ATTACHMENT I TO IPN-88-035

PROPOSED EMERGENCY TECHNICAL SPECIFICATIONS

RELATED TO 90°F SERVICE WATER TEMPERATURE

NEW YORK POWER AUTHORITY
INDIAN POINT 3 NUCLEAR POWER PLANT
DOCKET NO. 50-286
DPR-64

3. LIMITING CONDITIONS FOR OPERATION

For the case where no exception time is specified for inoperable components, this time is assumed to be zero.

*In the event, that service water temperature exceeds 90°F the unit shall be placed in at least hot shutdown within the next seven hours, and be in at least cold shutdown within the following thirty hours unless service water temperature is reduced to 90°F or less within these time intervals as measured from initial discovery or until the reactor is placed in a condition where this service water temperature is not applicable.

3.1 REACTOR COOLANT SYSTEM

Applicability

Applies to the operating status of the Reactor Coolant System; operational components; heatup; cooldown; criticality; activity; chemistry and leakage.

Objective

To specify those limiting conditions for operation of the Reactor Coolant System which must be met to ensure safe reactor operation.

Specification

A. OPERATIONAL COMPONENTS

1. Coolant Pumps

   a. When a reduction is made in the boron concentration of the reactor coolant, at least one reactor coolant pump or one residual heat removal pump (connected to the Reactor Coolant System) shall be in operation.

   b. When the reactor coolant system T_{avg} is greater than 350°F and electrical power is available to the reactor coolant pumps, and as permitted during special plant evolutions, at least one reactor coolant pump shall be in operation. All reactor coolant pumps may be de-energized for up to 1 hour provided no operations are permitted that would cause dilution of the reactor coolant system boron concentration, and core outlet temperature is maintained at least 10°F below saturation temperature.

   c. When the reactor coolant system T_{avg} is greater than 200°F and less than 350°F, and as permitted during special plant evolutions, at least one reactor coolant pump or one residual heat removal pump (connected to the Reactor Coolant System) shall be in operation. All reactor coolant pumps may be de-energized with RHR not in service for up to 1 hour provided no operations are permitted that would cause dilution of the reactor coolant system boron concentration, and core outlet temperature is maintained at least 10°F below saturation temperature.

   d. When the reactor coolant system Tavg is less than 200°F, but not in the refueling operation condition, and as permitted during special plant evolutions, at least one residual heat removal pump (connected to the Reactor Coolant System) shall be in operation.

* This specification expires at 0001 hours, October 1, 1988

The containment cooling and iodine removal functions are provided by two independent systems: (a) fan-coolers plus charcoal filters and (b) containment spray with sodium hydroxide addition. During normal power operation, the five fan-coolers are required to remove heat lost from equipment and piping within containment at design conditions (with a cooling water temperature of 85°F).* (4) In the event of a Design Basis Accident, any one of the following combinations will provide sufficient cooling to reduce containment pressure at a rate consistent with limiting off-site doses to acceptable values: (1) five fan-cooler units, (2) two containment spray pumps, (3) three fan-cooler units and one spray pump. Also in the event of a Design Basis Accident, three charcoal filters (and their associated recirculation fans) in operation, along with one containment spray pump and sodium hydroxide addition, will reduce airborne organic and molecular iodine activities sufficiently to limit off-site doses to acceptable values. (5) These constitute the minimum safeguards for iodine removal, and are capable of being operated on emergency power with one diesel generator inoperable.

If off-site power is available or all diesel generators are operating to provide emergency power, the remaining installed iodine removal equipment (two charcoal filters and their associated fans, and one containment spray pump and sodium hydroxide addition) can be operated to provide iodine removal in excess of the minimum requirements. Adequate power for operation of the redundant containment heat removal systems (i.e., five fan-cooler units or two containment spray pumps) is assured by the availability of off-site power or operation of all emergency diesel generators.

Due to the distribution of the five fan cooler units and two containment spray pumps on the 480 volt buses, the closeness to which the combined equipment approaches minimum safeguards varies with which particular component is out of service. Accordingly, the allowable out of service periods vary according to which component is out of service. Under no conditions do the combined equipment degrade below minimum safeguards.

* A cooling water temperature of 90°F is in effect until 0001 hours, October 1, 1988.

ATTACHMENT II TO IPN-88-035

SAFETY EVALUATION OF

PROPOSED EMERGENCY TECHNICAL SPECIFICATIONS

RELATED TO 90°F SERVICE WATER TEMPERATURE

NEW YORK POWER AUTHORITY
INDIAN POINT 3 NUCLEAR POWER PLANT
DOCKET NO. 50-286
DPR-64

SAFETY EVALUATION OF PROPOSED EMERGENCY TECHNICAL SPECIFICATIONS RELATED TO 90°F SERVICE WATER TEMPERATURE

Section I - Description of Changes

The Authority is requesting an emergency technical specification change which revises paragraph 3. of the Indian Point 3 Technical Specifications. The purpose of this emergency change is to permit seven hours before requiring the plant to be in the hot shutdown condition when service water temperature exceeds 90°F. The basis of Technical Specification 3.3 is also changed to reflect an 90°F cooling water temperature. It is requested that this proposed emergency change to the IP-3 Technical Specifications be placed in effect only until October 1, 1988.

Section II - Evaluation of Changes

In the event that service water temperature exceeds 90°F, the propsed changes allow seven hours to place IP-3 in hot shutdown and within the following 30 hours to be in cold shutdown. This change is necessitated by a rise in river water temperature due to a protracted heat wave in the Northeast, which is causing service water temperature to exceed the design temperature. As the duration of peak river water temperature is limited to three to five hours at mean high tide, the granting of this waiver is expected to permit full power operation for the limited duration of peak river water temperature.

The proposed change recommends placing the plant in hot shutdown within seven hours and in cold shutdown within the following thirty hours if the service water temperature exceeds 90°F. The seven hour Limiting Condition for Operation (LCO) is justified because the thermal phenomenon is tidal dependent and therefore is readily predictable and of a short duration. Operating with a seven hour LCO prevents unnecessary cycling of the plant, unneeded plant shutdowns and the creation of additional thermal stresses. In addition, a similar seven hour LCO has been approved by the NRC for a plant of similar design and age as IP-3.

The Authority has performed a nuclear safety evaluation (NSE-88-03-117 SWS, Rev. 0) which demonstrates the acceptability of continued plant operation with a service water temperature of 90°F. This NSE was based on a Justification for Continued Operation (JCO) performed by Westinghouse for a service water of 90°F at IP-3. A description of the operation of all applicable equipment is discussed in the NSE and JCO. JCO recommendations to maintain CCWS temperature in specification have been incorporated in procedures. Included as Appendix A to this submittal is the NSE and all associated attachments (including the JCO) which provide the specific technical details of the analysis performed.

