

Mr. Stephen E. Quinn
Vice President, Nuclear Power
Consolidated Edison Company
of New York, Inc.
Broadway and Bleakley Avenue
Buchanan, NY 10511

SUBJECT: INDIAN POINT NUCLEAR GENERATING UNIT NO. 2 - CORRECTION TO
AMENDMENT NOS. 188 AND 191 (TAC NOS. M96370 AND M96548)

Dear Mr. Quinn:

On March 31, 1997, and April 23, 1997, the Commission issued Amendment Nos. 188 and 191, respectively, to Facility Operating License No. DPR-26 for Indian Point Nuclear Generating Unit No. 2. The amendments implemented changes to Technical Specification (TS) Section 3.3, Engineered Safety Features.

TS Section 3.3 was revised as part of Amendment No. 188; however, upon issuance of Amendment No. 191, the changes incorporated as part of Amendment 188 were inadvertently omitted. Copies of the corrected TS pages are enclosed. Also enclosed is the bases change you submitted by letter dated March 12, 1997.

We regret any inconvenience this oversight may have caused. If you have any questions, please call me at (301) 415-1421.

Sincerely,

original signed by G.Wunder for
Jefferey F. Harold, Project Manager
Project Directorate I-1
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Docket No. 50-247

Enclosure: As stated

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UNITED STATES
NUCLEAR REGULATORY COMMISSION

WASHINGTON, D.C. 20555-0001

June 27, 1997

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Vice President, Nuclear Power
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of New York, Inc.
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A handwritten signature in cursive script, appearing to read "Jefferey F. Harold".

for
Jefferey F. Harold, Project Manager
Project Directorate I-1
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

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Stephen E. Quinn
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of New York, Inc.

Indian Point Nuclear Generating
Station Units 1/2

cc:

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3.3 ENGINEERED SAFETY FEATURES

Applicability

Applies to the operating status of the Engineered Safety Features.

Objective

To define those limiting conditions for operation that are necessary (1) to remove decay heat from the core in emergency or normal shutdown situations, (2) to remove heat from containment in normal operating and emergency situations, (3) to remove airborne iodine from the containment atmosphere following a Design Basis Accident, (4) to minimize containment leakage to the environment subsequent to a Design Basis Accident.

Specifications

The following specifications apply except during low-temperature physics tests.

A. SAFETY INJECTION AND RESIDUAL HEAT REMOVAL SYSTEMS

1. The reactor shall not be made critical except for low-temperature physics tests, unless the following conditions are met:
 - a. The refueling water storage tank contains not less than 345,000 gallons of water with a boron concentration of at least 2000 ppm.
 - b. Deleted
 - c. The four accumulators are pressurized to a minimum of 598 psig and a maximum of 685 psig and each contains a minimum of 723 ft³ and a maximum of 875 ft³ of water with a boron concentration of at least 2000 ppm. None of these four accumulators may be isolated.
 - d. Three safety injection pumps together with their associated piping and valves are operable.
 - e. Two residual heat removal pumps and heat exchangers together with their associated piping and valves are operable.

- f. Two recirculation pumps together with the associated piping and valves are operable.
 - g. Valves 842 and 843 in the mini-flow return line from the discharge of the safety injection pumps to the RWST are de-energized in the open position.
 - h. Valves 856A, C, D and E, in the discharge header of the safety injection header, are in the open position. Valves 856B and F, in the discharge header of the safety injection header, are in the closed position. The hot-leg valves (856B and F) shall be closed with their motor operators de-energized by locking out the circuit breakers at the Motor Control Centers.
 - i. The four accumulator isolation valves shall be open with their motor operators de-energized by locking out the circuit breakers at the Motor Control Centers.
 - j. Valve 1810 on the suction line of the high-head SI pumps and valves 882 and 744, respectively on the suction and discharge line of the residual heat removal pumps, shall be blocked open by de-energizing the valve-motor operators.
 - k. The refueling water storage tank low-level alarms are operable and set to alarm between 74,200 gallons and 99,000 gallons of water in the tank.
2. During power operation, the requirements of 3.3.A.1 may be modified to allow any one of the following components to be inoperable at any one time. If the system is not restored to meet the requirements of 3.3.A.1 within the time period specified, the reactor shall be placed in the hot shutdown condition utilizing normal operating procedures. If the requirements of 3.3.A.1 are not satisfied within an additional 48 hours, the reactor shall be placed in the cold shutdown condition utilizing normal operating procedures.
- a. One safety injection pump may be out of service, provided the pump is restored to operable status within 24 hours and the remaining two pumps are operable.

- b. One residual heat removal pump may be out of service, provided the pump is restored to operable status within 24 hours and the other residual heat removal pump is operable.
 - c. One residual heat removal heat exchanger may be out of service provided that it is restored to operable status within 48 hours.
 - d. Any valve required for the functioning of the system during and following accident conditions may be inoperable provided that it is restored to operable status within 24 hours and all valves in the system that provide the duplicate function are operable.
 - e. Deleted
 - f. One refueling water storage tank low-level alarm may be inoperable for up to 7 days provided the other low-level alarm is operable.
3. When RCS temperature is less than or equal to 305°F, the requirements of Table 3.1.A-2 regarding the number of safety injection (SI) pumps allowed to be energized shall be adhered to.

B. CONTAINMENT COOLING AND IODINE REMOVAL SYSTEMS

- 1. The reactor shall not be made critical unless the following conditions are met:
 - a. The recirculation fluid pH control system shall be operable with ≥ 8000 lbs. (148 cu. ft.) of trisodium phosphate (w/12 hydrates), or equivalent, available in storage baskets in the containment.
 - b. The five fan cooler-charcoal filter units and the two spray pumps, with their associated valves and piping, are operable.
- 2. During power operation, the requirements of 3.3.B.1 may be modified to allow any one of the following components to be inoperable. If the system is not restored to meet the requirements of 3.3.B.1 within the time period specified, the reactor shall be placed in the hot shutdown condition utilizing normal operating procedures. If the requirements of 3.3.B.1 are not satisfied within an additional 48 hours, the reactor shall be placed in the cold shutdown condition utilizing normal operating procedures.

