Carl L. Newman
Vice President

Regulatory Docket File

Consolidated Edison Company of New York, Inc.
4 Irving Place, New York, N. Y. 10003
Telephone (212) 460-5133

August 7, 1975

Re Indian Point Unit No. 2
Docket No. 50-247
Facility Operating License DPR-26

Mr. George Lear, Chief
Operating Reactors Branch #3
Division of Reactor Licensing
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Mr. Lear

By letter dated May 15, 1974, Consolidated Edison requested a change to the Technical Specifications on Indian Point Unit No. 2 to permit the underfrequency trip setpoint on the reactor coolant pumps to be lowered from 57.5 Hz to 55.0 Hz. In your February 25, 1975 letter, you requested additional information and justification in order to complete your evaluation of our proposal. Accordingly, we submit the attached responses in the six (6) areas enumerated in your letter. In light of these responses and the analyses that have been performed, we believe that safe shutdown of the reactor is assured by the lower underfrequency protection setpoint which we have requested.

Very truly yours

Carl L. Newman

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Vice President

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QUESTION (1):

Provide additional explanation and justification in support of the stated position that "system decay rates greater than 4 Hz/sec are not considered credible".

Received w/Ltr Dated 8-7-75

ANSWER:

At the present time, the northeastern utility companies have a policy of providing 25% automatic load relief which has been shown by studies to be adequate to meet all reasonable contingency requirements on a coordinated basis. The total non-coincident peak load in the area is greater than 46,000 megawatts. A 25% deficiency would, therefore, require the loss of more than 11,500 megawatts of generation. If the power grid remains electrically connected, deficiencies of 25% in this area are calculated to yield decay rates slighty less than 2 Hz/sec. Calculations show that generation deficiencies of over 40% are required to obtain system frequency decay rates of approximately 4 Hz/sec. These conditions are much less severe than the conditions for which the Westinghouse analysis (submitted with our May 15, 1974 request) was performed.

The Westinghouse analysis for Indian Point Unit No. 2 shows that the core DNBR is maintained greater than 1.30 for a trip setting of 55.0 Hz for system frequency decay rates as high as 12 Hz/sec. This decay rate represents a loading of approximately 2.8 times generator capability. In order to produce so severe an overload on the Indian Point Unit No. 2 machine, we must postulate that the unit is isolated from the power grid such that all of Westchester County and the Bronx, the entire Orange and Rockland system load and part of the Central Hudson system load would have to be electrically supplied by this one machine. This requires that more than twenty (20) tie feeders must open and that another 1000 MW of generation be lost within this electrical island. Such an event would involve the opening of at least forty (40) circuit breakers at a minimum of ten (10) different and widely separate transmission switching stations at various voltage levels ranging from 69 to 345 kv. This is considered to be an incredible occurrence.

QUESTION (2):

Provide additional information and justification to show that assumed delay times in the activation of pump breakers and reactor scrams are conservative.

ANSWER:

The conservatism of the assumed delay times in the actuation of reactor coolant pump breakers and reactor scrams can be verified by comparing them to the actual response of Indian Point Unit No. 2 underfrequency protection system. The Westinghouse analysis assumes a delay time of 0.6 seconds from the time the setpoint is reached to the time the reactor coolant pump breakers open and a total delay time of 1.0 second from the time the setpoint is reached to the time the rods begin to move into the core. Using the most conservative data and data combinations obtained from multiple measurements during the Indian Point Unit No. 2 startup tests, it has been determined that the actual response times of the underfrequency system are less than the delay times assumed in the Westinghouse analysis.

QUESTION (3):

Describe the adjustable delay feature of the underfrequency system and establish appropriate limits for the adjustable delay.

ANSWER:

The Westinghouse KF underfrequency relay used at Indian Point Unit No. 2 has, as one of its components, an adjustable auxiliary time delay unit. This unit consists of a telephone-type relay in conjunction with a solid-state timing circuit. It provides adjustable time delays from 0.1 to 0.5 seconds on pickup after the underfrequency sensing unit operates. Presently, an adjustable time delay setting of 0.1 seconds is being used. This delay setting results in actual response times that satisfy the assumptions of the Westinghouse analysis. The upper limit for allowable time delay settings is limited by the maximum actual response times of the underfrequency protection system permitted by the assumptions of the Westinghouse analysis.

QUESTION (4):

You indicated that the proposed change in the setpoint for the underfrequency trip would result in a setpoint that is more consistent with the known stability of the power grid and the maximum anticipated frequency decay rate. Provide an analysis that describes this stability and the specific frequency decay rate conditions for which the proposed change would prevent an unnecessary shutdown of Unit 2. In this regard, please discuss your consideration of the fact that most turbine generators trip at a frequency of 58.5 Hz since this fact would seem to invalidate any benefit of the proposed change.

ANSWER:

The stability of the northeast power grid and specific frequency decay rate conditions are discussed in the answers to Questions (1) and (6) of this response. Actually, most underfrequency transients experienced in this grid will exhibit small decay rates and, as a result of automatic load shedding, will be reversed so that system frequency is quickly restored to 60.0 Hz. Reducing the underfrequency trip setpoint from 57.5 Hz to 55.0 Hz would prevent the unnecessary shutdown of Indian Point Unit No. 2 and allow the grid to recover following many of these small transients.