It is the Authority's position that this emergency change to the IP-3 Technical Specifications should remain effective until October 1, 1988. This conclusion is based on information contained in, "The Final Environmental Statement Related to the Operation of Indian Point Nuclear Generating Plant Unit No. 3 (NUREG-75/002)," dated February, 1975. Table II-3 of this study (see Appendix B) provides a ten year composite (1959 - 1968) of average Hudson River temperatures in the vicinity of Indian Point 3. This table indicates that the Hudson River reaches annual high temperature plateaus from mid-July through mid-September, after which temperature starts decreasing. With weather forecasts in the Northeast predicting no relief in sight for the current heat wave, it is likely that river temperature decrease may not commence until the latter part of September. Therefore, October 1, is a good estimate of when the daily peak temperature of the Hudson River should remain below 85°F, precluding the need for the requested LCO.

Section III - Review of 10 CFR 50.91 Emergency Situation Criteria

Paragraph 10 CFR 50.91(a)(5) describes three criteria that must be satisfied for the Commission to find that an emergency situation exists. Each criteria is quoted and addressed below.

(1) "...failure to act in a timely way would result in derating or shutdown, or in prevention of either resumption of operation or of increase in power output up to the plant's licensed power level,..."

Failure to approve this emergency change to the Technical Specifications will result in the derating or shutdown of the plant whenever service water temperature exceeds 90°F. River water is peaking above 87°F on a daily basis and could peak above 90°F during tide changes. Until the current heat wave and its effects subside, IP-3 can be expected to cycle down and up in power each day unless this relief in specifications is granted.

(2) "...a licensee requesting an amendment must explain why this emergency situation occurred and ..."

This emergency situation occurred due to a protracted heat wave in the Northeast causing river water temperature to exceed the 85°F cooling water temperature described in the basis of the Technical Specifications. With no current LCO or specification for service water temperature, it is conservatively assumed that no exception time applies for exceeding this temperature and the plant must be in hot shutdown within four hours as required in other parts of the Technical Specifications where no exception time applies.

(3) "...why it could not avoid this situation,..."

The short notice required by this emergency change could not have been avoided. The length and degree of the current heat wave could not have been foreseen. This region is on record pace for the number of 90°F plus air temperature days for one summer. Early on when it became apparent that a significant break in the weather might not occur, the Authority initiated an engineering review to evaluate the impact on the IP-3 accident analyses of elevated cooling water temperatures. This three-to-four week effort culminated in a safety evaluation for an increase to a 90°F service water temperature.

<u>Section IV - No Significant Hazards Evaluation</u>

Consistent with the requirements of 10 CFR 50.92, the enclosed application is judged to involve no significant hazards based on the following information:

(1) Does the proposed license amendment involve a significant increase in the probability or consequences of an accident previously evaluated?

Response:

This change will not increase the probability of an occurrence or consequences of an accident or malfunction of equipment important to safety previously evaluated in the FSAR. Plant operation at service water temperatures up to 90°F will not result in peak accident containment pressure in excess of the containment design pressure nor above the maximum pressure at which containment and associated pressure containing components have been periodically tested. The component cooling system and the equipment cooled by it will remain operable to perform their safety related function during and following a design basis event. The addition of an LCO providing shutdown requirements when 90°F service water temperature is exceeded adds restrictions to plant operations in an area where no previous specification existed and does not impact accidents previously evaluated. Accordingly, neither the probability of an occurrence nor the consequences of an accident or malfunction of equipment important to safety will be increased.

(2) Does the proposed license amendment create the possibility of a new or different kind of accident from any accident previously evaluated?

Response:

The proposed changes, as analyzed, do not involve new or different kind of accidents, from those previously evaluated. Plant operation at service water temperature up to 90°F does not create the possibility of an accident or malfunction of any type other than those previously evaluated in the FSAR. This clarification on the application of LCO action requirements in the event service water exceeds 90°F does not create the possibility of a new or different accident.

(3) Does the proposed amendment involve a significant reduction in a margin of safety?

Response:

A significant reduction in a margin of safety is not involved. The containment integrity analysis was reanalyzed for operation with service water temperature of 90°F at an initial containment temperature of 130°F. The increase in service water temperature to 90°F impacts the heat removal ability of the containment Fan Cooler Units and results in a slight increase in the peak containment pressure (less than 1.5 psi) to 40.73 psig. The design case for an initial containment temperature of 120°F and service water temperature of 90°F was evaluated. For this case, peak containment pressure was shown to remain below 40.6 psig, the peak pressure stated in the basis of the Technical Specifications for the original containment integrity analysis. In both cases, the peak pressure is well below the containment design pressure of 47 psig. Containment leak rate testing has been performed at pressures in excess of the 40.73 psig peak containment accident pressure calculated for 90°F service water temperature and 130°F containment temperature.

The component cooling loop has been evaluated for a service water supply temperature of 90°F. The loop will provide sufficient cooling to enable continued sump and core recirculation following a LOCA. All safety-related heat loads served by Component Cooling during the recirculation phase have been evaluated at a service water temperature of 90°F. In each case all required equipment is shown to remain operable at the elevated temperature of 90°F over the time period for which it must function.

The peak accident containment pressure is shown to be less than the original containment integrity analysis (40.6 psig) with containment temperature at 120°F. For a containment temperature of 130°F, the peak pressure is only slightly more at 40.73 psig, which is less than the test pressures for all past containment integrated leak rate tests. All required safety related equipment and loads cooled by service water and component cooling water systems have been shown to remain operable for an initial service water temperature of 90°F. Therefore plant operation at service water temperatures up to 90°F does not constitute a significant hazards concern.

Section V - Impact of Change

This change will not adversely impact the following:

(1) ALARA Program
(2) Security and Fire Protection Programs
(3) Emergency Plan
(4) FSAR or SER Conclusions
(5) Overall Plant Operations and the Environment

Section VI - Conclusions

The incorporation of this change: a) will not increase the probability nor the consequences of an accident or malfunction of equipment important to safety as previously evaluated in the Safety Analysis Report; b) will not increase the possibility for an accident or malfunction of a different type than any evaluated previously in the Safety Analysis Report; c) will not reduce the margin of safety as defined in the bases for any Technical Specification; d) does not constitute an unreviewed safety question; and e) involves no significant hazards considerations as defined in 10 CFR 50.92.

Section VII - References

(a) IP-3 FSAR

(b) IP-3 SER

(c) NSE-88-03-117 SWS, Rev. 0, "Operation with Service Water Temperature of 90°F," dated August 16, 1988.

(d) "Update of INT Service Water Temperature JCO/ Recommendations, Indian Point Unit 3", by Westinghouse dated August 16, 1988.

(e) "Indian Point Unit 3; JCO with a Service Water Temperature of 90 Degrees F," by Westinghouse dated August 5, 1988.

APPENDIX A TO IPN-88-035

NSE-88-03-117 SWS, REV. 0

OPERATION WITH SERVICE WATER TEMPERATURE OF 90°F

NEW YORK POWER AUTHORITY
INDIAN POINT 3 NUCLEAR POWER PLANT
DOCKET NO. 50-286
DPR-64

NSE 88-03-117 SWS, REV. 0

OPERATION WITH SERVICE WATER TEMPERATURE OF 90^{0}F

I. PURPOSE

The purpose of this evaluation is to demonstrate the acceptability of continued plant operation with service water temperatures in excess of the original design temperatures for this system for 1988. In addition, this evaluation addresses the impact of higher than design service water temperatures on the Component Cooling Water System.