- a. One fan cooler unit may be inoperable during normal reactor operation for a period not to exceed 7 days provided both containment spray pumps are operable.
- b. One containment spray pump may be inoperable during normal reactor operation, for a period not to exceed 72 hours, provided the five fan cooler units and the remaining containment spray pump are operable.
- c. Any valve required for the functioning of the system during and following accident conditions may be inoperable provided it is restored to operable status within 7 days or 72 hours for the fan cooler or containment spray systems respectively, and all valves in the system that provide the duplicate function are operable.
- d. The storage baskets in the containment may contain less than the required amount of trisodium phosphate during normal reactor operation for a period not to exceed 72 hours.

C. ISOLATION VALVE SEAL WATER SYSTEM (IVSWS)

- 1. The reactor shall not be brought above cold shutdown unless the following requirements are met:
 - a. The IVSWS shall be operable.
 - b. The IVSW tank shall be maintained at a minimum pressure of 52 psig and contain a minimum of 144 gallons of water.
- 2. The requirements of 3.3.C.1 may be modified to allow any one of the following components to be inoperable at any one time:
 - a. Any one header of the IVSWS may be inoperable for a period not to exceed seven consecutive days.
 - b. Any valve required for the functioning of the system during and following accident conditions may be inoperable provided it is restored to an operable status within seven days and all valves in the system that provide a duplicate function are operable.

3. If the IVSWS system is not restored to an operable status within the time period specified, then:
 - a. If the reactor is critical, it shall be brought to the hot shutdown condition utilizing normal operating procedures. The shutdown shall start not later than at the end of the specified time period.
 - b. If the reactor is subcritical, the reactor coolant system temperature and pressure shall not be increased more than 25°F and 100 psi, respectively, over existing values.
 - c. In either case, if the IVSW System is not restored to an operable status within an additional 48 hours, the reactor shall be brought to the cold shutdown condition utilizing normal operating procedures. The shutdown shall start no later than the end of the 48-hour period.

D. WELD CHANNEL AND PENETRATION PRESSURIZATION SYSTEM (WC & PPS)

1. The reactor shall not be brought above cold shutdown unless:
 - a. All required portions of the four WC & PPS zones are pressurized at or above 47 psig.
 - b. The uncorrected air consumption for the WC & PPS is less than or equal to 0.2% of the containment volume per day.
2. The requirements of 3.3.D.1 may be modified as follows:
 - a. Any one zone of the WC & PPS may be inoperable for a period not to exceed seven consecutive days.
 - b. The uncorrected air consumption for the WC & PPS may be in excess of 0.2% of the containment volume per day for a period not to exceed seven consecutive days.

- c. With a portion of the weld channel pressurization system inoperable, and it is determined that it is not repairable by any practicable means, then that portion may be disconnected from the system.
3. If the WC & PP System is not restored to an operable status within the time period specified, then:
 - a. If the reactor is critical, it shall be brought to the hot shutdown condition utilizing normal operating procedures. The shutdown shall start no later than at the end of the specified time period.
 - b. If the reactor is subcritical, the reactor coolant system temperature and pressure shall not be increased more than 25°F and 100 psi, respectively, over existing values.
 - c. In either case, if the WC & PP System is not restored to an operable status within an additional 48 hours, the reactor shall be brought to the cold shutdown condition utilizing normal operating procedures. The shutdown shall start no later than the end of the 48-hour period.

E. COMPONENT COOLING SYSTEM

1. The reactor shall not be made critical unless the following conditions are met:
 - a. Three component cooling pumps together with their associated piping and valves are operable.
 - b. Two auxiliary component cooling pumps together with their associated piping and valves are operable.
 - c. Two component cooling heat exchangers together with their associated piping and valves are operable.
2. During power operation, the requirements of 3.3.E.1 may be modified to allow one of the following components to be inoperable at any one time. If the system is not restored to meet the conditions of 3.3.E.1 within the time period specified, the reactor shall be placed in the hot shutdown condition utilizing normal

operating procedures. If the requirements of 3.3.E.1 are not satisfied within an additional 48 hours, the reactor shall be placed in the cold shutdown condition utilizing normal operating procedures.

- a. One of the three operable component cooling pumps may be out of service provided the pump is restored to operable status within 14 days.
- b. An additional component cooling pump may be out of service provided a second pump is restored to operable status within 24 hours.
- c. One auxiliary component cooling pump may be out of service provided the pump is restored to operable status within 24 hours and the other pump is operable.
- d. One component cooling heat exchanger or other passive component may be out of service for a period not to exceed 48 hours provided the system may still operate at design accident capability.

F. SERVICE WATER SYSTEM

1. DESIGNATED ESSENTIAL HEADER

- a. The reactor shall not be above 350°F unless three service water pumps with their associated piping and valves are operable on the designated essential header.
- b. When the reactor is above 350°F and one of the three service water pumps or any of its associated piping or valves is found inoperable, and an essential service water header that meets the requirements of 3.3.F.1.a. cannot be restored within 12 hours, the reactor shall be placed in the hot shutdown condition within the next 6 hours and subsequently cooled below 350°F using normal operating procedures.

2. DESIGNATED NON-ESSENTIAL HEADER

- a. The reactor shall not be above 350°F unless two service water pumps with their associated piping and valves are operable on the designated non-essential header.
- b. When the reactor is above 350°F and one of the two service water pumps or any of its associated piping or valves is found inoperable, and a non-essential service water header that meets the requirements of 3.3.F.2.a cannot be restored within 24 hours, the reactor shall be placed in the hot shutdown condition within the next 6 hours and subsequently cooled below 350°F using normal operating procedures.

3. INTERCONNECTION OF HEADERS

Isolation shall be maintained between the essential and non-essential headers at all times when the reactor is above 350°F except for a period of up to 8 hours when the header may be connected to facilitate safety-related activities.

4. SERVICE WATER INLET TEMPERATURE

- a. The reactor shall not be above 350°F unless the service water inlet temperature is less than or equal to 95°F, or
- b. When the reactor is above 350°F and the service water inlet temperature exceeds 95°F, the reactor shall be placed in the hot shutdown condition within the next 7 hours and subsequently cooled below 350°F using normal operating procedures.
- c. The provisions of Specification 3.0.1 do not apply.

