BOSTON EDISON COMPANY
800 BOYLSTON STREET
BOSTON, MASSACHUSETTS 02199

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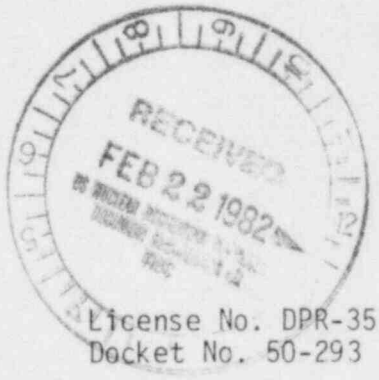

Mr. Domenic B. Vassallo, Chief
Operating Reactors Branch #2
Division of Licensing
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D. C. 20555

License No. DPR-35
Docket No. 50-293

Second Level Degraded Grid Voltage Protection

Reference: NRC Memorandum for T. A. Ippolito from K. T. Eccleston, "Meeting Summary - Boston Edison Company 4:00 PM, December 18, 1981 (Pilgrim I)", January 5, 1982

Dear Sir:

The following discussion addresses NRC concerns expressed in the reference:

A. Possibility for Equipment Damage As a Result of Synchronizing the Diesels Onto the System Under these Circumstances (Degraded Voltage).

The abnormal procedure (Attachment 1) prescribes a voltage range from 3745 to 4200 volts within which the Operator may parallel the diesels to the system during a low voltage condition. The lower limit is a conservative value (90%) chosen because, at this value, voltage at the 120 volt instrument buses goes below 108 volts. It is also the value at which automatic tripping would occur if the safety buses were fed from the Start-Up Transformer. If the safety bus voltage goes below this value before a diesel generator can be paralleled, the procedure instructs the Operator to scram the reactor.

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Depending on various levels of excitation and assuming loss of Automatic Voltage Regulation, this value of 3745 volts on the safety buses can represent grid voltages between 328 kv and 335 kv - main generator operating either at 0 MVAR output or in the lead (i.e., vars into the machine). Standard industry range for the nominal 345 kv level is 328 kV to 362 kv, ± 5%; although voltages in this range (328 to 335 kv) are grounds for concern and action, the system is by no means considered unstable.

The diesel-generator, while momentarily paralleled to the system, is in its "droop" mode of operation, and the amount of its load "grab" will be small, typically in the range of 100 KW, well within the machine's capability of 2600 KW. There is no intent for long paralleling times or for any attempt to correct or improve grid system voltage by use of the diesel-generator. Note that the Operator is instructed to trip open the Unit Auxiliary Transformer breaker immediately after closing the diesel-generator supply breaker.

A recent test of an operator starting and synchronizing a diesel generator (but not closing its breaker) was conducted. In an unhurried manner and while carefully following outlined procedures, the full synchronizing point was reached in less than 5 minutes. In no instance are two diesel-generators paralleled to each other (i.e., through the windings of the Unit Auxiliary Transformer). One diesel-generator at a time is to be paralleled, and its associated Unit Auxiliary Transformer breaker opened before the second diesel-generator is paralleled.

B. Possible Violations of General Design Criterion 17 and Safety Guide 6.

The restrictions imposed in the procedure preclude the possibility of common mode failure of the on-site (diesel-generators) power supplies.

After the Unit Auxiliary Transformer breakers are opened and the diesel-generators are supplying the safety buses, no paralleling of on-site power supplies can occur, thereby fully satisfying Safety Guide 6, which describes the acceptable degree of independence between redundant, standby (on-site) power sources and between their distribution systems.

Safety Guide 6 does not specifically address paralleling of off-site power sources with standby (on-site) power sources; its main concerns are parallel operation (either manually selected or automatic) of the various standby (on-site) power sources, independence of redundant load groups and redundant standby sources, and the vulnerability to common mode failures engendered by any lack of independence.

In any event, the rare, momentary paralleling of a diesel-generator with the Unit Auxiliary Transformer does not, we feel, violate the intent of this guideline. Regularly scheduled load testing of the diesel-generator involves paralleling to the grid system in order to fully load-test the diesel-generator's capability.

The intent of General Design Criterion 17 is met because the probability of losing electric power from the transmission network is reduced by allowing the nuclear power plant to remain on line during a temporary, degraded voltage condition, with the safety buses maintained at acceptable voltage. The potential cascading effect of immediately tripping the unit on other nuclear facilities, similarly connected to the grid system, should not be overlooked or underestimated.

The attached procedure also reduces the probability of loss of power from the on-site electric power supplies because the diesel-generators are started prior to their need, thereby assuring the Operator of safe shutdown power supplies if the system continues to degrade and the reactor must be scrammed. If a diesel-generator fails to start under this procedure, the time during continued operation will be spent attempting to correct the problem, thereby increasing the safety of the imminent shutdown. The System Dispatcher (REMVEC) can also utilize this time to prepare for shutdown of the nuclear unit and can mitigate the effects of the generation loss (e.g. by load reduction, dispatching pumped storage units, bringing fossil plants on line, etc.). Note that the procedure commits to an orderly shutdown process, even with both diesel-generators supplying the safety buses.

Our operating procedure fulfills the intent and more than meets the letter of the more applicable Regulatory Guide 1.93, Availability of Electric Power Sources, especially degraded condition 2 (Offsite AC Power Sources Are Two Less than the LCO).

An ancillary benefit of this abnormal procedure and training is that operating personnel are made aware of the importance of maintaining correct voltage levels, the deleterious effects of degraded voltage conditions, and the possible routes and measures to correct the situation and protect the nuclear facility.

The starting of the diesel-generators prior to their need eases the decision making process of the Operator because:

a. The activation of the diesel-generators prior to their requirement eliminates speculation on their starting capability.

b. The operation of the diesel-generators prior to their requirement reduces their load pickup time (by accident signal) to below the postulated 10 seconds.

Operation of an unloaded diesel for an extended time is not desirable: thus the procedure directs the Operator to switch the safety bus loads to the diesels if the degraded voltage condition is expected to last more than one hour, even if the safety bus and grid system voltages remain steady.

As requested in the reference, photographs of the Electric Control Board (Attachments 2 and 3) and drawings thereof (Attachments 4 and 5) are also enclosed.

Very truly yours,

W. H. Deacon
Acting Manager
Nuclear Operations Support

Attachments:

1. Procedure 2.4.144
2. Photograph of Electric Control Board
3. Photograph of Electric Control Board
4. Sketch, "Controls of Starting & Synch. Diesel-Generator A to Safety Bus A5".
5. Custom Engineering Company Drawing No. M-3121-3, Sh. 1 of 2