II. DESCRIPTION

The Service Water System is designed to supply cooling water from the Hudson River to various heat loads in both the primary and secondary portions of the plant. Provisions exist to assure a continuous flow of cooling water to those systems and components necessary for plant safety during normal operation or under abnormal and accident conditions. This is accomplished either directly or via the Component Cooling Water System (CCWS). The Component Cooling Water System is designed to remove residual and sensible heat from the RCS via the RHR loop during plant shutdown, to cool the letdown flow to the CVCS during power operation, and to provide cooling to dissipate waste heat from various primary plant components. During the injection phase of a LOCA (combined with a blackout) the CCWS serves as a heat sink for the high head Safety Injection (SI) pump bearings and recirculation pump motors. During the recirculation phase, the Component Cooling System serves as an intermediate loop for the transfer of decay heat from the recirculation sump via the RHR heat exchangers and for cooling of various heat loads associated with the safeguards pumps. The component cooling loop transfers its heat load to the Service Water System via the component cooling heat exchangers.

The Indian Point 3 Technical Specifications do not contain a limiting Condition for Operation (LCO) or a Surveillance Requirement for a specific service water temperature of 85^{0}F. The Westinghouse Standardized Technical Specification (STS) specify an LCO for an <u>average</u> water temperature under an optional specification for Ultimate Heat Sink. The STS further specifies a surveillance requirement to determine that the ultimate heat sink is operable at least once every

24 hours by verifying that the average water temperature is within its defined limit. Accordingly, at least once every 24 hours, the average service water temperature (i.e., IP-3 ultimate heat sink) is verified less than 90^{0}F. The methodology used to determine the temperature of the water entering the service water system has been evaluated. It has been determined in Attachment 3 ("Service Water System Temperature Analysis") that the temperatures recorded at the circulating water inlets are accurate and that the average of these temperatures represents the temperature of the water entering the service water system.

A Service Water temperature of 90F will affect Fan Cooler Unit (FCU) performance and therefore, the containment integrity analyses as well as diesel generator operating temperatures.

In addition, higher service water temperature will reduce the ability of the Component Cooling Water System to cool the various CCW heat loads during the post-LOCA recirculation phase.

An evaluation has been performed to demonstrate that the post-DBE containment pressure will remain within the design pressure and that all components required to mitigate the accident will perform their intended function in their intended manner at service water temperatures up to 90^{0}F.

Attachment 1 entitled, "Justification for Continued Operation with a Service Water Temperature of 90^{0}F at Indian Point Unit 3", documents the evaluations performed by Westinghouse. Specifically, the containment integrity analysis was reanalyzed for operation with service water temperature of 90^{0}F at an initial containment temperature of 130^{0}F. The increase in service water temperature to 90^{0}F impacts the heat removal ability of the FCUs and results in a slight increase in the peak containment pressure (less than 1.5 psig) to 40.73 psig. The design case for an initial containment temperature of 120^{0}F and service water temperature of 90^{0}F was evaluated. Peak containment temperature was shown to remain below 40.6 psig for that case. This is well below the containment design pressure of 47 psig. Note that these calculated peak containment pressures are the same as those identified in NSE 88-03-114 SWS, which addressed service water temperatures up to 87^{0}F. This is due to the enhanced modeling techniques employed in the containment integrity analysis for service water temperatures up to 90°F. Had these techniques been employed in the 87°F analysis, lower peak containment pressures would have resulted. Containment leak rate testing has been performed at pressures in excess of the 40.73 psig peak containment accident pressure calculated for 90°F service water temperature.

The component cooling loop has been evaluated for a service water supply temperature of 90°F. The loop will provide sufficient cooling to enable continued sump and core recirculation following a LOCA. All safety-related heat loads served by Component Cooling during the recirculation phase have been evaluated at a service water temperature of 90°F. In each case all required equipment is shown to remain operable at the elevated temperature of 90°F over the time period for which it must function (24 hours in the recirculation phase followed by one year of long-term recirculation).

In addition, certain other equipment cooled by Service Water is required to operate to support accident mitigation equipment, specifically the emergency diesel generators and FCU motor coolers. Accordingly, a review has been conducted to determine the impact of elevated service water temperatures on this equipment.

With respect to the emergency diesels, Attachment 2 documents a service water system evaluation demonstrating that the diesels will remain operable with service water supply temperatures up to 90°F for the maximum loading combination associated with the injection and recirculation phases of a design basis event. Similarly, the fan motor coolers have been evaluated (see Attachment 1) and shown to remain operable during the course of a design basis event for the elevated service water temperature condition.

Service water is also provided to the instrument air compressors and CCR air conditioning. All safety systems are designed to perform their safety function with loss of instrument air. Service water that flows to the CCR air conditioning will remain largely unchanged. Such air conditioning performance will not degrade beyond acceptable limits.

The operability determinations for the various safety related loads (cooled by CCW) at the elevated (90°F) service water temperature are contingent upon CCW heat exchanger exit temperature not exceeding 152°F. The CCW heat exchanger exit temperature is the CCW supply temperature to the safety related loads. This 152^{0}F temperature is the maximum exit temperature expected based on conservative calculations of heat input to the CCW loop and therefore serves as the limiting temperature for the equipment operability determinations. Accordingly, procedural precautions will require monitoring CCW exit temperatures during the recirculation phase with instruction to:

1. Maximize the Service Water flow to the CCW heat exchangers.

2. Maximize the use of available CCW Pumps.

3. If only one Service Water Pump is operating, reduce the number of operating Recirculation Pumps to one.

4. If only one Service Water Pump is operating, and CCW heat exchanger outlet temperture approaches 152^{0}F, prevent one Recirculation Pump from running through two RHR heat exchangers.

5. Isolate CCW flow to the Spent Fuel Pit heat exchanger.

III. REVIEW AND ANALYSIS

See supporting documents attached.

IV. SUMMARY AND CONCLUSIONS

In summary, the above described evaluation of plant operations at service water temperatures up to 90^{0}F can be performed based on the following conclusions:

A. This change will not increase the probability of an occurrence or consequences of an accident or malfunction of equipment important to safety previously evaluated in the FSAR. Temporary plant operation at service water temperatures up to 90^{0}F will not result in peak accident containment pressure in excess of the containment design pressure nor above the maximum pressure at which containment and associated pressure containing components have been periodically tested. The component cooling system and the equipment cooled by it will remain operable to perform their safety related function during and following a design basis event. Accordingly, neither the probability of an occurrence nor the consequences of an accident or malfunction of equipment important to safety will be increased.

B. Temporary plant operation at service water temperature up to 90^{0}F does not create the possibility of an accident or malfunction of any type other than those previously evaluate dint he FSAR.

