Attachment A

Technical Specification Page Revisions

Consolidated Edison Company of New York, Inc.
Indian Point Unit No. 2
Docket No. 50-247
August 10, 1988

2. The automatic Phase A containment isolation (trip) valves are actuated to the closed position either manually or by an automatically derived safety injection signal. The automatic Phase B containment isolation valves are tripped closed by automatic or manual containment spray actuation. The actuation system is designed such that no single component failure will prevent containment isolation if required.

C. Containment Systems

1. The containment vessel has an internal spray system which is capable of providing a distributed borated water spray of at least 2200 gpm. During the initial period of spray operation, sodium hydroxide would be added to the spray water to increase the removal of iodine from the containment atmosphere.[3]

2. The containment vessel has an internal recirculation system which includes five fan cooler units (centrifugal fans and water cooled heat exchangers), with a total heat removal capability of at least 308.5 MBTU/Hr. under conditions following a loss of coolant accident and at service water temperature of 90°F.[4] All of the fan cooler units are equipped with activated charcoal filters to remove volatile iodine following an accident.

References

(1) FSAR Section 5.1
(2) FSAR Section 5.1.2.7
(3) FSAR Section 6.3
(4) FSAR Section 6.4

Attachment B

Page Revision for Safety Assessment
Relating to Proposed
Technical Specification Amendment

Consolidated Edison Company of New York, Inc.
Indian Point Unit No. 2
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August 10, 1988

Safety Assessment

The proposed Technical Specification revisions in Attachment A would maintain the performance characteristics, operational flexibility and reliability of the essential service water system.

The proposed revisions to Technical Specification 5.2.C and Basis page 3.3-10 would revise the operability requirements of the fan cooler units to provide greater flexibility without affecting their safety function. Under the proposed amendment, this Technical Specification and Basis would be revised to maintain a total of 308.5 MBTU/Hr for 5 Fan Cooler Units.

The safety function of the fan coolers is to recirculate and cool the containment atmosphere in the event of a loss of coolant accident, thereby reducing the likelihood that the containment pressure would exceed its design value of 47 psig. Worst case containment pressure transients during hypothetical loss of coolant accidents were reanalyzed using the latest computer techniques and this reanalysis is contained in our June 12, 1987 submittal which was reviewed and approved by the NRC on June 29, 1988 by issuance of Technical Specification Amendment No. 132. The analysis shows that even during the worst case LOCA with minimum safeguards (3 fan coolers, 1 containment spray pump) the maximum containment pressure does not exceed 40.5 psig, which is well below design value. This peak pressure is calculated while using an assumed total FCU heat removal rate of 185.1 MBTU/Hr. This total heat removal rate can be obtained with 3 fan coolers at varying service water flows and river water temperatures as long as the assumed heat removal rate of 185.1 MBTU/Hr is maintained. In the June 29, 1988 approved license amendment the maximum service water temperature is 85°F which is based on 1400 GPM flow rate for each unit. To increase the maximum service water temperature to 90°F for the assumed heat removal rate of 185.1 MBTU/hr, a service water flow rate of 1510 GPM is required. In the original FSAR analysis, each fan cooler unit is designed to remove 81 MBTU/hr at a flow rate of 2000 GPM. Therefore, ample margin exists to accommodate a flow rate of 1510 GPM. Flow verification is accomplished by approved plant procedure. An assessment of the environmental qualification of electrical equipment inside containment based on other analysis was conducted and it is concluded that the margins in the current environmental qualification program would not be adversely affected by the proposed amendment. Hence, the minimum containment cooling safeguards requirements can be met with three fan cooler units and one spray pump under varying service water conditions, without having any adverse effects upon the health and safety of the public.

Attachment 1

Supplemental Safety Assessment

Consolidated Edison Company of New York, Inc.
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The currently effective IP-2 FSAR Table 9.6-1 lists essential Service Water System requirements. Not all of the equipment listed has safety related functions. The table highlights "Essential Service Water...." In this context, the table identifies equipment served by the Essential Service Water header. Not all of this equipment is safety-related. The effect of operating at up to 90°F Service Water System temperature on all the equipment listed in that table is described below:

1. Containment Cooling Coils - the impact of this temperature change was presented in our "Application for Emergency Amendment to Operating License" dated August 4, 1988. In that application it was concluded that the required heat removal capability of the fan cooler units is maintained under varying service water conditions, without having any adverse effects upon the health and safety of the public.

