3.3 EMERGENCY CORE COOLING, REACTOR BUILDING EMERGENCY COOLING AND REACTOR BUILDING SPRAY SYSTEMS

Applicability: Applies to the operating status of the emergency core cooling, reactor building emergency cooling, and reactor building spray systems.

Objective: To define the conditions necessary to assure immediate availability of the emergency core cooling, reactor building emergency cooling and reactor building spray systems.

Specification:

3.3.1 The reactor shall not be made critical unless the following conditions are met:

3.3.1.1 Injection Systems

a. The borated water storage tank shall contain a minimum of 350,000 gallons of water having a minimum concentration of 2,500 ppm boron at a temperature not less than 40°F. Specification 3.0.1 applies.

b. Two makeup pumps are operable in the engineered safeguards mode powered from independent essential buses. Specification 3.0.1 applies.

c. Two decay heat removal pumps are operable. Specification 3.0.1 applies.

d. Two decay heat removal coolers and their cooling water supplies are operable. (See Specification 3.3.1.4) Specification 3.0.1 applies.

e. Two BWST level instrument channels are operable.

f. The two reactor building sump isolation valves (DH-V-6A/B) shall be remote-manually operable. Specification 3.0.1 applies.

3.3.1.2 Core Flooding System

a. Two core flooding tanks each containing 940 $\pm$ 30 ft^3 of borated water at 600 $\pm$ 25 psig shall be available. Specification 3.0.1 applies.

b. Core flooding tank boron concentration shall not be less than 2,270 ppm boron.

c. The electrically operated discharge valves from the core flood tank will be assured open by administrative control and position indication lamps on the engineered safeguards status panel. Respective breakers for these valves shall be open and conspicuously marked. Specification 3.0.1 applies.

d. One core flood tank pressure instrumentation channel and one core flood tank level instrumentation channel per tank shall be operable.

Amendment No. 21, 98, 178

4.5.2 EMERGENCY CORE COOLING SYSTEM

Applicability: Applies to periodic testing requirement for emergency core cooling systems.

Objective: To verify that the emergency core cooling systems are operable.

Specification:

4.5.2.1 High Pressure Injection

a. During each refueling interval and following maintenance or modification that affects system flow characteristics, system pumps and system high point vents shall be vented, and a system test shall be conducted to demonstrate that the system is operable.

   The makeup pump and its required supporting auxiliaries will be started manually by the operator and a test signal will be applied to the high pressure injection (HPI) valves MU-V-16A/B/C/D to demonstrate actuation of the high pressure injection system for emergency core cooling operation.

b. The test will be considered satisfactory if the valves have completed their travel and the makeup pumps are running as evidenced by the control board component operating lights. Minimum acceptable injection flow must be greater than or equal to 431 gpm per HPI pump when pump discharge pressure is 600 psig or greater (the pressure between the pump and flow limiting device) and when the RCS pressure is equal to or less than 600 psig.

c. Testing which requires HPI flow through MU-V-16A/B/C/D shall be conducted only under either of the following conditions:

   1) T avg shall be greater than 332 °F.
   2) Head of the Reactor Vessel shall be removed.

4.5.2.2 Low Pressure Injection

a. During each refueling period and following maintenance or modification that affects system flow characteristics, system pumps and high point vents shall be vented, and a system test shall be conducted to demonstrate that the system is operable. The auxiliaries required for low pressure injection are all included in the emergency loading sequence specified in 4.5.1.

b. The test will be considered satisfactory if the decay heat pumps listed in 4.5.1.1b have been successfully started and the decay heat injection valves and the decay heat supply valves have completed their travel as evidenced by the control board component operating lights. Flow shall be verified to be equal to or greater than the flow assumed in the Safety Analysis for the single corresponding RCS pressure used in the test.

