UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555

OFFICE OF THE
COMMISSIONER

November 26, 1980

MEMORANDUM FOR: Chairman Ahearne
Commissioner Gilinsky
Commissioner Bradford

FROM: Joseph M. Hendrie

SUBJECT: ALAB-603 -- (SECY-A-80-140)

On October 14th, three of us voted for no review on ALAB-603 (St. Lucie-2) and the Commission's review period ended. Commissioner Gilinsky did not participate but had indicated his preference for Commission review. There is now running the 60-day period in which the Commission might reconsider its no-review decision.. The 60-day period will end about December 14th.

Denton's memorandum of November 10th to the Chairman on station blackout, discussing proposed staff actions related to ALAB-603, and the attached memo from Bernero, set me to reviewing the whole business. I conclude my vote not to review ALAB-603 was in error. There are some generic aspects of ALAB-603 that I think the Commission should consider very carefully. These are the use of probability numbers in the site review section of the Standard Review Plan to determine what events should be within the design basis of a plant and the way in which station blackout is framed as a design basis event.

I solicit your votes, first to reconsider the no-review decision, and second to take review of ALAB-603. SECY will please poll the Commission.

cc: SECY
OGC
OPE

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555

December 1, 1980

OFFICE OF THE
SECRETARY

Docket No. 50-389 CP
(ALAB-603)

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Subject: In the Matter of Florida Power & Light Company (St. Lucie Plant, Unit 2), Docket No. 50-389 CP

Gentlemen:

This is to inform you that Commissioner Hendrie has requested the Commission to reconsider its decision not to review the Appeal Board's decision in ALAB-603. The basis for this request is explained in the enclosed copy of Dr. Hendrie's memorandum of November 26, 1980 to the other Commissioners. Also enclosed is a copy of a staff memorandum of November 10, 1980 which was not available to the Commission when it was considering whether to review ALAB-603, but which raises significant questions regarding the potential effects of that decision on the regulatory process. For your convenience, I have also included the other documents referred to in the above-mentioned memoranda. The Commission has until December 13, 1980 to decide whether to reconsider ALAB-603, and you will be informed of its decision.

Sincerely,

Samuel J. Chilk
Secretary of the Commission

Enclosures:
1. Memo, 8/20/80, Ahearne to Dircks
2. Memo, 9/26/80, Denton to Ahearne
3. Memo, 10/24/80, Ahearne to EDO
4. Memo, 11/10/80, Denton to Ahearne
5. Memo, 11/26/80, Hendrie to Ahearne, Gilinsky, Bradford

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

CHAIRMAN

August 20, 1980

MEMORANDUM FOR: William Dircks, Acting Executive Director for Operations

FROM: John Ahearne

SUBJECT: STATION BLACKOUT

In ALAB-603, the Appeal Board has concluded that station blackout should be a design basis event for St. Lucie Unit 2. The Board goes on to say that such a result might also be appropriate for most reactors and recommends the Commission take expeditious action to ensure plants and operators are equipped to accommodate such an event.

Please review the current status of Task Action Plan A-44 in light of ALAB-603 and provide the Commission with your comments by September 15.

cc: Commissioner Gilinsky
Commissioner Hendrie
Commissioner Bradford
OGC
OPE

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SEP 26 1980

MEMORANDUM FOR: Chairman Ahearne

FROM: Harold R. Denton, Director
Office of Nuclear Reactor Regulation
(Signed) William J. Dircks

THRU: William J. Dircks, Executive Director
for Operations

SUBJECT: STATION BLACKOUT

This memorandum is in response to your request dated August 20, 1980, concerning the current status of Task Action Plan A-44 in light of ALAB-603. In ALAB-603, the Appeal Board made specific findings regarding St. Lucie Unit 2, and recommended that the Commission take expeditious action to ensure that other plants and operators are equipped to accommodate a station blackout event. This would include items such as a thorough analysis of the plant behavior during the blackout period, development of written procedures, and operator training for safe operation of the facility and restoration of AC power.

The Office of Nuclear Reactor Regulation is currently evaluating the necessary actions for implementing the Appeal Board recommendation. This effort will require contribution from several divisions, and it is expected that several weeks will be required to develop a position for operating reactors and OL's under review. We will report the results of this evaluation to the Commission in approximately one month. With regard to St. Lucie Unit 1, as a result of ALAB-603, we are requiring that the licensee implement actions similar to those required on St. Lucie Unit 2.

