June 12, 2003

Mr. John L. Skolds, Chairman
and Chief Executive Officer
AmerGen Energy Company, LLC
4300 Winfield Road
Warrenville, Illinois 60555

SUBJECT: CLINTON POWER STATION, UNIT 1 - ISSUANCE OF AMENDMENT (TAC NO. MB3578)

Dear Mr. Skolds:

The U.S. Nuclear Regulatory Commission (Commission) has issued the enclosed Amendment No. 156 to Facility Operating License No. NPF-62 for the Clinton Power Station, Unit 1. The amendment is in response to your application dated November 16, 2001 (RS-01-250), as supplemented by letters dated October 4, 2002 (RS-02-163), and March 28, 2003 (RS-03-066).

The amendment revises Technical Specification (TS) 3.6.2.2, “Suppression Pool Water Level,” and TS 3.6.2.4, “Suppression Pool Makeup (SPMU) System,” to permit draining the reactor cavity pool portion of the upper containment pool in MODE 3, “Hot Shutdown,” with the reactor vessel pressure less than 235 psig.

A copy of the Safety Evaluation is also enclosed. The Notice of Issuance will be included in the Commission's next biweekly *Federal Register* notice.

Sincerely,

***/RA/***

Douglas V. Pickett, Senior Project Manager, Section 2
Project Directorate III
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-461

Enclosures: 1. Amendment No. 156 to NPF-62
2. Safety Evaluation

cc w/encls: See next page

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*See Sweerakkody/DTrimble to AMendiola memo dated 4/29/03

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Clinton Power Station, Unit 1

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AMERGEN ENERGY COMPANY, LLC

DOCKET NO. 50-461

CLINTON POWER STATION, UNIT 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 156
License No. NPF-62

1. The U.S. Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by AmerGen Energy Company, LLC (the licensee), dated November 16, 2001, as supplemented by letters dated October 4, 2002, and March 28, 2003, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment, and paragraph 2.C.(2) of Facility Operating License No. NPF-62 is hereby amended to read as follows:

   (2) Technical Specifications and Environmental Protection Plan

   The Technical Specifications contained in Appendix A and the Environmental Protection Plan contained in Appendix B, as revised through Amendment No.

are hereby incorporated into this license. AmerGen Energy Company, LLC shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

3. This license amendment is effective as of its date of issuance and shall be implemented within 30 days of the date of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

***/RA/***

Anthony J. Mendiola, Chief, Section 2
Project Directorate III
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Attachment: Changes to the Technical
Specifications

Date of Issuance: June 12, 2003

ATTACHMENT TO LICENSE AMENDMENT NO. 156

FACILITY OPERATING LICENSE NO. NPF-62

DOCKET NO. 50-461

Replace the following pages of the Appendix "A" Technical Specifications with the attached revised pages. The revised pages are identified by amendment number and contain marginal lines indicating the areas of change.

| Remove Pages | Insert Pages |
|---|---|
| 3.6-31 | 3.6-31 |
| 3.6-34 | 3.6-34 |
| 3.6-35 | 3.6-35 |

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 156 TO FACILITY OPERATING LICENSE NO. NPF-62

AMERGEN ENERGY COMPANY, LLC

CLINTON POWER STATION, UNIT 1

DOCKET NO. 50-461

## 1.0 INTRODUCTION

By letter dated November 16, 2001, AmerGen Energy Company, LLC (the licensee) requested an amendment to Facility Operating License No. NPF-62 for the Clinton Power Station, Unit 1 (Clinton). The amendment would revise the Clinton Technical Specifications (TSs) to permit draining the reactor cavity portion of the upper containment pool while the plant is in TS MODE 3 (Hot Shutdown) with the reactor pressure less than 235 psig. The licensee stated that draining the reactor cavity portion of the upper containment pool in MODE 3 could shorten a refueling outage critical path by as much as four hours. The licensee provided additional information to support the proposed TS changes in letters dated October 4, 2002, and March 28, 2003.

The supplemental letters contained clarifying information and did not change the initial no significant hazards consideration determination and did not expand the scope of the original *Federal Register* Notice.

The proposed TS changes would revise Limiting Condition for Operation (LCO) 3.6.2.2, "Suppression Pool Water Level," to establish a new maximum suppression pool water level of 20 feet 1-inch with the plant in MODE 3, and with the reactor pressure less than 235 psig.