5. SERVICE WATER INLET TEMPERATURE MONITORING INSTRUMENTATION

- a. The service water inlet temperature monitoring instrumentation shall measure the Hudson River water temperature at the Indian Point Unit No. 2 intake structure,

- b. The service water inlet temperature monitoring instrumentation shall be operable when intake water temperature, averaged over a 24 hour period, reaches 80°F, and when the reactor is above 350°F,
- c. When the requirements of Specification 3.3.F.5.b apply, temperature measurements shall be taken every 4 hours up to and including a service water inlet temperature of 90°F; when the service water inlet temperature exceeds 90°F, temperature measurements shall be taken once an hour,
- d. If the service water inlet temperature monitoring instrumentation is declared inoperable, it shall be either restored to operable status or alternative measurements shall be taken with a calibrated portable instrument within the applicable measurement time frame requirements of Specification 3.3.F.5.c, and
- e. If the requirements of Specification 3.3.F.5.d cannot be met, the reactor shall be placed in the hot shutdown condition within the next 7 hours and subsequently cooled below 350°F using normal operating procedures.

G. HYDROGEN RECOMBINER SYSTEM AND POST-ACCIDENT CONTAINMENT VENTING SYSTEM

- 1. The reactor shall not be made critical unless the following conditions are met:
 - a. Both hydrogen recombiner units together with their associated piping, valves, oxygen supply system and control system are operable, with the exception of one recombiner unit's equipment located outside the containment which may be inoperable, provided it is under repair and can be made operable if needed.
 - b. The post-accident containment venting system is operable.
 - c. Hydrogen and oxygen supplies shall not be connected to the hydrogen recombiner units except under conditions of an accident or those specified in Specification 4.5.C.1.

2. During power operation, the requirements of 3.3.G.1 may be modified to allow any one of the following components to be inoperable. If the system is not restored to meet the requirements of 3.3.G.1 within the time specified, the reactor shall be placed in the hot shutdown condition utilizing normal operating procedures.
 - a. One hydrogen recombiner unit or its associated flow path, or oxygen supply system or control system may be inoperable for a period not to exceed thirty days, provided the other recombiner unit and the post-accident containment venting system are operable.
 - b. The post-accident containment venting system may be inoperable for a period not to exceed thirty days provided that both hydrogen recombiners are operable.

H. CONTROL ROOM AIR FILTRATION SYSTEM

1. The control room air filtration system shall be operable at all times when containment integrity is required.
2. From the date that the control room air filtration system becomes and remains inoperable for any reason, operations requiring containment integrity are permissible only during the succeeding 3.5 days. At the end of this 3.5 days period, if the conditions for the control room air filtration system cannot be met, the reactor shall be placed in the hot shutdown condition utilizing normal operating procedures. If the conditions are not satisfied within an additional 48 hours, the reactor shall be placed in the cold shutdown condition utilizing normal operating procedures.
3. Two independent toxic gas detection systems, each capable of detecting chlorine and anhydrous ammonia shall be operable at all times except as specified in 3.a, 3.b, or 3.c below. The alarm/trip setpoints for the chlorine and anhydrous ammonia gas detection systems shall be adjusted to actuate at a toxic gas concentration of less than or equal to 3.5 ppm and 25 ppm, respectively.
 - a. With one toxic gas detection system inoperable, restore the inoperable detection system to operable status within 7 days.

- b. If 3.a above cannot be satisfied within the specified time, then, within the next 60 hours, initiate and maintain operation of the control room ventilation system in the recirculation mode of operation.
- c. With both toxic gas detection systems inoperable for any one toxic gas, within one hour initiate and maintain operation of the control room ventilation in the recirculation mode of operation.

I. CABLE TUNNEL VENTILATION FANS

1. The reactor shall not be made critical unless the two cable tunnel ventilation fans are operable.
2. During power operation, the requirement of 3.3.1.1 may be modified to allow one cable tunnel ventilation fan to be inoperable for seven days, provided the other fan is operable.

Basis

The normal procedure for starting the reactor is, first, to heat the reactor coolant to near operating temperature by running the reactor coolant pumps. The reactor is then made critical by withdrawing control rods and/or diluting boron in the coolant⁽¹⁾. With this mode of start-up, the energy stored in the reactor coolant during the approach to criticality is substantially equal to that during power operation, and therefore the minimum required engineered safeguards and auxiliary cooling systems are required to be operable. During low-temperature physics tests there is a negligible amount of stored energy in the reactor coolant; therefore, an accident comparable in severity to the Design Basis Accident is not possible, and the engineered safeguards systems are not required.

When the reactor is critical, the probability of sustaining both a major accident and a simultaneous failure of a safeguards component to operate as designed is necessarily very small. Thus operation with the reactor critical with minimum safeguards operable for a limited period does not significantly increase the probability of an accident having consequences which are more severe than the Design Basis Accident.

The operable status of the various systems and components is to be demonstrated by periodic tests, defined by Specification 4.5. A large fraction of these tests will be performed while the reactor is operating in the power range. If a component is found to be inoperable, it will be possible in most cases to effect repairs and restore the system to full operability within a relatively short time. Inoperability of a single component does not negate the ability of the

system to perform its function⁽²⁾, but it reduces the redundancy provided in the reactor design and thereby limits the ability to tolerate additional equipment failures. To provide maximum assurance that the redundant component(s) will operate if required to do so, the redundant component(s) are to be tested prior to initiating repair of the inoperable component. If it develops that (1) the inoperable component is not repaired within the specified allowable time period, or (2) a second component in the same or related system is found to be inoperable, the reactor will initially be put in the hot shutdown condition to provide for reduction of the decay heat from the fuel and consequent reduction of cooling requirements after a postulated loss-of-coolant accident. This will also permit improved access for repairs in some cases. After a limited time in hot shutdown, if the malfunction(s) are not corrected, the reactor will be placed in the cold shutdown condition, utilizing normal shutdown and cooldown procedures. In the cold shutdown condition there is no possibility of an accident that would release fission products or damage the fuel elements.