C. Service water temperature is not a parameter controlled by Technical Specifications. Accordingly, plant operation at service water temperatures up to 90^{0}F will not reduce the margin of safety as defined in the basis for the Technical Specifications. The design service water temperature of 85^{0}F is referenced in the basis of certain technical specifications as an input to the calculation of the peak accident pressure of 40.6 psig (120^{0}F initial containment temperature). Re-analysis of the containment pressure transient using more current modeling methods, for river water temperatures up to 90^{0}F, all other conditions remaining the same, demonstrates that the peak accident pressure remains below 40.6 psig. Therefore, this change does not reduce the margin of safety as defined in the basis of the Technical Specifications.

D. Since the peak accident containment pressure is shown to be less than the design pressure and the pressure for which appendix J leak rate testing is performed and the component cooling system has been shown to remain operable, plant operation at service water temperatures up to 90^{0}F does not constitute an unreviewed safety question.

E. As previously noted, there is no Technical Specification control relating to service water temperature. Accordingly, temporary plant operation at service water temperatures up to 90^{0}F does not involve a change in Technical Specifications requiring pre-implementation review of the NRC.

F. Temporary plant operation at service water temperatures up to 90^{0}F does not affect the environmental impact of the plant or involve an unreviewed environmental safety question.

G. Temporary plant operation at service water temperatures up to 90°F does not involve a change in the Environmental Technical Specifications.

H. Temporary plant operation at service water temperatures up to 90°F does not impact and will not degrade the Security Plan, Quality Assurance Program or the Fire Protection Program.

V. <u>REFERENCES AND ATTACHMENTS</u>

1. JCO for Continued Operation with a Service Water Temperature of 90°F, by Westinghouse dated August 16, 1988.

2. Letter to Mr. L. Garafolo (NYPA) from Mr. A. B. Yanchitis (UE&C), Re: Diesel Generator Cooling During Post-LOCA Injection (90°F river water).

3. Service Water System Temperature Analysis.

ATTACHMENT 1

INT-88-714

Westinghouse Electric Corporation

Power Systems

Nuclear Technology Systems Division

Box 355
Pittsburgh Pennsylvania 15230-0355

Mr. Pete Kokolakis
Manager, Nuclear Licensing
New York Power Authority
123 Main Street
White Plains, NY 10601

August 16, 1988
NS-OPLS-OPL-II-88-535

Ref.: INT-88-705,
dated 8/5/88

NEW YORK POWER AUTHORITY
INDIAN POINT UNIT 3
UPDATE ON INT SERVICE WATER TEMPERATURE JCO/RECOMMENDATIONS

Dear Mr. Kokolakis:

Reference 1 provided NYPA with a Justification for Continued Operation (JCO) for a Service Water System temperature of 90°F. The JCO was in part based on the operators taking action, if required, to limit Component Cooling Water System (CCWS) temperature to 152°F. The cover letter transmitting the JCO included Westinghouse recommendations on what operator actions could be used to limit CCWS temperature. Following additional analysis, Westinghouse has determined that CCWS temperature can be kept below 152°F with a slightly simplified set of operator actions. These actions are listed below and should be performed in the following order:

1. Maximize the Service Water flow to the CCW heat exchangers.

2. Maximize the use of available CCW Pumps.

3. If only one Service Water Pump is operating, reduce the number of operating Recirculation Pumps to one.

4. If only one Service Water Pump is operating, and CCW heat exchanger outlet temperature approaches 152°F, prevent one Recirculation Pump from running through two RHR heat exchangers.

5. Isolate CCW flow to the Spent Fuel Pit heat exchanger.

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If you have any questions on the information presented in this letter please contact A. Ball, Jr. at (412) 374-5750 or the undersigned.

Very truly yours,

WESTINGHOUSE ELECTRIC CORPORATION

S. P. Swigart, Manager
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A. M. Sicari

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August 5, 1988
INT-88-705

NEW YORK POWER AUTHORITY
INDIAN POINT UNIT 3
JCO WITH A SERVICE WATER TEMPERATURE OF 90 DEGREES F

Dear Mr. Kokolakis:

Attached to this letter is the Justification for Continued Operation (JCO) for Indian Point Unit 3 based upon a plant service water temperature of 90°F. This safety assessment addresses plant operation with the Hudson River water temperature in excess of the Component Cooling Water System (CCWS) design temperature and supports the ability of the CCWS to perform its intended safety function during Normal and Post-Accident conditions. It must be noted that in order to permanently change the Indian Point Unit 3 design basis to incorporate a service water temperature of 90°F, additional confirmatory design calculations will be required.

Note that specific recommendations regarding CCW pump operating requirements are provided in the attached JCO. Please be advised that the general requirements upon which these limits are based are to ensure that CCW outlet temperature remains below 152°F. There are a number of general methods to accomplish this.

Interim emergency operating procedures should be developed to be implemented if component cooling heat exchanger temperatures are approaching 150°F. This could occur with possible combinations of pumps operating and the associated flows to the heat exchangers. The object is to maximize the CCW flow through the CCW HX and to reduce the CCW flow to the RHR HX, as necessary, to maintain CCW HX temperatures of 150°F or less. Provided below are our recommendations.

Limit CCW to below 152°F, allowing for instrument accuracy. Steps should be taken in the following order:

1. Maximize the use of available service water subsystems.

2. Maximize the use of available CCW pumps.

3. Reduce the number of operating recirculation pumps to 1.

4. Prevent 1 recirculation pump from running through 2 RHR heat exchangers.

5. Throttle recirculation flow to the RHR heat exchanger not to fall below 2400 gpm. A RHR heat exchanger tube side delta T should be reduced gradually to prevent isolating core cooling flow.

6. Isolate CCW flow to the Spent Fuel Pit heat exchanger.

If you have any questions on the information presented in this letter please contact A. Ball, Jr. at (412) 374-5750 or the undersigned.

Very truly yours,
WESTINGHOUSE ELECTRIC CORPORATION

S. P Swigart, Manager
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Rev. 0

Justification for Continued Operation With a Service Water Temperature of 90°F at Indian Point Unit 3

I. BACKGROUND

Indian Point Unit 3 has requested an evaluation of acceptable plant operation with a Service Water temperature of 90°F. The Service Water provides cooling for the Containment Cooling Fans and fan cooler motors which provide safety related containment cooling. The Service Water System also cools the Component Cooling Water System which in turn cools safety related components to support post-Loss-of-Coolant Accident recirculation.

The following provides an evaluation of the possible safety impact of increased Service Water temperature on the ability of the plant to perform the required safety functions associated with Containment Cooling Fans and Component Cooling Water.

A. Containment Cooling Fans and Fan Cooler Motors

The safety function of the Containment Cooling Fans affected by increasing Service Water temperature is the capability to cool the containment atmosphere following a LOCA. The Containment Cooling Fans operate as part of the Containment Air Recirculation Cooling and Filtration System (CARCFS). The CARCFS was designed to recirculate and cool the containment atmosphere in the event of a Loss-of-Coolant Accident (LOCA) and thereby ensure that the containment pressure will not exceed its design value of 47 psig at 271°F (100% relative humidity). The Technical Specifications currently indicate that the calculated peak post-accident containment pressure is 40.6 psig. The Containment Cooling Fan fan-coolers transfer heat from the containment atmosphere to the Service Water System. The heat transfer capability of the fan-coolers is accounted for in the containment integrity analysis presented in FSAR Chapter 14. Increasing the Service Water temperature will affect the fan-cooler performance and, therefore, affect the containment integrity analysis.

