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YANKEE

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July 24, 1980

United States Nuclear Regulatory Commission
Washington, D. C. 20555

Attention: Office of Nuclear Reactor Regulation
Mr. T. A. Ippolito, Chief
Operating Reactors Branch #3
Division of Operating Reactors

References:
1. License No. DPR-3 (Docket No. 50-29)
2. License No. DPR-28 (Docket No. 50-271)
3. License No. DPR-36 (Docket No. 50-309)
4. Docket No. 50-443 and 50-444
5. USNRC Letter, dated 8/12/7 (typical)
6. USNRC Letter, dated 6/3/77 (typical)
7. USNRC Letter, dated 10/16/79
8. VYNPC Letter No. WVY-76-114, dated 9/16/76 (typical)
9. VYNPC Letter No. WVY-77-65, dated 7/18/77 (typical)
10. VYNPC Letter No. WVY-79-139, dated 12/6/79

Subject: Mitigating the Effects of Grid Degradation on Safety Related Electrical Equipment

Dear Sir.

This letter is being written by Yankee Atomic Electric Company on behalf of the Yankee Rowe, Vermont Yankee, Maine Yankee, and Seabrook nuclear stations. These facilities have been identified as References (1, 2, 3 and 4).

BACKGROUND INFORMATION

The NRC position on degraded grid voltage (Reference 5, 6 and 7) requires automatic disconnection of the supply from the grid (offsite power supply) to the plant emergency buses any time the voltage drops below a pre-determined limit. The NRC is concerned that a sustained variation outside the safety related equipment's design rated limit could result in a loss of capability if the equipment were simultaneously required to perform its safety function.

Yankee Atomic has steadfastly opposed the NRC's position on degraded grid voltage because we believe that any changes made in equipment or circuitry

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should increase rather than decrease the level of overall nuclear plant safety; it is our opinion that in attempting to resolve one safety concern additional safety concerns should not be introduced in the process.

Yankee Atomic has proposed an alternative position (References 8, 9 & 10) which relies on operator action in lieu of an automatic trip to resolve the NRC's basic concerns on degraded grid voltage. On receipt of our letter dated 12/6/79 (Reference 10), the NRC requested a meeting to discuss Yankee Atomic's generic position on grid undervoltage. The meeting was held at the NRC offices on May 5, 1980.

At the above meeting. Yankee Atomic engineers acknowledged that the NRC's concerns for continued operation of safety related equipment under degraded voltage conditions were valid, but, stated that they could not ignore the fact that additional safety concerns were being introduced by the NRC position. These safety concerns were categorized into three areas:

a. Violations of GDC-17,
b. Disintegration of the entire grid,
c. Being left with a less reliable source of power or no source of power.

It was pointed out that the Yankee Atomic position (References 8, 9 & 10) relied on the station operator to assess the situation relating to grid degradation and to take appropriate action to ensure that degradation was being corrected. Failing this he would take additional steps to protect safety-related equipment from the influence of degraded grid voltage. The operator action would ensure that a further deterioration of safety would not result from any action directed at correcting the degradation.

At the meeting, the NRC stated that they had an ongoing concern with operator action; they did not have confidence in operator action and for that reason were opposed to placing any reliance on it.

As one alternative (henceforth known as Alternative 1), the NRC suggested that we consider interlocking the automatic trip with an accident signal. An automatic trip of the offsite power supply would then result only if a simultaneous grid degradation and an accident occurred.

Another alternative (henceforth known as Alternative 2), suggested by the NRC for our consideration subsequent to the meeting, was that we interlock the automatic trip with a signal indicating that the main generator was off-line. An automatic trip of the offsite power supply would then result only if grid degradation occurred when the generator was not synchronized to the grid.

Both the above alternatives assumed that manual operator action would be utilized in modes when the automatic trip was not applicable.

DISCUSSION:

We have considered the two NRC suggestions and have analyzed the merits of each scheme. These alternatives have then been compared with both the original NRC position (Reference 5, 6 & 7) and the Yankee Atomic position (References 8, 9 & 10) on degraded grid voltage.

Alternative 1

This alternative requires that the offsite power circuit breaker be automatically tripped if a simultaneous grid degradation and accident occurred.

The circuit breaker connecting offsite power to the emergency bus is shown in Figure 1. The first level undervoltage relay is shown as device 27A. The second level undervoltage relay is shown as device 27B. Both relays sense voltage on the emergency bus.

When voltage is degraded below that required to ensure the continued operation of safety-related equipment, the second level voltage relay 27B will be activated. Contacts of relay 27B will close in the breaker trip circuit as well as in the alarm circuit. The breaker will trip automatically if an accident signal is also received.

If bus voltage is severely degraded or lost altogether, the first level voltage relay 27A will also be activated. Contacts of relay 27A in the breaker trip circuit will cause an instantaneous trip of the circuit breaker.

