John D. O'Toole
Vice President

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4 Irving Place, New York, NY 10003
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May 27, 1982

Re: Indian Point Unit No. 2
Docket No. 50-247

Director of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

ATTN: Mr. Steven A. Varga, Chief
Operating Reactors Branch No. 1
Division of Licensing

Dear Mr. Varga:

Attachment A to this letter provides Con Edison's response to your March 30, 1982 request for additional information. The information provided herein has been reviewed by both Con Edison and the Power Authority.

Should you or your staff have any further questions, please contact us.

Very truly yours,

for J. O'Toole

attach.
cc: J. P. Bayne, Sr. Vice President
Nuclear Generation
Power Authority of the State of New York
10 Columbus Circle
New York, N. Y. 10019

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ATTACHMENT A

Con Edison's Response to NRC's
March 30, 1982 Request for Additional Information

Consolidated Edison Company of New York, Inc.
Indian Point Unit No. 2
Docket No. 50-247
May, 1982

Request No. 1 - Functional Routing of Cables:

At Indian Point Unit 3, protection system instrument cables are divided into four channels with a separate raceway system provided for each channel. Engineered safeguards power and control cables are divided into three basic channel systems with a separate raceway system provided for each channel. Also reactor trip and containment isolation power and control cables are divided into two channels with a separate raceway system provided for each channel.

At Unit 2, it is unclear as to the number of raceway systems provided to maintain channel separation. The licensee has documented that "separation is provided on a function by function basis. There is a minimum two channel raceway throughout with a third or fourth raceway provided at points where required." In addition, our Fire Protection Safety Evaluation Report has documented that "the reactor protection and engineered safety system cable circuits are divided into as many channels as is required to preserve the basic redundancy and independence of the systems." There is a possibility that only two separate raceway systems are provided at Unit 2 for the three engineered safeguards channels while Unit 3 has three separate raceway systems, one for each channel. Please provide additional information for the Indian Point Unit 2 design to clarify this issue. If there are only two separate raceway systems provided at Unit 2 for the three engineered safeguards/channels, please provide additional justification for the Indian Point 2 design.

RESPONSE:

The Indian Point 2 cable raceway systems are divided into four separate channels similar to Indian Point 3. The more extensive use of a "minimum of two separate channels" for heavy power (voltage level C) and control and small power (voltage level K) is enabled by extra hardware and components in the Indian Point 2 design that do not exist at Indian Point 3. Dual circuit breakers are used to route feeds from separate 480 volt safeguards buses 2A and 3A within the third power train to selected safeguards components (2 Service Water Pumps, 1 Safety Injection Pump and 1 Emergency Diesel). This allows power and control associated with one of these dual intra-train breakers to be routed in Train A and power and control associated with the alternate breaker to be routed in Train B. Thus a separate "Train C" routing for these components is not required to meet single failure in the raceway system.

Similarly the large number of components and the excess containment cooling capacity provided by the various combinations of 2 Containment Spray Pumps and 5 Recirculation Fan Coolers permits the routing of power and control for these components on buses 2A and 3A in two power trains. The "minimum of two separate channels" for control is also based on the two channel reactor protection system and engineered safeguards logic systems (Train A and Train B), which are identical to the two train logic arrangement at Indian Point 3. The only difference between the logics at both plants is that the diesel sequencing portion of the logics is located in the Control Room at Indian Point 2 while at Indian Point 3 it is located at the 480 volt switchgear and is divided into 3 separate channels. (For additional logic sequencing details, see the response to Request No. 5 below).

As stated previously, the Indian Point 2 cable raceway systems are divided into four channels similar to Indian Point 3. Within these four channels voltage level separation is also provided between instrumentation cable (J voltage level), control and small power cables (K and D voltage level), heavy power cables (C voltage level), and Diesel D.C. control feeds (F voltage level). For Indian Point 2, each voltage level includes as many separate channels as are required to preserve the basic redundancy and independence of the systems. For instrument cables, this requires four separate channels throughout. For control and small power cables, this requires a minimum of two separate channels throughout, a third in many portions of the raceway system and a fourth [illegible] as required. For heavy power cables, this requires a minimum of two separate channels throughout and a third channel in most portions of

the raceway system. For diesel and switchgear D.C. control feeds, this originally required a minimum of 2 separate channels but has been upgraded to 4 separate channels as part of the improvements made to the 125 VDC supplies for the 480V Switchgear and the diesels. (See response to Request No. 2 below).