In addition, increasing the service water temperature to 90°F will have a small affect on the fan cooler motor coolers. Adequate cooling for the fan cooler motors is required to ensure that the fan coolers can continue to operate in the post accident enviroment.

B. Component Cooling Water System

The safety functions performed by the Component Cooling Water (CCW) System are:

1. Supply the necessary service water to enable continued sump and core recirculation following a Loss-of-Coolant Accident (LOCA).

   Following a design basis LOCA (off-site power is assumed to be lost) the Emergency Core Cooling System (ECCS) draws water from the RWST and injects into the RCS cold legs. Pumped safety injection is provided by the RHR pumps and the High Head Safety Injection Pumps. As the RWST inventory is depleted, the ECCS is switched from the injection phase to the recirculation phase. During the ECCS recirculation phase the system is arranged so that the Recirculation Pumps take suction from the recirculation sump in the containment floor and deliver spilled reactor coolant and borated refueling water back to the core through the RHR heat exchangers. The system is also arranged to allow either of the RHR pumps to take over the recirculation function if required.

For small breaks the RCS depressurization is augmented by steam dump and auxiliary feedwater addition to the steam generators. For small breaks that do not depressurize enough to allow adequate recirculation flow from the Recirculation Pumps, the system is arranged to deliver water from the RHR heat exchanger to the suction of the high head safety injection pumps and by this external route, to the reactor coolant loops. Thus, if depressurization of the RCS proceeds slowly, the safety injection pumps may be used to augment the flow-pressure capacity of the Recirculation Pumps in returning the spilled coolant to the reactor. The Service Water System provides cooling to the Component Cooling Water loop, which in turns cools the High Head Safety Injection Pump oil and seal coolers, the Recirculation Pump motors, and the RHR pump mechanical seals if the RHR pumps are required to provide backup to the recirculation pumps. Providing adequate cooling to these components ensures that post-LOCA long term cooling can be maintained.

2. "One pump (either recirculation or residual heat removal) and one RHR heat exchanger of the recirculation system provides sufficient cooled recirculated water to keep the core flooded while simultaneously providing, if required, sufficient containment spray flow to prevent the containment pressure from rising above design limits because of boiloff from the core. Only one pump and one RHR heat exchanger are required to operate for this capability at the earliest time recirculation in initiated. With a recirculation (or RHR) pump in operation and with a spray header valve open, no Containment Cooling Fans are required." (FSAR page 6.3-10)

   The Service Water system provides cooling water to the component cooling loop, which in turn, cools the RHR heat exchangers. Only one Service Water Pump and one Component Cooling Water Pump and heat exchanger are required to meet the core cooling function.

II. EVALUATION

A. Containment Cooling Fans

The limiting case containment integrity analysis case was rerun assuming a Service Water temperature of 90°F.

The double-ended pump suction break case with minimum safeguards is the limiting case for containment integrity peak pressure concerns. An analysis was performed to determine the effect of an increased Service Water temperature of 90°F, which affects the fan cooler performance, on the peak calculated containment pressure response for this limiting case.

The base model and approach used for this analysis was described in Westinghouse letter INT-88-641, dated May 27, 1988. The results from the analysis discussed in INT-88-641 showed a peak containment pressure of 39.39 psig.

The initial containment temperature utilized for the evaluation was 130°F. The peak containment pressure based upon the increased Service Water temperature was calculated to be 40.73 psig which is below the design pressure of 47 psig. Considering an initial containment temperature of 120°F, and a 90°F service water temperature, the peak containment pressure is below 40.6 psig.

B. Component Cooling Water System

The ability of the Component Cooling Water (CCW) System to perform its functions is evaluated below.

1. Supply the necessary cooling service to enable continued containment sump and core recirculation following a LOCA.

   The CCWS provides cooling for the following heat loads during the post-LOCA recirculation phase:

   - HHSI Pumps (2)
   - Recirculation Pump (1)
   - RHR heat exchanger (1)
   - Spent Fuel Pit Heat Exchanger
   - RHR Pump (if required to provide backup to the recirculation pump)

   This portion of the evaluation was performed to ensure that the CCWS provides sufficient cooling to the High Head Safety Injection Pump oil coolers and seal coolers to ensure that the HHSI pumps can perform their post-LOCA recirculation functions if required, and to ensure that the CCWS provides sufficient cooling to the Recirculation Pump Motor air/water heat exchangers to ensure that the Recirculation Pumps can perform their post-LOCA recirculation function. In addition, an evaluation is provided for adequate cooling of the mechanical seals if a RHR pump is required as a backup to the Recirculation Pump.

   The evaluation determined the CCWS temperature as a function of time after the post-LOCA ECCS recirculation phase is established. The equipment was then evaluated to ensure that the CCWS could provide adequate cooling to ensure pump operation.

   Component Cooling Water Temperature vs Time

   For the post-LOCA scenario, the recirculation phase was determined to be the most limiting for the CCW System because the auxiliary heat load going to the CCW heat exchanger would be maximized due to the RHR heat exchanger cooling the recirculation sump water. Based on the sump water temperatures, a CCW system performance study was done to determine the temperature history of the CCW system. The system alignment assumed during post-LOCA recirculation was a minimum safeguards alignment of the CCWS, with one CCW heat exchanger and one RHR heat exchanger in service. It was determined that at the peak containment sump temperature of 274°F (which corresponds to the time at which switchover to recirculation is initiated), the CCW temperature out of the CCW heat exchanger will be no higher than 152°F, and will decrease and is expected to be below 120°F within 24 hours. The RHR heat exchangers will also act to reduce the containment sump temperature during this period, which is expected to fall below 200°F within a 24 hour period. This temperature/time data was then used to determine the resulting effects on the components receiving CCW flow during a post-LOCA scenario.

Operating with a service water temperature of 90°F may require operators to take action to limit CCW temperature to no greater than 152°F (accounting for instrument uncertainty) during post-LOCA recirculation.

In addition to evaluating the post-accident performance of the Component Cooling Water System, the impact of 90°F Service Water was evaluated relative to the affect on the CCWS's functions during normal operation.

The components in service during normal operations that are cooled by the CCWS were determined based on feedback from the plant and include:

- Reactor Vessel Support Pads
- Letdown Heat Exchanger (normal letdown)
- Seal Water Heat Exchanger (normal letdown)
- PD Pump (1)
- Reactor Coolant Pumps (4)
- Gross Failed Fuel Detector System
- Spent Fuel Pit Heat Exchanger
- Sample Heat Exchanger (1)
- Waste gas Compressor (1)

The CCWS must provide adequate cooling to ensure that the above recommended equipment operates within its design conditions. The maximum recommended CCW temperature for steady-state operation is 105°F and is limited by the Reactor Coolant Pump.

