

October 23, 1997

FOR: The Commissioners
FROM: L. Joseph Callan /s/ Executive Director for Operations
SUBJECT: INFORMATION ON STAFF ACTIONS TO ADDRESS ELECTRIC GRID RELIABILITY ISSUES--WITS NO. 9700205

PURPOSE:

To inform the Commission of the status and progress in implementing staff actions to address the electric grid reliability issues, as requested in the staff requirements memorandum (SRM) of May 27, 1997.

CATEGORY:

This paper transmits status information to the Commission.

BACKGROUND:

The impending deregulation of the electric power industry may affect grid reliability and thus, in turn, the availability of offsite power to nuclear power plants. Safe nuclear plant operation requires a source of power capable of maintaining acceptable voltage and frequency limits. The preferred power source for safe plant operation is the offsite electric power system, or the grid.

In 1979, the Nuclear Regulatory Commission identified the loss of all ac electrical power to a nuclear plant, (i.e., station blackout (SBO)), as an unresolved safety issue. SBO was

shown to be an important contributor to the total risk from nuclear power plant accidents. The NRC issued 10 CFR 50.63, "SBO rule," in 1988, which required that nuclear power plants be able to withstand an SBO event for a specified length of time. Experience at that time indicated that for most nuclear power plant sites, the grid was stable and reliable.

At present, grid control is decentralized; that is, each utility or a small group of utilities forms a control area containing a set of customers for which they are jurisdictionally responsible. There are approximately 150 of these control areas in the country. These control areas are organized in seven regional reliability councils (e.g., Mid-America Interconnected Network (MAIN) or Western Systems Coordinating Council (WSCC)) or various regional power pools (e.g., New England Power Pool (NEPOOL)).

On April 23 and 24, 1997, in separate but related meetings, the Commission was briefed by the staff and the representatives from the Department of Energy, Federal Electric Regulatory Commission, the electric power industry, coordinating councils, electric reliability councils, economic regulators, and industry groups on the issues related to electric grid reliability and utility restructuring. These meetings were the basis for the subject May 27, 1997, SRM.

Two relatively new factors are emerging: non-utility generation and deregulation. It is anticipated that, in the future, power suppliers, whether utilities or independent power producers, will actively compete to sell electric power to customers who may be located anywhere on the power grid. Regional grid control would be the responsibility of centralized Independent System Operators (ISOs). The responsibilities and authority of an ISO as discussed in the referenced Commission meetings have yet to be defined, but it is expected that they will be charged with maintaining grid reliability to facilitate the marketing of power. It is also uncertain how, or even if, the current method of maintaining reliability through voluntary compliance with guidelines established by consensus will be established in the new utility structure. These uncertainties raise questions about the continued supply of reliable offsite power to nuclear power plants.

DISCUSSION:

Listed below are the action items requested in the subject SRM, and the staff's response and planned activities to address each item.

I. The Commission asked the staff to give greater urgency to ensuring that related health and safety issues within NRC's jurisdiction are addressed, particularly in reviewing the terms of the licensing basis and validating assumptions about grid reliability.

An action plan (Attachment 1), which coordinates overall staff activities on electric grid issues contains the following task elements: (1) a generic communication regarding licensee design basis; (2) ongoing staff contact with the Federal Energy Regulatory Commission (FERC) and the Department of Energy (DOE); (3) development of a reliability assessment tool to review load dispatch operations; (4) assessment of the risk significance of potential grid instability due to deregulation; and (5) evaluation of the need for further regulatory action. In addition, NRR has contracted with Oak Ridge National Laboratories to assist the staff in assessing the impact of electric utility deregulation on grid stability.

II. The staff should make appropriate contacts with other agencies to ensure that the NRC remains informed and (as applicable) involved on these issues. Staff should inform the Commission of actions by Federal and State economic regulators in establishing membership requirements in the North America Electric Reliability Council (NERC). This should include a staff assessment of any requirements and the effectiveness of such requirements and enforcement policies relating to reliability.

At this time, grid reliability is controlled nationally through a voluntary governance structure under the NERC and the regional reliability councils with limited Federal oversight at FERC and DOE. DOE has created a task force to study the reliability of the U.S. electric system and to consider whether efforts to date to maintain reliability are sufficient to ensure reliable operation in the future and whether there is a need for Federal legislation to increase Federal authority in this area. In the absence of any legislation, NERC membership requirements and enforcement policies are voluntary. Attachment 2 describes recent staff activities to keep abreast of government and industry changes, as well as several independent assessments by the staff of regional conditions this past summer.