The functional routing of cables (i.e., separation among the different channels and trains) is primarily of interest with regard to postulated fire initiated events. The subject of functional routing of cables was included in the fire analysis portion of the recently completed Indian Point Probabilistic Safety Study (IPPSS) (Ref: Sections 7.3.1 and 7.3.2 of the IPPSS for Indian Point 2 and Indian Point 3, respectively). A comparison of both fire analyses will demonstrate that even from the probabilistic point of view, the differences between the units with regard to raceway separation have an insignificant impact on the overall risk from fire induced accident sequences.

In summary, both the Unit 2 and Unit 3 designs incorporate sufficient redundancy and separation in the functional routing of cables to assure acceptability. In fact, the Indian Point Probabilistic Safety Study has found sufficient diversity, redundancy and separation to support an adequate response to numerous severe accident initiators including challenges by such events as fire and seismic.

Request No. 2 - Automatic Transfer of D.C. Loads Between Redundant Power Sources:

Diesel generator and 480 volt switchgear control power loads for Unit 2 are automatically transferred between redundant power sources. In justification of this difference, the licensee has indicated that both Unit 3 and the proposed Unit 2 design satisfy the requirements of Regulatory Guide 1.6.

Based on our review of both Unit 2 and Unit 3 designs, we agree with the licensee's justification in regard to Unit 3 but disagree that Unit 2 meets Regulatory Guide 1.6. Position D.4.c of Regulatory Guide 1.6 states: "No provisions should exist for automatically transferring loads between redundant power sources." The proposed Unit 2 design makes provision for automatically transferring loads between redundant power sources. Please provide additional justification for the Indian Point 2 design.

RESPONSE:

The Staff position stated in the March 30, 1982 letter describes the previous Indian Point Unit No. 2 DC power system. As pointed out in Con Edison's May 9, 1980 90-day response to the NRR Director's February 11, 1980 Confirmatory Order, the original Indian Point 2 plant design incorporated automatic transfer of DC loads for the diesel generators and 480VAC safeguards buses between redundant station batteries 21 and 22. These two batteries also supply all the redundant load requirements for safeguards logic trains, DC solenoids, etc. Our May 9, 1980 submittal referenced an earlier April 23, 1980 Con Edison letter which described modifications being planned at that time to eliminate the automatic transfer of loads between batteries 21 and 22. The proposed modifications were approved by the NRC Staff by letter dated May 2, 1980 and were implemented during the unit's 1980/1981 refueling/maintenance outage. These modifications utilized the more recently installed batteries 23 and 24 as the "swing" batteries and eliminated the transfer of loads between batteries 21 and 22. Thus, the added reliability of an automatic DC transfer capability was maintained while at the same time eliminating the automatic transfer of loads between

redundant batteries 21 and 22. The present automatic transfer capability for DC loads is as follows:

Control Power Load	Primary Supply DC Power Panel	Backup Supply DC Power Panel
Bus 2A	22	24
Bus 3A	21	23
Bus 5A	21	23
Bus 6A	22	24
D.G. 21	21	23
D.G. 22	22	23
D.G. 23	22	24

Therefore, at least two of the four batteries must fail before a single diesel generator or 480V safeguards bus would be lost. This means that for Indian Point 2, an entire DC battery/power panel can be lost and yet all diesel generators and 480V safeguards power buses will still have control power and no components will be lost. By comparison, plants with a completely unitized design will lose a diesel generator and associated safeguards power bus on the loss of a single DC battery/power panel.

The Unit 2 and Unit 3 DC power systems were evaluated as part of the electric power system analyses in Sections 1.5.2.2.1 and 1.6.2.2.1 (Sections 1.3.5.12.2 and 1.3.6.12.2 provide additional point estimate analyses) of the Indian Point Probabilistic Safety Study (IPPSS). The Indian Point 2 portion of the analysis incorporates the present modified DC power system in the model. Tha major loads for each battery bus are listed in Table 1.5.2.2.1-6 of the IPPSS. As can be seen from that Table as well, batteries 23 and 24 are not the primary sources of DC power for any of the control power loads and, therefore, the DC automatic transfer devices do not affect the redundant primary source of DC control power (i.e., power transfer operations following a loss of voltage at DC power panel 21 do not affect DC power panel 22).

In summary, Unit No. 2, as modified during the 1980/1981 refueling/maintenance outage, exceeds the requirements of Regulatory Guide 1.6 by providing increased reliability against redundant electrical component failures and maintains adequate separation to prevent an increase in the probability of common mode failures.