TS Section 3.6.2.4, "Suppression Pool Makeup System," Condition A and its associated Required Action will also be revised to allow the combined suppression pool and upper containment pool water level limits to satisfy the minimum requirements of the LCO rather than the existing requirement which only specifies the allowable level of the upper containment pool.

Associated with the change to TS 3.6.2.4 Condition A is a change in Surveillance Requirement (SR) 3.6.2.4.1 which adds two alternative methods to verify compliance with the LCO when the plant is in MODE 3 with the reactor pressure less than 235 psig. The first alternative, i.e., SR 3.6.2.4.1.d, will require that the level of the reactor cavity pool (a portion of the upper containment pool) is greater than or equal to 824 feet 7 inches. The second alternative, i.e., SR 3.6.2.4.1.e, will require that the suppression pool water level is greater than or equal to 19 feet 9 inches.

The proposed changes affect the containment response to postulated loss-of-coolant accidents (LOCAs) and hydrodynamic loads on containment structures as a result of LOCAs and safety/relief valve (S/RV) actuations. Other areas examined include the effect of these changes on the available net positive suction head (NPSH) of emergency core cooling system (ECCS) pumps and long-term heating of the suppression pool which could adversely affect its ability as a heat sink.

The licensee's request is based, in part, on analyses performed using the GOTHIC computer code. The Electric Power Research Institute developed and maintains GOTHIC for use in containment and other multi-dimensional two-phase flow applications. GOTHIC has not been used as part of the Clinton licensing basis prior to this proposed TS change. It has been used by the nuclear power industry and the Nuclear Regulatory Commission (NRC) has previously accepted analyses using GOTHIC.

The staff has reviewed the licensee's proposal. We find the proposal to be acceptable. Our evaluation is provided below.

## 2.0 Regulatory Evaluation

### 2.1 Description of the Upper Containment Pool and its Safety Function

Clinton is a boiling-water-reactor BWR/6 with a Mark III containment. The containment building encloses the drywell. The drywell is a cylindrical reinforced concrete structure with a removable head. The reactor cavity portion of the upper containment pool lies above the drywell head. The drywell encloses the reactor vessel and the reactor coolant system. It is designed to withstand the pressure and temperature of the steam generated by a reactor coolant system pipe rupture and channel the steam to the suppression pool via horizontal vents located in the drywell wall. The suppression pool contains a large volume of water which rapidly condenses steam discharged into it. The air initially in the drywell is forced into the suppression pool by the steam discharging from the postulated break and pressurizes the containment. The containment's design pressure is 15 psig.

The drywell provides the structural support for the upper containment pool. The upper containment pool provides several functions: (1) radiation shielding when the reactor is in operation; (2) storage space for the dryer, separator and fuel assemblies during refueling; (3) an area for fuel transfer during refueling; (4) storage for control blade guides and a dummy fuel assembly; and (5) a large volume of water for suppression pool makeup after a postulated LOCA. Spent fuel assemblies are not stored in the upper containment pool during operation.

The upper containment pool provides water to the suppression pool following a LOCA by means of the suppression pool makeup system described in the Clinton updated safety analysis report (USAR), Section 6.2.7, "Suppression Pool Makeup System." The suppression pool makeup system consists of two one-hundred percent capacity lines which direct a portion of the upper containment pool water to the suppression pool by gravity when two normally closed valves in series in each line are opened. The initiation of this system by opening the dump valves is described in Clinton USAR Section 6.2.7.2, "System Design." The dump valves open upon a low-low suppression pool water level signal together with a LOCA permissive signal, or on the basis of a 30-minute timer following a LOCA signal alone. The purpose of the timer actuation is to ensure a long-term heat sink for small breaks which might not cause an upper containment pool dump on a low-low suppression pool level signal.

The location of the suppression pool makeup system pipe inlet limits the amount of upper containment pool water which can be dumped to the suppression pool.

The water supplied by the suppression pool makeup system, together with the water inventory in the suppression pool, is sufficient for all safety-related functions of the suppression pool. These safety-related functions include: (1) providing the ECCS with a source of water for injection into the vessel following a LOCA, (2) providing a heat sink for the decay and sensible heat released during reactor blowdown from the S/RV or from a LOCA, (3) providing adequate NPSH to the ECCS pumps, (4) condensing steam discharged from the reactor core isolation cooling (RCIC) system turbine, (5) providing a long-term heat sink for cooldown of the reactor, and (6) maintaining structural loads on the drywell and containment structures within acceptable limits.