Contact:
Paul Norian, NRR
49-29457

The station blackout issue is also being considered under Task Action Plan A-44 which was approved in July 1980 with a scheduled completion date of October 1982 (copy attached). Section 3 of TAP A-44 remains valid and provides the basis for continued plant operation and licensing pending completion of the action plan. The purpose of TAP A-44 is to evaluate the adequacy of current licensing design requirements to assure that nuclear power plants do not pose an unacceptable risk of a station blackout accident. The first effort scheduled for completion in the program involves the reassessment and documentation of a preliminary survey conducted in October 1979. The intent of this survey was to identify any operating plants having an exceptionally high probability of station blackout accidents. The preliminary staff effort found that there were no currently operating plants of unusually high susceptibility to a severe core damage accident resulting from a station blackout. To take better account of analytical uncertainties, it was decided to refine the survey. The updated assessment is scheduled for completion in the last quarter of 1980.

The longer term portions of the task action plan involve extensive use of reliability and risk assessment studies; much of this work will be performed by contractor personnel. The task action plan includes a detailed analysis of AC power supply reliability, an evaluation of potential accident sequence probabilities and consequences, and plant response analyses. A contract was recently placed with Oak Ridge National Laboratory (ORNL) for technical assistance in the AC power reliability and accident sequence analysis tasks. Also, preliminary plant response analyses for several station blackout accident scenarios are underway by the Division of Water Reactor Safety Research.

In summary, the board recommendation for expeditious action is being considered by the current NRR evaluation of actions needed for operating reactors. The results will be reported to the Commission next month. We believe that the longer range generic aspects of the ALAB-603 recommendations are addressed appropriately in Task Action Plan A-44. The tasks under TAP A-44 are continuing as scheduled at this time.

Harold R. Denton, Director
Office of Nuclear Reactor Regulation

Enclosure:
Task Action Plan A-44

cc: Commissioner Hendrie
Commissioner Gilinsky
Commissioner Bradford
GC
PE
SECY

TAP A-44

STATION BLACKOUT

Lead Responsibility:	RES - PAS
Lead Supervisor:	G. E. Edison
Task Manager:	P. W. Baranowsky
NRR Lead Supervisor:	K. Kniel
NRR Lead Reviewer:	P. J. Polk
Applicability:	All BWR and PWR
Projected Completion Date:	October 1982

1. DESCRIPTION OF PROBLEM

A. Statement of Issue

The complete loss of AC electrical power to the essential and non-essential switchgear buses in a nuclear power plant is referred to as a "Station Blackout." Because many safety systems required for reactor core decay heat removal are dependent on AC power, the consequences of a station blackout could be a severe core damage accident. Therefore, the technical issue is (a) whether the probability of a station blackout may be too high, and (b) what the consequences of a station blackout are; that is, whether severe core damage may result.

B. Background

The issue of Station Blackout arose because of the historical experience regarding the reliability of AC power supplies. A number of operating plants have experienced a total loss of offsite electrical power, and more occurrences are expected in the future. During each of these loss of offsite power events, the onsite emergency AC power supplies were available to supply the power needed by vital safety equipment. However, in some instances, one of the redundant emergency power supplies has been unavailable. In addition, there have been numerous reports of emergency diesel generators failing to start and run in operating plants.

The results of the Reactor Safety Study[1] showed that for one of the two plants evaluated, a station blackout accident could be an important contributor to the total risk from nuclear power plant accidents. Although this total risk was found to be small, the relative importance of station blackout accidents was established. This finding and the historical diesel generator failure experience raised the concern about Station Blackout to an unresolved safety issue.

C. Purpose

The purpose of this Task is to evaluate the adequacy of current licensing design requirements to assure that nuclear power plants do not pose an unacceptable risk of a station blackout accident.

The NRC safety design requirements applicable to station blackout can be grouped into three categories:

1. reliability of the offsite AC power supplies;
2. reliability of the emergency AC power supplies; and
3. capability of plants to remove decay heat with AC power supplies unavailable.

Appendix A to 10 CFR 50 defines a total loss of offsite power as an anticipated occurrence (Category 1 above). As such, it is required that an independent emergency onsite AC power supply be provided at nuclear plants. It is further required by NRC safety criteria that electric power for safety systems at nuclear plants be supplied by at least two redundant and

independent divisions (Categories 1 and 2). Each electrical division for safety systems includes an offsite AC power connection, an onsite emergency AC power supply (usually a diesel generator), and DC power sources. Those safety systems required to remove decay heat from the reactor core following shutdown are required to have available these diverse AC power supplies. Surveillance requirements include periodic testing for emergency diesel generators (Category 2) and other related electrical equipment. Additional requirements are that diverse power drives and supporting systems independent of AC power must be provided for one emergency feedwater train in PWRs (Category 3). The design practice for BWRs is to include at least one decay heat removal system (e.g., Reactor Core Isolation Cooling) driven by a source independent of AC power (Category 3).

