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October 10, 1984
5211-84-2235

Office of Nuclear Reactor Regulation
Attn: John F. Stolz, Chief
Operating Reactors Branch No. 4
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Sir:

Three Mile Island Nuclear Station, Unit 1 (TMI-1)
Operating License No. DPR-50
Docket No. 50-289
Decay Heat Removal (DHR) Technical Specifications

This is in response to your letter of July 18, 1984 concerning our submittal of January 26, 1982. The enclosed response addresses your request for additional information and proposes changes to TMI-1 Technical Specifications. The Technical Specification changes which are discussed will incorporate and modify existing GPUN administrative requirements which assure decay heat removal capability. In our response, we have addressed Standard Technical Specifications (STS), Revision 4, September 1980, Sections 3/4.4.1 and 3/4.9.8. GPUN takes exception to certain aspects of the STS. These areas are identified and the basis for each of these exceptions is given in the response.

Our letter of June 30, 1980, in response to IE Bulletin 80-12, described procedural changes which were being made at that time to put in place additional administrative controls to ensure that sufficient means of decay heat removal are available. Our letter dated January 26, 1982, responsed to your letter of July 22, 1981, and discussed TMI-1 compliance with the Model Technical Specifications which was provided. In our response, we referenced TMI-1 Technical Specifications, discussed administrative controls and other means by which decay heat removal capability can be assured, and stated that additional Technical Specifications were not needed.

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The enclosed response to your request for additional information provides the basis for an amendment to TMI-1 Technical Specifications and addresses the issue of maintaining a redundant means of decay heat removal capability and at the same time, allowing equipment to be taken out of service for maintenance or repair when the reactor is shutdown. GPUN requests your concurrence with the concepts we have presented prior to our submittal to amend the TMI-1 Technical Specifications.

Sincerely,

H. D. Hukill
Director, TMI-1

HDH:MRK:vjf

Enclosure

cc: R. Conte

RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION
DECAY HEAT REMOVAL

Item 1

For hot standby operation, the STSs require that two reactor coolant loops shall be operable, including the SG and at least one associated RC pump in each loop, and that at least one of the RC loops is operating. If these conditions are not met and corrective actions cannot restore both loops to operable status within 72 hours, the reactor is to be in hot shutdown within the next 12 hours. Boron dilution operations are to be stopped if an RC loop is not operating. The STSs also require periodic verification (once every 7 days) of the RC pump's operability and verification once every 12 hours that one cooling loop is operating.

In your response to this item, you stated that TS 3.1.1.1.b&c meet the STS requirements. TS 3.1.1.1.c covers boron dilution operation and meets the STS requirement as stated above. Your TS 3.1.1.1.b requires one reactor coolant pump in each loop and both loops to be in operation during power operation but does not address hot standby operation. Additionally, the TMI-1 TSs do not have surveillance requirements. Either provide the above aspect of hot standby and surveillance requirements in your TSs or provide justification as to why these requirements are not necessary.

GPUN RESPONSE

At TMI-1 Natural Circulation Cooling is sufficient to remove decay heat when not at power. The establishment and maintenance of this cooling mechanism is dependent on OTSG availability and does not require RCP operation.

TMI-1 Technical Specification 3.4 assures OTSG availability as a heat sink for decay heat removal and specifies requirements for EFW and Main Steam Safety Valves with reactor coolant system temperature above 250°F.

Applicability of this specification includes hot standby, hot shutdown, heatup and cooldown conditions as defined by TMI-1 Technical Specifications when reactor coolant temperature is greater than 250°F. TMI-1 Technical Specifications 4.8, 4.9, and 4.2 provide surveillance assurance of the OTSG heat sink capability.

Surveillance on RCP operation at power is performed continuously by the Reactor Protection System. Without a RCP in operation in each loop, the RPS will trip the reactor as per Table 2.3-1 of T.S. TMI-1 Technical Specification 4.1.1 (Table 4.1-1, Item 12) provides the surveillance requirements for the appropriate RPS setpoints.

Based on the existing TMI-1 T.S. as discussed above, GPUN concludes that redundant means of decay heat removal is required by current T.S. (including appropriate surveillance requirements) for all modes above 250°F.

Decay heat removal capability below 250°F is discussed in response to Item 2.

Item 2

With regard to shutdown modes, the STSs for the hot shutdown mode require at least two loops that are capable of removing decay heat to be operable. Either two reactor coolant loops (including the associated steam generators) and at least one associated RC pump per loop, or the two RHR loops, or one loop of each type must be operable. The STSs also require one of the above loops to be operating. If these conditions are not met and immediate corrective actions cannot restore the required loops to operable status, the reactor is to be in cold shutdown within 20 hours. Boron dilution operations are to be stopped if an RC loop is not operating. In addition, the STSs require that the RC pump's operability be verified once per 7 days, and at least one coolant loop shall be verified to be operating once per 12 hours.