Request No. 3 - A Single Backup AC Power Source for Each of Four Instrument Buses:

There is one difference between Unit 2 and 3 which should be justified by Unit 3. Unit 3 has a single alternate source of backup AC power to all instrument buses while each instrument bus at Unit 2 has its own backup AC power source.

In justification of this remaining difference, the licensee stated that both Unit 2 and the proposed Unit 3 designs meet present criteria.

We disagree with this justification. The single backup AC power source for the four instrument buses in Unit 3 with no restrictions on number of buses that can be simultaneously connected or definitive limiting conditions for operation does not meet present criteria. Please provide additional justification for the Indian Point Unit 3 design.

RESPONSE:

As indicated by letter to NRC dated April 29, 1982 from the Power Authority of the State of New York, the Indian Point Unit 3 technical specifications permit only one of the four 118 VAC vital instrument buses to be supplied from the backup AC power source during unit operation. Thus, a limiting condition for operation already exists for the backup power source. This limiting condition was also acknowledged in Section 1.6.2.2.1.2.4 of the IPPSS. The Unit 3 electric power system models did not include cases in which more than one instrument bus was powered from the backup supply, because such cases would be a direct violation of the technical specifications.

Request No. 4 -- Concurrent Undervoltage and SI or Turbine Trip Signal Needed to Transfer to Onsite Power:

AC power from the Unit 3 diesel generators is automatically connected to the 480 volt buses on a undervoltage signal. For Unit 2, AC power from the diesel generators is automatically connected to the 480 volt buses on an undervoltage signal concurrent with SI or unit (turbine) trip signal. Unit 2 is different in that the additional coincident SI or unit trip signal is required.

In justification of this design difference, the licensee stated that both designs meet present criteria. We disagree with this justification. The Unit 2 design using a non-Class 1E unit trip signal to perform a Class 1E function, does not meet the single failure criterion and present NRC review guidelines (Section 8.3.1, Part III, Item 2 and Section 7.3, Appendix A, Item 3.a of NRC Standard Review Plan). Please provide additional justification for the Indian Point Unit 2 design.

RESPONSE:

The SI signal is Class IE. Should an SI signal be generated in the presence of an undervoltage condition, the logic will automatically actuate diesel generator/safeguards bus loading. The coincident turbine trip signal at Indiam Point 2 is an additional anticipatory signal to initiate diesel generator connection for safe shutdown in the absence of an SI signal. Although this signal is non-Class IE, it is provided by separate, redundant, high-quality, commercial grade circuitry which actuates the main electrical generator primary and backup lockout relays.

Even in the unlikely event that a double failure prevented the redundant turbine/generator trip signals from reaching the Class 1E diesel sequencing logic, the large steam generator water inventories in the Indian Point 2 design provide at least one half hour within which the diesels can be manually connected to their buses. In fact, auxiliary feedwater can still be provided to the steam generators by the steam-driven AFW pump which is independent of the 480VAC power supplies. The pump can be started manually either from the central control room or locally and will still automatically start on sensing "Lo-Lo level" in at least two steam generators.

The plant-specific signals initiating an automatic transfer to the diesel generator power supplies are described in Sections 1.5.2.2.1.2.2.2.4 and 1.6.2.2.1.2.2.2.4 of the IPPSS for the Unit 2 and Unit 3 electric power systems. The electric power analyses were conducted assuming an initiating event had occurred which made the power supply from the main generator unavailable. It was determined that the reliability and redundancy of the main generator trip signal inputs under these conditions results in a negligible effect on the power transfer operation. The power transfer signal unavailability provided a negligible contribution to the unavailability of power.

Therefore, the differences between the two units in the sources of their bus transfer signals did not affect the analysis results. Furthermore, because signal failures provide an insignificant contribution to power unavailability, the probability of operator recovery actions in response to these events was not evaluated. Nevertheless, since automatic transfer signal failures do not preclude the manual starting and loading of the diesel generators, quick recovery from these failure scenarios is expected should they occur.

In summary, the existing design of Indian Point Unit No. 2 is acceptable because it has a Class 1E path to complete its function (undervoltage coincident with SI signal). The second path (undervoltage coincident with turbine trip) is a diverse extension of the system with sufficient separation so that it does not degrade the 1E function nor increase its susceptibility to common mode failures.