III. The staff is asked to provide more information on followup actions to the event at Summer Nuclear Power Station.

Attachment 3 transmits the requested information regarding the followup actions taken subsequent to the July 11, 1989, grid disturbance at the Summer Nuclear Power Station.

IV. The Commission asked that appropriate representatives from each regional office visit a power pool and reliability council with jurisdiction in their region, to establish appropriate contacts, and achieve better understanding of regional grid reliability issues.

A letter was sent to the regional administrators (Attachment 4) asking each regional office to select a representative and to participate in visits arranged by NRR to the appropriate power pool and/or regional reliability council. Earlier this year, NRR and Regional staff made several visits to power pools and load dispatch centers. The staff intends to integrate the information gathered during these visits with the information that will be obtained from the visits to be scheduled as noted above.

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Attachments:

1. NRR Task Action Plan on Grid Reliability
2. Summary of Staff Activities--Grid Reliability
3. Status of Followup Actions Regarding the July 1989, Event at V.C. Summer
4. Letter to Regional Administrators dated September 3, 1997 (w/o attachments)

STAFF PLAN FOR ADDRESSING GRID RELIABILITY ISSUES

OBJECTIVE

Determine what, if any future regulatory actions are needed to ensure risk for commercial nuclear power plants operation remains acceptable. In order to accomplish the above objective, the following issues are identified for further study and action:

- Assess and evaluate the risk significance of potential grid instability due to deregulation. SPSB will utilize the inputs provided from EELB and AEOD studies to determine the overall risk significance.
- To reassess the risks and effectiveness of the SBO rule for reducing risk to public health and safety due to grid-centered loss of offsite power initiators. This item is an extension of the ongoing staff effort (Item 1.7 of the PRA Implementation Plan).
- Issue generic communications to reemphasize the need for licensees to maintain their design basis with respect to the stability and reliability of offsite power and to maintain a process for ensuring that they continue to meet their design basis for the remainder of their license.
- Assess any requirements and the effectiveness of such requirements (with respect to reactor safety) imposed by the North American Electric Reliability Council (NERC).

PROPOSED ACTIONS

The following actions will be taken to achieve the above objective:

Task 1:	Develop technical information to assess and evaluate the risk significance of potential grid instability due to deregulation.	
	Milestone	Date
	a. Complete survey of electric grid performance	2/98
	b. Assess projected risk from grid-centered loss of offsite	4/98

	power events by conducting a bounding case study	
	c. Inform Commission	11/98
Resource Requirements: 1.0 FTE/NRR; 0.5 Contractor Staff		
Supporting Organizations: NRR/DE/EELB; NRR/DSSA/SPSB; ORNL		
Task 2:	Monitor industry deregulation and its impact on the reliability of offsite power to nuclear power plants. Develop and implement ongoing staff-level contacts with the Federal Energy Regulatory Commission (FERC) and the Department of Energy (DOE). Assist Regional personnel in establishing contacts with power pools and reliability councils in their area.	
	Milestone	Date
	a. Conduct meetings with NERC, Regional Reliability Councils, FERC and DOE	ONGOING
	b. Develop staff reliability assessment tool to review load dispatch operations	1/98
	c. Inform Commission	11/98
Resource Requirements: 0.5 FTE/NRR; 0.2 FTE/REGIONS; 0.5 Contractor Staff Year		
Supporting Organizations: NRR/DE/EELB; RI thru RIV; ORNL		
Task 3:	Evaluate design-basis requirements and issue generic communication.	
	Milestone	Date
	a. Draft Generic Communication	9/97
	b. Office Concurrences	10/97
	c. ACRS Review (if necessary)	NA
	d. CRGR Review (if necessary)	12/97
	e. EDO Concurrence (if necessary)	1/98
	f. Commission Approval (if necessary)	2/98
	g. Issue Generic Communication	3/98
Resource Requirements: 0.4 FTE/NRR		
Supporting Organizations: NRR/DE/EELB; NRR/DRPE/PDI		
Task 4:	Evaluate, based upon Task 1.b results, the need for regulatory actions. Evaluate method(s) to identify grid-centered event precursors. Evaluate the impact of deregulation on SBO risk reduction goals. Assess any requirements and the effectiveness of such requirements and enforcement policies as imposed by NERC.	
	Milestone	Date
	a. Review the results from AEOD JC E8247, Tasks 18-25 to revise NUREG-1032 for implications regarding grid-centered LOOP events	10/97
	b. Complete feasibility study on methods to identify grid-center loss of offsite power (LOOP) event precursors	8/98
	c. Assess the implications of grid-centered LOOP events to SBO risk reduction goals. Analyze additional case studies as needed.	9/98
	d. Determine what additional regulatory activities are necessary (if any).	10/98
	e. Inform Commission	11/98
Resource Requirements: 1.0 FTE/NRR; 0.5 Contractor Staff Year		