The Clinton TSs specify limits on the minimum and maximum suppression pool level. The minimum suppression pool water level limit ensures adequate coverage of the horizontal vents during the initial portion of the LOCA. This ensures that steam discharged from the S/RV quenchers, main vents, and the RCIC turbine exhaust lines is completely condensed. The ECCS takes suction from the suppression pool. The suppression pool water is injected into the reactor vessel and spills out the break. This break water forms a pool in the bottom of the drywell inside the weir wall. This pool is referred as the drywell pool. The water in the drywell pool is not available to the suppression pool until the water level rises sufficiently to overflow the drywell weir wall; this overflow returns to the suppression pool. The water inside and below the top of the weir wall remains unavailable as well as water entrapped in other volumes. This entrapped water, which reduces the volume of water in the suppression pool, is referred to as suppression pool drawdown.

The sizing of the upper containment pool provides sufficient water to the suppression pool to maintain the minimum suppression pool level 2 feet above the top row of vents, considering the entrapped water which cannot return to the suppression pool. The entrapped volumes considered in the current analysis are:

1. The free volume inside the drywell below the top of the drywell weir wall,

2. The added water volume needed to fill the vessel from the level at normal power operation to a post-accident complete fill of the vessel, including the top dome,

3. The volume in the steam lines out to the first main steam isolation valve (MSIV) for three lines and out to the second MSIV in the fourth line (assuming a single failure), and,

4. The containment spray hold-up on equipment and structural surfaces.

The maximum suppression pool water level limit ensures that clearing loads from S/RV discharges and suppression pool swell loads following a LOCA will not be excessive. The maximum level also ensures adequate freeboard (i.e., the elevation difference between the suppression pool surface and the top of the weir wall) so that an inadvertent dump of water from the upper containment pool will not overflow the weir wall into the drywell.

2.2 Proposed Changes to the Clinton TSs

The licensee is proposing to change several TS requirements dealing with the water levels in the suppression pool and the upper containment pool. LCO 3.6.2.2, “Suppression Pool Water Level,” currently requires that the suppression pool water level shall be greater than 18 ft 11 inches and less than 19 ft 5 inches in TS MODEs 1, 2 and 3. The licensee proposes to revise LCO 3.6.2.2 to:

> Suppression pool water level shall be:
> a. ≥ 18 ft 11 inches and ≤ 19 ft 5 inches.
> b. ≥ 18 ft 11 inches and ≤ 20 ft 1 inches, in MODE 3 with reactor pressure less than 235 psig.

The licensee also proposes revising LCO 3.6.2.4, “Suppression Pool Makeup (SPMU) System.” Currently, LCO 3.6.2.4 Condition A states:

> Upper containment pool water level not within limit

The required action is to restore the upper containment pool water level to within limit in 4 hours.

The licensee proposes to revise Condition A to:

> Combined upper containment pool and suppression pool water levels not within limits.

The required action is to restore the upper containment pool and suppression pool water levels to within limits in 4 hours.

SR 3.6.2.4.1 currently requires the licensee to:

> Verify upper containment pool level is:
> a. ≥ 825 feet 6 inches.
>
> b. ≥ 825 feet 10 inches when the inclined fuel storage pool to steam dryer storage pool gate is not open.
>
> c. ≥ 827 feet 1 inch when the reactor cavity to steam dryer pool gate is not open.

The licensee proposes to extend this surveillance by adding:

OR

d. Reactor cavity pool level ≥ 824 ft 7 inches in MODE 3 with reactor pressure less than 235 psig.

OR

e. Suppression pool water level ≥ 19 ft 9 inches in MODE 3 with reactor pressure less than 235 psig

2.3 Applicable Regulatory Requirements and Guidance

General Design Criterion (GDC) 4 requires that structures, systems and components important to safety (such as the containment and the suppression pool) shall be appropriately protected against dynamic effects. Standard Review Plan (SRP) Section 6.2.1.1.c specifies that this includes suppression pool dynamic effects during a LOCA or following the actuation of one or more reactor coolant system S/RVs. The licensee's proposal affects the water level in the suppression pool and therefore affects the hydrodynamic loads on the containment structure, including the drywell and the suppression pool.

GDC 16 requires the containment to be a "leak tight structure" and to assure that the containment design conditions important to safety are not exceeded for as long as postulated accident conditions require. The amount of water in the suppression pool, both initially and supplied by the SPMU, is an important part of satisfying the requirements of GDC 16.

GDC 38 requires that the containment heat removal system remove heat from the reactor containment following a LOCA so that the containment pressure and temperature following a LOCA will be maintained at acceptably low levels. The amount of water in the suppression pool, both initially and that suppled by the SPMU, is an important part of satisfying the requirements of GDC 38.