Request No. 5 - Two Sequencers Provide Actuation Signals to Redundant Loads:

Loads are automatically sequenced onto each diesel generator by sequencing logic circuitry. A separate logic circuitry is provided for each diesel generator at Unit 3. There are three diesel generators and three separate dedicated sequencing logic circuitries. At Unit 2 there are only two sequencing logic circuitries for the three diesel generators. Signals from either of the two logic circuitries will simultaneously actuate and sequence all respective loads onto the three diesel generators.

In justification of this design difference, the licensee has stated that both designs meet present criteria. We disagree with this justification. A single sequencing logic that provides start signals to redundant load groups does not meet the single failure criterion and present NRC review criteria. Please provide additional justification for the Indian Point Unit 2 design.

RESPONSE:

The Indian Point Unit 2 design does meet the present single failure criterion. Furthermore, when performing analyses for accidents beyond the design basis (such as the IPPSS) where multiple failures are evaluated, the flexibility and reliability provided by transfer devices and cross-ties within piping and electrical systems makes the Indian Point Unit No. 2 design superior to the completely unitized 2-100% train designs of power and control that are common in the latest generation of nuclear power plants. In fact, inherent triple redundancy exists for the majority of "less than maximum" credible events by virtue of the 3-50% power train design.

The transfer devices and redundant logic signals are distributed to the components of the three power trains so as to minimize any potential for inter-train interactions (e.g., double circuit protection on transfer devices and "contact-to-coil-to-coil-to-contact" separation between redundant [illegible] provide operational flexibility combined with the

independent alternate safe shutdown system provided by separately routed feeds from Indian Point Unit 1 buses to selected safe shutdown equipment at Indian Point Unit 2 adds to the basic reliability of the safety system design.

Each essential component load on Unit 2 is provided with an individual time delay sequencing relay which controls the operation of its supply breaker. Failure of the time delay relay will prevent the component from starting automatically but will not prevent the starting of other components. The data for individual component failures utilized in the IPPSS includes these types of control circuit malfunctions, and the time delay relay failures are incorporated in the component models through the site specific failure data.

Two trains of actuation logic are provided for the Unit 2 components and these trains are extended to the interface with the individual time delay relays. Each component receives a starting signal from both logic trains through actuation relays associated with the 480V power supply bus. The following table summarizes the allocation of these actuation relays among the four essential load buses:

Bus	Train A Relay	Train B Relay
2A	3-2	3-12
3A	3-5	3-15
5A	3-3	3-13
6A	3-4	3-14

Thus, all components powered from bus 2A receive starting signals from relays 3-2 and 3-12. The Train A relays are powered from DC power panel [illegible] the Train B relays are powered from DC power panel 22. The individual bus control power supplies are aligned according to the primary and backup configurations discussed in response to Request No. 2, above.

Failure of power at DC power panel 21 will disable the Train A actuation relays for all four buses and will disable the primary source of control power for buses 3A and 5A. However, the components on all four buses will receive redundant starting signals from the Train B relays, and the automatic control power transfer devices will provide breaker operating control power at buses 3A and 5A from DC power panel 23. Therefore, multiple DC power failures, multiple actuation relay failures, or combinations of power failures and relays failures are required before even one component fails to receive a start signal. These failure combinations were not evaluated explicitly in the Unit 2 electric power system analysis contained in Section 1.5.2 of the IPPSS, but they are bounded by the DC power point estimate analysis presented in Section 1.3.5.12.2 of that study.

It should be noted that Unit 3 also has only two actuation logic trains. Train A is supplied from DC power panel 31, and Train B is supplied from DC power panel 32. The sequencing logic and control for Diesel Generator 33 and associated 480V Safeguards Bus 5A are powered solely by battery 31 and the sequencing logic and control for Diesel Generator 32 and associated 480V Safeguards Bus 6A are powered solely by battery 32. However, while the remaining Diesel Generator 31 and associated 480V Safeguards Bus 2A/3A receive their control power from a third battery 33, the sequencing logic for this third power train is actuated by dual Train A (battery 31) and Train B (battery 32) signals just like all the buses at Indian Point 2. Thus, for two of the three power trains, a single

failure will result in the loss of a diesel generator and its entire associated 480V bus, and for the third power train the failure of the single battery providing control power will lead to loss of the diesel generator and its associated bus.

In summary, the Indian Point Unit No. 2 design exceeds the single failure criterion, by providing enhanced reliability for numerous multiple failures and provides sufficient separation and diversity to prevent an increase in the probability of common mode failures.