2. PLAN FOR PROBLEM RESOLUTION

A. Approach

Technical analyses in all three of the above categories are planned for this task. However, the principal focus will be on category 2, reliability of emergency AC power supply. This is justified by several considerations. First, the questions raised about category 2 were basically responsible for identification of Station Blackout as a safety issue. Second, if safety improvements are required, it will be easier to analyze and identify them and implement them in category 2 rather than in categories 1 and 3. For example, offsite power reliability (category 1) is dependent

on a number of factors which are difficult to analyze and to control, such as regional electrical grid stability, weather phenomena, local industrial and population growth, and repair and restoration capability. Also, the capability of a plant to withstand a station blackout (category 3) would require many decay heat removal-related systems, components, instruments and controls to be independent of AC power. These will vary from plant to plant, requiring considerable effort to analyze all of them and to assure that the plants indeed have that capability. Third, some progress has been made in category 3. A significant improvement is underway for all operating PWRs by backfitting the auxiliary feedwater system to make it independent of AC power. Thus, the reliability of emergency AC power supplies is of principal importance to this task.

During the development of this task action plan, a preliminary screening analysis was begun to identify plants most likely to suffer core damage due to a loss of all A.C. power supplies. The intent of this work was to survey the frequency and implication of station blackout accidents in operating plants and identify any especially high risk plants which might require further analysis or action on an urgent basis. Initial results showed no such plants. Completion of this task is the first step in resolving this issue.

A more detailed evaluation of station blackout concerns will follow the completion of the preliminary analysis. It is recognized that this issue is centered around a concern for the adequacy of A.C. power supply reliability, especially for emergency onsite AC power supplies. As such, this area will comprise the major program effort to resolve this issue. Typical offsite and emergency A.C. power supplies will be evaluated including a review of past operating (failure) experience. This effort is limited to power supply availability and will not include an evaluation of power distribution network adequacy or power capacity requirements.

In order to provide a consequence perspective, tasks to evaluate station blackout accident sequences and associated plant response analyses are included. The Interim Reliability Evaluation Program (IREP), which will be carried out concurrently with this program, will be used as a primary information source in developing the shutdown cooling reliability models and accident scenarios needed to perform these tasks.

Upon completion of the technical evaluation tasks, a regulatory position will be developed for review and comment. A NUREG report documenting the technical studies of this program and final regulatory position will be published.

B. Management of Work

The responsibility for carrying out a program to resolve this issue was transferred to RES by memorandum dated July 13, 1979, from the Director of NRR to the Director of RES. The Probabilistic Analysis Staff of RES will provide the program management; however, NRR will remain cognizant through assignment of liaison personnel and participation in subtasks as identified in this TAP. In addition, NRR has the responsibility of obtaining and providing to the task manager operating experience information required from licensees as identified in this plan. NRR also has the responsibility of taking licensing related actions on station blackout issues during the conduct of this program.

C. Tasks

1. Preliminary Screening Analysis of Operating Plants

A probabilistic safety assessment will be performed and documented to provide a preliminary evaluation of station blackout accident sequences at operating nuclear power plants. The purpose of this work will be to effectuate a screening analysis to identify any plants of unusually high susceptibility to station blackout and subsequent core damage. As may be necessary, safety improvements in design and operation will be identified.

2. A.C. Power Supply Reliability Evaluation

Failure modes and reliability analyses will be performed for typical offsite and emergency A.C. power supplies. These analyses will include an indepth examination of the potential causes, frequency, and duration relationships for station blackouts. The A.C. power supply reliability subtasks will include:

2.1 A.C. power supply design review--Typical offsite and emergency A.C. power supply configurations will be identified and generically grouped. Consideration will be given to type of power source, line diagrams showing redundancy and switching, plant systems supplied by each bus/division, AC power dependence on DC power, and operational characteristics.

2.2 A.C. power supply operating experience review--The operational experience regarding loss of offsite power and emergency A.C. power supplies (particularly diesel generators) will be reviewed. This will include the identification of data needs and the collection of the information. Knowledge gained from previous studies of offsite and emergency AC power supply reliability will be included. The intent of this task is to obtain enough operational experience

information to allow the construction of meaningful reliability models with due consideration to the limitations of such models.