2. Component Coolers - Attachment 2 presents an evaluation by Westinghouse of the impact on Component Cooling Water System (CCW) safety functions of operating with a Service Water System temperature of up to 90°F. That evaluation confirmed the ability of the CCW System to perform its safety functions given that procedures exist requiring isolation of component cooling flow to the spent fuel heat exchanger during the recirculation phase of the accident if less than two Component Cooling Pumps are operable. Isolation of component cooling flow to the Spent Fuel Pool with alternate cooling utilizing water from either the primary water tank or the fire protection system has been within the design basis since plant inception. More recently the concept was reviewed by the NRC in the Safety Evaluation performed in conjunction with Amendment 75 to the operating license and found to be acceptable. The heat load on the spent fuel pool that was evaluated considered a full-core discharge after the last normal refueling discharge. This is a condition which is more severe than any condition which could result from the hypothetical accident heat load being considered for this amendment. Under these conditions the required makeup rate was 50 gpm. The primary water tank supply can be provided to the pool by either of two 150 gpm primary water makeup pumps. The primary water storage tank and the makeup pumps are seismic Category I; the piping from the tank to the spent fuel pool is classified as Seismic II. However it was analyzed as being equivalent to Seismic I piping.

   Based on the above evaluation and the institution of the changes to the Emergency Operating Procedures which has been completed, there is no degradation of the CCW safety functions.

3. Diesel Generators - The manufacturer of the diesel generators (ALCO) has provided component performance data and the results of their evaluation which concluded that changing the present diesel generator service water cooling to allow 90°F service water temperature will not adversely affect the operation of the diesel generators. An independent consultant has analyzed the original diesel generator lube oil/jacket water cooling system and confirmed ALCO's conclusions. The results indicate that at 90 degrees F service water inlet temperature to lube oil cooler and subsequent 93.8 degrees F service water inlet temperature to the jacket water cooler, the lube oil and jacket water will remain within the recommended temperature limits. Based on the manufacturer's conclusions and our independent evaluation, the Diesel Generators will not be adversely affected by a maximum Service Water temperature of 90°F.

4. Turbine Oil Coolers - These components do not have safety related functions.

5. Seal Oil Coolers/Steam Generator Feed Pump Oil Coolers - These components do not have safety related functions.

6. Radiation Sample Coolers - The radiation sample cooler mixes the samples from the containment coolers and motor coolers with service water supply to maintain a temperature below the 130°F alarm setpoint in CCR. The alarm response procedure instructs the operator to locally measure flow and ensure the essential service water supply valve to the mixing nozzle is open. This valve is normally throttled. The maximum environmental temperature is limited by the scintillation detector and is 160°F. If temperature exceeds 130°F the monitor could be isolated and manual sampling initiated. The above process will not change with the proposed change in service water temperature.

   New radiation monitors which are in the final stages of acceptance were designed to handle samples with temperatures between 60°F and 160°F. Again cooling water at 90°F will not adversely affect the operation of the radiation monitor.

7. Air Compressor Heat Exchanger - The operation of the Unit No. 2 Instrument Air ("IA") Compressors will not be affected by an increase in service water temperature to 90°F. A service water flow of 65 gpm is supplied to the IA compressors. Additional cooling capacity is now available for the system, as a consequence of removing the CCR Air Conditioning load (the only other previous load). The IA Compressors are not used during accident conditions. For a seismic event the IA operation is manually initiated, and the additional cooling capacity required would be available because of the reduction in flow required for the containment cooling coils. Therefore, adequate IA Compressor Cooling will be available.

8. Service Water Pump Strainer Blowdown - This is a flushing function of Service Water which is not dependent on the temperature of the liquid.

9. Central Control Room (CCR) Air Conditioner - As indicated in footnote "f" to Table 9.6-1, the CCR air conditioners no longer use service water for cooling purposes.

The Fan Cooler Unit Motor Coolers are not specifically addressed in table 9.6-1 but nevertheless have been evaluated. The Service Water System provides cooling to the air which provides the primary cooling to the motor coolers. Calculations have been performed to determine the impact on that air cooling of a service water temperature of 90°F. The calculated effect on both the inlet air and outlet air temperature in the motor cooler heat exchanger is a rise of approximately five degrees Farenheit. Con Edison Electrical Engineering has evaluated this change and determined that it will have no degrading effect on the motors.