The CCW temperature was estimated based on CCWS capability for several Service Water temperatures. Operation with a Service Water temperature above 89°F could result in CCWS temperatures greater than 105°F, and could result in damage to the RCPs. Acceptable CCW performance is maintained however, with a service water temperature of 90°F, if CCW temperature remains below 105°F.

<u>Component Evaluation</u>

Various auxiliary pumps and associated appurtenances (such as oil coolers and seal coolers) will be subjected to the increased Component Cooling Water temperatures which have been identified for normal plant operation and for the post-LOCA recirculation phase. The increased Component Cooling Water temperatures will have no detrimental effect on the structural integrity of the pumps. Thus the evaluation of auxiliary pumps concerns only the operability of pumps which have appurtenances serviced by component cooling water. For the normal plant operating mode, the evaluation is limited to the positive displacement charging pump and the waste gas compressor. For the post-LOCA recirculation phase, the evaluation is limited to the Recirculation Pump motors, the High Head Safety Injection Pumps, and the RHR Pumps.

Normal Plant Operation

The component cooling water temperature during normal plant operation will not exceed 105°F. This cooling water services the charging pump lube oil cooler and gyrol oil cooler and the waste gas compressor mechanical seal cooler. The thermal-hydraulic performance characteristics of these coolers have been reviewed for the identified component cooling water flow rates and the maximum temperature of 105°F. It has been concluded that the equipment coolers are adequately sized to allow continuous operation of the equipment with the normal plant component cooling water conditions.

Post-LOCA Recirculation Phase

The component cooling water temperature during the post-LOCA recirculation phase is 152°F upon the initiation of recirculation and decays to 120°F within 24 hours. This cooling water services the SI recirculation pump motor coolers and the high head SI pump seal water coolers and lube oil coolers. The descriptions of the operability evaluations for these components follow.

SI Recirculation Pump Motors

The SI recirculation pump motors are totally enclosed water to air cooled motors. The motor exhaust air is cooled by heat exchangers and recirculated to the motor air intakes in an enclosed system. The increased component cooling water temperature will result in increased stator winding and bearing temperatures. These motors were originally qualified by WCAP-7829 for a containment ambient temperature of 324°F. Actual containment temperatures for Indian Point Units 2 and 3 will not exceed 270°F. This qualification demonstrated that the stator winding and bearing temperatures were well within acceptable limits with the ambient temperature of 324°F and various component cooling water temperatures.

Based on the results of WCAP-7829, the stator winding temperatures with increased cooling water temperatures are expected to remain within the maximum allowable temperature limit for Class F insulation systems. Thus no abnormal insulation degradation is expected to occur within the 24 hour period of component cooling water temperatures above 120°F. There will be no reduction of the motor qualified life. The motor bearing temperatures are predominantly dependent on the ambient temperature and not the component cooling water temperature. The test results for the ambient temperature of 324°F are bounding for the actual ambient temperature in conjunction with the increased component cooling water temperature. Therefore, the recirculation pump motors will remain operable for the component cooling water temperatures experienced during the post-LOCA recirculation phase.

Safety Injection Pumps

The safety injection pumps contain two mechanical seal coolers and a lube oil cooler which are serviced by component cooling water. The mechanical seal coolers are intended to maintain temperatures in the mechanical seal chambers within limits that will prevent abnormal seal wear. The lube oil cooler is required to maintain the oil temperature at a level which will provide adequate lubrication to the bearings and prevent accelerated viscosity breakdown. These coolers are supplied cooling water through a common header which delivers a total of 15 gpm. The evaluation considered that each cooler receives a cooling water flowrate of 5 gpm.

SI Pump Mechanical Seals

The high head SI pumps utilize John Crane mechanical seals. The mechanical seals are cooled by component cooling water which flows through the pump seal coolers. Seal chamber fluid is pumped by a pumping ring through the mechanical seal coolers and returned to the seal chambers. Mechanical seals are installed on both ends of the pump shaft and each seal has its own mechanical seal cooler.

The cooling water temperature to the seal coolers was determined to be 152°F at the beginning of the LOCA decaying to 120°F within 24 hours. The seal evaluation considered that 5 gpm of cooling water flows to each seal cooler. The seal chamber temperature is influenced by the pump suction temperature due to migration of the pumped fluid into the seal chamber. Therefore it was also considered that the pump suction temperature will correspond to the discharge temperature from the RHR heat exchanger at the beginning of the LOCA (approximately 215°F), reducing with time.

The effect of elevated temperatures on the seal would be an increase in seal wear and a reduction in seal life. Tests performed by the seal manufacturer with 300°F seal cavity temperatures with no seal cooling resulted in insignificant wear to the seals. The seal temperature conditions posed here are much less severe especially since there will be cooling of the seal cavity temperature from the seal coolers. Consequently, it was determined that the post-LOCA recirculation conditions will have little effect in reducing seal life. Lastly, both of these seals are furnished with a safety bushing which in the event of catastrophic failure to the primary seal will limit leakage from the seal to maintain the operability of the SI pump.

SI Pump Lube Oil Cooler

The safety injection pumps utilize a pressurized lubrication system which provides oil to the two shaft journal bearings and a thrust bearing. The hot oil leaving the bearings is drained to a 3 gallon reservoir. This reservoir is the source of oil for the lube oil pump which supplies oil through the lube oil cooler to the pump bearings. The oil used in the pumps has a nominal viscosity rating of 150 SSU at 100°F.

Increased component cooling water temperatures will result in increased oil temperatures at both the inlet and outlet of the pump bearings. The thrust bearing is the most sensitive to oil temperature and is the source of the majority of heat load in the oil system, thus only the thrust bearing must be evaluated for the increased oil temperatures. The journal bearings will be bounded by this evaluation since the heat load is less than the thrust bearing heat load.

A thermal evaluation of the oil cooler for a cooling water flow rate of 5 gpm demonstrated that there will be an 18 degree temperature differential between the cooling water entering the cooler and the oil exiting the cooler. At the maximum cooling water temperature of 152°F, the oil leaving the cooler will have a temperature of 170°F. This temperature corresponds to the thrust bearing inlet temperature. The thrust bearing was analyzed for nominal 150 SSU oil at a temperature of 170°F and the thrust load that will act on the bearing during the post-LOCA operating mode. The analysis demonstrated that the oil viscosity at 170°F is adequate to maintain an oil film thickness sufficient to prevent bearing failure. The analysis also predicted a maximum bearing metal temperature of 190°F and an oil outlet temperature from the bearing of 186°F. The bearing metal temperature is well below the limit of 200°F which will prevent accelerated bearing wear. The oil outlet temperature is slightly higher than the continuous operating limit of this oil, which is 185°F. However, for short term operation oil temperatures as high as 195°F are acceptable to prevent excessive oil viscosity breakdown, since oil breakdown is a function of both time and temperature. The cooling water temperature will drop by 3 degrees in less than 2 hours and the oil temperature at the bearing outlet will fall below the continuous operating limit within this very short period of time. Thus the analyses of the lube oil cooler and the thrust bearing have demonstrated that the increased component cooling water temperatures will have no detrimental effect on the functioning of the SI pump lube oil system.