2.3 Reliability of A.C. power supplies--A reliability analysis of the typical A.C. power supply configurations will be performed. Both offsite and onsite power supplies will be modeled with special consideration given to interactive and common cause failure modes, including those induced by human error. The effect of regional and local factors on the loss and recovery of A.C. power will be considered where possible. Aspects of design and operation which have the potential to improve A.C. power supply reliability will be identified and the amount of improvement will be estimated. Design and operational recommendations to assure AC power supply reliability will be developed.

3. Accident Sequence Analysis

An investigation into the probability and consequence of station blackout accidents will be conducted through both generic and plant specific studies. The insights gained from the IREP will be used to enhance the limited detail of the generic evaluations. These studies will include the reliability of shutdown cooling systems given a loss

of A.C. power supplies, an evaluation of the hazards posed by extended blackouts, and reactor coolant inventory requirements during station blackouts. These considerations will be coupled with the results of Task 2 to identify a generic set of dominant station blackout accident scenarios. The subtasks for this evaluation will include:

3.1 Accident sequence review--Event and fault tree analyses will be reviewed to identify dominant station blackout sequences, failure modes, and consequences. These will include the Crystal River 3 analyses and, if available, the first six plant group of IREP. This information will supplement that currently available from the Reactor Safety Study[1] and follow-on studies.

3.2 Shutdown cooling reliability--A generic review of systems and components used for shutdown cooling will be performed to identify A.C. power dependencies and requirements, adequacy of A.C. independent systems, and the reliability of these systems during a station blackout. The system reliability results obtained from accident sequence reviews will be factored into this subtask.

3.3 Generic accident sequence evaluation--A set of generic event trees will be developed and the dominant

station blackout accident scenarios will be characterized. The probability and consequence of these scenarios will be used to provide a simplified risk perspective. This information will be used to establish acceptable requirements for AC power supply reliability and decay heat removal capability for station blackout.

4. Plant Response to Station Blackout

Reactor coolant system response analyses will be performed for station blackout accident scenarios. Typical NSSS designs (at least one for each LWR vendor) will be analyzed to provide an estimate of the core damage times and to determine the important operational characteristics associated with these accidents. The subtasks for this work are:

4.1 Develop plant response models--Generic and plant specific response characteristics will be considered in the development of analysis models for each LWR vendor. A preliminary and simplified event tree and accident scenario list will be used to determine the modeling requirements. Models will be best estimate where possible using existing computer codes.

4.2 Analysis matrix--An initial accident analysis matrix will be developed from simplified event trees. The accident sequence evaluations of Task 3 and initial

accident sequence analysis results will be used to revise the accident analyses matrix into a final set of plant response analyses which will provide a characterization of reactor thermal response for station blackout accidents.

4.3 Plant response analyses--Analyses will be performed for each LWR vendor NSSS to assess the time dependence and consequences of station blackout accident sequences; i.e., mitigation by adequate core cooling or damage to the core and possible melting. These results will be reviewed to identify important system or component availability and operational characteristics, including operator actions.

5. Licensing Requirements

The results of Tasks 1-4 will be used to develop any licensing requirements which may be needed to resolve this issue. Upon completion of Tasks 2-4, a recommended revision or reaffirmation of current licensing requirements will be provided. The development of a draft NUREG covering the conduct and conclusions of this program and appropriate internal and public review of the draft report are included in this task.

D. Schedule

The following schedule has been developed for the completion of the major tasks of this program:

1. Interim Study

Draft report	August 1980
Final report	October 1980

2. AC Power Reliability

Power supply design review	February 1981
Operating experience evaluation	August 1981
Reliability evaluation	December 1981

3. Accident Sequence Analysis

IREP review	April 1981
Shutdown cooling reliability	August 1981
Accident sequence evaluation	January 1982

4. Plant Response to Station Blackout

Plant response models	December 1980
Analysis matrix	February 1981
Plant response analyses	June 1981

5. Licensing Position

Internal-Peer Review	March 1982
Draft position (draft NUREG)	May 1982
Final position (NUREG approved)	October 1982

3. BASIS FOR CONTINUED PLANT OPERATION AND LICENSING PENDING COMPLETION OF TASK

As stated in Section 1, the purpose of this task is to evaluate the adequacy of current licensing design requirements regarding the risk of a station blackout accident resulting in unacceptable core

damage. In particular, the adequacy of emergency AC power supplies reliability has been questioned. The current licensing criteria require licensees to provide redundant emergency AC power supplies, to demonstrate emergency AC power supply reliability (R.G. 1.108), and to include the capability of removing decay heat using at least one shutdown cooling train independent of AC power.