The plant operating procedures require immediate action to effect repairs of an inoperable component, and therefore in most cases repairs will be completed in less than the specified allowable repair times. The specified repair times do not apply to regularly scheduled maintenance of the engineered safeguards systems, which is normally to be performed during refueling shutdowns. The limiting times to repair are based on two considerations:

1. assurance with high reliability that the safeguard system will function properly if required to do so, and
2. allowance of sufficient time to effect repairs using safe and proper procedures.

Assuming the reactor has been operating at full-rated power for at least 100 days, the magnitude of the decay heat decreases after initiating hot shutdown. Thus the requirement for core cooling in case of a postulated loss-of-coolant accident while in the hot shutdown condition is significantly reduced below the requirements for a postulated loss-of-coolant accident during power operation. Putting the reactor in the hot shutdown condition significantly reduces the potential consequences of a loss-of-coolant accident, and also allows more free access to some of the engineered safeguards components in order to effect repairs.

Failure to complete repairs within 48 hours of going to the hot shutdown condition is considered indicative of a requirement for major maintenance, and therefore in such a case the reactor is to be put into the cold shutdown condition.

Valves 1810, 744 and 882 are kept in the open position during plant operation to assure that flow passage from the refueling water storage tank will be available during the injection phase of a loss-of-coolant accident. As an additional assurance of flow passage availability, the valve

motor operators are de-energized to prevent an extremely unlikely spurious closure of these valves to take place. This additional precaution is acceptable since the ability to manually re-establish power to close valves 1810 and 882, following the injection phase, is tolerable as a single failure. Valve 744 will not need to be closed following the injection phase. The accumulator isolation valve motor operators are de-energized to prevent an extremely unlikely spurious closure of these valves from occurring when accumulator core cooling flow is required.

With respect to the core cooling function, there is some functional redundancy for certain ranges of break sizes. The measure of effectiveness of the Safety Injection System is the ability of the pumps and accumulators to keep the core flooded or to reflood the core rapidly where the core has been uncovered for postulated large area ruptures. The result of the performance is to sufficiently limit any increase in clad temperature below a value where emergency core cooling objectives are met⁽⁹⁾. The range of core protection as a function of break diameter provided by the various components of the Safety Injection System is presented in Figure 6.2-9 of the UFSAR.

The requirement regarding the maximum number of SI pumps that can be energized when RCS temperature is less than or equal to 305°F is discussed under Specification 3.1.A.

The containment cooling function is provided by two independent systems: (1) fan-coolers plus charcoal filters and (2) containment spray. 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 95°F)⁽¹²⁾. In the event of a Design Basis Accident, sufficient cooling to reduce containment pressure at a rate consistent with limiting offsite doses to acceptable values is provided by three fan-cooler units and one spray pump. These constitute the minimum safeguards and are capable of being operated on emergency power with one diesel generator inoperable.

The iodine removal function is provided by two independent operating trains of the containment spray system. In the event of a Design Basis Accident, one containment spray pump provides sufficient flow to remove air borne elemental and particulate iodine at a rate consistent with limiting offsite doses to acceptable values.

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 offsite power or operation of all emergency diesel generators.

The operability of the recirculation fluid pH control system ensures that there is sufficient trisodium phosphate (TSP) available in containment to guarantee a sump pH ≥ 7.0 during the recirculation phase of a postulated LOCA. This pH level is required to reduce the potential for

chloride induced stress corrosion of austenitic stainless steel and assure the retention of iodine in the recirculating fluid. The specified amounts of TSP will result in recirculation fluid pH between 7.0 and 9.5.

One of the five fan cooler units is permitted to be inoperable during power operation. This is an abnormal operating situation, in that the normal plant operating procedures require that an inoperable fan-cooler be repaired as soon as practical.

However, because of the difficulty of gaining access to make repairs, it is important on occasion to be able to operate temporarily without at least one fan-cooler. Compensation for this mode of operation is provided by the high degree of redundancy of containment cooling systems during a Design Basis Accident.

The Component Cooling System is different from the system discussed above in that the pumps are so located in the Auxiliary Building as to be accessible for repair after a loss-of-coolant accident⁽⁶⁾. During the recirculation phase following a loss-of-coolant accident, only one of the three component cooling pumps is required for minimum safeguards⁽⁷⁾. With two operable component cooling pumps, 100% redundancy will be provide. A total of three operable component cooling pumps will provide 200% redundancy. The 14 day out of service period for the third component cooling pump is allowed since this is the 200% redundant pump.

A total of six service water pumps are installed. Only two of the set of three service water pumps on the header designated the essential header are required immediately following a postulated loss-of-coolant accident⁽⁸⁾. The limit on the service water maximum inlet temperature assures that the service water and component cooling water systems will be able to dissipate the heat loads generated in the limiting design basis accident.⁽¹²⁾

During the second phase of the accident, one additional service water pump on the non-essential header will be manually started to supply the minimum cooling water requirements for the component cooling loop.

The limits for the accumulators and their pressure and volume assure the required amount of water injection following a loss-of-coolant accident, and are based on the values used for the accident analysis⁽⁹⁾.

Two independent diverse systems are provided for removal of combustible hydrogen from the containment building atmosphere: (1) the hydrogen recombiners, and (2) the post-accident containment venting system. Either of the two (2) hydrogen recombiners or the post-accident containment venting system are capable of wholly providing this function in the event of a design basis accident.

Two full-rated hydrogen recombination systems are provided in order to control the hydrogen evolved in the containment following a loss-of-coolant accident. Either system is capable of preventing the hydrogen concentration from exceeding 2% by volume within the containment. Each system is separate from the other and is provided with redundant features. Power supplies for the blowers and ignitors are separate, so that loss of one power supply will not affect the remaining system. Hydrogen gas is used as the externally supplied fuel. Oxygen gas is added to the containment atmosphere through a separate containment feed to prevent depletion of oxygen in the air below the concentration required for stable operation of the combustor (12%). The containment atmosphere sampling system consists of a sample line which originates in each of the containment fan cooler units. The fan and sampling pump head together are sufficient to pump containment air in a loop from the fan cooler through a containment penetration to a sample vessel outside the containment, and then through a second penetration to the sample termination inside the containment. The design hydrogen concentration for operating the recombiner is established at 2% by volume. Conservative calculations indicate that the hydrogen content within the containment will not reach 2% by volume until 13 days after a loss-of-coolant accident. There is therefore no need for immediate operation of the recombiner following an accident, and the quantity of hydrogen fuel stored at the site will be only for periodic testing of the recombiners.

