



UNITED STATES
NUCLEAR REGULATORY COMMISSION

WASHINGTON, D.C. 20555-0001

April 8, 1997

MEMORANDUM TO: Chairman Jackson
Commissioner Rogers
Commissioner Dicus
Commissioner Diaz
Commissioner McGaffigan

FROM: L. Joseph Callan *[Signature]*
Executive Director for Operations

SUBJECT: CASE STUDY — GRID PERFORMANCE FACTORS

Attached is the final AEOD Case Study, "Grid Performance Factors." This study was issued as a draft for peer review to industry organizations and within the NRC in July 1996. The attached final report has been revised to reflect the comments received. The report has been distributed throughout the NRC and has been sent to the public document room. It is being sent to you in preparation for the Commission Briefing on Electrical Grid Reliability on April 23, 1997.

This study was initiated to examine factors affecting the reliability of offsite power by collecting current operating experience and providing background information on grid performance and the impact of grid performance on nuclear power plants.

The North American Electric Reliability Council (NERC) has adopted programs and procedures to deal with forecasting, normal operations, emergency conditions, and recovery from system collapse. They have developed programs and procedures for orderly operation. There are reliability constraints on the individual systems which include, but are not limited to, low reserve margins, a shortage of transmission facilities, and technical problems in transmitting power over long lines. The grid, the bulk power supply, as managed by the NERC members, has adequate resources to give reasonable assurance that the reliability of the system will be maintained under normal conditions. On the whole, the grid is stable and reliable.

With respect to the electrical grid, the Standard Review Plan states, "The basic requirement is that loss of the largest operating unit on the grid will not result in loss of grid stability and availability of offsite power to the plant under consideration." The Virgil Summer final safety analysis report states "Stability study results have demonstrated that the system is stable for (1) the loss of the unit generator, (2) the loss of the largest system

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generating unit, and (3) the loss of the most limiting transmission line." However, in 1989 work on the Virgil Summer generator caused the reactor to trip. The nearby plants could not make up for the Summer load loss and the failure generated a cascading grid effect that resulted in the loss of 16 generating units. Subsequently, the Summer safety busses isolated from offsite power due to low voltage on the grid. The emergency diesel-generators supplied power to their associated safety busses for about 2 hours.

The AEOD report did identify several other events where offsite power to nuclear plants was challenged due to grid disturbances. In most cases, the result was a plant trip without loss of offsite power. Other problems described in the regional assessments as stated in Section 4 of the study are also of concern.

In addition to operating experience, the report found that Arkansas Nuclear One Unit 1; Haddam Neck and Millstone Units 1, 2, and 3; Salem Units 1 and 2 and Hope Creek; and Point Beach Units 1 and 2 and Kewaunee, after reviewing their grid analyses, discovered potential instability problems for certain situations. Licensee corrective actions included power restrictions for certain grid conditions.

The condition of the grid is dynamic, due to factors such as increased demand, decreasing margins, changing transmission patterns, aging equipment, non-utility generation, increased competition, industry restructuring, and deregulation. Many of these factors are different now than they were when the current nuclear plants were licensed.

AEOD staff recommendation is to request licensees to confirm that they continue to meet their licensing bases with respect to the stability and reliability of offsite electric power. The NRR staff is considering the course of action for this recommendation.

AEOD plans to monitor losses of offsite power to determine trends and the need for appropriate actions. The staff has met with the Department of Energy, NERC, the Federal Energy Regulatory Commission, the Connecticut Valley Electric Exchange, Commonwealth Edison, the Edison Electric Institute, and the New England Power Pool to discuss the impending changes in the grid. The meetings are intended to provide additional insights into the complex problems that are inherent in assuring reliability in the changing industry.

Attachment: Grid Performance Factors Study

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