In the event of a total loss of AC power at PWRs, the auxiliary feedwater (AFW) system can provide a heat sink via the steam generators to remove the core decay heat. Since the TMI-2 accident and subsequent studies further highlighted the importance of the AFW systems, the Bulletins and Orders Task Force[2] performed a review of these systems for operating Combustion Engineering and Westinghouse designed PWRs. The objectives of this study were to: (1) identify necessary changes in AFW system design or related procedures to assure continued safe operation, and (2) to identify other system characteristics in the AFW system design of these plants which, on a long term basis, may require system modification. Based on this study, the Bulletins and Orders Task Force made a number of recommendations to improve the reliability of the AFW systems. Some of these recommendations were specifically made to cover the concern for the total loss of offsite and onsite AC power. For the near term, the Bulletins and Orders Task Force required that as-built plants be capable of providing the required AFW flow for at least 2 hours from one AFW pump train independent of any AC power source. For the long term, it is required that this function be performed

automatically in addition to various other improvements. The near term recommendation has been met for most CE and Westinghouse PWRs; the long term improvements are scheduled to be completed by January 1, 1982.

The reliability of the AFW systems for the Babcock and Wilcox operating PWRs was reviewed as part of the May 1979 shutdowns for these plants. This review resulted in various short-term system and emergency procedure modifications to improve the availability of these systems. A more systematic reliability review of these plants is now in progress. These plants will also be required to meet the long term requirements discussed above.

Boiling water reactors contain various systems to remove core decay heat following the total loss of AC power. These systems include the isolation condensers on BWR/1 through BWR/3 plants and the steam driven high pressure coolant injection (HPCI) and reactor core isolation cooling (RCIC) system.....For BWR/1, BWR/2 and early BWR/3 plants, the isolation condenser will provide an adequate heat sink for a minimum of 40 minutes. For other BWRs, adequate cooling can be maintained for approximately 2 hours. The Bulletins and Orders Task Force did not require any specific improvements for these systems following its review; however, a review of BWRs is included in this study.

In addition to the above, a preliminary study of operating plants was performed to assess plant vulnerability using probabilistic

B. Division of Systems Interaction. Provides review and comment on the technical evaluations provided by the Task Manager in the areas of instrumentation and control, electrical and power systems, reactor and auxiliary systems, and systems interactions. DSI will provide assistance in the identification of design and operational characteristics of AC power supplies and systems required for shutdown cooling. In addition, DSI will contribute to the formulation, review, and approval of interim and final licensing positions.

Manpower requirements

Instrumentation and Control Systems Branch	0.05	my
Power Systems Branch	0.10*	my
Reactor Systems Branch	0.05	my
Auxiliary Systems Branch	0.05	my
Systems Interaction Branch	0.05	my

*reflects PSB responsibility directly related to station blackout

C. Division of Human Factors. Provides review and comment on those technical evaluations involving man/machine interfaces. In this area, DHF will contribute to the formulation, review, and approval of interim and final licensing positions.

Manpower requirements

Human Factors Engineering Branch	0.05	my
Procedures and Test Review Branch	0.05	my

D. Division of Safety Technology. Provides liaison between NRR and PAS, and provides general assistance in the coordination of activities performed within NRR which are part of this Task Action Plan. DST has primary responsibility for the initial

review of draft licensing recommendations and for coordination of the internal management and public review process required to adopt the final licensing positions. DST will also coordinate the formal revision and publication of licensing documents (i.e., regulatory guides, standard review plan, etc.) with the Office of Standards Development.

Manpower requirements

Generic Issues Branch	0.20* my
Licensing Guidance Branch	0.05 my
Reliability and Risk Assessment Branch	0.05 my

*reflects GIB overall coordination responsibility

6. TECHNICAL ASSISTANCE

Direct technical assistance to the program will be required for Tasks 2 and 3. Funding will be provided by the Office of Nuclear Reactor Regulation. Technical assistance requirements for Task 4 will be developed and funded directly by the Division of Reactor Safety Research, RES. The following is a brief description of the technical assistance required for Tasks 2 and 3 for this program.

