RHR pump (in the LPCI mode) is more than sufficient to maintain level. During LPCI operation, the pumps take suction from the pressure suppression pool and discharge to the reactor vessel into the core region through the selected recirculation loop. Operation of the LPCI loop select logic results in the LPCI pump discharge into the unbroken recirculation loop. Any spillage through a break in the lines within the primary containment returns to the pressure suppression pool through the pressure suppression vent lines.

5.0 TECHNICAL ANALYSIS

A review of the TS versus the ECCS single failure analysis for the MNGP indicated that allowable combinations of low pressure ECCS equipment out-of-service were not included within the Required Actions to the ECCS Specification, i.e., Specification 3.5.1 in the MNGP TS. Various equipment out-of-service allowances including two LPCI subsystems inoperable, one Core Spray subsystem inoperable and one LPCI subsystem (or one or two LPCI pump(s)) inoperable, or both Core Spray subsystems inoperable, have been previously approved by the NRC for various plants, solely or in combination, with a Completion Time of 72 hours. The plants are listed below.

- Dresden Units 2 and 3
- Quad Cities Unit 1 and 2
- Limerick Unit 1
- Fermi Unit 2
- Duane Arnold

These units are of the BWR/3 and BWR/4 designs, with the same complement of ECCS systems, as the MNGP. The PWR STSs provide a 72 hour Completion Time for restoring an entire ECCS train[6] to OPERABLE status.

Based upon the MNGP single failure analysis, existing precedents within the PWR STS NUREGs and several BWR/3 and BWR/4 plant TSs, it is proposed to revise the Required Actions in Specification 3.5.1, based upon purely deterministic considerations, to address the following situations. The changes[7] proposed to the Required Actions (and associated Completion Times) of Specification 3.5.1 are:

- Revise existing Condition D to apply to two entire LPCI subsystems being inoperable. Condition D currently applies to inoperable injection paths.

- Add a new Condition E to provide a 72 hour Completion Time when one Core Spray subsystem and one LPCI subsystem (i.e., a low pressure ECCS division), (or one or two LPCI pump(s) (may be in the same LPCI or opposite LPCI subsystems)) are inoperable.

- Add a new Condition F to provide a 72 hour Completion Time when both Core Spray subsystems are inoperable.

Each LPCI subsystem consists of a common suction line from the suppression pool, parallel flowpaths through the two RHR pumps, and a common injection line to the reactor pressure vessel. An inoperable "LPCI pump" refers to the condition where inoperable components associated with the flowpath through one of the two parallel RHR pumps renders that LPCI pump flowpath inoperable, but the common portions of the associated LPCI subsystem remain OPERABLE. For this condition the LPCI function can still be performed by the remaining OPERABLE LPCI pump in the associated LPCI subsystem. The TS Bases to Specification 3.5.1 have been revised to clarify this concept, so that it is clear that the Required Actions apply to the inoperable components associated with a LPCI pump flowpath rather than just a LPCI pump. Note that an inoperable component in the common LPCI subsystem sections would result in the entire LPCI subsystem being declared inoperable.

These proposed changes have been previously approved by the NRC for plants with the same complement of ECCS as the MNGP, are consistent with the MNGP ECCS single failure analysis and consistent with the philosophy of the STS for PWRs.

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6. A PWR ECCS train generally consists of high pressure and low pressure injection pumps supplied from offsite power backed-up by an emergency diesel generator (EDG). Loss of an EDG for a BWR/3 or 4 results in the loss of a single low pressure ECCS injection/spray division (the steam driven High Pressure Coolant Injection System is still available to provide high pressure ECCS injection).
7. Additional changes to re-label the existing Conditions and Required Actions to reflect the insertion of the new Required Actions and provide clarification where no action exists are shown in the marked-up TS in Enclosure 2.

5.1 Inconsistency Between the Required Actions for the ESW System Specification and the ECCS Specification

The MNGP ECCS components of Specification 3.5.1 are served by several support systems. There is an inconsistency between the Completion Time allowed for one subsystem of the Emergency Service Water (ESW) System being inoperable (i.e., 72 hours) and the Completion Time allowed for a division of low pressure ECCS injection/spray subsystems being inoperable, as described below. This section discusses the discrepancy and the impact on plant operations. Several of the following sections discuss proposed TS changes (and supporting analyses) which remedy this situation.

Emergency Service Water - Specification 3.7.2

The MNGP ESW System provides a safety-related source of cooling water for removal of heat from safety-related equipment; including the RHR pumps motor thrust bearings[(8)], the Core Spray pumps motor thrust bearings, and the ECCS Room Coolers. Each ECCS Room Cooler provides area cooling to its associated division of ECCS equipment. The ESW System consists of two independent subsystems each taking supply from the ultimate heat sink (UHS).

In accordance with Condition A of Specification 3.7.2, "Emergency Service Water (ESW) System and Ultimate Heat Sink (UHS)," a 72 hour Completion Time is provided for restoration when one ESW subsystem is inoperable.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One ESW subsystem inoperable.	A.1 Restore the ESW subsystem to OPERABLE status.	72 hours

Two of the components served by ESW are the RHR/Core Spray Room Coolers (V-AC-4 and V-AC-5), referred to as the ECCS room coolers. At the MNGP there are two ECCS room coolers, one for each low pressure ECCS division. Cooling water to each ECCS room cooler is supplied by the ESW subsystem associated with that ECCS division. When the required cooling flow can not be supplied to the ECCS room cooler due to a problem with its ESW subsystem (resulting in the inability to cool the RHR / Core Spray Pump Room) 72 hours is allowed to restore the ESW subsystem to OPERABLE status in accordance with Condition A of Specification 3.7.2.

8. Two of the four RHR pump motor upper bearings, one in each ECCS division, were replaced with models that do not require cooling water.

Conversely, when there is a problem with an ECCS room cooler (having the same result – the inability to cool the RHR / Core Spray Pump Room) the Required Actions for Specification 3.5.1 direct LCO 3.0.3 entry via Condition M, requiring a plant shutdown and the unit to be in Mode 4 in 37 hours.

5.2 Grouping of BWR Plants by Pertinent ECCS Characteristics

BWR plant designs have evolved over time resulting in changes to the RHR and Core Spray Systems. Nonetheless, the design changes have been generally evolutionary or reflect design options. For example, in the Core Spray subsystems, two half-capacity pumps instead of one full capacity pump have sometimes been utilized in a subsystem to provide the required flow.

Table 2.1 (see next page) from page 2-2 of NUREG/CR-5268, (Reference 6), illustrates six groupings developed for a study of BWR RHR System designs. The most common configuration is the two RHR subsystem (loop) design, with two RHR pumps per subsystem and one or two heat exchangers for each subsystem. Note that for all GE designs when utilized for ECCS operation the RHR pumps are put in a specific lineup referred to as the LPCI injection mode.

As can be seen, grouping plants by RHR System characteristics indicates that DAEC, Fermi, Dresden, Quad Cities and Monticello plants have the same general ECCS RHR System design (Group 1). The Group 1 design has two RHR (LPCI) pumps per subsystem (loop) with two RHR (LPCI injection) subsystems and one RHR heat exchanger per subsystem.[9][10][11] Note that Limerick is in Group 3 and Dresden 2 and 3 are in Group 5. The Limerick and Hope Creek (late BWR/4 designs) evolved to independent injection lines from the common injection line design associated with the BWR/3 and earlier BWR/4 designs.

9. The difference between Groups 1 and 2 is that Group 2 has two RHR heat exchangers per RHR Subsystem.
10. Group 3 retained the one RHR heat exchanger per division of Group 1, but instead of having two LPCI subsystems (with two LPCI injection pumps per subsystem), each LPCI pump was a stand alone subsystem with separate injection paths.
11. The BWR/5 and BWR/6 RHR System designs are contained in Group 4.

