SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

GPU NUCLEAR CORPORATION

METROPOLITAN EDISON COMPANY

PENNSYLVANIA ELECTRIC COMPANY

JERSEY CENTRAL POWER & LIGHT COMPANY

DOCKET NO. 50-320

THREE MILE ISLAND NUCLEAR STATION UNIT NO. 2

INTRODUCTION

By letter dated November 6, 1984, GPU Nuclear Corporation (GPUNC) requested the approval of changes to modify the Proposed Technical Specifications (PTS) of Operating License No. DPR-73. Additional information supporting this request was provided in a letter dated March 27, 1985. In another letter dated March 26, 1985, GPUNC also requested exemptions from 10 CFR 50, Appendix A, General Design Criteria (GDC) 34 and 37. These exemptions are required to support the requested changes to the PTS. The primary purpose of these changes and exemptions is to more accurately reflect the present condition and requirements of the TMI-2 reactor.

DISCUSSION

(A) Limiting Conditions for Operation (LCO)

Section 3.1.1 Boration Control, Borated Cooling Water Injection

The licensee has proposed to modify the PTS to require two operable borated water injection systems consisting of; (1) two operable flow paths downstream from the Borated Water Storage Tank (BWST) and common dropline, and (2) dedicated on-site equipment for a Reactor Building Sump Recirculation System. In addition, the borated water inventory of the BWST is to

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be maintained above 390,000 gallons at a boron concentration of between 4350 and 6000 ppm. (The lower limit of boron concentration has been changed from 3500 ppm to 4350 ppm by a subsequent PTS change request submitted by the licensee and approved by the staff.) Presently the PTS requires that; the Standby Reactor Coolant System Pressure Control System (SPC), the Mini-Decay Heat Removal System (MDHRS), and the Decay Heat Removal System (DHRS) pumps and its recirculation pathways be operable to maintain RC inventory and boration level.

The present and future decay heat generation by the core is very low (less than 12 Kw thermal). Loss-to-ambient cooling, the present method of decay heat removal since January 1981, is adequate to maintain reactor coolant temperature below 170°F even for the limiting plant conditions, i.e., lowest RCS water level at El. 314' (bottom of the hot leg nozzles) and an ambient reactor building air temperature of 116°F (the predicted maximum temperature reached if no containment purge flow or cooling is assumed during peak summer conditions). Further, since the reactor will be maintained in a sub-critical, shutdown condition, there are no additional emergency core cooling requirements beyond removal of decay heat. Based on these considerations for decay heat removal and emergency core cooling functions, no active, forced borated water recirculation systems are required as long as the core remains covered for loss-to-ambient cooling. As discussed later in this document, this function of the MDHRS and the DHRS pumps and pathway can be replaced by the gravity feed from BWST and the reactor building sump recirculation system. The function of the Standby Reactor Coolant Pressure Control System (SPC) is to maintain the

RCS in a water-solid condition in order to promote long term natural circulation for core cooling. This function of the SPC is no longer necessary now that adequate ambient cooling has been demonstrated with the reactor vessel head removed.

Currently, the RCS is depressurized with the reactor vessel head removed. During the remainder of the recovery, there are no plans to reinstall the head or to repressurize the RCS. In an earlier Amendment of Order (December 19, 1984), the PTS were modified to state that the RCS will be kept open to the atmosphere and the need for a Safety Limit on RCS pressure was eliminated. The deletion of the RCS pressure control function is, therefore, appropriate.

Throughout the defueling operation, core cooling and criticality control are facilitated by maintaining borated water coverage above the core. For the purpose of this evaluation, this level is assumed to be the bottom of the reactor vessel nozzles (El. 314'). To maintain this RCS inventory during a loss-of-coolant event, the licensee has proposed to modify the PTS to require the operability of gravity feed from the BWST, and in the long term, the recirculation of the borated reactor building basement water into the RCS. The following are pertinent considerations in determining the capability of the proposed systems to maintain RCS inventory.

The only credible leakage path from the reactor vessel below the nozzles (El. 314') is through the postulated failure of the incore instrument tubes which penetrate the bottom of the vessel. We have considered the credible causes of failure of these incore instrument tubes and the resulting reactor coolant leakage rates. The worst case potential leak rate resulting from a load drop onto the reactor vessel breeching the incore instrument tubes has also been evaluated (Safety Evaluation for Heavy Load Handling over the TMI-2 Reactor Vessel, May 2, 1985). The bounding leakage rate postulating the breaking of all 52 incore instrument tubes is approximately 20 gpm. Other potential causes of incore instrument tube failures have also been considered, e.g., corrosion failures. However, it is unlikely that such other causes of failure will result in a leak rate higher than the 20 gpm assumed for the simultaneous break of all 52 tubes. It is not expected that heavy load handling with potential consequences more severe than those analyzed in the Safety Evaluation for Heavy Load Handling will be required during the remaining defueling operation. Should such requirement arise, the licensee must submit a safety analysis for staff review and approval prior to the operation. It is expected that other conditions such as pathway restrictions will be imposed such that potential RCS leak rate due to load drop accident will still be kept below the 20 gpm estimated.