With Alternative 1, a grid degradation experienced without an accident signal will only cause an alarm. Established plant procedures require the operator to take specific steps to assess the magnitude and expected duration of the grid degradation. If he is not assured that the disturbance is transitory, and that recovery is imminent, he may choose to manually trip the offsite power circuit breakers after ensuring that a further deterioration of safety will not result from his proposed action.

Advantages

1. Violations of GDC 17 are precluded.

2. An accident signal would itself cause a trip of the main generator; therefore, any resulting collapse or disintegration of the grid could not be attributed to this circuit modification.

3. The reliance on operator action in the event of a simultaneous accident and degraded grid condition is avoided.

4. Operator action would be maintained for all non-accident conditions, thus precluding our concerns expressed in References (8, 9 and 10).

Disadvantages

1. If the reactor is at power and all onsite ac power is determined to be unavailable, (i.e. all diesel generators lost) the reactor will be brought to a cold shutdown condition in accordance with technical specification requirements. If, during this mode, an accident signal and a grid degradation were to occur, the offsite power supply breaker would trip leaving the plant with a total loss of all onsite and offsite ac power.

This scenario is being identified in spite of its extremely low probability because firstly, the basis for the NRC position on grid degradation is to design for a simultaneous accident and grid degradation, and secondly, loss of all onsite ac power has occurred at a number of facilities. The combined probability, however, remaining extremely low.

Alternative 2

This alternative requires that the offsite power circuit breaker be tripped automatically if a grid degradation occurs when the generator is not connected to the grid.

The circuit breaker connecting offsite power to the emergency bus is shown in Figure 2. The first level undervoltage relay is shown as device 27A. The second level undervoltage relay is shown as device 27B. Both relays sense voltage on the emergency bus.

When voltage is degraded below that required to ensure the continued operation of safety-related equipment, the second level voltage relay 27B will be activated. Contacts of relay 27B will close in the breaker trip circuit as well as in the alarm circuit. The circuit breaker will trip automatically if it is determined by a logic circuit that the generator is not connected to the grid.

If bus voltage is severely degraded or lost altogether, relay 27A will also be activated. Contacts of relay 27A in the breaker trip circuit will cause an instantaneous trip of the circuit breaker.

With Alternative 2, a grid degradation experienced with the generator connected to the grid will only cause an alarm. Established plant procedures require the operator to take specific steps to assess the magnitude and expected duration of the grid degradation. If he is not assured that the disturbance is transitory, and that recovery is imminent, he may choose to manually trip the offsite power circuit breakers after ensuring that a further deterioration of safety will not result from his proposed action.

Advantages

1. Violations of GDC-17 are precluded.
2. Disintegration of the entire grid is precluded.
3. This alternative prevents the second level undervoltage relay from automatically tripping the offsite power circuit breaker during plant operation. Our concerns expressed in References (8, 9 and 10) relating to a plant trip are thereby removed.

Disadvantages

If the reactor is at power and all onsite ac power is determined to be unavailable (i.e. all diesel generators lost), the reactor will be brought to a cold shutdown condition in accordance with technical specification requirements. Once the generator is disconnected from the grid, this circuit will cause the circuit breaker to trip if a grid degradation also occurs; the plant will now face a total loss of all onsite and offsite ac power. This situation is extremely undesirable because of the unpredictable consequences of this transient.

CONCLUSION

We have carefully analyzed four possible methods of mitigating the effects of grid degradation on safety related equipment. These methods were:

(a) NRC Position
(b) Yankee Atomic Position
(c) Alternative 1
(d) Alternative 2

Of these four methods, we believe Alternative 1 is the most desirable scheme for our facilities. Additionally, the low probability disadvantages of Alternative 1 are outweighed by the advantages. We, therefore, propose to adopt Alternative 1 for mitigating the effects of a grid degradation. The sensors, and circuit to be utilized will be as detailed in Figure 1, and as described in the text above.

PROPOSED ACTION AND SCHEDULE

We are assuming your continued endorsement of Alternative 1, and will therefore immediately commence engineering changes to incorporate this modification for our Yankee Rowe, Vermont Yankee, and Maine Yankee facilities. It is anticipated that engineering for these changes will be completed by November 1980. Installation will follow at the first opportune shutdown following completion of engineering and receipt of materials. Similar changes will be made on our Seabrook facility and will be documented in the FSAR and installed prior to commencement of fuel loading.

Should you have any comments on this proposed course of action and schedule, please notify us by August 15, 1980.