ENCLOSURE

Three Mile Island Nuclear Plant, Unit 1 (TMI-1)
Operating License No. DPR-50
Docket No. 50-289
Technical Specification Change Request No. 263

1.0 TECHNICAL SPECIFICATION CHANGE REQUEST (TSCR):

GPU Nuclear (GPUN) Inc. requests changes to the TMI-1 Technical Specifications, on the replacement pages designated below, as follows:

- Deletion of the wording "either manually or" in specification 3.3.1.1.f, eliminates the "manual only" provision as a means to satisfy the operability requirement for DH-V-6A/B. During a recent inspection (Inspection 50-289/96-201), GPU Nuclear made a commitment to the NRC to make this change.
- Reduction of the core flood tank level in specification 3.3.1.1.a from 1040 ft^3 to 940 ft^3 based on new analyses by Framatome Inc to provide for power operation up to 2772 MWt. GPUN Inc. desires to implement a power uprate to 2620 MWt at mid-cycle, during Cycle 12 operation for which a separate TSCR will be submitted. This change is needed to accommodate the uprate to 2620 MWt at mid-cycle without incurring a plant shutdown.
- Reduction in the HPI flow rate to provide additional operating margins based upon the new Framatome analyses for 2772 MWt which also bounds operation at 2568 MWt or any other intermediate power level (less than 2772 MWt).
- Minor editorial changes have been made on p. 4-41 to correct grammar and component or system nomenclature, which have no impact upon the intent or implementation of specifications affected.

Please insert the revised replacement Technical Specification pages 3-21, and 4-41.

2.0 REASON FOR CHANGE:

Background:

DH-V-6A/B Operability:

During a recent inspection at TMI (50-289/96-201), the NRC inspection team questioned whether use of the current specification could result in operation of the plant outside of the design basis because the operator response time for opening these valves, as assumed by the calculations for borated water storage tank (BWST) drawdown and swapover to the reactor building (RB) sump, was based on opening the valves remotely. The NRC also stated that it did not believe the plant was ever operated taking credit for local manual operability of DH-V-6A/B (without the valves being remote-manually operable), so there was no operability or operational concern.

With regard to radiation dose and the time available (assumed in design basis calculations with regard to swapping to RB Sump as a suction source), local manual operation of DH-V-6A/B does not support the safety analysis assumptions. Therefore, the Technical Specification LCO is being revised to conform the specification to the safety analyses and require that DH-V-6A/B be remote-manually operable.

Core Flood Tank (CFT) Level and HPI Flow Changes:

Each CFT is partially full of borated water, pressurized by nitrogen and connected by a single injection line to the reactor vessel downcomer. Check valves in the injection line prevent filling and pressurizing the tank from the reactor coolant system (RCS) and interconnected Decay Heat Removal (DHR) system. The injection line isolation valves are open while the plant is operating. The Sample/Drain, Vent, and Fill/Nitrogen Supply lines are normally isolated. The system is passive such that when RCS pressure drops below the CFT pressure the borated water in the tank is injected into the vessel downcomer at a rate based on the differential pressure and line resistance. Its function is to provide the initial injection of borated water into the vessel following a LOCA before the active systems (HPI and LPI) provide injection. After the blowdown phase of a large break LOCA (LBLOCA) some reactor coolant would remain in the lower plenum. During the reflood phase of a LBLOCA the inventory of the two CFTs would fill the reactor vessel downcomer to the level of the cold legs, fill the lower plenum and cover a small portion of the core. "Steam binding" in the core region would prevent the water from rising significantly in the core region. As a result the water level in the downcomer would rise, creating a level difference to offset the higher pressure in the core region, as in a manometer.

High pressure injection is actuated on low RCS pressure to makeup for inventory lost from the RCS during a LOCA. Borated water from the Borated Water Storage Tank (BWST) is injected through four lines, each connected to a cold leg at the RCP discharge. No credit is taken for HPI in the LBLOCA analyses. The two injection sources for those analyses are the CFTs and Low Pressure Injection (LPI). Credit is taken for HPI in the small break LOCA (SBLOCA) analyses where the borated water provides core cooling and refills the RCS.

The reactor core is required to remain intact and in a coolable geometry following any design basis accident. This ensures that the fuel does not exceed design limits and the cladding continues to maintain a fission product release barrier. Maintaining the core's geometry also ensures that it can be shutdown using soluble poison and control rods. In order to ensure that the coolant flow channels remain open, it is necessary for the injection sources (HPI, LPI and CFT) to provide borated water to reflood the reactor vessel downcomer and lower plenum and refill the core region to the outlet plenum. These injection systems are required to maintain the clad temperature less than 2200°F and to minimize the metal-water reaction to that representing less than 1 percent of the clad.