GDC 50 requires that the reactor containment structure and its internal compartments accommodate, without exceeding the design leakage rate and with sufficient margin, the calculated pressure and temperature conditions resulting from a LOCA. The margin must include conservatism of the calculation model and input parameters. The amount of water in the suppression pool, both initially and supplied by the SPMU, is important in satisfying the requirements of GDC 50. In addition, as stated previously, the licensee is proposing to use a computer code for justification of the proposed TSs changes that has not been previously applied as part of the Clinton licensing basis. This analytical method is different from that specified as acceptable to the NRC in SRP Section 6.2.1.1.c, Section II. The adequacy of GOTHIC for this application is addressed in the Technical Evaluation section of this safety evaluation.

Clinton USAR Section 6.2.7.1 lists 10 design bases for the SPMU. These are listed below along with an indication of the effect on each design basis of the proposed changes in the licensee's submittal of November 16, 2001. The staff's evaluation of compliance of the proposed changes with these design bases is discussed in Section 3.0 of this safety evaluation report.

a. The SPMU system is to be redundant with two 100 percent capacity lines. The redundant lines shall be physically separated and the electrical power and control shall be separated into two divisions in accordance with Institute of Electrical and Electronic Engineers-279.

The licensee has not proposed changing the physical design of the system and, therefore, this design basis will not change.

b. The SPMU system shall be Safety Class 2, Seismic Category I, and Quality Group B.

The physical design of the system will not change and therefore, this design basis will not change.

c. The minimum long-term post-accident suppression pool water coverage over the top of the top drywell vents shall be 2 feet.

This design basis has not changed. The proposed changes to the suppression pool and upper containment pool water level are based on maintaining the water coverage over the top of the top drywell vents at greater than or equal to 2 feet.

d. The suppression pool volume, between normal operation low [water] level and the minimum post-accident pool level, plus the makeup volume from the upper pool, shall be adequate to supply all possible post-accident entrapment volumes for suppression pool water.

The licensee has revised the amount of water assumed to be in the entrapped volumes. In addition, the proposed changes to the TSs revise the required amount of water in the suppression pool and the upper containment pool. By letter dated March 26, 2003, the licensee stated that makeup water from an external source to the suppression pool is not needed.

e. The post-accident entrapment volumes causing suppression pool water level drawdown include:

1. The free volume inside and below the top of the drywell weir wall,

2. The added water volume needed to fill the vessel from a condition of normal power operation to a post-accident complete fill of the vessel, including the top dome,

3. The volume in the steam lines out to the first MSIV for three lines and out to the second MSIV on one line [single failure], and,

4. An allowance for containment spray hold-up on equipment and structural surfaces.

The proposed changes to the TSs revise Item 1. by reducing this free volume by the volume of equipment and structures located in this part of the drywell (licensee's March 26, 2003 letter), and revise Item 2. by taking credit for operator action to limit the reactor vessel water level to the narrow range high water level (Level 8) in accordance with the emergency operating procedures. This is evaluated in Section 3.0 of this safety evaluation.

f. No credit for feedwater or HPCS [high pressure core spray injection] from RCIC storage tank is taken in calculating minimum post-accident suppression pool [water] level.

This design basis has not changed.

g. The minimum normal operation freeboard distance from the suppression pool high [water] level to the top of the weir wall shall be adequate to store the upper containment pool makeup volume without flooding into the drywell over the weir wall in case of an inadvertent dump of the upper containment pool.

This design basis has not changed. The freeboard distance has been revised.

h. The minimum normal operation suppression pool volume at the low level shall be adequate to act as a short-term energy sink without taking credit for upper pool dump.

This design basis has not changed.

i. The long-term containment pressure and suppression pool temperature shall take credit for the volume added post-accident from the upper containment pool.

This design basis has not changed.

j. The [upper containment pool makeup] system shall dump the makeup volume through one of two redundant lines within a time period such that minimum vent coverage is maintained with all ECCS pumps operating at maximum runout flow rate.

This design basis has not changed but was re-evaluated for the new suppression pool and upper containment pool levels. This is evaluated in Section 3 of this safety evaluation.

3.0 Technical Evaluation

The staff evaluated the licensee's proposal to ensure that the applicable regulations, SRP guidance, USAR design bases of the upper containment pool, SPMU system and the suppression pool discussed in Section 2.3 of this safety evaluation remain satisfied or that the proposed changes are acceptable.