The licensee's analyses show that substantially greater flow rates to refill the RCS are available from systems required to be operable. Initially, following the failure of incore instrument tubes, gravity flow from the BWST exceeding 600 gpm will be available. As the BWST inventory decreases, the available flow rate is estimated to remain at over 140 gpm when the head differential is reduced to 2 feet (from 45 feet initially). With the postulated bounding leak rate of 20 gpm, the BWST inventory available for gravity feed (approximately 300,000 gallons) would provide sufficient makeup for over 10 days. This should provide sufficient time to set up the Reactor Building Sump Recirculation System (RBSRS) to recirculate the RCS leakage from the reactor building sump and replenish the RCS inventory. The capacity of the RBSRS (two submersible pumps with a capacity of 200 gpm each) is substantially greater than the credible RCS leakage rate.

From the above considerations, we conclude that the proposed methods of borated water injection will exceed the credible RCS leakage rate in the event of a LOCA and therefore the function of the higher capacity DHRS pumps (at about 3,000 gpm) can be replaced by the BWST gravity feed and the RBSRS without adversely affecting the health and safety of the public.

For a postulated loss of both on-site and off-site AC power, we concur with the licensee's reliability study that AC power can be restored within five hours. If the maximum credible reactor coolant system leakage occurs at the same time, the loss of RC inventory during the five hours would be about 6,000 gallons which corresponds to a decrease of RCS level of about

2-1/2 feet. Assuming an additional RCS level drop of 1 foot prior to leak detection and an additional hour for the valves to actuate gravity feed from the BWST, the maximum drop of RCS level prior to gravity feed from BWST is about 4 ft. Since there is a minimum margin of about 7 ft. between the water level in the IIF and the bottom of the reactor vessel nozzles prior to the postulated RCS leakage, there should be sufficient time for the initiation of gravity feed to replenish the RCS inventory.

All components of the RBSRS will not be installed but will be available onsite on a standby basis. The electrical connections, however, are already installed in the reactor building. Redundant mechanical components of the recirculation system such as pumps, hoses and controls are available and the pumps will be periodically tested as required in the concurrently issued modifications to the Recovery Operations Plan. Assuming maximum credible RCS leakage through the failed incore instrument tubes, reactor building sump recirculation would not be required for over 10 days. This should allow sufficient time for the licensee to secure the highly borated water which may be necessary to increase the sump water boron concentration to above 4350 ppm prior to recirculation into the RCS.

The modified PTS requires two operable flow paths downstream from the BWST common dropline. These flow paths are available from several piping system connections. The availability of these redundant flow paths and associated active components (i.e., valves) meets the single failure criteria for

active components required to initiate flow. Upstream of the BWST common dropline, the single valve is maintained in a locked open position and requires no activation for borated water injection.

Based on the above considerations, we conclude that there is reasonable assurance that the proposed borated water injection systems will provide adequate reactor coolant inventory control in the event of a LOCA.

Reactivity control (i.e., maintenance of a subcritical condition in the core) is assured by maintaining RCS inventory for core coverage and by maintaining the RCS boric acid concentration within the PTS limits. During the gravity feed phase of borated water injection, providing boric acid concentrations within the proper limits is assured by the boric acid concentration requirements of the BWST inventory.

The maximum inventory of water in the basement sump prior to RCS leak is limited by administrative procedure to less than 70,000 gallons. If the boron concentration of the sump water when mixed with the RC leakage is less than 4350 ppm, addition of highly borated water, mixing and sampling would be necessary prior to recirculating the sump water mixture back to the RCS. We have reviewed the licensee's study (RCS Recirculation Make-up Capability, Revision 2, October 1984) and conclude that there is reasonable assurance that sources of highly borated water will be available by the time when recirculation is necessary. Plant procedures have been established for the reactor building sump sampling, introduction of highly

borated water, and adequate mixing prior to recirculation into the RCS. These procedures provide the required assurance that recirculation would not become a pathway for boron dilution.