Table 2.1 Grouping of Plants by RHR System Characteristics

GROUP	PLANTS	RHR SYSTEM CHARACTERISTICS	
1	Arnold Brunswick 1 & 2 Cooper Fermi 2 Fitzpatrick Hatch 1 & 2 Monticello Pilgrim Quad Cities 1 & 2 Shoreham Susquehanna 1 & 2	Loops: 2 Pumps: 2 Per Loop HX's: 1 Per Loop	
2	Browns Ferry 1, 2 & 3 Peach Bottom 2 & 3	Loops: 2 Pumps: 2 Per Loop HX's: 2 Per Loop	
3	Hope Creek Limerick HX's: 2 Total	Loops: 4 Pumps: 4 Total	
4	Clinton Grand Gulf 1 & 2 La Salle 1 & 2 Nine Mile Point 2 Perry River Bend WNP2	Loops: 3 Pumps: 3 Total HX's: 2 Total	
5	Dresden 2 & 3 Millstone 1	Separate LPCI/SDC Systems SDC Loops: 2 SDC Pumps: 2 SDC HX's: 2	 LPCI Loops: 2 LPCI Pumps: 4 LPCI HX's: 2*
6	Nine Mile Point 1 Oyster Creek	No LPCI System SDC Loops: 3 SDC Pumps: 3 SDC HX's: 3	

* LPCI HX's used for containment cooling only.

For the BWR/3 and BWR/4 Core Spray System designs there are two different configurations. There is one configuration with each subsystem containing one Core Spray pump and a second configuration with each subsystem containing two half capacity pumps.

5.3 Review of the Dresden 2 and 3 and Quad Cities 1 and 2 ECCS Specifications

The Dresden Units 2 and 3 Specification 3.5.1, "Emergency Core Cooling System (ECCS) and Isolation Condenser (IC) System, ECCS – Operating," and the Quad Cities Units 1 and 2 Specification 3.5.1, "Emergency Core Cooling System (ECCS) and Reactor Core Isolation Cooling System (RCIC), ECCS – Operating," both indicate Required Action D as stated below. This condition correlates to Condition D within the MNGP TS.

CONDITION	REQUIRED ACTION		COMPLETION TIME
D. Two LPCI subsystems inoperable for reasons other than Condition C.[12]	D.1	Restore one LPCI subsystem to OPERABLE status.	72 hours

The section entitled "Additional TS Changes and Beyond-Scope Items" in the Dresden Units 2 and 3 NRC Safety Evaluation (SE) (Reference 7) and the Quad Cities Units 1 and 2 NRC SE (Reference 8) approved the incorporation of the above Required Action into the TS for each unit during the conversion of each unit to ITS. An excerpt from that section of each SE (identical wording for Dresden and Quad Cities) is provided below. (Emphasis added by underlining certain items.)

> More Restrictive Shutdown Requirements for LPCI Inop. (ITS 3.5.1. DOC M.1)
>
> [custom TS] CTS 3.5.A.2 defines the LPCI subsystem as being comprised of four LPCI pumps and a flow path capable of taking suction from the suppression chamber and transferring the water to the reactor vessel. ITS 3.5.1 will define two LPCI subsystems, each consisting of two motor driven pumps, piping, and valves capable of transferring water from the suppression pool to the RPV via the "selected" recirculation loop. CTS 3.5.A Action 2.b, which allows the entire LPCI System to be inoperable for 7 days, has been modified to allow only one LPCI subsystem to be inoperable (ITS 3.5.1, Condition B) or one LPCI pump in each LPCI subsystem to be inoperable (ITS 3.5.1 Condition C) for 7 days, or both LPCI subsystems to be inoperable for 72 hours (ITS 3.5.1 Action D). These changes represent additional restrictions on plant operation. The staff finds these changes to be acceptable.

The NRC approved changes for Dresden Units 2 and 3 and Quad Cities Units 1 and 2 allow two entire LPCI subsystems to be out-of-service for 72 hours. As

12. Condition C allows one LPCI pump in each subsystem to be inoperable for 7 days.

indicated previously, the Dresden and Quad Cities units are of the BWR/3 design, with the same complement of ECCS systems, as the MNGP. Therefore, the changes proposed by the NMC for the MNGP are consistent with the changes previously approved by the NRC for Dresden and Quad Cities during their ITS conversions and are applicable to the MNGP.

5.4 Review of the Duane Arnold ECCS Specification

On May 22, 1998, Amendment Number 223 (Reference 5) was issued to the DAEC authorizing a full conversion from the custom TS to the ITS. As stated in the cover letter to the amendment, this "amendment also revised the TS requirements for the combinations of emergency core cooling systems / subsystems that may be out of service". The pertinent revised Required Actions for the DAEC Specification 3.5.1, "Emergency Core Cooling System (ECCS) and Reactor Core Isolation Cooling System (RCIC), ECCS – Operating," after approval are shown below.[13] These conditions correlate to proposed Conditions E and F within the MNGP TS.

CONDITION	REQUIRED ACTION		COMPLETION TIME
C. One Core Spray subsystem inoperable.	C.1	Restore Core Spray subsystem to OPERABLE status.	72 hours
<u>AND</u>	<u>OR</u>		
One or two RHR pump(s) inoperable.	C.2	Restore RHR pump(s) to OPERABLE status.	72 hours
D. Both Core Spray subsystems inoperable.	D.1	Restore one Core Spray subsystem to OPERABLE status.	72 hours

Section G, "Evaluation of Other TS Changes Included in the Application for Conversion to Improved Technical Specifications," in the NRC SE for the DAEC ITS conversion provides the NRC evaluation of the ECCS conditions shown above. An excerpt from that section of the SE (pages 51 and 52) is provided below. (Emphasis has been added by underlining certain subjects.)

> <u>The NRC staff has concluded that, because the licensee used NRC approved ECCS analysis codes and methods, the following changes to the CTS are acceptable</u>. <u>These changes take credit for</u> the lower flow rates found adequate in the computer calculations for ECCS systems (SAFER/

13. One Core Spray subsystem together with one LPCI subsystem out-of-service for 72 hours was approved by the NRC for Fermi in Amendment No. 134.

GESTR, approved June 1, 1984 in a letter from C. Thomas (NRC) to J.Quirk (GE)) as well as the combinations of ECCS equipment found adequate to meet 10 CFR 50, Appendix K, requirements. Detailed discussions of the individual changes falling in this category are provided below.

L2. ITS 3.5.1 action C establishes required actions and completion times for the situation when one Core Spray subsystem and one or two RHR (LPCI) pump(s) are inoperable. ITS 3.5.1 is less restrictive than CTS 3.5.A.4, which allows one RHR pump to be inoperable for 30 days, and CTS 3.5.A.5, which allows two RHR pumps (i.e., the LPCI subsystem) to be inoperable for up to 7 days, provided the remaining RHR (LPCI) active components, both Core Spray subsystems, the Containment Spray subsystem, and the DGs are verified to be operable. The CTS does not allow one Core Spray subsystem and one or two RHR pump(s) to be inoperable at the same time. The LOCA analysis, conducted in accordance with an approved methodology and presented in NEDC-31310P, (Duane Arnold Energy Center SAFER/GESTR-LOCA Loss-of-Coolant Accident Analysis, pursuant to DAEC License Amendment #142, dated May 7, 1987), indicates that an adequate level of protection is provided by the remaining operable ECCS subsystems in this condition. The accident analysis also demonstrates that, in this condition, the peak clad temperature remains below the regulatory limit. However, another single failure may place the plant in a condition where adequate core cooling may not be available during a design basis LOCA. Therefore, a completion time of 72 hours has been established to either restore the inoperable Core Spray subsystem or the inoperable RHR pump(s).