The reactor vessel contains and directs the coolant to the reactor core. The vessel and its internals are designed to normally separate the incoming cold coolant from the outgoing hot coolant. However, following a cold leg LOCA, if the pressure in the outlet plenum exceeds the pressure in the vessel downcomer, due to boiling in the core, the reactor vessel internals vent valves (RVVV) open to relieve the pressure. This prevents a pressure build-up that could force the water covering the core downward and out of the reactor vessel to the break location, thus uncovering the core.

3.0 SAFETY EVALUATION JUSTIFYING CHANGE

DH-V-6A/B Operation:

These valves are opened in response to a LOCA to allow the emergency core cooling system (ECCS) pumps to draw suction from the RB sump, after the BWST is depleted. The current Technical Specification wording allows either local-manual or remote-manual operation to satisfy the operability requirements of the valves. While this specification has existed since the original operating license was granted, it was determined that design basis operation would be exceeded with respect to dose consequences and the time allowance for operator actions if these valves were operated by means of local controls. Therefore, the LCO is being revised to conform the technical specifications to the safety analyses and hence require remote-manual operation.

Core Flood Tank Level Change:

Analyses to evaluate the effects of pre-accident CFT level and pressure on the LOCA LHR limits was performed by Framatome (FTI) for the B&W Owners Group Analysis Committee (References 6.1 - 6.5). The current LOCA LHR limits are based on the results of those analyses. Given values of CFT liquid inventory (nominally 1040 ft^3) and pressure (nominally 600 psig) that exist prior to the event, the injection rate as a function of time can be determined for a given size LBLOCA, call it Case 1. Holding nitrogen pressure constant, if the initial liquid inventory in the CFT is reduced then the volume of nitrogen in the tank is increased. A new injection rate as a function of time can be determined for the same size LBLOCA, call it Case 2. The CFT pressure in Case 2 (reduced liquid inventory) would remain higher than in Case 1 for a longer period of time. Because the injection rate is a function of pressure difference between the reactor vessel downcomer and the CFT, the injection flow rate would also be higher for Case 2. Based on the ideal gas law, a given change in volume of a large volume of gas (Case 2) produces a smaller decrease in pressure than does the same change in volume of a smaller volume of gas (Case 1).

CFT injection occurs at a critical time during the reflood phase of the transient when the core is experiencing an adiabatic heatup with very little liquid inventory remaining in the reactor vessel. The core region is covered by a steam blanket that alone cannot prevent the cladding temperature from increasing. A higher injection rate from the CFTs during this period reduces the rate at which the temperature increases. The Peak Clad Temperature (PCT) would be lower for a case with increased injection rate. Case 2, discussed above, can then be analyzed at higher LHRs, raising the PCT, until the PCT is approximately equal to the value from Case 1 and within the limits of 10 CFR 50.46.

A pre-accident CFT inventory of 985 ft^3 and pressure of 580 psia were used in the recent LOCA analyses performed at 2772 MWt (Reference 6.6). These values bound the proposed Technical Specification limits, and include instrument error. Those analyses were performed in accordance with 10 CFR 50.46 and 10 CFR 50 Appendix K. The results of the analyses were that the calculated PCTs were less than 2200°F, the maximum amount of core-wide oxidation (metal-water reaction) did not exceed 1 percent of the fuel cladding, and the maximum calculated local cladding oxidation was less than 17%. Additionally, the cladding remained amenable to cooling and therefore, core cooling requirements are met with a reduced CFT inventory.

Analysis of operation with a reduced CFT inventory of 940±30 ft^3 at a power level of 2568 MWt results in a lower PCT when compared with the results of current LOCA analysis using a CFT inventory of 1040 ft^3. The injection rate from the CFTs during the adiabatic heatup portion of the transient would be greater, and the resulting PCT would be lower. Therefore, the LOCA linear heat rate limits are conservative for operation at 2568 MWt.