Concerning the statement that most turbine-generators trip at a frequency of 58.5 Hz, turbine manufacturers do indicate that sustained operation at frequencies below 58.5 Hz can present a risk to the turbine due to vibration and possible resonance of long low-pressure blades in the steam turbine. Some companies have, therefore, applied underfrequency relays to protect their turbines agianst this possibility. Most of these companies, however, do not shut down the unit, but attempt to keep the generator running either with load or with its own auxiliaries. Those who do trip use a time delay an order of magnitude longer than is being considered here for reactor protection. Our company at present does not trip its large fossil fueled turbine-generator units on system underfrequency conditions.

QUESTION (5):

Discuss and/or analyze the turbine trip features of Unit 2 as they relate to your proposed change to the underfrequency trip setpoint.

ANSWER:

The turbine protection system for Indian Point Unit No. 2 will initiate a turbine trip upon sensing a generator trip, reactor trip, safety injection signal or various mechanical faults. With the exception of the generator initiated turbine trip, all turbine and reactor trips (i.e., non-electrical) will initiate a generator trip as well. The present trip logic incorporates a 30-second time delay upon receipt of such trip signals before the generator breaker is opened and the 6.9 kv buses are transferred from unit power to offsite power. (The 6.9 kv buses supply power to the reactor coolant pumps). This 30-second trip delay prevents excessive overspeed of the turbine and precludes the possibility of losing a reactor coolant pump during 6.9 kv bus transfer for at least 30 seconds following a trip.

The generator protection system is designed to trip the generator immediately (i.e., the 30-second time delay is bypassed) upon sensing a safety injection signal, turbine thrust bearing failure or certain electrical faults. However, present plans are to modify the turbine-generator trip logic to incorporate the above 30-second trip delay upon receipt of a safety injection signal as well. This will place Indian Point Unit No. 2 in agreement with the Westinghouse generic position concerning reactor coolant pump overspeed during LOCA. The subject delay following a safety injection signal will permit blowdown of the primary system following a LOCA without generating possible reactor coolant pump overspeed. It should be noted that this 30-second delay to generator trip during a safety injection condition has been included in the Indian Point Unit No. 3 trip logic and plant construction.

There is, however, no specific sensing or tripping function performed by the turbine or generator protection systems on system underfrequency conditions. An underfrequency transient will be sensed by the underfrequency protection circuitry of the reactor protection system , which will then open the reactor coolant pump breakers. The opening of the pump breakers will cause a direct reactor trip thereby initiating a turbine trip, which will trip the generator following the 30-second trip time delay discussed above.

QUESTION (6):

The adjustable delay features of the underfrequency trip system are designed for the purpose of preventing electrical transients from causing an unnecessary reactor shutdown. Provide an analysis to show why the adjustable delay would not accomplish the desired effect of preventing unnecessary reactor trips from the underfrequency system.

ANSWER:

The adjustable delay feature of the underfrequency trip protection system may theoretically be used in preventing electrical transients from causing unnecessary reactor shutdowns before automatic load shedding can restore system frequency. Re-establishing the frequency, however, can require relatively long periods of time. Times of 1.0 second and longer are not unreasonable depending on the amount of generation deficiency and the amount of load shed automatically. It is clear that the underfrequency trip time delay will necessarily have to be large if it is to span the times required to restore system frequency. With such lengthy delays incorporated into the underfrequency trip protection system, the frequencies at which the reactor coolant pumps and the reactor will ultimately be shut down will be low should a large frequency decay rate be experienced.

If the adjustable time delay associated with the KF underfrequency relay could be set such that a delay of 1.0 second was established instead of the present 0.1 second delay, this increase in trip delay would only be sufficient to span the more quickly restored frequency transients. If the present underfrequency trip setpoint of 57.5 Hz is maintained with this hypothetical 1.0-second trip delay, the actual frequency at which the trip is initiated will vary greatly depending on the frequency decay rate. A small frequency decay rate of 0.5 Hz/sec. will yield the high trip initiate frequency of 56.85 Hz. A large decay rate of 4 Hz/sec., however, will result in the trip initiate frequency of 52.95 Hz. This frequency is lower than the trip initiate frequency which would be attained with a setpoint of 55.0 Hz and the present trip delay setting of 0.1 seconds. Decay rates greater than 4 Hz/sec. or longer trip delay times will only increase the uncertainty and range of the trip initiate frequency.

The proposed trip setpoint of 55.0 Hz with a trip delay satisfying the assumptions of the Westinghouse analysis will prevent unnecessary shutdowns of Indian Point Unit No. 2 by providing a sufficient margin to allow restoration of system frequency via automatic load shedding for even the maximum anticipated frequency decay rate. In addition to improving the reliability of the plant, lowering the setpoint to this value will not yield such a variable trip initiate frequency and will not compromise reactor safety as demonstrated by the Westinghouse analysis.