RHR Pump Mechanical Seals

The RHR pump is equipped with a mechanical seal cooler which is serviced by component cooling water. The mechanical seal cooler is intended to maintain temperatures in the mechanical seal chamber within limits that will prevent abnormal seal wear. The RHR pump mechanical seals are manufactured by John Crane and are very similar in design to the high head SI pump mechanical seals. The RHR pump mechanical seals will be subjected to a peak pump suction temperature of 274 degrees, reducing with time, and a peak component cooling water temperature of 152 degrees F, also reducing with time. Thus the manufacturer test which qualified the seal for 300 degree F seal chamber temperatures with no seal cooling bounds the RHR pump mechanical seal operating conditions. It was determined that the increased component cooling water temperatures for the post-LOCA recirculation conditions will have an insignificant effect on the mechanical seal life and will not affect the pump operability.

Reactor Containment Fan Cooler Motors

The Reactor Containment Fan Cooler (RCFC) Motor coolers are cooled by

Service Water and are therefore evaluated for an increase in Service Water temperature to 90°F.

The RCFC motors are closed cycle air cooled units with an integral heat exchanger mounted in the base of the motor stand.

The heat exchanger is cooled with service water and maintains the motor circulating air temperature below maximum containment temperature for accident conditions. An increase of 5°F in the cooling water will cause a proportional small increase in the motor temperature which will not prevent the motor from performing its post accident function. Extended operation with 90°F water will result in a small reduction in qualified motor life.

Conclusion of Auxiliary Pump Evaluation

The auxiliary pumps and associated appurtenances have been evaluated for the increased component cooling water system temperatures. The evaluation determined that normal plant operation for extended periods of time with a cooling water temperature of 105°F will have no effect on the operability of the auxiliary pumps. The evaluation also determined that a post-LOCA cooling water temperature of 152°F decaying to 120°F within 24 hours will have no effect on the operability of the pumps during this short period of operation. Beyond this 24 hour period of operation, the pumps will remain capable of performing their long-term safety related functions with component cooling water temperatures below 120°F.

2. Provide sufficient cooled recirculation flow to prevent containment pressure from rising above design limits because of boiloff from the core.

The heat removal capability of one train of Containment Cooling Fans and one recirculation loop was assessed. The heat transfer through the RHR heat exchanger to the CCW in conjunction with the heat removed by the Containment Cooling Fans exceeded the decay heat load during the recirculation phase. Because the heat removal capability exceeds the decay heat load, the containment sump temperature decreases with time as reflected in the CCW temperature transient described above. It is our judgement, therefore, that adequate heat removal capability is provided to prevent the containment pressure from rising above design limits because of boiloff from the core during recirculation.

FSAR Chapter 6.2.2 (page 6.2-10) states that if one recirculation (or RHR) pump is in operation and one spray header valve is open, that no containment fans are required. This configuration (only one Recirculation Pump, and no Containment Cooling Fans available) is beyond the design basis as the Containment Air Recirculation Cooling and Filtration System and the Containment Spray System are both designed as a two train, redundant systems. The single failure of one train of safeguards will provide a minimum of one train (three out of five) of Containment Cooling Fans and one recirculation loop (Recirculation Pump, heat exchanger and spray header valve).

III. SUMMARY/CONCLUSIONS

Westinghouse believes that the continued operation of Indian Point Unit 3 is justified for a Service Water Temperature of 90°F based on the following:

1. Containment integrity has been reanalyzed with a Service Water temperature of 90°F and it has been determined that acceptable containment cooling is provided.

2. The Component Cooling Water System has been evaluated for a Service Water temperature of 90°F, and it has been determined that the CCW provides sufficient cooling to enable continued sump and core recirculation following a LOCA.

3. The recirculation loop/Component Cooling Water System and the Service Water/containment cooling fan heat removal capability is sufficient to prevent containment pressure from rising above design limits as a result of boiloff from the core during recirculation.

4. The CCWS can perform its cooling functions during normal operations with a Service Water Temperature of 90°F.

TELECOPY NO. 3263 ATTACHMENT 2

TO: L. GAROFOLO - WPO

FROM: A. B. YANCHITIS - UNITED

(1 PAGE)

August 9, 1988

Re: DIESEL GENERATOR COOLING FOR POST-LOCA

This teleocpy supercedes Telecopy 3262, sent on 8/?/88, which addressed only diesel generator cooling during the post LOCA injection phase. This telecopy addresses diesel generator cooling during both post-LOCA injection and recirculation.

As you requested, UNITED has performed an evaluation to determine if the Service Water (SW) system can adequately cool the diesel generator coolers during the post-LOCA injection phase when the river temperature is 90°F.

The condition that UNITED has evaluated is as follows:

*Service water flow: 400 gpm

River water temperature: 90°F

At these service water conditions, the diesel generator coolers can support a heat load of approximately 4.7 million Btu/hr provided that the heat exchangers are not fouled beyond design fouling. During the post-LOCA injection phase, diesel #32 would be operating at 2262 HP (per Table 8.2-1 of the FSAR) which corresponds to a heat load of 4.0 million Btu/hr. Since the coolers can support a heat load greater than the heat load applied, the service water system can provide adequate cooling at 90°F.

Diesel generator cooling during the post-LOCA recirculation phase was also evaluated for a service water temperature of 90°F. The results of this evaluation concluded that the diesel generators could be adequately cooled for the recirculation phase service water conditions (Reference Calculation Set 6604.219-8-SW-010). This evaluation assumed a guillotine break of the 10 inch SW header supplying the diesel generator coolers, which resulted in a service water flow rate of approximately 280 gpm to diesels 32 and 33.

Note that even at the maximum operating loads on the diesel generators during both the Post-LOCA injection and recirculation phases as defined in Table 8.2-1 of the FSAR, the diesels would remain operable for all post LOCA operating modes with a service water temperature of 90°F.

UNITED will formalize the results of the evaluation for the post-LOCA injection phase in a calculation set and submit it to NYPA by 8/19/88.

A. B. Yanchitis

* For conservatism, UNITED used a flow of 400 gpm, which corresponds to the coolers' design flow. The actual service water flow during injection, concurrent with a loss of instrument air, would be 440 gpm. (Reference Case 4 of the Service Water Evaluation Report).

ATTACHMENT 3

NEW YORK POWER AUTHORITY

NUCLEAR ENGINEERING AND DESIGN

SERVICE WATER TEMPERATURE ANALYSIS

REVISION	DATE	PREPARED BY	REVIEWED BY
0	8-5-88	D. DUNNING	J.L. BENCIVENGA
1	8-9-88	D. DUNNING	B.T. YOUNG

APPROVED BY:

Brian G. Young for K.M.

Director of Nuclear
Engineering & Design

8808240228

SERVICE WATER TEMPERATURE ANALYSIS

INTRODUCTION

The objective of this analysis was to evaluate the methodology used to determine the temperature of the river water entering the service water system. The analysis addressed the following areas:

1) Accuracy of the instrumentation used.
2) Determination of service water system inlet temperature.
3) Dynamics of the Hudson river Adjacent to the plant.