The Post-Accident Containment Venting System consists of a common penetration line which acts as a supply line through which hydrogen-free air can be admitted to the containment, and an exhaust line, with parallel valving and piping, through which hydrogen-bearing gases from containment may be vented through a filtration system.

The supply flow path makes use of instrument air to feed containment. The nominal flow rate from either of the two instrument air compressors is 200 scfm. If the instrument air system is not available, the station air system is available as a backup.

The exhaust line penetrates the containment and then is divided into two parallel lines. Each parallel line contains a pressure sensor and all the valves necessary for controlling the venting operation. The two lines then rejoin and the exhaust passes through a flow sensor and a temperature sensor before passing through roughing, HEPA and charcoal filters. The exhaust is then directed to the plant vent.

The post-accident containment venting system is a passive system in the sense that a differential pressure between the containment and the outside atmosphere provides the driving force for the venting process to take place. The system is designed such that a minimum internal containment pressure of 2.14 psig is required for the system to operate properly.

The flow rate and the duration of venting required to maintain the hydrogen concentration at or below 3 percent of the containment volume are determined from the containment hydrogen concentration measurements and the hydrogen generation rate. The containment pressure necessary to obtain the required vent flow is then determined. Using one of the air compressors, hydrogen-free air is pumped into the containment until the required containment pressure is reached. The air supply is then stopped and the supply/exhaust line is isolated by valves outside the containment. The addition of air to pressurize the containment dilutes the hydrogen; therefore, the containment will remain isolated until analysis of samples indicates that the concentration is again approaching 3 percent by volume. Venting will then be started. This process of containment pressurization followed by venting is repeated as may be necessary to maintain the hydrogen concentration at or below 3 volume percent.

The post-accident venting system is used only in the absence of hydrogen recombiners and only when absolutely necessary. From the standpoint of minimizing offsite radiation doses, the optimum starting time for the venting system, if needed, is the latest possible time after the accident. Consistent with this philosophy, the selected venting initiation point of 3 percent hydrogen maximizes the time period before venting is required while at the same time allows a sufficient margin of safety below the lower flammability limit of hydrogen.

The control room air filtration system is designed to filter the control room atmosphere for intake air and/or for recirculation during control room isolation conditions. The control room system is designed to automatically start upon control room isolation. Control room isolation is initiated either by a safety injection signal or by detection of high radioactivity in the control room. If the control room air filtration system is found to be inoperable, there is no immediate threat to the control room and reactor operation may continue for a limited period of time while repairs are being made. If the system cannot be repaired within 3.5 days, the reactor is placed in the hot shutdown condition.

The control room ventilation system is equipped with toxic gas detection systems consisting of redundant monitors capable of detecting chlorine and anhydrous ammonia. These toxic gas detection systems are designed to isolate the control room from outside air upon detection of toxic concentration of the monitored gases in the control room ventilation system. The operability of the toxic gas detection systems provides assurance that the control room operators will have adequate time to take protective action in the event of an accidental toxic gas release. Selection of the gases to be monitored and the setpoint established for the monitors are based on the results described in the Indian Point Unit No. 2 Control Room Habitability Study dated June 10, 1991.

The cable tunnel is equipped with two temperature-controlled ventilation fans. Each fan has a capacity of 21,000 cfm and is connected to a 480v bus. One fan will start automatically when

the temperature in the tunnel reaches 100°F. Under the worst conditions, i.e., loss of outside power and all the Engineering Safety Features in operation, one ventilation fan is capable of maintaining the tunnel temperature below 104°F. Under the same worst conditions, if no ventilation fans were operating, the natural air circulation through the tunnel would be sufficient to limit the gross tunnel temperature to below the tolerable value of 140°F. However, in order to provide for ample tunnel ventilation capacity, the two ventilation fans are required to be operable when the reactor is made critical. If one ventilation fan is found inoperable, the other fan will ensure that cable tunnel ventilation is available.

Valves 856A, C, D and E are maintained in the open position during plant operation to assure a flow path for high-head safety injection during the injection phase of a loss-of-coolant accident. Valves 856B and F are maintained in the closed position during plant operation to prevent hot-leg injection during the injection phase of a loss-of-coolant accident. As an additional assurance of preventing hot-leg injection, the valve motor operators are de-energized to prevent spurious opening of these valves. Power will be restored to these valves at an appropriate time in accordance with plant operating procedures after a loss-of-coolant accident in order to establish hot-leg recirculation.

Valves 842 and 843 in the mini-flow return line from the discharge of the safety injection pumps to the refueling water storage tank are de-energized in the open position to prevent an extremely unlikely spurious closure which would cause the safety injection pumps to overheat if the reactor coolant system pressure is above the shutoff head of the pumps.

The specified quantities of water for the RWST include unavailable water (4687 gals) in the tank bottom, inaccuracies (24,800 gals) in the alarm setpoints, the minimum quantity required during the injection (246,000 gals)⁽¹²⁾ for accident mitigation and the minimum quantity required during the recirculation phase (60,000 gals) for accident mitigation. The minimum RWST inventory (i.e., 345,000 gals) provides approximately 9,500 gallons margin.

The seven-day out-of-service period for the Weld Channel and Penetration Pressurization System and the Isolation Valve Seal Water System is allowed because no credit has been taken for operation of these systems in the calculation of offsite accident doses should an accident occur. No other safeguards systems are dependent on operation of these systems⁽¹¹⁾. The minimum pressure settings for the IVSWS and WC & PPS during operation assures effective performance of these systems and assures that the containment design pressure of 47 psig is not exceeded. Portions of the Weld Channel Pressurization System are in areas that are not accessible, such as below the concrete floor of containment or in high radiation areas. If it is determined that it is not practicable to repair an inoperable portion of the system, then that portion may be disconnected.