Based on the above considerations, we conclude that the functions of the borated water injection systems will be enhanced by the proposed PTS in that it more accurately reflects that status of the RCS. In the event of RCS leakage through incore instrument tube failure, the initial response for RCS inventory control would be through the passive gravity feed flow path from the BWST. The proposed PTS requires an increased BWST inventory (from 100,000 gallons to 390,000 gallons) and two operable flow paths for gravity feed. For long term RCS recirculation, the PTS requires the availability of the reactor building sump recirculation system whose components will be maintained and tested. We conclude that borated water injection systems required by the PTS would provide better assurance for adequate RCS inventory control than the presently relied upon decay heat removal pumps and pathways. The decay heat removal pumps and pathways presently contain contaminated accident generated water. The entire pathway has not been tested since the accident (because of the contaminated water in the system) and there is no assurance that there would be no leakage spreading the contamination if the decay heat removal pumps and pathways were used for RCS inventory control. We note, however, even though the DHRS has been deleted from the PTS requirements, the licensee still intends to maintain the DHRS pumps and pathways although its operability will not be required for RCS inventory control.

Based on the above considerations, the staff concludes that the proposed gravity feed system and RBSRS should be able to provide the adequate RCS inventory and boron concentration control functions in the event of RCS leakage. The staff, therefore, concurs with the requested change.

Section 3.7.3.1 Nuclear Services Closed Cooling System (NSCCS)
The NSCCS provides cooling to several systems which originally had safety functions. These systems include the Spent Fuel Coolers, Reactor Building Spray Pump and Motor, Make-up Pump and Motor, Reactor Building Emergency Cooling Booster Pump Motor, and the Mini-Decay Heat Removal System (MDHRS). The function of the Spent Fuel Cooler is no longer necessary to maintain acceptable spent fuel pool temperature when spent fuel is stored since loss-to-ambient cooling is adequate for cooling in the reactor vessel and this method should be also acceptable for fuel canisters temporarily stored in the pool. The original function of the Reactor Building Spray Pump and the Reactor Building Emergency Cooling Booster Pump is to reduce the building pressure and airborne concentration of radioactive iodine during a LOCA. Because the RCS is no longer pressurized and the decay heat level of the fuel is less than 12 Kw, there is no potential for elevated building atmosphere pressure or airborne radioactive iodine release and those components no longer have a safety function. The safety functions of the Make-up Pump and the MDHRS can be replaced by BWST gravity feed and the RBSRS as discussed in Section 3.1.1. The staff, therefore, concurs with the request to delete the PTS requirements associated with the NSCCS.

Section 3.7.3.2 Decay Heat Closed Cooling Water System (DHCCWS)

The function of the DHCCWS is to provide cooling to the DHRS when that system is needed for pump cooling during LOCA conditions. Discussions in Section 3.1.1 show that adequate decay heat removal is provided by loss-to-ambient when RCS inventory is maintained. RCS inventory will be maintained during a LOCA initially by gravity feed from the BWST and, in the long term, by the reactor building sump recirculation system. Since the DHRS is no longer necessary as discussed in Section 3.1.1, its cooling water system is also not required and the staff concurs with the request to delete the PTS requirements on the DHCCWS.

Section 3.7.3.3 Mini-Decay Heat Removal System (MDHRS)

The safety function of the MDHRS is to remove decay heat by forced circulation cooling. As discussed in the staff's discussion in Section 3.1.1, forced circulation core cooling is no longer required. The staff concurs with the request to delete the PTS requirements on the MDHRS.

(B) Bases - The following bases sections were modified or deleted in accordance with the above discussions.

Section 3/4.1.1 Boration Control and Borated Cooling Water Injection

Section 3/4.7.3 Closed Cycle Cooling Water System

Section 3/4 7.3.1 Nuclear Services Closed Cycle Cooling System

Section 3/4 7.4 Nuclear Service River Water System

Modifications to the P/S resulting from the above discussion are attached to this SER (see Enclosure 3 for the modified pages). The acceptability of these modifications is discussed in section (A) above.

ENVIRONMENTAL CONSIDERATIONS

We have determined that the changes do not authorize a change in effluent types or total amounts nor an increase in power level and will not result in any significant environmental impact. Having made this determination, and, as reflected in the Environmental Assessment and Notice of Finding of No Significant Environmental Impact prepared pursuant to 10 CFR 51.2 and 51.30 through 51.32, issued concurrently herewith, we have further concluded that the change involves an action which is insignificant from the standpoint of environmental impact and that an environmental impact statement need not be prepared in connection with the issuance of this action.

CONCLUSION

Based upon our review of the above discussed changes as modified, the staff finds that the requested revision of the proposed Technical Specifications is acceptable.

We have also 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, and

(2) such activities will be conducted in compliance with the Commission's regulations and the implementation of this change will not be inimical to the common defense and security or to the health and safety of the public.