A. Offsite Power Reliability

1. Contractor - to be selected.

2. NRC managing organization - PAS (RES).

3. Scope - Identify initiating events which can cause a loss of offsite power, evaluate the expected frequency, and determine dominant factors affecting the reliability of

offsite power supplies and the recovery of offsite power. This will include consideraion of power supply and circuit configurations, operational characteristics (technical specifications, limiting conditions of operation, operating procedures, human interactions), and location dependent factors (multiple unit sites, proximity to alternate power supplies, regional grid reliability). In the context of these considerations, operating experience data will be evaluated, reliability models will be developed, and reliability estimates will be provided. Features which may improve the reliability of offsite power supplies will also be evaluated.

4. Funding requirements - $150K.

B. Emergency A.C. Power Reliability

1. Contractor - to be selected.

2. NRC managing organization - PAS (RES).

3. Scope - Identify range of emergency A.C. power supply design configurations used at nuclear power plants. Collect and analyze operating experience data. Quantify probabilities of dominant emergency power supply failure modes. Review experience at several operating nuclear plants. Review emergency power supply reliability experience from other applications such as DOD and FAA. Develop

predictive reliability models for emergency A.C. power supplies including component and design differences, operational characteristics, and power supply recovery from failure. Identify practical reliability improvements and quantitative reliability goals. Earlier NRR qualitative studies and other studies will be reviewed and incorporated. Estimate reliability increases possible and associated costs.

4. Funding requirements - $300K.

C. Station Blackout Accident Sequence Evaluation

1. Contractor - to be selected.

2. NRC managing organization - PAS (RES).

3. Scope - Develop generic event trees, characterize dominant accident scenarios, and provide a risk/consequence perspective for station blackout accidents. A review of IREP accident sequences and shutdown cooling systems reliability associated with a station blackout will be conducted to supplement the generic evaluations. The results of the offsite and emergency A.C. power supply reliability studies will be used in conjunction with the generic accident sequence and shutdown cooling reliability assessment to provide station blackout accident perspectives.

4. Funding requirements - $150K.

7. INTERACTIONS WITH OUTSIDE ORGANIZATIONS

Interaction with outside organizations could include EPRI, NSAC, INPO, FERC, FAA, utilities, NSSS vendors, A&Es, and emergency diesel generator manufacturers. Peer review will be conducted through ACRS briefings and by the establishment of a peer review panel selected from outside NRC having appropriate expertise.

8. POTENTIAL PROBLEMS

The potential problem areas which have been identified are provided below:

A. Program funding must be approved and obtained. If competitive contractor bidding is necessary, the program will be delayed by approximately one year.

B. Identification of reliability goals and translation of probabilistic results into licensing requirements.

C. Obtaining necessary operating experience on AC power supplies.

D. Uncertainty in what information will be available from IREP and on what schedule.

E. Liaison needed between NRR and RES.

REFERENCES

1. U.S. Nuclear Regulatory Commission, "Reactor Safety Study," NRC Report WASH-1400, NTIS, October 1975.

2. NUREG-0645, "Report of the Bulletins and Orders Task Force," January 1980.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

CHAIRMAN

October 24, 1980

MEMORANDUM FOR: Executive Director for Operations

FROM: John Ahearne

SUBJECT: STATION BLACKOUT

I have several follow-up questions regarding the September 26 report on the status of Task Action Plan A-44 (TAP A-44) -- station blackout. Section 3 of TAP A-44 relied on a preliminary staff study which did not identify any operating plant as having an "unusually high susceptibility" to severe core damage from a station blackout. This criterion is not defined. Please identify the plants for which the probability of station blackout is comparable to or exceeds the value for St. Lucie No. 2. For these plants is there any basis for not now requiring the changes already made at the two St. Lucie Units, including the implementation of training programs and procedures for Station operation during a blackout and for restoration of ac power?

Please provide a response with the report referenced in the September 26 response.

cc: Commissioner Gilinsky
Commissioner Hendrie
Commissioner Bradford
OGC
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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

NOV 1 0 1980

MEMORANDUM FOR: Chairman Ahearne

FROM: Harold R. Denton, Director
Office of Nuclear Reactor Regulation

THRU: William J. Dircks (Signed) William J. Dircks
Executive Director for Operations

SUBJECT: STATION BLACKOUT

In our memorandum dated September 26, 1980, we presented the A-44 Task Action Plan for station blackout (loss of all AC power events) and indicated that implementation of the ALAB-603 recommendations was being evaluated in response to your inquiry of August 20, 1980. The purpose of this memorandum is to describe the action plan which we believe will resolve the Board's concern and to respond to your subsequent follow-up questions of October 24, 1980.