References

- (1) UFSAR Section 9
- (2) UFSAR Section 6.2
- (3) DELETED
- (4) UFSAR Section 6.4
- (5) Reference Deleted
- (6) UFSAR Section 9.3
- (7) UFSAR Section 9.3
- (8) UFSAR Section 9.6.1
- (9) UFSAR Section 14.3
- (10) Indian Point Unit No. 2, UFSAR Sections 6.2 and 6.3 and the Safety Evaluation accompanying "Application for Amendment to Operating License" sworn to by Mr. William J. Cahill, Jr. on March 28, 1977.
- (11) UFSAR Sections 6.5 and 6.6
- (12) WCAP-12312, "Safety Evaluation for An Ultimate Heat Sink Temperature to 95°F at Indian Point Unit 2", July, 1989.

4.5 ENGINEERED SAFETY FEATURES

Applicability

Applies to testing of the Safety Injection System, the Containment Spray System, the Hydrogen Recombiner System, and the Air Filtration System.

Objective

To verify that the subject systems will respond promptly and perform their design functions, if required.

Specifications

A. SYSTEM TESTS

1. Safety Injection System

- a. System tests shall be performed at each reactor Refueling Interval (#). With the Reactor Coolant System pressure less than or equal to 350 psig and temperature less than or equal to 350°F, a test safety injection signal will be applied to initiate operation of the system. The safety injection pumps are made inoperable for this test.
- b. The test will be considered satisfactory if control board indication and visual observations indicate that all components have received the safety injection signal in the proper sequence and timing; that is, the appropriate pump breakers shall have opened and closed, and the appropriate valves shall have completed their travel.
- c. Conduct a flow test of the high head safety injection system after any modification is made to either its piping and/or valve arrangement.
- d. Verify that the mechanical stops on Valves 856 A, C, D and E are set at the position measured and recorded during the most recent ECCS operational flow test or flow tests performed in accordance with (c) above. This surveillance procedure shall be performed

following any maintenance on these valves or their associated motor operations and at a convenient outage if the position of the mechanical stops has not been verified in the preceding three months.

B. CONTAINMENT SPRAY SYSTEM

1. System tests shall be performed at each reactor Refueling Interval (#). The tests shall be performed with the isolation valves in the spray supply lines at the containment blocked closed. Operation of the system is initiated by tripping the normal actuation instrumentation.
2. The spray nozzles shall be tested for proper functioning at least every five years.
3. The test will be considered satisfactory if visual observations indicate all components have operated satisfactorily.

C. HYDROGEN RECOMBINER SYSTEM

1. A complete recombiner system test shall be performed at each Refueling Interval (#) on each unit. The test shall include verification of ignition and attainment of normal operating temperature.
2. A complete control system test shall be performed at intervals not greater than six months on each unit. The test shall consist of a complete dry run startup using artificially generated signals to simulate light off.
3. The above tests will be considered satisfactory if visual observations and control panel indication indicate that all components have operated satisfactorily.
4. Each recombiner air-supply blower shall be started at least at two-month intervals. Acceptable levels of performance shall be that the blowers start, deliver flow, and operate for at least 15 minutes.

D. CONTAINMENT AIR FILTRATION SYSTEM

Each air filtration unit specified in Specification 3.3.B shall be demonstrated to be operable:

1. At least once per 31 days by initiating, from the control room, flow through the HEPA filters and charcoal adsorbers and verifying that the unit operates for at least 15 minutes.
2. At least once every Refueling Interval (#), or (1) after any structural maintenance on the HEPA filters or charcoal adsorber housings, or (2) at any time painting, fire or chemical releases could alter filter integrity by:
 - a. verifying a system flow rate at ambient conditions of 65,600 cfm \pm 10% during filtration unit operation when tested in accordance with ANSI N510-1975. Verify that the flow rate through the charcoal adsorbers is \geq 8,000 cfm.
 - b. verifying that the HEPA filters and/or charcoal adsorbers satisfy the in-place testing acceptance criteria and uses the test procedures of Regulatory Positions C.5.a and C.5.c of Regulatory Guide 1.52, Revision 2, March 1978, at ambient conditions and at a flow rate of 65,600 cfm \pm 10% for the HEPA filters.
 - c. verifying within 31 days after removal that a laboratory analysis of a representative carbon sample obtained in accordance with Regulatory Position C.6.b of Regulatory Guide 1.52, Revision 2, March 1978, meets the laboratory testing criteria of Regulatory Position C.6.a (except for Position C.6.a(1)) of Regulatory Guide 1.52, Revision 2, March 1978.
3. After every 720 hours of charcoal adsorber operation, by verifying within 31 days after removal that a laboratory analysis of a representative carbon sample obtained in accordance with Regulatory Position C.6.b of Regulatory Guide 1.52, Revision 2, March 1978, meets the laboratory testing criteria of Regulatory Position C.6.a (except for Position C.6.a(1)) of Regulatory Guide 1.52, Revision 2, March 1978.
4. At least once every Refueling Interval (#) by:
 - a. Verifying that the pressure drop across the moisture separator and HEPA filters is less than 6 inches Water Gauge while operating the filtration unit at ambient conditions and at a flow rate of 65,600 cfm \pm 10%.
 - b. Verifying that the unit starts automatically on a Safety Injection Test Signal.

5. After each complete or partial replacement of a HEPA filter bank, by verifying that the HEPA filter banks remove greater than or equal to 99% of the DOP when they are tested in-place in accordance with ANSI N510-1975 while operating the unit at ambient conditions and at a flow rate of 65,600 cfm \pm 10%.
6. After each complete or partial replacement of a charcoal adsorber bank, verify that the flow rate through the charcoal adsorbers is \geq 8,000 cfm when the system is operating at ambient conditions and a flow rate of 65,600 cfm \pm 10% when tested in accordance with ANSI N510-1975.

E. CONTROL ROOM AIR FILTRATION SYSTEM

The control room air filtration system specified in Specification 3.3.H shall be demonstrated to be operable:

1. At least once per 31 days by initiating, from the control room, flow through the HEPA filters and charcoal adsorbers and verifying that the system operates for at least 15 minutes.
2. At least once every Refueling Interval(#) or (1) after any structural maintenance on the HEPA filter or charcoal adsorber housings, or (2) at any time painting, fire or chemical releases could alter filter integrity by:
 - a. verifying a system flow rate, at ambient conditions, of 1840 cfm \pm 10% during system operation when tested in accordance with ANSI N510-1975.
 - b. verifying that, with the system operating at ambient conditions and at a flow rate of 1840 CFM \pm 10% and exhausting through the HEPA filters and charcoal adsorbers, the total bypass flow of the system to the facility vent, including leakage through the system diverting valves, is less than or equal to 1% when the system is tested by admitting cold DOP at the system intake.
 - c. verifying that the system satisfies the in-place testing acceptance criteria and uses the test procedures of Regulatory Positions C.5.a, C.5.c and C.5.d of Regulatory Guide 1.52, Revision 2, March 1978, at ambient conditions and at a flow rate of 1840 cfm \pm 10%.