L3. ITS 3.5.1 action D establishes required actions and completion times for the situation when two Core Spray (CS) subsystems are inoperable. ITS 3.5.1 is less restrictive than CTS 3.5.A.2, which allows only one Core Spray subsystem to be inoperable. CTS 3.5.A.6 would require the plant to be in Hot Shutdown within 12 hours and Cold Shutdown within the following 24 hours if both Core Spray subsystems were inoperable. With two CS subsystems inoperable, the LOCA analysis presented in NEDC-31310P, (Duane Arnold Energy Center SAFER/GESTR-LOCA Loss-of-Coolant Accident Analysis), indicates that the remaining operable low pressure ECCS subsystem (LPCI) with all four RHR pumps operable (only 3 of which are required), provides adequate protection. However, another single failure may place the plant in a condition where adequate core cooling may not be available during a design basis LOCA. Therefore, a completion time of 72 hours has been established to restore one Core Spray subsystem to operable status.

The NRC approved changes for the DAEC and Fermi units to allow one division of low-pressure ECCS equipment to be out-of-service for 72 hours. The approved change allows one or two RHR pump(s) in the LPCI mode in either ECCS division to be inoperable for the DAEC for 72 hours. In summary, this flexibility, consistent with the DAEC and Fermi units ECCS accident analysis allows either one entire LPCI subsystem, or two RHR pump LPCI flowpaths to be inoperable for 72 hours. This DAEC TS change also allowed both Core Spray subsystems[(14)] to be inoperable for 72 hours.

As indicated previously, the DAEC and Fermi units are of the BWR/4 design, with the same complement of ECCS systems, as the MNGP. The changes proposed by the NMC for the MNGP are consistent with changes previously approved by the NRC for DAEC and Fermi, and hence previously determined acceptable.

5.5 Review of the Limerick ECCS Specification

This change, to allow one division of low pressure ECCS equipment to be out-of-service for 72 hours is included within the Limerick TS. The Limerick units are of the late BWR/4 design, with a similar complement of ECCS systems, as the MNGP. As described in the LCO to Specification 3/4.5.1, "ECCS – OPERATING," for Limerick Unit 1, the pertinent low pressure ECCS are defined as:

3/4.5 EMERGENCY CORE COOLING SYSTEMS

3/4.5.1 ECCS - OPERATING

LIMITING CONDITION FOR OPERATION

3.5.1 The emergency core cooling systems shall be OPERABLE with:

a. The core spray system (CSS) consisting of two subsystems with each subsystem comprised of:

1. Two OPERABLE CSS pumps, and

2. An OPERABLE flow patch capable of taking suction from the suppression chamber and transferring the water through the spray sparger to the reactor vessel.

b. The low pressure coolant injection (LPCI) system of the residual heat removal system consisting of four subsystems with each subsystem comprised of:

1. One OPERABLE LPCI pump, and

2. An OPERABLE flow path capable of taking suction from the suppression chamber and transferring the water to the reactor vessel.

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14. The MNGP custom TS until 1991 included a 7-day allowable out-of-service time for both Core Spray subsystems inoperable (Reference 9).

Limerick has two Core Spray subsystems and four LPCI subsystems. As stated in the Actions to Limerick, Unit 1, Specification 3/4.5.1, b. for the LPCI system:

```
4.   With two LPCI subsystems inoperable, provided that at least one
     CSS subsystem is OPERABLE, restore at least three LPCI
     subsystems to OPERABLE status within 7 days or be in at least
     HOT SHUTDOWN within the next 12 hours and in COLD SHUTDOWN
     within the following 24 hours.
5.   With three LPCI subsystems inoperable, provided that both CSS
     subsystems are OPERABLE, restore at least two LPCI subsystems to
     OPERABLE status within 72 hours or be in at least HOT SHUTDOWN
     within the next 12 hours and in COLD SHUTDOWN within the
     following 24 hours.
```

Limerick Action b.4 provides a 7 day period (Completion Time) to restore one LPCI subsystem to OPERABLE (from an initial condition of one Core Spray subsystem inoperable and two LPCI subsystems inoperable), in other words one low pressure ECCS division out-of-service. This condition correlates to proposed Condition E within the MNGP TS.

Limerick Action b.5 provides a 72 hour period (Completion Time) to restore two LPCI subsystems to OPERABLE (from an initial condition of three LPCI subsystems inoperable).

The Limerick units are of the late BWR/4 design, with a similar complement of ECCS systems, as the MNGP. Therefore, the changes proposed by the NMC for the MNGP are in compliance with changes previously approved by the NRC for the Limerick units and hence previously demonstrated acceptable.

5.6 MNGP Updated Safety Analysis Report Accident Analysis Assumptions

The General Electric SAFER/GESTR set of computer codes (Reference 1) are the evaluation model used for ECCS LOCA licensing basis analysis for the MNGP. The ECCS-LOCA analysis (References 2 and 3) was performed assuming the single failures presented in Updated Safety Analysis Report (USAR) Table 14.7-11. All of these situations are bounded by the existing single failure analysis assumptions within the LOCA accident analysis, however these assumptions are not fully reflected within the MNGP TS. The Required Actions of Specification 3.5.1 are proposed to be revised and new Conditions added (along with the associated Completion Times) to address the above situations which were evaluated as part of the original single failure analysis. USAR Section 14.7.2.3.2, “Single Failure Considerations,” states:

> In order to determine the acceptability of the response to a LOCA, the most limiting combination of break size, location, and single failure must be determined. The single failures that are considered must reflect any failure of an ECCS component or support system which might be postulated to occur

during a LOCA. The component failures typically considered for BWR-3 plants are listed below:

- An emergency diesel generator
- A [Direct Current] DC power source (Battery)
- A LPCI injection valve
- The HPCI System
- An ADS valve

The single failure in the analysis is considered in conjunction with the unavailability of offsite power. The ECC Systems remaining available following a single failure are shown in [USAR] Table 14.7-11.

The ECCS receive emergency alternating current (AC) power from two diesel generators. One specific DC power source failure (Item 2) can disable the HPCI System and one emergency diesel generator. This failure results in ADS, one Core Spray subsystem and two RHR pumps in the LPCI injection mode remaining available. A modified[15] USAR Table 14.7-11 is provided below:

Table 14.7-11 Single Failures and Available Systems

	Break Location	Assumed Single Failure[16]	Systems Remaining Available[17]	TS 3.5.1 Condition
1.	Recirc Suction	None	2 CS + 4 LPCI + HPCI + ADS	
2.	Recirc Suction	DC Power	1 CS + 2 LPCI + ADS	E.
3.	Recirc Suction	Diesel Generator	1 CS + 2 LPCI + HPCI + ADS	E.
4.	Recirc Suction	LPCI Injection Valve	2 CS + HPCI + ADS	D.
5.	Recirc Suction	HPCI System	2 CS + 4 LPCI + ADS	
6.	Core Spray Line [18]	DC Power	2 LPCI + ADS	F.

15. A column indicating which proposed Specification 3.5.1 out-of-service Condition applies to a particular break and the limiting single failure was added.
16. Other postulated failures are not specifically considered because they all result in at least as much ECCS capacity as one of the above assumed failures.
17. Systems remaining, as identified in this table, are applicable to all non-ECCS line breaks. For a LOCA from an ECCS line break, the systems remaining are those listed, less the ECCS system in which the break is assumed.
18. The Core Spray Line failure is shown for illustration and also because proposed Condition F applies.

	Break Location	Assumed Single Failure[16]	Systems Remaining Available[17]	TS 3.5.1 Condition
7.	Feedwater Line	DC Power	1 CS + 2 LPCI + ADS	
8.	Steamline	DC Power	1 CS + 2 LPCI + ADS	

The limiting licensing basis event is the design basis accident (DBA) recirculation suction line break LOCA. As can be seen for the bounding cases analyzed, with the various limiting single failures assumed, proposed Condition D (which would result in both LPCI subsystems being inoperable, i.e., 4 LPCI inoperable) and Condition E (which would result in one Core Spray subsystem and one LPCI subsystem (or one or two LPCI pump(s)) being inoperable, i.e., 1 CS + 2 LPCI inoperable) results in the systems shown above remaining available for LOCA response.