Very truly yours,

YANKEE ATOMIC ELECTRIC COMPANY

D. E. Vandenburgh

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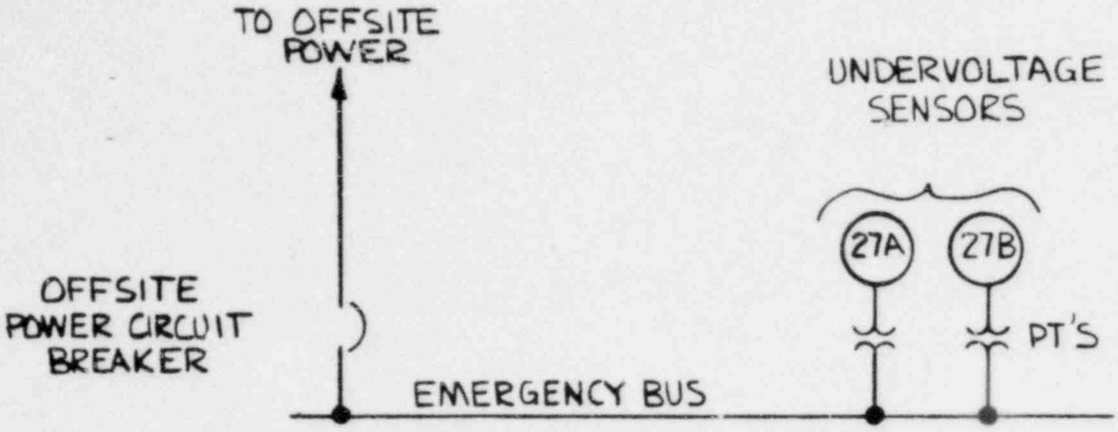
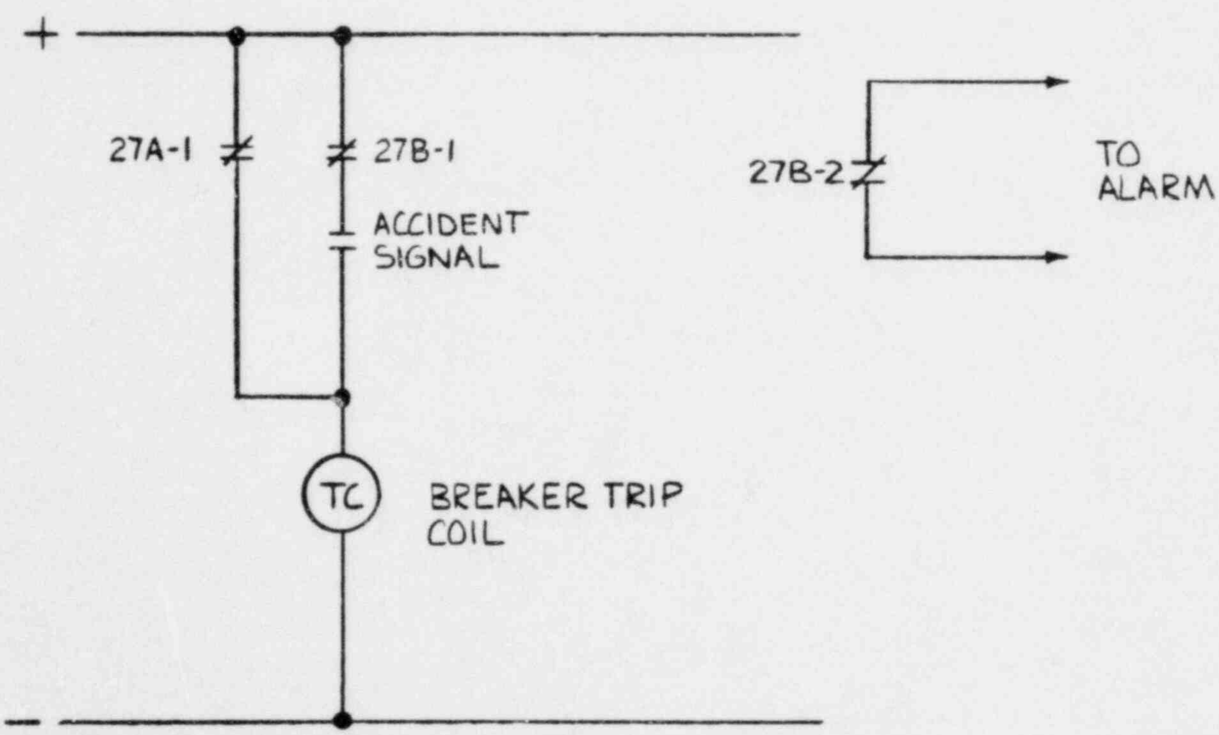
Senior Vice President