The Atomic Safety and Licensing Appeal Board (ALAB-603) concluded that station blackout should be considered a design basis event for St. Lucie Unit 2 and recommended that, in view of the completion schedule for Task A-44, "for nuclear power facilities with a station blackout likelihood comparable to that of St. Lucie Unit 2, expeditious measures be taken to ensure that these plants and their operators are equipped to accommodate such an event in a manner that assures the public health and safety." Our initial response to the Board's decision was to amend the construction permit for St. Lucie Unit 2 (September 18, 1980) to require that station blackout be included as a design basis event, as was ordered by the Board. A similar requirement has been imposed on St. Lucie Unit 1, under the provisions of 10 CFR Part 50.54 (f), in order to provide consistency in the design basis for the sister plant.

As described in the attached memorandum from R. M. Bernero dated August 22, 1980 (Enclosure 1), the probability of station blackout is not significantly different between St. Lucie and all other nuclear power plants. This assertion is based on the preliminary staff study mentioned in Section 3 of TAP A-44. All plants, including St. Lucie, are comparable in station blackout probability within the uncertainty band. We are currently updating that study with improved data and more careful documentation of the assumptions and limitations. Section 3 of TAP A-44 provides the basis for continued plant licensing and operation. The preliminary probabilistic study provides supplementary information to the Bulletins and Orders requirements cited in that section, which were the principal bases for continued operation. The extent to which station blackout should be considered in the design of all other plants, and the criteria by which it should be considered, will be established by Task A-44. We have reviewed the schedule for Task A-44 and conclude that it cannot be significantly improved. Nevertheless, we concur with the Board's recommendation that some interim measures should be taken while Task A-44 is being conducted.

Contact:
C. Grimes, DOL
X28204

Consequently, we plan to issue the enclosed generic letter (Enclosure 2), which requires that all licensees and applicants develop interim emergency procedures and a training program for station blackout events. We believe that this action will resolve the Board's concern for the period while Task A-44 is being conducted. In addition, there are some short-term system improvements associated with other actions which will reduce the potential for and consequences of a station blackout event. These are:

1. The short-term improvements to the auxiliary feedwater system in PWR plants associated with Task II.E.1.1 of the TMI-2 Action Plan (NUREG-0660). These improvements are scheduled to be completed by July 1, 1981.

2. The installation of quencher safety-relief valve discharge devices in BWR plants associated with the Mark I Containment Long Term Program. The schedules for the Mark I-related plant modifications are described in SECY-80-359 and SECY-80-359A.

3. The recommendations for improvements to the emergency diesel generators which have evolved from a recent contractor study of diesel reliability (NUREG/CR-0660). These recommendations are currently being implemented on OL license applications and a program for implementation for the operating reactors, including improvements to the related Technical Specifications, is being developed.

We believe that the development of emergency procedures and training programs, as described in the enclosed generic letter, coupled with the stated basis for continued plant operation described in the A-44 Task Action Plan, are sufficient to resolve the Board's concern relative to the ability of the operating plants to accommodate a station blackout event.

Harold R. Denton

11/7/80

Harold R. Denton, Director
Office of Nuclear Reactor Regulation

Enclosures:
1. Memorandum from R. M. Bernero to H. R. Denton dated August 22, 1980.
2. Station Blackout Generic Letter

cc: Commissioner Gilinsky
Commissioner Hendrie
Commissioner Bradford
OGC
OPE
SECY

ENCLOSURE 1

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

AUG 22 1980

MEMORANDUM FOR: Harold R. Denton, Director
Office of Nuclear Reactor Regulation

THRU: Thomas E. Murley, Acting Director TEM
Office of Nuclear Regulatory Research

FROM: Robert M. Bernero, Director
Division of Systems and Reliability Research
Office of Nuclear Regulatory Research

SUBJECT: ALAB DECISION 603 DATED JULY 30, 1980 ON STATION BLACKOUT AT ST. LUCIE UNIT 2

The purpose of this memorandum is to offer comments on the recent ruling by the Appeal Board on St. Lucie 2 (ALAB-603). We do not agree with conclusion 4, "that a complete loss of AC power--station blackout--must be considered a design basis event for St. Lucie Unit 2." Flaws are apparent in ALAB-603 in a number of areas:

1. The quantitative criterion for action.

2. The foreclosure of alternatives to deal with blackout.

3. Assumption that St. Lucie 2 is exceptionally prone to blackout.

These problem-areas are discussed further below.