Operation at the current CFT inventory (1040 ft^3) and pressure limits (600 psig) would result in the release of nitrogen to the RCS when the liquid inventory is depleted at low RCS pressure, following a LBLOCA. Reducing the liquid inventory (to 940 ft^3) will cause the CFTs inventory to deplete at a higher pressure and release more nitrogen gas to the RCS. Release of nitrogen gas to the RCS has been evaluated by Framatome and found to be acceptable (Reference 6.7). During a large break LOCA, the core flow will be so turbulent that adequate core heat transfer will exist even with entrained nitrogen. The nitrogen may collect in the OTSGs or RC loops. However, the OTSGs are not used for heat removal.

A reduced CFT inventory has a negligible effect on the post-LOCA RB sump liquid inventory. The RB sump level decrease (1500 gals. less in the RB, where the vol./ft is approximately 70,000 gals/ft) associated with this CF tank level reduction is approximately 1/4". The effect of the very slight decrease in RB sump level is insignificant with respect to ECCS pump NPSH when taking suction from the RB Sump. Also, the changes in total boron concentration and pH will be insignificant. The magnitude of the boron concentration and pH changes can be bounded by assessing the CFT volume change (approximately 1500 gals) as a percentage of total volume (400 000 gals) recirculated from the sump. The change in CFT level is approximately 0.375% at the lower level and therefore is insignificant. On the same basis as described above, the effects on the evaluations for boron precipitation in the core region, dose consequences and changes in the post-LOCA, RB pressure and temperature, are also insignificant.

During a SBLOCA, the nitrogen addition rate would be slow and the core is submerged so that adequate core heat removal exists, and nitrogen may collect in the OTSGs and RC loops. However, the range of SBLOCA sizes that require primary-to-secondary heat transfer is small and for those break sizes the RCS pressure remains high and decreases slowly. The Abnormal Transient Procedures would open the high point vents to release the non-condensable gases from the reactor vessel head and hot legs in the event that primary-to-secondary heat transfer is desired but cannot be established.

Once LPI flow is adequate to cool the core, or, if HPI in conjunction with break flow is adequate to cool the core, then OTSG heat removal is no longer required. Reference 6.8 indicates that the effects of nitrogen gas release during a LOCA are "inconsequential or beneficial." Therefore, there is no consequence resulting from the release of nitrogen to the RCS and the condition is considered to be acceptable.

HPI Flow Rate Change

Since no credit is taken for HPI in the LBLOCA analyses the following discussion only pertains to SBLOCA. HPI is actuated automatically by low RCS pressure or manually by the operator on a loss of SCM. Reduced HPI flow would result in reduced core cooling and longer time to refill the RCS following initiation.

An HPI flow rate of 431 gpm was used in the new LOCA analyses performed at 2772 MWt (Reference 6.6). The results are bounding for operation at the current power level of 2568 MWt.

Partial core uncovering occurred for a small spectrum of intermediate sized SBLOCAs in the new analyses. Clad heatup occurred in the upper core regions; however, the calculated PCTs were significantly below 2200°F. In addition, the maximum amount of core-wide oxidation (metal-water reaction) did not exceed 1 percent of the fuel cladding, and the maximum calculated local cladding oxidation was less than 17%. As a result, the cladding remained amenable to cooling and long-term cooling can be established and maintained after the LOCA.

Editorial Changes:

In technical specifications (TS) 4.5.2.1.a and .b "M. U." was changed to the word: 'makeup'; and, TS 4.5.2.1.c.(1) the word "the" is changed to 'than.' In TS 4.5.2.2.b the words "equal or greater than" are changed to: 'equal to or greater than.'

4.0 NO SIGNIFICANT HAZARDS CONSIDERATION:

GPU Nuclear has determined that this TSCR poses no significant hazard as defined by 10 CFR 50.92.

4.1 State the basis for the determination that the proposed activity will not represent a significant increase in the probability of occurrence or consequences of an accident.

This TSCR revises the LCO for RB sump isolation valves, the LCO for the core flood tank level, and the surveillance requirement for HPI injection flow rate. The Core Flood and HPI systems are not actuated until an event occurs. The CFT level used in the new accident analysis is that level required to be maintained in the CFT throughout operation (i.e., pre-accident). The new CFT level does not prevent safe accident mitigation.