The proposed changes to the TSs are discussed in Section 2.2 of this safety evaluation. Changes are proposed to the water levels in the upper containment pool and the suppression pool to provide sufficient water to meet the requirements of the SPMU system design criteria and the accident analyses while permitting a portion of the upper containment pool to be drained in MODE 3.

The licensee's submittal dated November 16, 2001, considered the different areas affected by the proposed change. These are:

3.1 Post-accident vent coverage
3.2 Hydrodynamic loads
3.3 ECCS NPSH
3.4 Long Term Heat Sink
3.5 Small Break LOCA with Steam Bypass of the Suppression Pool

In addition, the staff requested the licensee to address external makeup to the suppression pool. The licensee's letter dated March 26, 2003, stated that no external makeup is necessary as a result of the changes proposed by this license amendment request.

Each of these topics is discussed below.

3.1 Post-Accident Vent Coverage

In order to compensate for the reduction in upper containment pool water inventory in MODE 3 with a portion of the upper containment pool drained and with the reactor pressure less than 235 psig, the licensee proposes to reduce the total entrapped volume which is currently part of the Clinton licensing basis.

The licensee proposes a reduction in the amount of water required to meet the design basis requirement of a suppression pool water level at least two feet above the top weir wall top vent by revising the assumption that the reactor operator will fill the reactor vessel to the top of the vessel dome following a LOCA. The water filling the reactor vessel to the vessel dome would not be available to the suppression pool. Therefore, reducing the amount of water filling the reactor vessel to the vessel dome reduces the entrapped water volume. The licensee proposes that the reactor vessel be assumed filled to Level 8. The Clinton emergency operating procedures direct the operators to maintain the vessel level between Level 3 and Level 8 (October 4, 2002, licensee letter, response to Question 8).

Note that even though the operator is directed to maintain the reactor vessel level at Level 8, which is below the reactor vessel connection to the main steam lines, the licensee continues to assume that the main steam lines are flooded and that this water is not available to the suppression pool. The licensee's submittal of November 16, 2001, states that the vessel water level is conservatively assumed to be raised to one inch above the bottom of the steam nozzle. This allows flooding the vessel until there is overflow into the main steam lines.

The emergency operating procedures provide a broad control band in which to maintain reactor water level following a LOCA which reflects possible operator difficulty in controlling the ECCS flow rate to obtain a fixed value of reactor vessel level. Since Level 8 is at the top of the permissible band and this band is wide, the staff concludes that there is a reasonable assurance that Level 8 will not be exceeded.

Although the containment spray is not credited for a large break LOCA, the licensee has not changed the allowance for containment spray hold-up on equipment and structural surfaces since the operator may use the sprays to control containment pressure.

The revised TS low and high suppression pool water level limits are nominal values. The licensee's submittal dated November 16, 2001, explains that the uncertainty associated with the narrow range instruments used to measure these water levels is included in the analyses. The staff finds this acceptable.

The licensee also points out that there are alternate water sources which could be used, if available, to add water to the reactor vessel and hence to the suppression pool. These include feedwater injection and HPCS injection from the RCIC storage tank.

The GOTHIC computer code was used by the licensee to perform calculations in support of the requested TS changes. The results of these calculations are given in Attachment E to the licensee's submittal dated November 16, 2001.

Attachment E also describes the benchmarking done by the licensee between GOTHIC and USAR analyses and Extended Power Uprate analyses which used General Electric Company containment computer codes. The staff has independently calculated containment conditions for the Clinton extended power uprate with the staff's containment analysis code CONTAIN 2.0 and obtained results very close to those of the licensee. The licensee's GOTHIC calculations also produced results very close to the licensee's extended power uprate results.

In addition, GOTHIC has been successfully validated against a wide variety of data and analytical problems. This general validation of GOTHIC and the staff's independent analyses of benchmarking calculations by the licensee as well as the licensee's benchmarking provide adequate justification for approval of GOTHIC for this application.

In the licensee's letter dated October 4, 2002, stated that:

> The design basis SPMU volume is calculated separately from the containment analysis by combining all of the [entrapment] volumes that may be filled in different accident scenarios.

That is, one would not expect any particular design-basis accident to result in all the entrapment volumes being completely filled. For example, the licensee's response to staff Question 6 states that;

> In the DBA [design-basis accident] recirculation line break analysis with minimum ECCS flow, the bottom of the drywell will fill with water, but the RPV [reactor pressure vessel] water level does not reach Level 8 or the main steam lines.