Basis for No Significant Hazards Consideration Determination:

The Commission has provided guidance concerning the application of the standards for determining whether a significant hazards consideration exists by providing certain examples (48 FR 14870). Example (vi) of those involving no significant hazards consideration discusses a change which may reduce a safety margin but where the results are clearly within all acceptable criteria with respect to the system or component. The Proposed change to change the maximum service water temperature requirement is in a less restrictive direction and may initially appear to reduce a safety margin. However, consistent with the Commission's criteria in 10 CFR 50.92, we have determined that the proposed change does not involve a significant hazards consideration because the operation of Indian Point Unit No. 2 in accordance with this change would not:

(1) involve a significant increase in the probability or consequences of an accident previously evaluated. The proposed changes are based on conservative analyses which demonstrate that the performance of the safety-related equipment will continue without degrading its safety function. Thus, the same safety criteria as previously evaluated are still met with the proposed changes.

(2) create the probability of a new or different kind of accident from any accident previously evaluated. The proposed change to the maximum service water system temperature for the performance of safety-related equipment being supplied by the service water system does not modify the plant's configuration or operation, and therefore the identical postulated accidents are the only ones that require analysis and resolution. Nothing would be added or removed that would conceivably introduce a new or different kind of accident mechanism or initiating circumstance than that previously evaluated.

    In general, the proposed changes do not adversely affect the ability of plant systems to perform their required safety functions, and allow those plant systems to mitigate the consequences of a design basis accident in a manner equivalent to that previously approved.

(3) involve a significant reduction in a margin of safety. With the proposed change, safety criteria previously evaluated are still met, remain conservative, and continue to maintain the previous margins of safety.

    The safety function of the service water system is to provide a cooling water supply to equipment needed to perform safety related functions during hypothetical design basis accident conditions.

Therefore, based on the above, we conclude that the proposed changes do not constitute a significant hazards consideration.

The proposed changes have been reviewed by the Station Nuclear Safety Committee and the Consolidated Edison Nuclear Facilities Safety Committee. Both committees concur that these changes do not represent a significant hazards consideration.

Attachment 2

Component Cooling Water System Analysis

Consolidated Edison Company of New York, Inc.
Indian Point Unit No. 2
Docket No. 50-247
August 10, 1988

Justification for Continued Operation

With a Service Water Temperature of 90°F

at Indian Point Unit 2

I. BACKGROUND

Indian Point Unit 2 has requested an evaluation of acceptable plant operation with a Service Water temperature of 90°F. The Service Water System, among other functions, 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 Component Cooling Water.

Component Cooling Water System

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

1. Supply the necessary service 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 and the Recirculation Pump motor. 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 6.2-10)

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 only one Component Cooling Water Pump and heat exchanger are required to meet the core cooling function.

II. EVALUATION

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 as a 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 RHR pump mechanical seals if the 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 exchanger 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, or alternate cooling sources (primary or city water) should be provided to cool the safety injection pumps (if the safety injection pumps are required for small break LOCAs).

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 (4)
- 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 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 87°F could result in CCWS temperatures greater than 105°F, [illegible] Acceptable CCW performance is maintained however, with a service water temperature of 90°F, if CCW temperature remains below 105°F.

Component Evaluation

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 (No. 22)

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 188°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.

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 6.2.2.1.2 (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. As stated in FSAR Section 6.4.3.1 (page 6.4-24), following a LOCA both the containment spray and the containment fan cooler sytems are placed in operation. During the injection phase of the accident, a minimum of one spray pump and three of five fan coolers are in operation. The heat removal requirement for the design basis accident is met with this minimum requirement during both the injection and recirculation phase. 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 2 is justified based on the following:

1. 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.

2. 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.

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

Attachment 3

Chesterton Mechanical Seal Analysis

Consolidated Edison Company of New York, Inc.
Indian Point Unit No. 2
Docket No. 50-247
August 10, 1988

Evaluation of Chesterton Mechanical
Seals with a Service Water Temperature of 90°F

SI Pump Mechanical Seals (No. 21 and 23)

The high head SI pumps utilize Chesterton 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. The 5 degree increase of river water temperature which will effect a subsequent increase in cooling water will not affect the A. W. Chesterton seals adversely. This conclusion is based on known temperature ratings for the various component parts as defined by the attached published data sheets. 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 is 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.

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 Chesterton 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 qualified the seal for 300 degrees F seal chamber temperatures with no seal cooling which bounds the RHR pump mechanical seal operating conditions. It can be 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.