For the non-limiting Core Spray line break LOCA, with the limiting single failure of a loss of DC Power assumed, proposed Condition F (which would result in one LPCI subsystem, both Core Spray subsystems and the HPCI System being inoperable, i.e., 2 LPCI + 2 CS + HPCI inoperable) results in the systems shown above remaining available for LOCA response.

As indicated above, a review of USAR Table 14.7-11 indicates that the proposed TS changes and the resulting equipment out-of-service combinations are all within the bounds of the existing MNGP ECCS single failure analysis. Also as discussed previously, Completion Times for each of these combinations have been established and approved by the NRC previously for other BWRs. A Completion Time of 72 hours has been determined to be acceptable by the NRC for these ECCS out-of-service configurations, by the licensing precedents previously discussed. Since plants currently with this specification have the same complement of ECCS and design, these previously approved ECCS out-of-service / single failure combinations and Completion Times are also applicable to the MNGP.

5.7 Review of ITS Development

The TS reflect a conservative representation of the accident analysis. A review of Specification 3.5.1 for the Monticello, and the BWR/4 and BWR/6 STS (NUREG-1433 and NUREG-1434 respectively), indicated that the Monticello ITS wording was standard (both for the Required Action and the associated Bases).

A review of other BWR technical specifications indicated that most plants did not credit in their TS some of the systems / subsystems available (out-of-service combinations) based upon the single failure considerations in their accident analyses. While it can not be established why this appears to be the case, it is worth noting that the PWR STS do appear to provide Required Actions to reflect ECCS trains (or equipment) out-of-service to the defined limits of their accident analyses.

This condition did not originate with ITS as the conversions generally carry over the existing ECCS equipment combination analysis from the prior standard or custom TS. A discussion with one of the lead developers of the Monticello ITS who was involved with the development of the original ITS BWR NUREGs indicated that the disconnect between BWR ECCS single failure analysis and TS allowances was recognized during development of the original ITS NUREGs by the involved industry/NRC/and Excel personnel but was not pursued.

5.8 Application of These Considerations to the MNGP ECCS Technical Specification Required Actions

Based upon a review of the MNGP ECCS single failure analysis and the other considerations discussed previously, it has been demonstrated that the following combinations of low pressure ECCS equipment out-of-service are acceptable for the MNGP and meet the licensing constraints of the LOCA analysis. Also, it has been determined that the following combinations of out-of-service have been reflected in NRC approved TS Required Actions (and associated Completion Times) for other BWR units of the same ECCS complement as the MNGP.

- Revise existing Condition D to apply to two entire LPCI subsystems being inoperable.

- Add a new Condition E to provide a 72 hour Completion Time when one Core Spray subsystem and one LPCI subsystem (or one or two LPCI pump(s) (may be in the same LPCI or opposite LPCI subsystems)) are inoperable.

- Add a new Condition F to provide a 72 hour Completion Time when both Core Spray subsystems are inoperable.

There are no inherent differences between the ECCS design at the MNGP and these other plants which would preclude application of these Required Actions and Completion Times at the MNGP. As previously described, the NRC staff has concluded that because these licensees used NRC approved ECCS analysis codes and methods, that these changes were acceptable. These TS changes took credit for the combinations of ECCS equipment found adequate to meet 10 CFR 50, Appendix K, requirements. Based upon purely deterministic considerations, the MNGP ECCS LOCA analysis and the associated single failure analysis, and existing licensing precedents for other BWR plants, it is appropriate to apply these Required Actions and Completion Times at the MNGP.

6.0 REGULATORY ANALYSIS

6.1 No Significant Hazards Determination

In accordance with the requirements of 10 CFR 50.90, the Nuclear Management Company, LLC (NMC) requests an amendment to facility Renewed Operating License DPR-22, for the Monticello Nuclear Generating Plant (MNGP) to revise Specification 3.5.1.

The NMC has evaluated the proposed amendment in accordance with 10 CFR 50.91 against the standards in 10 CFR 50.92 and has determined that the operation of the MNGP in accordance with the proposed amendment presents no significant hazards. NMC's evaluation against each of the criteria in 10 CFR 50.92 follows.

1. **Does the proposed amendment involve a significant increase in the probability or consequences of an accident previously evaluated?**

   Response: No.

   The low pressure Emergency Core Cooling System (ECCS) subsystems are designed to inject to reflood or to spray the core after any size break up to and including a design basis Loss of Coolant Accident (LOCA). The proposed changes to the Required Actions and associated Completion Times do not change the conditions, operating configurations, or minimum amount of operating equipment assumed in the safety analysis for accident mitigation. No changes are proposed to the manner in which the ECCS provides plant protection or which would create new modes of plant operation.

   The proposed changes will not affect the probability of any event initiators. There will be no degradation in the performance of, or an increase in the number of challenges imposed on, safety related equipment assumed to function during an accident situation. There will be no change to normal plant operating parameters or accident mitigation performance.

   Therefore, the proposed changes do not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. **Does the proposed amendment create the possibility of a new or different kind of accident from any accident previously evaluated?**

   Response: No.

   There are no hardware changes nor are there any changes in the method by which any plant systems perform a safety function. This request does not affect the normal method of plant operation.

   The proposed changes do not introduce new equipment, which could create a new or different kind of accident. No new external threats, release pathways, or equipment failure modes are created. No new accident scenarios, transient precursors, failure mechanisms, or limiting single failures are introduced as a result of this request.

   Therefore, the implementation of the proposed changes will not create a possibility for an accident of a new or different type than those previously evaluated.

3. **Does the proposed amendment involve a significant reduction in a margin of safety?**

   Response: No.

   The ECCS are designed with sufficient redundancy such that a division of low pressure ECCS may be removed from service for maintenance or testing. The remaining subsystems are capable of providing water and removing heat loads to satisfy the Updated Safety Analysis Report requirements for accident mitigation or unit safe shutdown.

   There will be no change to the manner in which the safety limits or limiting safety system settings are determined nor will there be any change to those plant systems necessary to assure the accomplishment of protection functions. There will be no change to post-LOCA peak clad temperatures.

   For these reasons, the proposed amendment does not involve a significant reduction in a margin of safety.

Based on the above, the NMC has determined that operation of the facility in accordance with the proposed change does not involve a significant hazards consideration as defined in 10 CFR 50.92(c), in that it does not: (1) involve a significant increase in the probability or consequences of an accident previously evaluated; or (2) create the possibility of a new or different kind of accident from any accident previously evaluated; or (3) involve a significant reduction in a margin of safety.

6.2 Applicable Regulatory Requirements

10 CFR 50.36, "Technical specifications," provides the regulatory requirements for the content required in the Technical Specifications (TSs). As stated in 10 CFR 50.36, the TSs will include Surveillance Requirements (SRs) to assure that the limiting conditions for operation (LCO) (and associated remedial actions) are met.

The MNGP was designed largely before the publishing of the 70 General Design Criteria (GDC) for Nuclear Power Plant Construction Permits proposed by the Atomic Energy Commission (AEC) for public comment in July 1967, and constructed prior to the 1971 publication of Appendix A, "General Design Criteria for Nuclear Power Plants", to 10 CFR Part 50. As such, the MNGP was not licensed to the Appendix A, General Design Criteria (GDC).

The MNGP USAR, Section 1.2, lists the principal design criteria for the design, construction and operation of the plant. USAR Appendix E provides a plant comparative evaluation to the 70 proposed AEC design criteria. It was concluded that the plant conforms to the intent of the 70 proposed GDCs. The applicable GDCs and proposed GDCs are discussed below.

GDC Criterion 35 - Emergency core cooling.

A system to provide abundant emergency core cooling shall be provided. The system safety function shall be to transfer heat from the reactor core following any loss of reactor coolant at a rate such that (1) fuel and clad damage that could interfere with continued effective core cooling is prevented and (2) clad metal-water reaction is limited to negligible amounts.