SUMMARY OF STAFF ACTIVITIES--GRID RELIABILITY

- On January 15, 1997, NRC staff from the Electrical Engineering Branch (NRR) and the Reactor Analysis Branch (AEOD) met with Department of Energy (DOE) staff to discuss offsite power issues at DOE's Emergency Operations Center (EOC). The group met to discuss the role and responsibilities of Federal agencies for the performance and reliability of the U.S. electric power transmission system, also called the "power system grid." The group also discussed how deregulation may change the reliability of the power system grid.
- On February 13, 1997, NRC staff from the Electrical Engineering Branch (NRR) and the Reactor Analysis Branch (AEOD) met with Federal Energy Regulatory Commission (FERC) staff to discuss offsite power issues at FERC Headquarters. The group met to discuss the role and responsibilities of Federal agencies for the performance and reliability of the U.S. electric power system grid. In addition, the attendees discussed how deregulation may change the reliability of the power system grid.
- On February 18, 1997, NRC staff from the Electrical Engineering Branch (NRR) and the Reactor Analysis Branch (AEOD) met with North American Electric Reliability Council (NERC) staff to discuss offsite power issues at NERC headquarters in Princeton, NJ. The group met to discuss the role and responsibilities of NERC and other electric utility groups concerning the performance and reliability of the U.S. electric power system grid. In addition, the group discussed how deregulation may change the reliability of the power system grid.
- On February 28, 1997, NRC staff from the Electrical Engineering Branch (NRR) and the Reactor Analysis Branch (AEOD) met with Department of Energy (DOE) policy staff to discuss the ongoing restructuring of the U.S. electric power industry and implications for existing nuclear generating capacity. EELB discussed the regulatory basis and presented the staff's concerns regarding offsite power issues. DOE staff discussed ongoing efforts through its Task Force on Electric System Reliability as well as other restructuring concerns (e.g., adequacy of decommissioning funds, spent fuel and radioactive waste increase due to early plant retirements). DOE staff also discussed the possible application of DOE's economic model of the U.S. electric power industry to problems of mutual interest to DOE and NRC.
- On March 20, 1997, NRR, RES, and Region III staff met with ComEd staff to discuss offsite power issues at ComEd's Bulk Power Operations Center in Lombard, IL. The group discussed staff questions regarding the capacity and voltage security of the ComEd power system for the upcoming summer, given the number of nuclear units expected to be shut down in the region as well as the role and responsibilities of ComEd and industry reliability councils with respect to the performance and reliability of the local power system grid. The following items were discussed: (1) control center operations; (2) transmission system operations (specifically dispatcher coordination, operating studies, and outage scheduling of transmission equipment); (3) emergency load conservation procedures; and (4) plans for a Midwest independent system operator (ISO).
- On March 25, 1997, NRR staff attended the second meeting of the DOE-sponsored Task Force on Electric System Reliability to discuss NERC policy and institutional issues and power marketing organizations.
- On April 1, 1997, NRC staff from the Electrical Engineering Branch (NRR), visited the New England Power Pool (NEPOOL) in Holyoke, Massachusetts, as part of an assessment of the adequacy and reliability of the electrical power supply in New England for late spring and summer of 1997. EELB also visited the New England Power Exchange (NEPEX) which manages the central dispatch power throughout New England via four satellite control centers viz., Connecticut Valley Electric Exchange (CONVEX); Rhode Island - Eastern Massachusetts - Vermont Energy Control (REMVEC); New Hampshire Control Center; and Maine Power Exchange.
- On April 23, 1997, the staff briefed the Commission on the findings in AEOD Report C97-01, "Grid Performance Factors," and presented its course of action in response to the rapid changes arising from deregulation.
- On May 7, 1997, EELB staff developed a report entitled "New England Power Pool--1997 Summer Capacity Assessment," in response to management concerns about the impact that summer electric peak conditions would have on the offsite power sources for those nuclear power plants operating in the New England region.
- On June 3, 1997, NRC staff from the Electrical Engineering Branch (NRR) attended the third meeting of the DOE-sponsored Task Force on Electric System Reliability. Discussions included the roles of FERC, a proposed National Reliability Organization, Regional Independent System Operator and States and Regional Reliability Agencies.
- On June 12, 1997, EELB staff developed another report, entitled "Mid-America Interconnected Network (MAIN)--1997 Summer Capacity Assessment," to review anticipated summer conditions for the Midwest region.
- On June 19, 1997, NRR staff and Nuclear Energy Institute (NEI) staff met at a public meeting in Rockville, MD, to discuss emerging issues concerning the reliability of electric power grids in the United States. NRR staff told NEI about its concerns regarding the impending deregulation of the power system grid and the potential effect on the reliability and stability of offsite power sources to nuclear power plants.
- On July 10, 1997, NRC staff from the Electrical Engineering Branch (NRR) attended a presentation at DOE Headquarters (Washington, D. C.) concerning transmission access ISOs.
- On July 21, 1997, NRC staff met with members of the University of California Energy Institute (UCEI) and discussed the status, details, and expected impact of the California Public Utility Commission's plan for the reorganization and deregulation of the State's electricity industry (public utilities and independent power producers). NRC staff reviewed a list of studies that the UCEI has conducted for the Public Utility Commission and the staff obtained and will review several UCEI reports regarding post-deregulation electric power reliability.
- On July 22, 1997, staff from NRR and Region IV met with Pacific Gas & Electric (PG&E) staff to discuss offsite power issues for Diablo Canyon at