When downtime and labor are considered... CHESTERTON® 123 CARTRIDGE SEALS prove their worth

COMPARE THESE TYPICAL LABOR TIMES FOR BACK PULL OUT (BPO) PUMPS

17 STEPS TO REPLACE PACKING WITH PACKING

1. Remove old packing.
2. Clean bore to remove stuck on packing fibers.
3. If necessary remachine bore to prevent roughness from hanging up packing as it is slid into box.
4. Smooth out sleeve (filing, sanding, etc.).
5. If wear is too severe, replace sleeve.
6. Check runout and endplay.
7. Cut rings on a mandrel or pump sleeve.
8. Check packing manufacturer's instructions for special recommendations of break-in lubricant.
9. Tamp each ring into place one at a time, avoid gaps on cut ends—remember to stagger the joints.
10. If used, make sure lantern ring is positioned under flush inlet.
11. Tighten gland nuts finger tight.
12. Jog pump, look for small stream.
13. Start up pump and adjust gland for desired leakage.
14. Let pump run for four to six hours with constant monitoring and periodic gland adjustment.
15. Finally, readjust gland for optimum leakage control.
16. Readjust on regular basis to control leakage.
17. Add a ring of packing as needed.

16 STEPS TO REPLACE A SEAL WITH CONVENTIONAL SINGLE SEALS

1. Remove old seal.
2. Thoroughly clean old sleeve if a rubber bellows was used.
3. Replace sleeve if fretting has occurred.
4. Check runout and endplay.
5. If needed, adjust impeller prior to assembly of pump.
6. Put Blue Layout Fluid or similar dye on shaft.
7. Reassemble stuffing box to pump.
8. Mark position of stuffing box face on shaft.
9. Remove stuffing box.
10. Measure and mark installation dimension from face of stuffing box mark on shaft.
11. Slide on seal components.
12. Position rotary on the new mark and tighten down.
13. Replace stuffing box.
14. Use shim stock and center stationary and gland around shaft.
15. Tighten gland nuts.
16. Remove shim stock.

6 STEPS TO REPLACE PACKING OR SEAL WITH CHESTERTON 123 CARTRIDGE SEAL

1. Remove old seal or packing.
2. Check runout and endplay.
3. Slide seal on shaft.
4. Replace stuffing box.
5. Tighten gland nuts and set screws.
6. Remove centering clips.

CHESTERTON CARTRIDGE SEALS SAVE DOWNTIME, LABOR, MONEY

CHESTERTON® TWO WAY PROGRAM FOR REPLACEMENT

1) Spare Seal Program
Provides replacement for all wearing parts at a fraction of the cost of a new seal. You will be purchasing the following NEW internal components:

a. Rotary with carbon face
b. Stationary face
c. Springs
d. Set screws
e. Centering clips
f. O-rings
g. Retaining rings
h. Gasket

2a) Exchange Program
If you return the used rotary and stationary units you will receive an exchange spare seal (all parts listed in 1) except that the rotary and stationary units will be rebuilt and in "like new" condition.

2b) A complete exchange seal is also available for customers who do not have the facilities to rebuild their own seals.

CHESTERTON EXCLUSIVE WARRANTY PROGRAM

If for any reason a new 123 seal fails and has to be removed within 90 days of start-up, return the rotary and stationary with warranty card. An exchange spare seal will be returned at ½ its normal cost.

CHESTERTON 123 SEAL TECHNICAL DATA

U.S. Patent No. 3972536
G.B. Patent No. 1513940

Materials
- All 316 and 316L stainless steel construction throughout.
- Pure 658RC carbon rotary face.
- 99.5% Alumina ceramic or solid tungsten carbide stationary face.
- Hastelloy "C" springs.
- Fluorocarbon (Viton or Fluorel) o-rings supplied as standard. Ethylene Propylene o-rings supplied as spares. Kalrez o-rings are available upon request.

Temperature
Determined by o-ring used.
- Fluorocarbon o-rings 400°F (205°C) maximum.
- Ethylene Propylene o-rings 300°F (150°C) maximum. STS
- Kalrez* o-rings 500°F (260°C). Higher temperatures possible for specific operating conditions. RHR

Pressure
Varies with size and shaft speed.
400 psi (28 kg/cm²) maximum.

Sizes
New sizes constantly being added.
See your Chesterton distributor for latest information.

*DuPont's registered trademark.

A.W. CHESTERTON CO.
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