Suitable redundancy in components and features, and suitable interconnections, leak detection, isolation, and containment capabilities shall be provided to assure that for onsite electric power system operation (assuming offsite power is not available) and for offsite electric power system operation (assuming onsite power is not available) the system safety function can be accomplished, assuming a single failure.

Proposed GDC Criterion 38 - Reliability and Testability of Engineered Safely Features

All engineered safety features shall be designed to provide high functional reliability and ready testability. In determining the suitability of a facility for proposed site, the degree of reliance upon and acceptance of the inherent and engineered safety afforded by the systems, including engineered safety features, will be influenced by the known and the demonstrated performance capability and reliability of the systems, and by the extent to which the operability of such systems can be tested and inspected where appropriate during the life of the plant.[19]

NMC has evaluated the proposed changes against the applicable regulatory requirements and acceptance criteria. The technical analysis concludes that the proposed changes will continue to assure that the design requirements and acceptance criteria of MNGP ECCS LOCA analysis and single failure analysis are met. Based on this, there is reasonable assurance that the health and safety of the public, following approval of this change, is unaffected.

19. PDC Criterion 38 corresponds approximately to 10 CFR 50, Appendix A, GDC Criterion 37 – Testing of emergency core cooling system.

7.0 ENVIRONMENTAL EVALUATION

NMC has determined that the proposed amendment would not change a requirement with respect to installation or use of a facility or component located within the restricted area, as defined in 10 CFR 20, nor would it change an inspection or surveillance requirement. The proposed amendment does not involve (i) a significant hazards consideration, or (ii) authorize a significant change in the types or a significant increase in the amounts of any effluent that may be released offsite, or (iii) result in a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed amendment meets the eligibility criterion for a categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, NMC concludes pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed amendment.

REFERENCES

1. NRC letter (C. O. Thomas) to GE (J. F. Quirk), Acceptance for Referencing of Licensing Topical Report NEDE-23785P, Revision 1, Volume III (P), "The GESTR-LOCA and SAFER Models for the Evaluation of the Loss-of-Flow Accident," June 1, 1984.

2. GE Nuclear Energy, NEDC-32514P, Revision 1, "Monticello Nuclear Generating Plant SAFER/GESTR-LOCA Loss-of-Coolant Accident Analysis," dated October 1997.

3. GE Nuclear Energy, GE-NE-J1103878-09-02P, "Monticello ECCS-LOCA Evaluation for GE14," August 2001.

4. Letter NMC to NRC, Licensee Event Report (LER) 2007-04, "Degradation of Emergency Service Water Flow to Emergency Core Cooling System Room Cooler," (L-MT-07-060) dated August 30. 2007.

5. NRC letter (C. O. Thomas) to DAEC (J. F. Quirk), Amendment No. 223 to Facility Operating License No. DPR-49, Duane Arnold Energy Center (TAC No. M97197), dated May 22, 1998.

6. NUREG/CR-5268, "Aging Study of Boiling Water Reactor Residual Heat Removal System," prepared for the U.S. NRC by the Brookhaven National Laboratory (BNL-NUREG--2177), published June 1989.

7. NRC letter (S. N. Bailey) to Exelon (O. D. Kingsley), "Issuance of Amendments (TAC Nos. MA8382 and MA8383)," dated March 30, 2001.

8. NRC letter (S. N. Bailey) to Exelon (O. D. Kingsley), "Issuance of Amendments (TAC Nos. MA8378 and MA8379)," dated March 30, 2001.

9. NRC letter (W. O. Long) to NSP (T. M. Parker), Amendment No. 79 to Facility Operating License No. DPR-22: (TAC No. M79653), dated April 9, 1991.

ENCLOSURE 2

MONTICELLO NUCLEAR GENERATING PLANT

MARKED-UP PROPOSED TECHNICAL SPECIFICATION CHANGES

LICENSE AMENDMENT REQUEST
REVISION TO REQUIRED ACTIONS FOR SPECIFICATION 3.5.1
EMERGENCY CORE COOLING SYSTEM

(5 pages follow)

3.5 EMERGENCY CORE COOLING SYSTEM (ECCS) AND REACTOR CORE ISOLATION COOLING SYSTEM (RCIC)

3.5.1 ECCS - Operating

LCO 3.5.1 Each ECCS injection/spray subsystem and the Automatic Depressurization System (ADS) function of three safety/relief valves shall be OPERABLE.

---NOTE---
Low pressure coolant injection (LPCI) subsystems may be considered OPERABLE during alignment and operation for decay heat removal with reactor steam dome pressure less than the Residual Heat Removal (RHR) shutdown cooling supply isolation interlock in MODE 3, if capable of being manually realigned and not otherwise inoperable.

APPLICABILITY: MODE 1,
MODES 2 and 3, except high pressure coolant injection (HPCI) and ADS valves are not required to be OPERABLE with reactor steam dome pressure ≤ 150 psig.

ACTIONS

---NOTE---
LCO 3.0.4.b is not applicable to HPCI.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One LPCI pump inoperable.	A.1 Restore LPCI pump to OPERABLE status.	30 days
B. One LPCI subsystem inoperable for reasons other than Condition A. <u>OR</u> One Core Spray subsystem inoperable.	B.1 Restore low pressure ECCS injection/spray subsystem to OPERABLE status.	7 days

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
C. One LPCI pump in both LPCI subsystems inoperable.	C.1	Restore one LPCI pump to OPERABLE status.	7 days
D. Two LPCI subsystems inoperable ~~due to inoperable injection paths.~~ for reasons other than Condition C or H.	D.1	Restore one LPCI ~~injection path~~ subsystem to OPERABLE status.	72 hours Insert A
G ~~E~~. Required Action and associated Completion Time of Condition A, B, C, ~~or~~ D, E or F not met.	G ~~E~~.1 AND G ~~E~~.2	Be in MODE 3. Be in MODE 4.	12 hours 36 hours
H ~~F~~. Two LPCI subsystems inoperable due to open RHR intertie return line isolation valve(s).	H ~~F~~.1	Isolate the RHR intertie line.	18 hours
I ~~G~~. Required Action and associated Completion Time of Condition ~~F~~ H not met.	I ~~G~~.1	Be in MODE 2.	6 hours
J ~~H~~. HPCI System inoperable.	J ~~H~~.1 AND J ~~H~~.2	Verify by administrative means RCIC System is OPERABLE. Restore HPCI System to OPERABLE status.	Immediately 14 days

Specification 3.5.1 - ECCS Required Actions

Action

CONDITION	REQUIRED ACTION	COMPLETION TIME

INSERT A

CONDITION	REQUIRED ACTION	COMPLETION TIME
E. One Core Spray subsystem inoperable. AND One LPCI subsystem inoperable. OR One or two LPCI pump(s) inoperable.	E.1 Restore Core Spray subsystem to OPERABLE status. OR E.2 Restore LPCI subsystem to OPERABLE status. OR E.3 Restore LPCI pump(s) to OPERABLE status.	72 hours 72 hours
F. Both Core Spray subsystems inoperable.	F.1 Restore one Core Spray subsystem to OPERABLE status.	72 hours

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
K ~~I~~. HPCI System inoperable. AND Condition A, B, or C entered.	K ~~I~~.1 Restore HPCI System to OPERABLE status. OR K ~~I~~.2 Restore low pressure ECCS injection/spray subsystem(s) to OPERABLE status.	72 hours 72 hours
L ~~J~~. One ADS valve inoperable.	L ~~J~~.1 Restore ADS valve to OPERABLE status.	14 days
M ~~K~~. One ADS valve inoperable. AND Condition A, B, or C entered.	M ~~K~~.1 Restore ADS valve to OPERABLE status. OR M ~~K~~.2 Restore low pressure ECCS injection/spray subsystem(s) to OPERABLE status.	72 hours 72 hours
N ~~L~~. Required Action and associated Completion Time of Condition ~~H, I,~~ J, ~~or~~ K, L or M not met. OR Two or more ADS valves inoperable. OR HPCI System or one or more ADS valves inoperable and Condition D ~~or F~~ E, F, or H entered.	N ~~L~~.1 Be in MODE 3. AND N ~~L~~.2 Reduce reactor steam dome pressure to ≤ 150 psig.	12 hours 36 hours