7. Each toxic gas detection system shall be demonstrated operable by performance of a channel check at least once per day, a channel test at least once per 31 days and a channel calibration at least once each Refueling Interval(#).

F. FUEL STORAGE BUILDING AIR FILTRATION SYSTEM

The fuel storage building air filtration system specified in Specification 3.8 shall be demonstrated operable:

1. At least once per 31 days by initiating, from the control room, flow through the HEPA filters and charcoal adsorbers and verifying that the system operates for at least 15 minutes.
2. At each refueling, prior to refueling operations, or (1) after any structural maintenance on the HEPA filter or charcoal adsorber housings, or (2) at any time painting, fire or chemical releases could alter filter integrity by:
 - a. verifying a system flow rate at ambient conditions of 20,000 cfm \pm 10% during system operation when tested in accordance with ANSI N510-1975.
 - b. verifying that the system satisfies the in-place testing acceptance criteria and uses the test procedures of Regulatory Positions C.5.a, C.5.c and C.5.d of Regulatory Guide 1.52, Revision 2, March 1978, at ambient conditions and at a flow rate of 20,000 cfm \pm 10%.
 - c. verifying within 31 days after removal that a laboratory analysis of a representative carbon sample obtained in accordance with Regulatory Position C.6.b of Regulatory Guide 1.52, Revision 2, March 1978, meets the laboratory testing criteria of Regulatory Position C.6.a of Regulatory Guide 1.52, Revision 2, March 1978.
3. Prior to handling spent fuel which has decayed for less than 35 days, verify within 31 days after removal that a laboratory analysis of a representative carbon sample obtained in accordance with Regulatory Position C.6.b of Regulatory Guide 1.52, Revision 2, March 1978, meets the laboratory testing criteria of Regulatory Position C.6.a of Regulatory Guide 1.52, Revision 2, March 1978. Such an analysis is good for 720 hours of charcoal adsorber operation. After 720 hours of operation, if spent fuel with a decay time of less than 35 days is still being handled, a new sample is required along with a new analysis.

4. At each refueling prior to refueling operations by:
 - a. verifying that the pressure drop across the combined HEPA filters and charcoal adsorber banks is less than 6 inches water gauge while operating the system at ambient conditions and at a flow rate of 20,000 cfm $\pm 10\%$.
 - b. verifying that the system maintains the spent fuel storage pool area at a pressure less than that of the outside atmosphere during system operation.
5. After each complete or partial replacement of a HEPA filter bank, by verifying that the HEPA filter banks remove greater than or equal to 99% of the DOP when they are tested in-place in accordance with ANSI N510-1975 while operating the system at ambient conditions and at a flow rate of 20,000 cfm $\pm 10\%$.
6. After each complete or partial replacement of a charcoal adsorber bank, by verifying that the charcoal adsorbers remove greater than or equal to 99.95% of a halogenated hydrocarbon refrigerant test gas when they are tested in-place in accordance with ANSI N510-1975 while operating the system at ambient conditions and at a flow rate of 20,000 cfm $\pm 10\%$.

G. POST-ACCIDENT CONTAINMENT VENTING SYSTEM

The post-accident containment venting system shall be demonstrated operable:

1. At least once every Refueling Interval(#), or (1) after any structural maintenance on the HEPA filter or charcoal adsorber housings, or (2) at any time painting, fire or chemical releases could alter filter integrity by:
 - a. verifying no flow blockage by passing flow through the filter system.
 - b. verifying that the system satisfies the in-place testing acceptance criteria and uses the test procedures of Regulatory Positions C.5.a, C.5.c and C.5.d of Regulatory Guide 1.52, Revision 2, March 1978, at ambient conditions and at a flow rate of 200 cfm $\pm 10\%$.

- c. at Refueling Intervals (#), verify within 31 days after removal that a laboratory analysis of a representative carbon sample obtained in accordance with Regulatory Position C.6.b of Regulatory Guide 1.52, Revision 2, March 1978, meets the laboratory testing criteria of Regulatory Position C.6.a of Regulatory Guide 1.52, Revision 2, March 1978.
2. After every 720 hours of charcoal adsorber operation, by verifying within 31 days after removal that a laboratory analysis of a representative carbon sample obtained in accordance with Regulatory Position C.6.b of Regulatory Guide 1.52, Revision 2, March 1978, meets the laboratory testing criteria of Regulatory Position C.6.a of Regulatory Guide 1.52, Revision 2, March 1978.
 3. At least once every Refueling Interval(#) by:
 - a. verifying that the pressure drop across the combined HEPA filters and charcoal adsorber banks is less than 6 inches water gauge while operating the system at ambient conditions and at a flow rate of 200 cfm $\pm 10\%$.
 - b. verifying that the system valves can be manually opened.
 4. After each complete or partial replacement of a HEPA filter bank, by verifying that the HEPA filter banks remove greater than or equal to 99% of the DOP when they are tested in-place in accordance with ANSI N510-1975 while operating the system at ambient conditions and at a flow rate of 200 cfm $\pm 10\%$.
 5. After each complete or partial replacement of a charcoal adsorber bank, by verifying that the charcoal adsorbers remove greater than or equal to 99.95% of a halogenated hydrocarbon refrigerant test gas when they are tested in-place in accordance with ANSI N510-1975 while operating the system at ambient conditions and at a flow rate of 200 cfm $\pm 10\%$.

H. RECIRCULATION FLUID PH CONTROL SYSTEM

1. The recirculation fluid pH control system shall be demonstrated operable each Refueling Interval (#) by visually verifying that:
 - a. The trisodium phosphate storage baskets are in place, and

- b. they have maintained their integrity, and
- c. they contain at least the minimum amount of trisodium phosphate.