Likewise, the reduced HPI flow cannot cause an event to occur; and while such flow results in less injection to the RCS when actuated, this is acceptable as demonstrated in the LOCA analyses. Changes to the LCO for the RB sump isolation valves support the safety analysis assumptions. The action statements related to both the level requirement and flow rates remain unchanged by this request. The function, operation and surveillance intervals for the isolation valves (DH-V-6A/B), the CFT level and HPI injection system are not changed by this request. Therefore, this activity does not increase the probability of occurrence of an accident, previously evaluated in the SAR.

Reducing the CFT nominal volume and reducing the HPI flow acceptance criteria in the Technical Specifications will not increase the radiological consequences of any LOCA evaluated in the SAR. The results of analyses using the reduced CFT inventory and reduced HPI flow demonstrate that the consequences are within the limits of 10 CFR 50.46. No fuel failure in addition to that assumed in the evaluation of the dose consequences would occur. Therefore, the radiological consequences would not increase.

The editorial changes described above have no impact upon the probability of occurrence or consequences of an accident.

4.2 State the basis for the determination that the activity does not create the possibility of an accident of a new or different type than any previously analyzed in the SAR.

This TSCR revises the LCO for RB sump isolation valves, the LCO for the core flood tank level, and the surveillance requirement for HPI injection flow rate. This change will not adversely affect the capability of the emergency core cooling systems in the event of a LOCA. The function, operation and surveillance intervals for both the borated water level in the core flood tank, and ECCS systems are not changed by this request and no physical changes or modifications are being made to Core Flood and HPI system boundaries. Therefore, because there are no configuration changes this activity does not create the possibility of an accident or malfunction of a different type than previously analyzed in the SAR.

In addition, the editorial changes described above do not create the possibility of an accident of a new or different type than any previously analyzed in the SAR.

4.3 State the basis for the determination that the margin of safety is not significantly reduced.

This TSCR revises the LCO for RB sump isolation valves, the LCO for the core flood tank level, and the surveillance requirement for HPI injection flow rate. No system configuration changes (hardware modifications) will be made to implement the change request, upon approval of the license amendment. The action requirements for these technical specifications have not changed. Actions to be taken if operability requirements are not met include plant shutdown under certain conditions.

Furthermore, impact upon the margin to safety is limited because the results of the LOCA analyses demonstrate that the 10 CFR 50.46 acceptance criteria are met, specifically: the PCT limit and the core-wide oxidation limit of 1 percent of the fuel cladding, as identified in the Technical Specification bases. Hence the margin of safety as defined in the bases of any technical specification is not significantly reduced or impacted by the implementation of this change request, or the editorial changes described above.

5.0 IMPLEMENTATION:

GPU Nuclear Inc. requests that the amendment authorizing this change become effective prior to the restart from the 12R refueling outage scheduled to begin on September 5, 1997 and which will last approximately 45 days.

6.0 REFERENCES:

GPU Nuclear Inc. will make available on-site the following referenced proprietary documents for NRC inspection, if required, which were used in the Safety Evaluation above:

6.1 BWNT Document 86-1202153-00, "Mk-B9 LL Spectrum LOCA Study," dated 6/27/91.

6.2 BWNS Document 86-1201110-00, "TACO3 4-FT LOCA LHR Limit Analysis for 177-Fuel Assembly Lowered Loop Plants," dated December 10, 1990.

6.3 BWNT Document 51-1239250-00, "PSC 5-94 LOCA Reanalysis," dated June 9, 1995.

6.4 BWNT Document 51-1[illegible]9658-00, "Assessment of PSC 5-94 on Core Limits," dated August 9, 1995.

6.5 BWFC Document 51-1235309-00, "Op. Limit Eval. for PSC 5-94," dated December 13, 1994.

6.6 FTI Document BAW 10222, "TMI-1 2772 MWt LOCA Analysis with RELAP5/MOD2-B&W," dated March 1997.

6.7 FTI Document 74-1152414-08, "Emergency Operating Procedures Technical Bases Document," Rev. 8, dated November 18, 1996.

6.8 FTI Document BAW 10192P, "BWNT Loss of Coolant Accident Evaluation Model for Once-Through Steam Generator Plants," Rev. 0, dated February 1994.