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
~~M~~ O. Two or more low pressure ECCS injection/spray subsystems inoperable for reasons other than Condition C, D, ~~or F.~~ E, F or H. OR HPCI System and one or more ADS valves inoperable.	~~M~~ O.1	Enter LCO 3.0.3.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.5.1.1	Verify, for each low pressure ECCS injection/spray subsystem, the piping is filled with water from the pump discharge valve to the injection valve.	31 days
SR 3.5.1.2	Verify each ECCS injection/spray subsystem manual, power operated, and automatic valve in the flow path, that is not locked, sealed, or otherwise secured in position, is in the correct position.	31 days
SR 3.5.1.3	Verify ADS pneumatic pressure is as follows for each required ADS pneumatic supply: a. S/RV Accumulator Bank header pressure $\geq$ 88.3 psig; and b. Alternate Nitrogen System pressure is $\geq$ 410 psig.	31 days

ENCLOSURE 3

MONTICELLO NUCLEAR GENERATING PLANT

DRAFT TECHNICAL SPECIFICATION BASES PAGES

(FOR INFORMATION)

LICENSE AMENDMENT REQUEST
REVISION TO REQUIRED ACTIONS FOR SPECIFICATION 3.5.1
EMERGENCY CORE COOLING SYSTEM

(11 pages follow)

B 3.5 EMERGENCY CORE COOLING SYSTEM (ECCS) AND REACTOR CORE ISOLATION COOLING (RCIC) SYSTEM

B 3.5.1 ECCS - Operating

BASES

BACKGROUND

The ECCS is designed, in conjunction with the primary and secondary containment, to limit the release of radioactive materials to the environment following a loss of coolant accident (LOCA). The ECCS uses two independent methods (flooding and spraying) to cool the core during a LOCA. The ECCS network consists of the High Pressure Coolant Injection (HPCI) System, the Core Spray (CS) System, the low pressure coolant injection (LPCI) mode of the Residual Heat Removal (RHR) System, and the Automatic Depressurization System (ADS). The suppression pool provides the required source of water for the ECCS. Although no credit is taken in the safety analyses for the condensate storage tanks (CSTs), they are capable of providing a source of water for the HPCI, LPCI, and CS Systems.

On receipt of an initiation signal, ECCS pumps automatically start and the system aligns and the pumps inject water, taken either from the CSTs or suppression pool, into the Reactor Coolant System (RCS) as RCS pressure is overcome by the discharge pressure of the ECCS pumps. Although the system is initiated, ADS action is delayed, allowing the operator to interrupt the timed sequence if the system is not needed. The HPCI pump discharge pressure almost immediately exceeds that of the RCS, and the pump injects coolant into the vessel to cool the core. If the break is small, the HPCI System will maintain coolant inventory as well as vessel level while the RCS is still pressurized. If HPCI fails, it is backed up by ADS in combination with LPCI and CS. In this event, the ADS timed sequence would be allowed to time out and open the selected safety/relief valves (S/RVs) depressurizing the RCS, thus allowing the LPCI and CS to overcome RCS pressure and inject coolant into the vessel. If the break is large, RCS pressure initially drops rapidly and the LPCI and CS cool the core.

Water from the break returns to the suppression pool where it is used again and again. Water in the suppression pool is circulated through a heat exchanger cooled by the RHR Service Water System. Depending on the location and size of the break, portions of the ECCS may be ineffective; however, the overall design is effective in cooling the core regardless of the size or location of the piping break.

The combined operation of all ECCS subsystems are designed to ensure that no single active component failure will prevent automatic initiation and successful operation of the minimum required ECCS equipment.

BASES

BACKGROUND (continued)

The CS System (Ref. 1) is composed of two independent subsystems. Each subsystem consists of a motor driven pump, a spray sparger above the core, and piping and valves to transfer water from the suppression pool to the sparger. The CS System is designed to provide cooling to the reactor core when reactor pressure is low. Upon receipt of an initiation signal, the CS pumps in both subsystems are automatically started in approximately 15 seconds after AC power is available. When the RPV pressure drops sufficiently, CS System flow to the RPV begins. A full flow test line is provided to route water from and to the suppression pool to allow testing of the CS System without spraying water in the RPV.

LPCI is an independent operating mode of the RHR System. There are two LPCI subsystems (Ref. 2), each consisting of two motor driven pumps in the same RHR loop and piping and valves to transfer water from the suppression pool to the RPV via the selected recirculation loop. Each LPCI subsystem consists of a common suction line from the suppression pool, parallel flowpaths through the two RHR pumps, and a common injection line to the RPV. An inoperable "LPCI pump" refers to the condition where inoperable components associated with the flowpath through one of the two parallel RHR pumps renders that LPCI pump flowpath inoperable, but the common portions of the associated LPCI subsystem are OPERABLE.

The LPCI System is equipped with a loop select logic that determines which, if any, of the recirculation loops has been broken and selects the non-broken loop for injection. If neither loop is determined to be broken, a preselected loop is used for injection. The LPCI System cross-tie valve must be open to support OPERABILITY of both LPCI subsystems. Similarly, the LPCI swing bus, consisting of two motor control centers which are directly connected together, is required to be energized from the Division 1 power supply (normal source), with automatic transfer capability to the Division 2 power supply (backup source) to support both LPCI subsystems. The LPCI subsystems are designed to provide core cooling at low RPV pressure. Upon receipt of an initiation signal, all four LPCI pumps are automatically started (pumps A and B approximately 5 seconds after AC power is available and pumps C and D approximately 10 seconds after AC power is available). RHR System valves in the LPCI flow path are automatically positioned to ensure the proper flow path for water from the suppression pool to inject into the selected recirculation loop. When the RPV pressure drops sufficiently, the LPCI flow to the RPV, via the selected recirculation loop, begins. The water then enters the reactor through the jet pumps. Full flow test lines are provided for each LPCI subsystem to route water from and to the suppression pool, to allow testing of the LPCI pumps without injecting water into the RPV. These test lines also provide suppression pool cooling capability, as described in LCO 3.6.2.3, "RHR Suppression Pool Cooling." An intertie

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BACKGROUND (continued)

line is provided to connect the RHR shutdown cooling suction line with the two RHR shutdown cooling loop return lines to the associated recirculation loop. This line includes two RHR intertie return line isolation valves that are normally closed and a RHR intertie suction line isolation valve that is normally open. The purpose of this line is to reduce the potential for water hammer in the recirculation and RHR systems. The isolation valves are opened during a cooldown to establish recirculation flow through the RHR suction line and return lines, thereby ensuring a uniform cooldown of this piping. The RHR intertie loop return line isolation valves receive a closure signal on LPCI initiation. In the event of an inoperable RHR intertie loop return line isolation valve, there is a potential for some of the LPCI flow to be diverted to the broken loop during a LOCA. This may cause early transition boiling during a LOCA. The RHR intertie line flow is not permitted in MODE 1 to eliminate the need to compensate for the small change in jet pump drive flow and a reduction in core flow during a loss of coolant accident.

The HPCI System (Ref. 3) consists of a steam driven turbine pump unit, piping, and valves to provide steam to the turbine, as well as piping and valves to transfer water from the suction source to the core via the feedwater system line, where the coolant is distributed within the RPV through the feedwater sparger. Suction piping for the system is provided from the CSTs and the suppression pool. Pump suction for HPCI is normally aligned to the CSTs to minimize injection of suppression pool water into the RPV. However, if the water level in any CST is low, or if the suppression pool level is high, an automatic transfer to the suppression pool water source ensures a water supply for continuous operation of the HPCI System. The steam supply to the HPCI turbine is piped from a main steam line upstream of the associated inboard main steam isolation valve.