PG&E headquarters in San Francisco. The group discussed grid operation, plant modifications, and grid procedure changes precipitated by the grid disturbance event of August 10, 1996; the impact of deregulation on the PG&E grid operation; and interface with the independent system operator (ISO) and the Power Exchange, two organizations that are scheduled to begin operations in January 1998.

- On July 23--24, 1997, NRR staff attended a public meeting of the DOE-sponsored Task Force on Electric System Reliability. The current draft Task Force Interim Report, which includes recommendations on the security of the U.S. bulk power system (generation and transmission, and control facilities), was discussed.

ATTACHMENT 3

STATUS OF FOLLOWUP ACTIONS REGARDING THE JULY 1989 EVENT AT V.C. SUMMER

Background

On July 11, 1989, Virgil C. Summer Nuclear Station was operating at 100-percent power during a record power demand on the South Carolina Electric & Gas Company (SCE&G) system. During maintenance activities, the generator stator cooling water signal was inadvertently lost, causing a turbine trip and a reactor trip. This turbine trip caused an unexpectedly large voltage disturbance on the grid; subsequently, several other generating stations were lost within the SCE&G system, resulting in an estimated loss of about 1500 megawatts. This significant loss of power resulted in a degraded grid voltage condition at Summer.

Licensee Actions:

A licensee evaluation of the event showed that a grid instability after the turbine trip and subsequent cascade tripping of other generating stations occurred because the SCE&G system could not compensate for the loss of the 440 megavars (MVARs) being delivered by Summer. This evaluation also showed that the setpoints of the generator backup relays at other generating stations, McMeekin and Saluda, were lower than the standard settings. These setpoints were established many years ago and were never reverified. As a result of the subject event, the licensee

1. limited V.C. Summer MVARs generation to a maximum of 300 MVARs,
2. recalculated and reset generator backup protection relays throughout the SCE&G system,
3. generated MVARs at other system locations so that station voltage levels were maintained at appropriate levels,
4. directed Fairfield pump storage units to be operated in the condensing mode to support maintenance of the system voltage,*
5. directed PARR station gas turbines to be used to, as necessary, offset peak loading periods,*
6. use the Summer station to generate MVARs** after exhausting other offsite sources,
7. installed a voltage regulator for the 115/7.2-kV emergency safety features transformer,
8. added 270 MVARs of switchable capacitors to the grid in the Columbia area,
9. added a 410-MW Cope plant to the SCE&G system,
10. upgraded the excitation systems at the Saluda Hydro with a faster response static excitation system,
11. maintained the 300-MVAR limit until October 1996.***

*Note: Temporary actions that were discontinued after the 115/7.2-kv emergency safety features transformer voltage regulator was installed

Staff Actions:

In response to the July 1989 event at the V.C. Summer nuclear power plant, the NRC staff

- issued Information Notice 89-83, "Sustained Degraded Voltage on the Offsite Electrical Grid and Loss of Other Generating Stations as a Result of a Plant Trip," and
- reviewed the licensee's corrective actions which were documented in Licensee Event Report 89-012, "Turbine Trip/Rx Trip Due to Inadvertent Shorting of Stator Water Cooling Signal" (see licensee actions).

** MVARs in excess of 300 would need Plant Manager approval.

*** The limit was withdrawn after a System Stability Analysis Study indicated the limit was no longer necessary due to corrective actions 1-10.