The licensee's responses to Questions 2, 4 and 6 provide more detail. This conservative assumption results in conservative water level limits in the suppression pool and upper containment makeup pool.

For the reasons given above, the staff finds the licensee's determination of water inventory to offset the draining of a portion of the upper containment pool to be conservative and acceptable.

3.2 Hydrodynamic Load Considerations Associated with the Change in Suppression Pool Water Level

Proposed LCO 3.6.2.2.b permits a higher suppression pool high water level in MODE 3 than currently allowed by LCO 3.6.2.2. LCO 3.6.2.2.b allows the suppression pool high water level to increase to 20 feet 1 inch which is an increase of 8 inches above the current high water level permitted by LCO 3.6.2.2. A higher suppression pool level affects the postulated hydrodynamic loads on the containment following a LOCA or an S/RV discharge. For consideration of hydrodynamic loads, the licensee assumed the suppression pool high water level to be one foot above the current high water level limit (i.e., 20 feet 5 inches).

NUREG-0978, "Mark-III LOCA Related Hydrodynamic Load Definition" specifies the load definitions to be used for evaluating hydrodynamic loads for Mark III containments. The specific loads for Clinton are discussed in the Clinton USAR Section 3.8A. The licensee's submittal of November 16, 2001, states that each of these containment loads was considered.

The hydrodynamic loads considered are: water jet loads; LOCA air bubble loads; pool swell, drag, and impact loads; fallback loads; froth impingement and drag loads; condensation oscillation and chugging loads, S/RV discharge loads and drywell depressurization loads.

The licensee also considered the effect of the level change on the ECCS suction strainer loads.

The licensee's submittal of November 16, 2001, discusses the impact of the increase in the suppression pool high water level limit on hydrodynamic loads. The following table provides a summary of the results of the licensee's analysis for revised high suppression pool water level.

The staff agrees with the licensee's conclusion that the effect on hydrodynamic loads imparted with 20 feet 5 inches suppression pool level and the reactor pressure $\leq$ 235 psig are bounded by those from a design-basis accident (full reactor pressure and power) with the suppression pool at the current high water level limit.

TABLE: Effect of Increasing the Suppression Pool High Water Level in MODE 3 With Reactor Coolant System Pressure Less Than 235 psig

| Load | Effect of Increasing the Suppression Pool High Water Level in MODE 3 |
|---|---|
| Water Jet Loads | These loads are small compared with other loads. |
| LOCA Air Bubble Loads | The lower reactor pressure results in a decrease in these loads compared with the case of a LOCA at full reactor pressure. |
| Pool Swell Drag and Impact Loads | Increase in pool level increases the bubble pressure. However, with the decrease in reactor pressure, the drywell pressure driving the bubble is smaller. The licensee's GOTHIC calculations show that at the lower reactor pressure, the top vent passes almost all the flow. NUREG-0978 shows that loads are greatly reduced when only the top vents clear. |
| Fallback Loads | Since the pool swell is bounded by the DBA, the fallback impact loads will be less for a low pressure LOCA. |
| Froth Impingement and Drag Loads | These loads are bounded by the DBA case. |
| Condensation Oscillation and Chugging Loads | Condensation oscillations are independent of vent submergence and therefore not increased by these changes. Resolution of Humphrey Concern 19.1[1] demonstrated that the margins inherent in the chugging loads are adequate to accommodate increased vent submergence up to 4.5 feet which is less than allowed by the licensee's proposed changes. The major hydrodynamic loads on the ECCS suction strainers are due to chugging and are bounded by the MODE 1 case. |
| SRV Discharge Loads | Increased suppression pool level will increase these loads. However, resolution of Humphrey Concern 19.1 has shown these loads to be acceptable for suppression levels greater than allowed by this change to the Clinton technical specifications. In addition, at lower reactor coolant system pressure, the loads will be much lower than those from an S/RV discharge from full reactor coolant system pressure. |
| Drywell Depressurization | MODE 3 LOCA results in a lower containment pressure which results in lower drywell depressurization loads. |

3.3 Net Positive Suction Head (NPSH) of the ECCS Pumps

The licensee's submittal dated November 16, 2001, discusses the impact of the TS changes on ECCS pump NPSH:

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[1] In a May 8, 1982, letter, Mr. John Humphrey, a former General Electric Company engineer, notified the Grand Gulf Nuclear Station licensee of safety concerns regarding the Mark III containment. The NRC staff met with Mr. Humphrey, the Grand Gulf Nuclear Station utility, General Electric Company (the Mark III containment designer), and representatives of other utilities proposing to build BWR/6 reactors with Mark III containments, including representatives of Illinois Power Company which was applying for a license for the Clinton Power Station. The Clinton licensee responded to these concerns. The responses were evaluated by the NRC. The NRC's evaluation is given in Supplement No. 6 to the Clinton Power Station Safety Evaluation Report, NUREG 0853, dated July 1986.