The HPCI System is designed to provide core cooling for a wide range of reactor pressures (150 psig to 1120 psig). Upon receipt of an initiation signal, the HPCI turbine stop valve and turbine steam supply valve open and the turbine accelerates to a specified speed. As the HPCI flow increases, the turbine governor valve is automatically adjusted to maintain design flow. Exhaust steam from the HPCI turbine is discharged to the suppression pool. A full flow test line is provided to route water from and to the CSTs to allow testing of the HPCI System during normal operation without injecting water into the RPV.

The ECCS pumps are provided with minimum flow bypass lines, which discharge to the suppression pool. The valves in these lines automatically open or remain open to prevent pump damage due to overheating when other discharge line valves are closed. To ensure rapid delivery of water to the RPV and to minimize water hammer effects,

BASES

BACKGROUND (continued)

all ECCS pump discharge lines are filled with water. The LPCI and CS System discharge lines are kept full of water using a "keep fill" system (Condensate Service System). The HPCI System is normally aligned to the CSTs. The height of water in the CSTs is sufficient to maintain the piping full of water up to the first closed isolation valve in the discharge piping. The relative height of the feedwater line connection for HPCI is such that the water in the feedwater lines keeps the remaining portion of the HPCI discharge line full of water. Therefore, HPCI does not require a "keep fill" system.

The ADS (Ref. 4) consists of three of the eight S/RVs. It is designed to provide depressurization of the RCS during a small break LOCA if HPCI fails or is unable to maintain required water level in the RPV. ADS operation reduces the RPV pressure to within the operating pressure range of the low pressure ECCS subsystems (CS and LPCI), so that these subsystems can provide coolant inventory makeup. The ADS valves are normally supplied by the Instrument Nitrogen System. This pneumatic supply will automatically transfer to the Instrument Air System on high or low Instrument Nitrogen System pressure. However, both of these pneumatic supplies are non-safety related and are not assumed to operate following an accident. The safety grade pneumatic supply to two of the ADS valves is the Alternate Nitrogen System and to the third ADS valve is the S/RV Accumulator bank. The Alternate Nitrogen System contains two independent trains (i.e., subsystems) of safety related replaceable gas cylinders that supply two of the three ADS valves (S/RVs A and C). One Alternate Nitrogen System train supplies one ADS valve and other non-ADS related pneumatic loads and the other Alternate Nitrogen System train supplies a different ADS valve and other non-ADS related pneumatic loads. The S/RV Accumulator Bank supplies the third ADS valve (S/RV D), and consists of a dedicated safety related backup accumulator bank and an associated inlet check valve.

APPLICABLE SAFETY ANALYSES

The ECCS performance is evaluated for the entire spectrum of break sizes for a postulated LOCA. The accidents for which ECCS operation is required are presented in References 5 and 6. The required analyses and assumptions are defined in Reference 7. The results of these analyses are also described in References 5 and 6.

This LCO helps to ensure that the following acceptance criteria for the ECCS (Ref. 8), established by 10 CFR 50.46 (Ref. 9), will be met following a LOCA, assuming the worst case single active component failure in the ECCS:

a. Maximum fuel element cladding temperature is ≤ 2200°F;

b. Maximum cladding oxidation is ≤ 0.17°times the total cladding thickness before oxidation;

BASES

APPLICABLE SAFETY ANALYSES (continued)

c. Maximum hydrogen generation from a zirconium water reaction is ≤ 0.01 times the hypothetical amount that would be generated if all of the metal in the cladding surrounding the fuel, excluding the cladding surrounding the plenum volume, were to react;

d. The core is maintained in a coolable geometry; and

e. Adequate long term cooling capability is maintained.

The limiting single failures are discussed in Reference 10. For a large discharge pipe break LOCA, failure of the LPCI valve on the unbroken recirculation loop is considered the most limiting break/failure combination. For a small break LOCA, HPCI failure is the most severe failure. One ADS valve is assumed to fail for events requiring ADS operation. The remaining OPERABLE ECCS subsystems provide the capability to adequately cool the core and prevent excessive fuel damage.

The ECCS satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii).

LCO

Each ECCS injection/spray subsystem and three ADS valves are required to be OPERABLE. The ECCS injection/spray subsystems are defined as the two CS subsystems, the two LPCI subsystems, and one HPCI System. The low pressure ECCS injection/spray subsystems are defined as the two CS subsystems and the two LPCI subsystems.

With less than the required number of ECCS subsystems OPERABLE, the potential exists that during a limiting design basis LOCA concurrent with the worst case single failure, the limits specified in Reference 9 could be exceeded. All ECCS subsystems must therefore be OPERABLE to satisfy the single failure criterion required by Reference 9.

As noted, LPCI subsystems may be considered OPERABLE during alignment and operation for decay heat removal when below the actual RHR shutdown cooling supply isolation interlock in MODE 3, if capable of being manually realigned (remote or local) to the LPCI mode and not otherwise inoperable. Alignment and operation for decay heat removal includes when the required RHR pump is not operating or when the system is realigned from or to the RHR shutdown cooling mode. This allowance is necessary since the RHR System may be required to operate in the shutdown cooling mode to remove decay heat and sensible heat from the reactor. At these low pressures and decay heat levels, a reduced complement of ECCS subsystems should provide the required core cooling, thereby allowing operation of RHR shutdown cooling when necessary.

BASES

APPLICABILITY	All ECCS subsystems are required to be OPERABLE during MODES 1, 2, and 3, when there is considerable energy in the reactor core and core cooling would be required to prevent fuel damage in the event of a break in the primary system piping. In MODES 2 and 3, when reactor steam dome pressure is ≤ 150 psig, ADS and HPCI are not required to be OPERABLE because the low pressure ECCS subsystems can provide sufficient flow below this pressure. ECCS requirements for MODES 4 and 5 are specified in LCO 3.5.2, "ECCS - Shutdown."

ACTIONS

A Note prohibits the application of LCO 3.0.4.b to an inoperable HPCI subsystem. There is an increased risk associated with entering a MODE or other specified condition in the Applicability with an inoperable HPCI subsystem and the provisions of LCO 3.0.4.b, which allow entry into a MODE or other specified condition in the Applicability with the LCO not met after performance of a risk assessment addressing inoperable systems and components, should not be applied in this circumstance.

A.1

If one LPCI pump is inoperable, the inoperable pump must be restored to OPERABLE status within 30 days. In this condition, the remaining OPERABLE pumps provide adequate core cooling during a LOCA. However, overall LPCI reliability is reduced, because a single failure in one of the remaining OPERABLE LPCI subsystems, concurrent with a LOCA, may result in the LPCI subsystems not being able to perform their intended safety function. The 30 day Completion Time is based on a reliability study cited in Reference 11 that evaluated the impact on ECCS availability, assuming various components and subsystems were taken out of service. The results were used to calculate the average availability of ECCS equipment needed to mitigate the consequences of a LOCA as a function of allowable repair times (i.e., Completion Times).

B.1

If a LPCI subsystem is inoperable for reasons other than Condition A, or a CS subsystem is inoperable, the inoperable low pressure injection/spray subsystem must be restored to OPERABLE status within 7 days. In this condition, the remaining OPERABLE subsystems provide adequate core cooling during a LOCA. However, overall ECCS reliability is reduced, because a single failure in one of the remaining OPERABLE subsystems, concurrent with a LOCA, may result in the ECCS not being able to perform its intended safety function. The 7 day Completion Time is based

BASES

ACTIONS (continued)

on a reliability study (Ref. 11) that evaluated the impact on ECCS availability, assuming various components and subsystems were taken out of service. The results were used to calculate the average availability of ECCS equipment needed to mitigate the consequences of a LOCA as a function of allowed outage times (i.e., Completion Times).