Basis

The Safety Injection System and the Containment Spray System are principal plant safeguards that are normally inoperative during reactor operation. Complete systems tests cannot be performed when the reactor is operating because a safety injection signal causes reactor trip, main feedwater isolation and containment isolation, and a Containment Spray System test requires the system to be temporarily disabled. The method of assuring operability of these systems is, therefore, to combine systems tests to be performed during plant refueling shutdowns, with more frequent component tests, which can be performed during reactor operation.

The refueling systems tests demonstrate proper automatic operation of the Safety Injection and Containment Spray Systems. With the pumps blocked from starting, a test signal is applied to initiate automatic action and verification made that the components receive the safety injection signal in the proper sequence. The test demonstrates the operation of the valves, pump circuit breakers, and automatic circuitry⁽¹⁾.

During reactor operation, the instrumentation which is depended on to initiate safety injection and containment spray is generally checked daily and the initiating circuits are tested monthly (in accordance with Specification 4.1). The testing of the analog channel input is accomplished in the same manner as for the reactor protection system. The engineered safety features logic system is tested by means of test switches to simulate inputs from the analog channels. Test switches are also provided down stream of the master relay output contacts. The purpose of these test switches is to prevent actuation of engineered safety features equipment during testing. Verification that the logic is accomplished is indicated by the matrix test light and/or master relay operation.

Other systems that are also important to the emergency cooling function are the accumulators, the Component Cooling System, the Service Water System and the containment fan coolers. The accumulators are a passive safeguard. In accordance with Specification 4.1, the water volume and pressure in the accumulators are checked periodically. The other systems mentioned operate when the reactor is in operation and, by these means, are continuously monitored for satisfactory performance.

For the four flow distribution valves (856 A, C, D and E), verification of the valve mechanical stop adjustments is performed periodically to provide assurance that the high head safety injection flow distribution is in accordance with flow values assumed in the core cooling analysis.

The hydrogen recombiner system is an engineered safety feature which would be used only following a loss-of-coolant accident to control the hydrogen evolved in the containment. The system is not expected to be started until approximately 13 days have elapsed following the accident. At this time the hydrogen concentration in the containment will have reached 2% by volume, which is the design concentration for starting the recombiner system. Actual starting of the system will be based upon containment atmosphere sample analysis. The complete functional tests of each unit at refueling shutdown will demonstrate the proper operation of the recombiner system. More frequent tests of the recombiner control system and air-supply blowers will assure operability of the system. The biannual testing of the containment atmosphere sampling system will demonstrate the availability of this system.

The recirculation fluid pH control system is a passive safeguard with the baskets of trisodium phosphate located in the containment sump area. Periodic visual inspections are required (Refueling#) to verify the storage baskets are in place, have maintained their integrity, and filled with trisodium phosphate.

The charcoal portion of the in-containment air recirculation system is a passive safeguard which is isolated from the cooling air flow during normal reactor operation. Hence the charcoal should have a long useful lifetime. The filter frames that house the charcoal are stainless steel and should also last indefinitely. However, the required periodic visual inspections will verify that this is the case. The iodine removal efficiency cannot be measured with the filter cells in place. Therefore, at periodic intervals a representative sample of charcoal is to be removed and tested to verify that the efficiency for removal of methyl iodide is obtained⁽²⁾. Such laboratory charcoal sample testing together with the specified in-place testing of the HEPA filters will provide further assurance that the criteria of 10 CFR 100 continue to be met.

The control room air filtration system is designed to filter the control room atmosphere for intake air and/or for recirculation during control room isolation conditions. The control room air filtration system is designed to automatically start upon control room isolation. High-efficiency particulate absolute (HEPA) filters are installed upstream of the charcoal adsorbers to prevent clogging of these adsorbers. The charcoal adsorbers are installed to reduce the potential intake of radioiodine by control room personnel. The required in-place testing and the laboratory charcoal sample testing of the HEPA filters and charcoal adsorbers will provide assurance that Criterion 19 of the General Design Criteria for Nuclear Power Plants, Appendix A to 10 CFR Part 50 continues to be met.

The fuel storage building air filtration system is designed to filter the discharge of the fuel storage building atmosphere to the plant vent. This air filtration system is designed to start automatically upon a high radiation signal. Upon initiation, isolation dampers in the ventilation system are designed to close to redirect air flow through the air treatment system. HEPA filters and charcoal adsorbers are installed to reduce potential releases of radioactive material to the atmosphere. Nevertheless, as required by Specification 3.8.B.6, the fuel storage building air filtration system must be operating whenever spent fuel is being moved unless the spent fuel has had a continuous 35-day decay period. The required in-place testing and the laboratory charcoal sample testing of the HEPA filters and charcoal adsorbers will provide added assurance that the criteria of 10 CFR 100 continue to be met.

The post-accident containment venting system may be used in lieu of hydrogen recombiners for removal of combustible hydrogen from the containment building atmosphere following a design basis accident. As was the case for hydrogen recombiner use, this system is not expected to be needed until approximately 13 days have elapsed following the accident. Use of the system will be based upon containment atmosphere sample analysis and availability of the hydrogen recombiners. When in use, HEPA filters and charcoal adsorbers will filter the containment atmosphere discharge prior to release to the plant vent. The required in-place testing and laboratory charcoal sample testing will verify operability of this venting system and provide further assurance that releases to the environment will be minimized.

As indicated for the previously mentioned engineered safety feature (ESF) air filtration systems, high-efficiency particulate absolute (HEPA) filters are installed upstream of the charcoal adsorbers to prevent clogging of these adsorbers. The charcoal adsorbers are installed to reduce the potential release of radioiodine to the environment. The laboratory charcoal sample testing periodically verifies that the charcoal meets the iodine removal efficiency requirements of Regulatory Guide 1.52, Revision 2. Should the charcoal of any of these filtration systems fail to satisfy the specified test acceptance criteria, the charcoal will be replaced with new charcoal which satisfies the requirements for new charcoal outlined in Regulatory Guide 1.52, Revision 2.

References

- (1) UFSAR Section 6.2
- (2) UFSAR Section 6.4

1. In this instance Refueling Interval is defined by R#.