> The ECCS pumps, including the Low Pressure Coolant Injection mode of the Residual Heat Removal System, HPCS System, and Low Pressure Core Spray System pumps, have been analyzed for NPSH requirements at 212 °F, atmospheric pressure, runout flow, and their respective suction strainer fully loaded. Under these conditions, the minimum suppression pool level at which adequate NPSH is available is 9 feet above the bottom of the suppression pool. Nine feet of water is also sufficient to eliminate concerns such as vortexing, flashing and cavitation during a low pressure LOCA. The emergency operating procedures caution operators about operating the ECCS pumps with the suppression pool level less than 11 feet. With no suppression pool makeup and all of the design basis hold up volumes removed from the pool, the minimum water level would be more than 11 feet above the bottom of the suppression pool. Therefore, there are no concerns regarding ECCS pump NPSH requirements as a result of these proposed changes.

The licensee's analysis of the effects of the level change on the NPSH of the ECCS pumps has satisfactorily addressed all the relevant issues. The staff therefore finds the licensee's analysis of the effects of the proposed TS changes on ECCS pump NPSH to be acceptable.

3.4 Long-Term Heat Sink

The suppression pool provides the long-term heat sink for the decay and sensible heat released following a LOCA. The suppression pool cooling system transfers the heat from the suppression pool to the ultimate heat sink to keep the suppression pool within its design basis.

The net effect of the proposed changes in level in the suppression pool and the upper containment pool is a reduction in the long-term amount of water in the suppression pool. Reducing the suppression pool volume could impact the long-term suppression pool temperature and consequently, the containment air pressure and temperature.

The licensee examined the effect this reduction in water inventory would have on the containment pressure and temperature by increasing the suppression pool temperature and found that the effect would be less than a 2 °F increase in suppression pool temperature.

The impact of long-term reduced suppression pool inventory was addressed by Humphrey Concern 4.1[2]. This issue dealt with the isolation of the entrapped drywell volume from the suppression pool and the resulting effect on suppression pool temperature. Resolution of this issue demonstrated that a large reduction in suppression pool water inventory will not

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[2] Similar to footnote 1, the Clinton licensee responded to the Humphrey concerns and the staff's evaluation is given in Supplement 6 to the Clinton Power Station Safety Evaluation Report, NUREG-0853, dated July 1986.

significantly affect the long-term suppression pool temperature. The staff concurs with this conclusion.

3.5 Drywell Bypass

3.5.1 Description of Drywell Bypass Scenario

Clinton's Mark III containment is designed so that any steam released from the reactor coolant system into the drywell is directed to and condensed in the suppression pool and will not, therefore, contribute to increasing the containment pressure. However, the design basis for the containment assumes that a limited amount of the steam bypasses the suppression pool and pressurizes the containment. This is termed drywell bypass leakage.

Section 6.2.1.1.5 of the Clinton USAR discusses LOCAs with drywell bypass leakage. The allowable leakage is defined in Section 6.2.1.1.5.2 as the amount of steam which could bypass the suppression pool without exceeding the containment design pressure (15 psig). The USAR analyses assume operation in MODE 1 at full reactor pressure prior to the LOCA. The most limiting break is a small break which (1) does not actuate the automatic depressurization system to depressurize the reactor coolant system, and (2) maintains the level in the suppression pool annulus above the top of the top row of horizontal vents. This maximizes the pressurization of the drywell and therefore maximizes the drywell bypass leakage. It is assumed that the operators depressurize the reactor coolant system within a conservatively long 6 hours.

The bypass leakage is described in terms of the parameter $A/\sqrt{K}$, where A is the flow area of the leakage path and K is a measure of the flow resistance of the leakage path. The limiting value of $A/\sqrt{K}$ for the allowable drywell bypass leakage from MODE 1, taking credit for the containment spray and heat sinks, is 1.0 $ft^2$ (See USAR Section 6.2.1.1.5.5.)

The licensee examined the effect of drywell bypass leakage on the proposed TS changes. Increasing the suppression pool level as a result of the proposed TS changes increases the pressure in the drywell required to clear the top vent and therefore potentially could increase the drywell bypass leakage.