For the cold shutdown modes, the STSs require that two RHR loops be operable and at least one loop to be operating. Otherwise, immediate action must be taken to restore the required loops to operable status as soon as possible. The STSs also require that boron dilution operations be suspended if no RHR loop is operating, and that RHR loop operation should be verified once per 12 hours.

In your response you indicated that the TMI-1 TS 3.1.1.2.a, 3.4.2, 3.1.1.1.c, 3.3.1.4 and 3.3.2 already met the intent of the STS requirements. TS 3.1.1.2.a requires that both steam generators be operable when RC temperature is greater than 250° F, TS 3.3.1.4 covers the cooling water system. TS 3.3.2 covers maintenance during power operation, and TS 3.4.2 covers the main steam safety valves. TS 3.1.1.1.c regarding boron concentration meets the intent of Action Item b of the STS sections 3.4.1.2 and 3.4.1.3, but your discussion regarding Decay Heat Removal system downtime is not acceptable as a justification for permitting operation during cold shutdown without redundant decay heat removal capability as described in the STSs. The situation you describe was precisely the scenario leading to issuance of IE Bulletin 80-12. Your proposed alternatives -- OTSG with natural circulation and HPI bleed and feed -- are not acceptable as the normal redundancy for decay heat removal. Additional discussion is provided in IE Bulletin 80-12, particularly item 7. Accordingly, we request that you revise your TS to provide redundant decay heat removal capability with one loop in operation during both hot shutdown and cold shutdown operations. Your TSs should also include appropriate action statements and surveillance requirements.

GPUN RESPONSE

GPUN agrees that without reliance on administrative requirements or management directive, changes to TMI-1 Technical Specifications would be needed to assure redundant DHR capability for plant conditions with reactor coolant temperature less than 250°F. GPUN proposes to add technical specification requirements which meet the intent of STS in avoiding the kinds of problems identified in IE Bulletin 80-12. GPUN, however, takes exception to certain aspects of STS as described below:

I. A broader spectrum of methods exist for decay heat removal than only those allowed by STS.

Although GPUN concurs that decay heat removal below 250°F is best suited by either the 'A' or 'B' Decay Heat Removal (DHR) Systems, other means exist which are acceptable and also provide the required heat removal capability. These are discussed below:

1. Ambient Losses to Reactor Building - When decay heat load is very low the heat loss to the Reactor Building atmosphere provides adequate heat removal capability. This is the situation that TMI-2 has been operating under quite successfully for an extended period. Since this cooling method requires no active components and relies upon basic heat transfer principles GPUN feels that the proposed Technical Specifications should recognize this as an acceptable means of decay heat removal.

   Under the present plant conditions at TMI-1, heat loss to ambient is sufficient to provide adequate decay heat removal capability. STS, however, does not recognize this method as an acceptable means of decay heat removal. GPUN feels that any changes to TMI-1 Technical Specifications should permit this method of decay heat removal for low decay heat levels.

2. OTSG Cooling - If all of the conditions are met for operation above 250°F reactor coolant temperature, including both OTSGs, three independent EFW pumps and associated flow paths, it should be recognized that such a capability constitutes redundant decay heat removal capability without the need to actually be above 250°F. Heatup would be allowed and subcooling could be maintained through the pressurizer and through the use of forced or natural circulation.

3. Alternate Flow Paths - The DHR System is not the only system capable of providing a flow of borated cooling water through the Reactor Vessel. Other means are available in addition to those described by STS which are acceptable. The proposed Technical Specifications should allow for the use of such methods either by specifying the alternate flow path or by specifying a performance requirement that the system be capable of maintaining the RCS $\leq$ 200°F during the period of intended use. Surveillance requirements would also be included to verify operability of the alternate flow path.

II. Cooldown by natural circulation is an acceptable means of decay heat removal.

The adequacy of natural circulation cooldown as a stable means of decay heat removal is described in Appendix 1 of BAW-10069, by Babcock and Wilcox.

III. Technical Specifications should not prohibit preventive maintenance or corrective maintenance that would necessitate a limited loss of redundancy.

There may be situations where the decay heat load and plant conditions make the DHR System the preferred operable system, as defined by Technical Specifications. Normally both 'A' and 'B' trains would be operable in such cases; however, the Technical Specifications should not prohibit preventive or corrective maintenance that may be necessary to ensure the continued reliability of these components.

Allowing a limited period for this type of maintenance provides Technical Specification assurance that appropriate action will be taken to restore the system to operable status in a timely manner, without prohibiting maintenance which is needed to decrease the likelihood of actual in-service failures. A maintenance period of up to 7 days appears to be appropriate considering the probability and consequences of a system failure.