C.1

If one LPCI pump in each subsystem is inoperable, one inoperable LPCI pump must be restored to OPERABLE status within 7 days. In this condition, the remaining OPERABLE ECCS subsystems provide adequate core cooling during a LOCA. However, overall ECCS reliability is reduced because a single failure in one of the remaining OPERABLE ECCS subsystems, concurrent with a LOCA, may result in the ECCS not being able to perform its intended safety function. The 7 day Completion Time is based on a reliability study (Ref. 11) that evaluated the impact on ECCS availability, assuming various components and subsystems were taken out of service. The results were used to calculate the average availability of ECCS equipment needed to mitigate the consequences of a LOCA as a function of allowed outage times (i.e., Completion Times).

D.1

If two LPCI subsystems are inoperable for reasons other than Condition C or H, one inoperable subsystem must be restored to OPERABLE status within 72 hours. In this condition, the remaining OPERABLE CS subsystems provide adequate core cooling during a LOCA. However, overall ECCS reliability is reduced, because a single failure in one of the remaining CS subsystems, concurrent with a LOCA, may result in ECCS not being able to perform its intended safety function. The 72 hour Completion Time is based on a reliability study cited in Reference 11 that evaluated the impact on ECCS availability, assuming various components and subsystems were taken out of service. The results were used to calculate the average availability of ECCS equipment needed to mitigate the consequences of a LOCA as a function of allowable repair times (i.e., Completion Times).

BASES

ACTIONS (continued)

E.1 and E.2

If any one low pressure CS subsystem is inoperable in addition to either one LPCI subsystem OR one or two LPCI pump(s), adequate core cooling is ensured by the OPERABILITY of HPCI and the remaining low pressure ECCS subsystems. This condition results in a complement of remaining OPERABLE low pressure ECCS (i.e., one CS and either two or three LPCI pumps) whose makeup capacity is bounded by the minimum makeup capacity evaluated in the accident analysis, which assumes the limiting single component failure (Reference 10). However, overall ECCS reliability is reduced, because a single active component failure in the remaining low pressure ECCS, concurrent with a design basis LOCA, could result in the minimum required ECCS equipment not being available. Since both a CS subsystem is inoperable and a reduction in the makeup capability of the LPCI System has occurred, a more restrictive Completion Time of 72 hours is required to restore either a CS subsystem or, either a LPCI subsystem OR the LPCI pump(s) to OPERABLE status. The Completion Time was developed using engineering judgment based on a reliability study cited in Reference 11 and previous BWR licensing precedents. This Completion Time has been found to be acceptable through operating experience.

F.1 and F.2

If both low pressure CS subsystems are inoperable, adequate core cooling is ensured by the OPERABILITY of HPCI and the two remaining low pressure LPCI subsystems. However, overall ECCS reliability is reduced, because a single active component failure in a LPCI subsystem, concurrent with a design basis LOCA, could result in the minimum required ECCS equipment not being available. Since both CS subsystems are inoperable, a more restrictive Completion Time of 72 hours is required to restore one CS subsystem to OPERABLE status.

The Completion Time was developed using engineering judgment based on a reliability study cited in Reference 11 and previous BWR licensing precedents. This Completion Time has been found to be acceptable through operating experience.

BASES

ACTIONS (continued)

G.1 and G.2

If any Required Action and associated Completion Time of Condition A, B, C, ~~or~~ D, E or F is not met, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 12 hours and to MODE 4 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

H.1

If two LPCI subsystems are inoperable due to open RHR intertie return line isolation valve(s), the RHR intertie line must be isolated within 18 hours. The line can be isolated by closing both RHR intertie return line isolation valves or by closing one RHR intertie return line isolation valve and the RHR intertie suction line isolation valve. The 18 hour Completion Time is reasonable, considered the low probability of a DBA occurring during this period.

I.1

If the Required Action and associated Completion Time of Condition H is not met, the plant must be brought to a MODE in which the RHR intertie return line isolation valves are not required to be closed. To achieve this status, the plant must be brought to at least MODE 2 within 6 hours. The allowed Completion Time is reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

J.1 and J.2

If the HPCI System is inoperable and the RCIC System is verified to be OPERABLE, the HPCI System must be restored to OPERABLE status within 14 days. In this condition, adequate core cooling is ensured by the OPERABILITY of the redundant and diverse low pressure ECCS injection/spray subsystems in conjunction with ADS. Also, the RCIC System will automatically provide makeup water at most reactor operating pressures. Verification of RCIC OPERABILITY is therefore required immediately when HPCI is inoperable. This may be performed as an administrative check by examining logs or other information to determine

BASES

ACTIONS (continued)

if RCIC is out of service for maintenance or other reasons. It does not mean to perform the Surveillances needed to demonstrate the OPERABILITY of the RCIC System. If the OPERABILITY of the RCIC System cannot be immediately verified, however, Condition N must be entered. In the event of component failures concurrent with a design basis LOCA, there is a potential, depending on the specific failures, that the minimum required ECCS equipment will not be available. A 14 day Completion Time is based on a reliability study cited in Reference 11 and has been found to be acceptable through operating experience.

K.1 and K.2

If any one low pressure ECCS injection/spray subsystem, or one LPCI pump in both LPCI subsystems, is inoperable in addition to an inoperable HPCI System, the inoperable low pressure ECCS injection/spray subsystem(s) or the HPCI System must be restored to OPERABLE status within 72 hours. In this condition, adequate core cooling is ensured by the OPERABILITY of the ADS and the remaining low pressure ECCS subsystems. However, the overall ECCS reliability is significantly reduced because a single failure in one of the remaining OPERABLE subsystems concurrent with a design basis LOCA may result in the ECCS not being able to perform its intended safety function. Since both a high pressure system (HPCI) and a low pressure subsystem(s) are inoperable, a more restrictive Completion Time of 72 hours is required to restore either the HPCI System or the low pressure ECCS injection/spray subsystem(s) to OPERABLE status. This Completion Time is based on a reliability study cited in Reference 11 and has been found to be acceptable through operating experience.

L.1

The LCO requires three ADS valves to be OPERABLE in order to provide the ADS function. Reference 12 contains the results of an analysis that evaluated the effect of one ADS valve being out of service. Per this analysis, operation of only two ADS valves will provide the required depressurization. However, overall reliability of the ADS is reduced, because a single failure in the OPERABLE ADS valves could result in a reduction in depressurization capability. Therefore, operation is only allowed for a limited time. The 14 day Completion Time is based on a reliability study cited in Reference 11 and has been found to be acceptable through operating experience.

BASES

ACTIONS (continued)

M.1 and M.2

If any one low pressure ECCS injection/spray subsystem, or one LPCI pump in both LPCI subsystems, is inoperable in addition to one inoperable ADS valve, adequate core cooling is ensured by the OPERABILITY of HPCI and the remaining low pressure ECCS injection/spray subsystem. However, overall ECCS reliability is reduced because a single failure in one of the remaining OPERABLE subsystems concurrent with a design basis LOCA may result in the ECCS not being able to perform its intended safety function. Since both a high pressure system (ADS) and a low pressure subsystem(s) are inoperable, a more restrictive Completion Time of 72 hours is required to restore either the low pressure ECCS subsystem(s) or the ADS valve to OPERABLE status. This Completion Time is based on a reliability study cited in Reference 11 and has been found to be acceptable through operating experience.

N.1 and N.2

If any Required Action and associated Completion Time of Condition ~~H, I,~~ J, ~~or~~ K, L or M is not met, or if two or more ADS valves are inoperable, or if the HPCI System or one or more ADS valves are inoperable and Condition D, E, F or H entered, the plant must be brought to a condition in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 12 hours and reactor steam dome pressure reduced to ≤ 150 psig within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

O.1

If two or more low pressure ECCS injection/spray systems are inoperable for reasons other than Conditions C, D, E, F or H, the plant is in a degraded condition not specifically justified for continued operation, and may be in a condition outside of the accident analyses. Therefore, LCO 3.0.3 must be entered immediately.

For some cases, per the single failure assumptions of the accident analysis the plant may not be in an unanalyzed condition (Ref. 10) but the allowable duration for operation in the condition has not been justified, therefore LCO 3.0.3 must be entered immediately.