3.5.2 Small-Break LOCA with Steam Bypass of the Suppression Pool in MODE 3

The licensee used GOTHIC to determine the impact of raising the suppression pool level on drywell bypass leakage with the reactor in MODE 3 and the reactor pressure equal to 235 psig. The drywell bypass leakage used was the existing design basis value of $A/\sqrt{K}$ = 1.0 $ft^2$. This is the maximum licensed drywell bypass leakage and is limiting for all break sizes. Measured values of $A/\sqrt{K}$ from Clinton TS surveillance tests are much less than this value[3]. The licensee stated that the size of the break assumed is approximately 0.5 $ft^2$ and the value of $A/\sqrt{K}$ used was 1.0 $ft^2$.

To eliminate spray entrapment concerns, credit was not taken for containment spray. The licensee states that this was not necessary since for a small-break "the drywell pool does not

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[3] Letter from Illinois Power Company, to the US NRC, August 12, 1994

form or forms only minimally." Figure E12 of Attachment E of the licensee's November 16, 2001, letter shows that the containment design pressure is not exceeded. The staff finds the licensee's analysis of a small-break LOCA with containment bypass to be acceptable.

3.5.3 Large-Break LOCA with Steam Bypass of the Suppression Pool in MODE 3

Humphrey Issue 5.1 asserted that the worst case of drywell bypass leakage had been established as a small-break accident but an intermediate break accident will actually produce the most limiting drywell bypass leakage prior to initiation of the containment sprays. The NRC staff addressed this issue in the March 23, 1987, NRC safety evaluation on issues raised by Mr. Humphrey. The NRC stated that Mr. Humphrey's concern was adequately addressed by the licensee since the NRC requires Mark III owners to consider the entire spectrum of break sizes in their analyses of drywell bypass leakage.

3.6 Drywell Freeboard

To prevent drywell flooding during normal operation and transients, the weir wall height is designed to prevent overflow into the drywell volume inside the suppression pool weir wall for the case of an inadvertent actuation of the SPMU system with the maximum amount of water available. The licensee has reanalyzed the available weir wall freeboard and has concluded that, even though the suppression pool level has been increased and the freeboard height, therefore, has decreased (from 4 feet 4 inches to 3 feet 9 inches), the freeboard criterion is still satisfied. The staff finds this acceptable.

3.7 Maintaining Minimum Vent Coverage During Upper Containment Pool Dump

It is necessary to maintain suppression pool minimum vent coverage during the upper containment pool dump, even while the ECCS pumps are removing water inventory from the suppression pool. This is demonstrated by showing the upper containment pool water is added to the suppression pool at a faster rate than the rate at which it is being pumped from the suppression pool. This is assured by calculating that the makeup water addition from the upper containment pool is within a "dump time" which must be less than the minimum calculated "pump time."

The "pump time" is determined by dividing the pumping volume by the ECCS pumping rate. The pumping volume considers the suppression pool makeup volume. The "dump time" includes the time required for the SPMU isolation valves to open.

The licensee's March 28, 2003, letter states that:

> The dump time versus pump time calculation that was prepared for the current configuration is not adversely affected by the proposed license amendment request... This is because the volume that is dumped is smaller ... than the amount assumed in the current configuration; however, the line size, minimum head of water that serves as the forcing function, and the initiating signals are unchanged.

The staff agrees with this conclusion and finds it acceptable.

In summary, the licensee proposes to drain a portion of the upper containment pool in MODE 3.

In order to justify this request, the licensee has analyzed the effects of this proposed change on accident analysis, including pressure and temperature conditions as well as resulting structural loads. The staff has reviewed the licensee's submittal and finds that it is in compliance with the regulations and the criteria of the SRP and the design basis criteria. Furthermore, the use of conservative assumptions ensure that safety is maintained.

The licensee has done a thorough examination of the effect these changes will make on the Clinton accident analysis and plant emergency operating procedures. Therefore, the proposed changes to the Clinton TSs are acceptable and the staff therefore finds that this amendment request is acceptable.

## 4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Illinois State official was notified of the proposed issuance of the amendment. The State official had no comments.

## 5.0 ENVIRONMENTAL CONSIDERATION

This amendment changes a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20 or changes a surveillance requirement. The NRC staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendment involves no significant hazards consideration and there has been no public comment on such finding (67 FR 15621). Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendment.

## 6.0 CONCLUSION

The staff has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

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