IV. There is no technical basis for requirements that equipment be in operation without regard for the need to operate the equipment.

a) STS Section 3.4.1.3 requires that in hot shutdown, two of the loops listed below be operable and at least one of the four loops listed be in operation:

1. Reactor Coolant Loop (A) and its associated steam generator and at least one associated reactor coolant pump.
2. Reactor Coolant Loop (B) and its associated steam generator and at least one associated reactor coolant pump.
3. Decay Heat Removal Loop (A).
4. Decay Heat Removal Loop (B).

STS allows that all reactor coolant pumps and decay heat removal pumps may be de-energized for up to 1 hour provided (1) no operations are permitted that would cause dilution of the reactor coolant system boron concentration, and (2) core outlet temperature is maintained at least 10°F below saturation temperature. GPUN sees no technical basis for the requirements that one loop be in operation for the analogous TMI-1 operating conditions as long as core outlet temperature is maintained at least 10°F below saturation temperature. Depending on the decay heat generation rate, reactor coolant temperature could stay within these limits for longer than one hour.

b) STS section 3.4.1.4 requires that in cold shutdown, two decay heat removal loops be operable and at least one decay heat removal loop be in operation.

STS allows that the decay heat removal pump may be de-energized for up to 1 hour provided 1) no operations are permitted that would cause dilution of the reactor coolant system boron concentration, and 2)

core outlet temperature is maintained at least 10°F below saturation temperature. GPUN sees no technical basis for the requirements that one decay heat removal loop be in operation as long as core outlet temperature is maintained at least 10°F below saturation temperature. Depending on the decay heat generation rate, reactor coolant temperature could stay within these limits for longer than 1 hour.

c) STS section 3.9.8.1 requires that in the refueling mode, at least one decay heat removal loop be in operation. STS allows the decay heat removal loop to be removed from operation for up to one hour per 8-hour period during the performance of core alterations in the vicinity of the reactor pressure vessel hot legs.

The basis states that the requirements for one decay heat removal loop to be in operation ensures that sufficient cooling capacity is available to remove decay heat and maintain the water in the reactor pressure vessel below 140°F.

GPUN sees no technical basis for requiring a decay heat removal loop to be in operation as long as the water in the reactor coolant pressure vessel can be maintained below 140°F.

GPUN proposes to prepare a request to amend the TMI-1 TS to adopt additional requirements for decay heat removal capability below 250°F reactor coolant temperature. Such a change would require redundant means for decay heat removal while 1) allowing those methods, in addition to the methods allowed by STS which are proven to be adequate, 2) recognizing natural circulation cooldown as an acceptable means of decay heat removal, 3) requiring equipment to be in operation only when needed to maintain the appropriate reactor coolant temperature, and 4) allowing a limited period of up to 7 days to perform necessary maintenance or repair work on a redundant decay heat removal component.

Item 3

For refueling operation when the water level is more than 23 ft above the top of the reactor vessel flange, the STSs require that one RHR loop be operable and in operation. If the RHR loop cannot be made operable, the STSs action statements require that all refueling operations must be suspended, all boron dilution operations prohibited, and containment penetrations providing direct access to the environment must be isolated within four hours.

If the water level above the top of the reactor vessel flange is less than 23 ft, the STSs require that two RHR loops be operable, with one in operation. If two RHR loops are not operable, the STSs require that the inoperable RHR loop be restored to operable status, or the water level above the vessel flange could be raised to above 23 ft and thereby enter the mode described above.

In your response you indicate that TS 3.8.3 and 3.1.1.1.c already meet the STS requirements. TS 3.8.3 requires one decay heat removal loop be operable and TS 3.1.1.1.c covers boron dilution operation. Your TS do not adequately address our concern as discussed in IE Bulletin 80-12. It is the staff's position that one RHR loop should be operable and in operation if the water level above the top of the reactor vessel flange is more than 23 ft, except as noted in STS 3.9.8.1.b. Additionally, when the water level above the top of the reactor vessel flange is less than 23 feet, both decay heat removal loops should be operable with one loop in operation. We request that you revise your TSs to meet the intent of IE Bulletin 80-12, and include appropriate action statements and surveillance requirements or provide justification for not including this in your TSs.

GPUN RESPONSE

GPUN concurs that the current TMI-1 Technical Specifications do not fully satisfy the concerns raised in IE Bulletin 80-12. A change to assure that the redundant or diverse DHR requirements are addressed in the TMI-1 Technical Specifications is planned as discussed earlier.

Included in this change will be a provision to allow the inventory in the fuel tranfer canal to be classified as a diverse decay heat removal "system" when the water level is more than 23 feet above the top of irradiated fuel seated in the core. With less than 23 feet of water above the fuel, this "system" will be declared inoperable and may not be used to meet the proposed DHR operability requirements.

As in response to Item 2, GPUN takes exception to the requirement that a system be in operation regardless of the need for such operation.