DISCUSSION

1. Accuracy of Instrumentation

The temperature of the river water entering the service water system is determined hourly by monitoring temperature readings at six different locations in the circulating water system of Unit #3. These readings are taken in each of the circulating water pipe inlets to the main condenser. The temperature sensors utilized are thermocouples which provide their signals to a central processing unit, the output of which is available to the plant operators. The indicated temperature readings have been verified to be within 0.5 degree F of calibrated thermometer readings at approximately 85°F.

2. Determination of Service Water System Temperature

Water temperature is measured across the entire face of the intake i.e., in each of the six circulating water inlet pipes. The temperature variation among the intake pipes during the summer is less than 1°F. This small temperature variation is due to the fact that river flow in front of the plant is highly dynamic and nonuniform. As a result of the small temperature variation across the intake, and the fact that the service water bays are located in the center of the intake, it is reasonable to assume that the arithmetic average of the six circulating water bay temperatures represents the temperature of the water entering the service water system.

3. <u>Hydrodynamics of the Hudson River Adjacent to the Plant</u>

The temperature that is observed during ebb tide represents the ambient temperature of the river in the Indian Point vicinity, i.e., that which exists without the recirculation of heated water discharged from the plant.

During ebb tide and slack before flood tide, heated water from the discharge canal is transported and remains downriver of the plant. Under these tidal conditions, the temperature of water withdrawn by the plant from the river would be that of ambient river water.

During flood tide and slack before ebb tide, heated water from the discharge canal that is recirculated in front of the intake, could increase the temperature of the river in the Indian Point vicinity by up to 5^{o}F. If the discharge of heated water into the river is terminated during slack before ebb tide, any residual heated water in front of Inddian Point would be relatively stationary. Under this scenario, water temperatures above river ambient that are due to the recirculation of heated discharge water, could occur for up to the length of the slack tide, i.e. approximately 1 hour. After slack tide, the water mass in front of the plant would be swept downriver by the ebb tide. If the discharge of heated water into the river is terminated during flood tide, the movement of the tide would displace heated water upriver where it would be diffused.

CONCLUSIONS

The methodology used to determine the temperature of the river water entering the service water system has been evaluated. It has been determined that the temperatures recorded at the circulating water inlets are accurate and that the average of these temperatures represents the temperature of the water entering the service water system. The highest temperature in the service water system would occur during the periodic recirculation of heated water discharged into the river during normal plant operation.

APPENDIX B TO IPN-88-035

TEN YEAR (1959-1969) AVERAGE

HUDSON RIVER TEMPERATURE

NEW YORK POWER AUTHORITY
INDIAN POINT 3 NUCLEAR POWER PLANT
DOCKET NO. 50-286
DPR-64

Table II-3. Ten-year (1959–1969) average Hudson River temperatures (°F) in the vicinity of Indian Point

Date	May		June		July		August		September		October	
	Maximum	Mean	Maximum	Mean	Maximum	Mean	Maximum	Mean	Maximum	Mean	Maximum	Mean
1	57.0	51.4	67.0	63.1	79.0	74.4	81.0	77.8	78.0	76.0	73.0	69.3
2	57.0	52.2	67.0	63.7	75.0	74.1	81.0	78.0	78.0	75.9	73.0	68.9
3	59.0	52.2	68.0	63.7	76.0	74.3	81.0	78.0	78.0	75.9	73.0	68.7
4	59.0	52.9	68.0	64.0	76.0	74.1	81.0	77.8	78.0	75.9	72.0	67.9
5	59.0	53.2	67.0	64.4	76.0	74.0	81.0	77.8	79.0	75.5	72.0	67.7
6	59.0	53.4	68.0	64.7	76.0	73.6	81.0	77.4	79.0	75.2	72.0	66.6
7	59.0	54.1	68.0	65.3	76.0	74.0	81.0	77.4	79.0	74.8	71.0	66.6
8	59.0	54.6	68.0	65.9	76.0	74.4	81.0	77.4	79.0	74.8	71.0	66.3
9	59.0	54.7	69.0	66.4	76.0	74.5	81.0	77.5	78.0	74.5	71.0	66.1
10	59.0	55.2	70.0	67.0	77.0	75.1	81.0	77.5	78.0	74.8	71.0	65.9
11	61.0	55.4	70.0	67.5	78.0	75.1	80.0	77.3	79.0	74.8	71.0	65.7
12	61.0	55.7	71.0	67.8	79.0	75.6	80.0	77.3	79.0	74.5	71.0	65.5
13	61.0	55.9	70.0	68.0	79.0	75.8	79.0	76.9	79.0	74.3	70.0	65.2
14	63.0	56.4	70.0	68.4	80.0	75.8	80.0	77.0	79.0	73.8	70.0	65.0
15	63.0	56.6	71.0	68.8	81.0	75.8	80.0	76.8	80.0	73.5	68.0	64.7
16	59.0	56.5	71.0	68.8	81.0	76.0	80.0	76.5	79.0	73.1	68.0	64.6
17	59.0	56.8	72.0	68.9	80.0	76.0	80.0	76.4	78.0	72.8	68.0	64.6
18	63.0	58.1	71.0	69.0	80.0	76.3	80.0	76.4	76.0	72.1	68.0	64.4
19	63.0	58.4	70.0	68.9	80.0	76.4	80.0	76.3	76.0	72.4	67.0	63.6
20	63.0	58.9	71.0	69.1	80.0	76.5	80.0	76.8	76.0	71.9	66.0	63.3
21	63.0	59.1	71.0	69.6	79.0	76.8	81.0	76.5	76.0	71.6	66.0	62.9
22	63.0	59.7	72.0	70.4	79.0	76.9	81.0	76.9	74.0	70.9	64.0	62.2
23	63.0	59.7	72.0	70.5	79.0	77.0	80.0	76.8	75.0	71.1	64.0	62.2
24	63.0	60.3	73.0	71.1	79.0	77.1	79.0	76.3	73.0	70.4	64.0	61.6
25	65.0	61.1	73.0	71.3	80.0	77.4	79.0	76.7	75.0	70.5	64.0	61.4
26	65.0	61.7	73.0	71.2	80.0	77.2	79.0	76.6	75.0	70.3	64.0	60.9
27	65.0	61.9	73.0	71.2	81.0	77.7	79.0	76.2	75.0	69.6	64.0	60.8
28	65.0	62.0	76.0	72.3	79.0	77.2	78.0	76.3	75.0	69.9	63.0	60.5
29	65.0	61.8	76.0	72.8	81.0	77.4	79.0	76.4	74.0	69.3	63.0	60.0
30	67.0	62.6	78.0	73.3	80.0	77.3	78.0	76.0	73.0	68.7	61.0	59.4
31	66.0	62.6			81.0	77.7	78.0	76.1			61.0	59.2

Source: U.S. Geological Survey data supplied by applicant (ER, IP-3, Suppl. 11, Table 9-1).