Enclosure 3

PROPOSED TECHNICAL SPECIFICATION CHANGES

FACILITY OPERATING LICENSE NO. DPR-73

DOCKET NO. 50-320

Replace the following pages of Appendix "A" Proposed Technical Specifications with the enclosed pages as indicated. The revised pages contain vertical lines indicating the area of change.

3.1-1
3.7-1
B 3/4 1-1
B 3/4 7-1

3.1 WATER INJECTION COOLING AND REACTIVITY CONTROL SYSTEMS

3.1.1 BORATION CONTROL

BORATED COOLING WATER INJECTION

3.1.1.1 The following systems, capable of injecting borated cooling water into the Reactor Coolant System, shall be OPERABLE with:

a. Two operable flowpaths downstream from the Borated Water Storage Tank and common drop line.

b. Dedicated on-site equipment for a Reactor Building Sump Recirculation System:

c. The BWST shall contain at least 390,000 gallons of borated water except as changed per procedures approved pursuant to Specification 6.8.2 at a minimum temperature of 50 degrees Farenheit and a boron concentration of between 4350 and 6000 ppm.

APPLICABILITY: RECOVERY MODE

ACTION:

a. With one flowpath from the BWST inoperable, restore to operable status or establish an alternate flowpath within 72 hours.

b. With both flowpaths from the BWST inoperable, suspend all operations involving CORE ALTERATIONS and/or the Reactor Coolant System and restore the inoperable flowpaths to OPERABLE status within 72 hours.

c. With the dedicated Reactor Building Sump Recirculation System inoperable, restore to operable status within 7 days.

d. With the BWST water volume or boron concentration out-of-specification, suspend all operations involving CORE ALTERATIONS and/or the Reactor Coolant System and restore the BWST to specification within 72 hours.

3.7 PLANT SYSTEMS

3.7.1 FEEDWATER SYSTEM

Deleted by Amendment of Order Dated April 1, 1982.

3.7.2 SECONDARY SERVICES CLOSED COOLING WATER SYSTEM

Deleted by Amendment of Order Dated April 1, 1982.

3.7.3 CLOSED CYCLE COOLING WATER SYSTEM

NUCLEAR SERVICES CLOSED CYCLE COOLING SYSTEM

3.7.3.1 Deleted.

DECAY HEAT CLOSED COOLING WATER SYSTEM

3.7.3.2 Deleted.

MINI DECAY HEAT REMOVAL SYSTEM (MDHRS)

3.7.3.3 Deleted.

3/4.1.1 BORATION CONTROL AND BORATED COOLING WATER INJECTION

The limitation on minimum boron concentration ensures that the core will remain subcritical under all credible conditions which may exist during the long-term cooling mode. The maximum boron concentration is provided to ensure that precipitation of boron will not occur in the RCS and thereby cause possible flow restrictions. The specification requires the OPERABILITY of systems capable of injecting borated cooling water into the RCS within the required boron concentration limits. The required volume of borated water in the BWST provides sufficient water to keep the core covered in the event of an unisolatable leak from the reactor vessel. The specified water volume is sufficient to provide a continuous supply of water to the vessel during the interim period before the recirculation flowpath from the Reactor Building Sump can be placed in service. Minimum boron concentration limits have been provided for the Refueling Canal (deep end) and Spent Fuel Storage Pool "A" to provide assurance that any event involving these volumes of water will not result in a margin of safety less than that analyzed for the reactor vessel.

3/4.1.3 CONTROL ASSEMBLIES

All full-length control rods were fully inserted as a result of the reactor trip on March 28, 1979. This Specification has been deleted since the reactor vessel head has been removed.

3/4.7 PLANT SYSTEMS

BASES

3/4.7.1 FEEDWATER SYSTEM

Deleted by Amendment of Order Dated April 1, 1982.

3/4.7.2 SECONDARY SERVICES CLOSED COOLING WATER SYSTEM

Deleted.

3/4.7.3 CLOSED CYCLE COOLING WATER SYSTEM

3/4.7.3.1 NUCLEAR SERVICES CLOSED CYCLE COOLING SYSTEM

Deleted.

3/4.7.3.2 DECAY HEAT CLOSED COOLING WATER SYSTEM

Deleted.

3/4.7.4 NUCLEAR SERVICE RIVER WATER SYSTEM

The Nuclear Service River Water System uses river water to cool the diesel generators. Therefore, it must be OPERABLE also. This system rejects its heat to the river as the Ultimate Heat Sink.

3/4.7.6 FLOOD PROTECTION

The limitation on flood protection ensures that facility protective actions will be taken in the event of flood conditions. The limit of elevation of 301 ft. Mean Sea Level USGS datum is the elevation at which facility flood control measures are required to be taken to provide protection to Safety Related equipment.