FIGURE 1

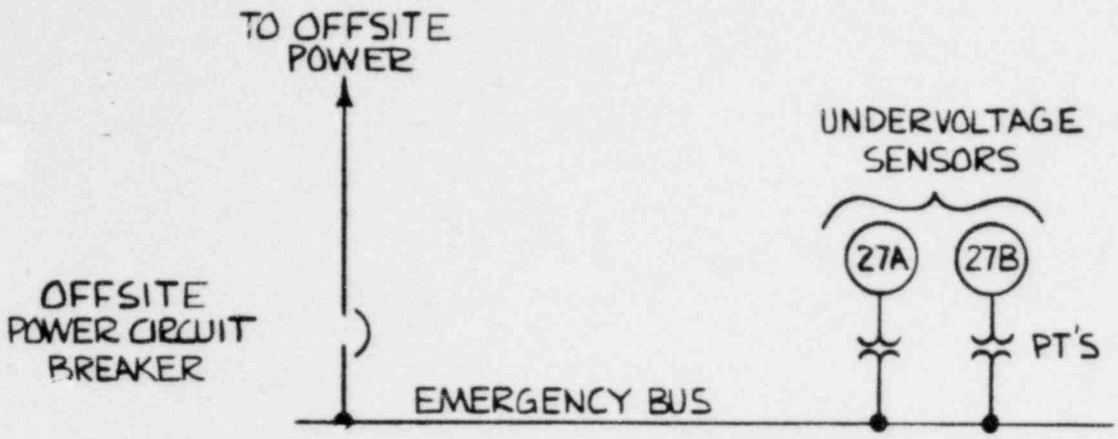


ONE LINE REPRESENTATION

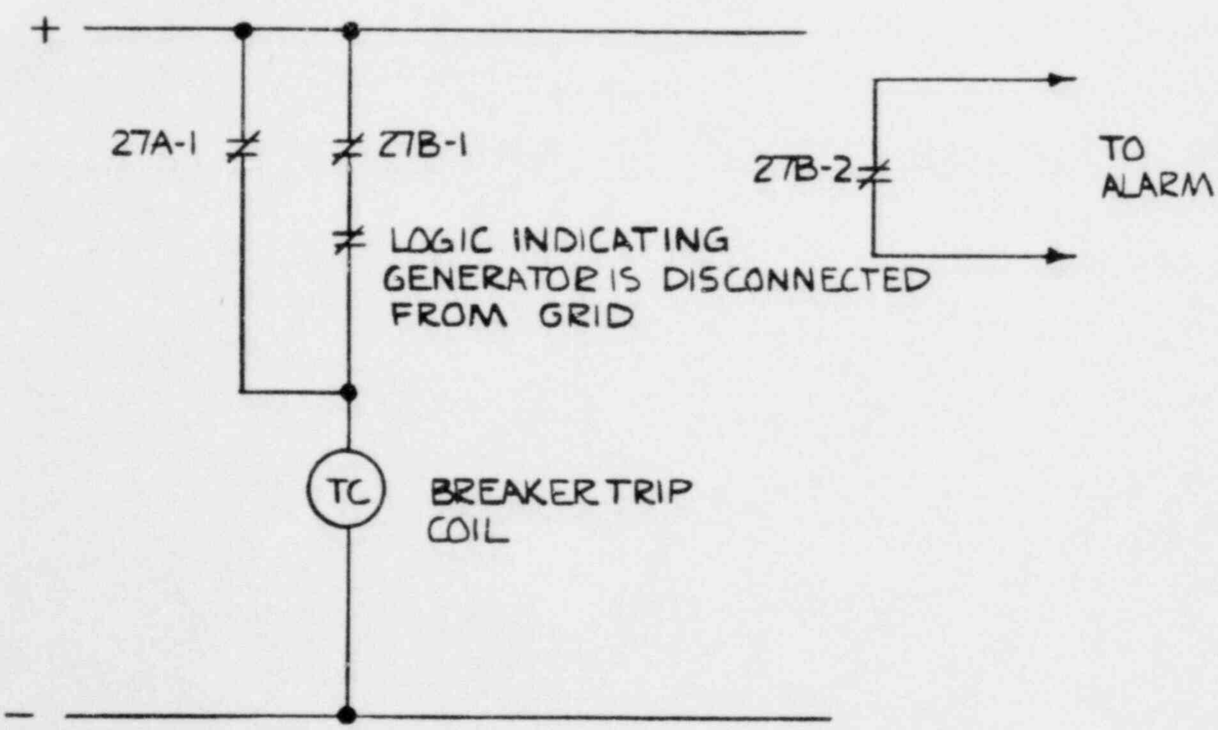


SCHEMATIC REPRESENTATION OF OFFSITE POWER CIRCUIT BREAKER TRIP CIRCUIT

FIGURE 2



ONE LINE REPRESENTATION



SCHEMATIC REPRESENTATION OF OFFSITE POWER CIRCUIT BREAKER TRIP CIRCUIT