1. Quantitative Criterion for Action

It is clear the criterion of acceptability chosen by ALAB (p. 31 of the decision) was never intended by the staff to be applied in such a way. Section 2.2.3 of the Standard Review Plan explicitly limits the use of the 10^{-7} criterion (areas of review) to "accidents involving nearby industrial, military, and transportation facilities" and "potential accidents involving hazardous materials or activities in the vicinity of the plant"--that is, to external hazards such as nearby transportation of toxic gases or explosives. This is not to say that a probability goal is not appropriate for station blackout. Station blackout lends itself more readily to a probabilistic goal than do some other event sequences. However, we believe a probabilistic goal in the neighborhood of 10^{-5} per plant-year is more reasonable for a potential core damage accident resulting from station blackout. As an interim goal, for say 5 years, a range of 10^{-5} to 10^{-4} would entail a minimal risk at operating reactors

while a more permanent probabilistic staff objective is developed. Indeed, improvements over the last 7 or 8 years in our knowledge of the severity of core damage accidents raise the question of whether the 10^{-7} criterion might be unnecessarily restrictive even for external hazards.

We recognize that there exists no criterion in the record, so one can hardly blame the Appeal Board for somewhat arbitrarily selecting Section 2.2.3 as their basis. Clarification of the staff objective is sorely needed, and we believe this should be a top priority--not only for station blackout but for other important transients such as loss of feedwater.

2. Foreclosure of Alternatives

The ALAB-603 conclusions do not provide for what we think is an acceptable alternative to making station blackout a design basis event. One alternative is to reduce the probability of a station blackout. This could be done by improving the reliability of the emergency onsite AC power supply system. For example, an additional diesel generator (with diversity in manufacturer, size, testing, etc.), or a gas turbine could make significant improvement. Another alternative would be an NRC-approved plan and procedures for the restoration of offsite power and emergency onsite power. Note that ALAB assumed the probability of restoring offsite power was zero and also that the probability of getting one of the diesel generators started (after initially failing to start) was zero. Yet, the conclusion was drawn on page 69 that "there is a high likelihood that following station blackout, a source of AC power can be restored before events resulting from its loss produce reactor core damage." If the Board had included a probability for AC power restoration, we think (and their above-stated conclusion supports us) it could reduce the calculated core damage probability from station blackout by as much as a factor of 10. Approved AC power restoration procedures could also significantly limit the time interval for which it is necessary to assure that the decay heat removal systems are independent of AC power.

3. Assumption that St. Lucie is Exceptionally Prone to Blackout

There are at least two potential major impacts of ALAB-603 on the licensing process and on operating reactors. First, if the conclusion requiring station blackout to be a design basis event at St. Lucie is accepted, then it surely must be applied to other operating reactors since most are in the same probability range, i.e., 10^{-5} to 10^{-4} per plant-year for experiencing a station blackout. Current estimates of station blackout probability, based on operating experience, do not confirm the premise that Florida-based plants are exceptionally prone to that event. Compared to other plants in

the U.S., for example, the loss of offsite power at Florida plants is only a little more frequent (perhaps a factor of 2) than the national average. A crude survey of operating experience indicates to us that there are at least 8 plant sites with more frequent loss of offsite power than any of the Florida plants. This may be because different failure mechanisms such as tornadoes, ice storms, lightning, electrical demand surges, grid reliability, etc. are operating in different geographical regions. For example, two of the higher frequency plants are in the midwest (tornadoes?), two are on northern great lakes (winds, ice, lightning?), three are on the northeast seaboard (weather, grid ties, demand surges?) and one is near the Gulf of Mexico (weather, grid connection?). Thus, while grid reliability may be somewhat lower for Florida plants, a number of other causes of power loss are not present in Florida.

Furthermore, the loss of onsite emergency AC power does not appear to be a strong function of geographical location. Thus, Florida plants (including St. Lucie Unit 2) would not appear to have inherent failure mechanisms of their emergency AC power that are peculiar to the peninsular geography.

A second possible impact could occur if the application of the 10^{-7} criterion to a potential accident sequence (such as a station blackout transient) is accepted; it might then become a precedent by which to judge other transients and LOCAs. It is likely that no current or planned commercial operating reactor could meet such a severe criterion. The probability of core damage accidents due to other transient and LOCA sequences has frequently been estimated by NRC over the last 8 years to be in the 10^{-3} to 10^{-4} range at operating reactors.

In summary, while we agree with much of ALAB-603 and feel it is a well-written lucid presentation of the station blackout concerns, we do not agree that station blackout must be considered a design basis event at St. Lucie Unit 2.

Harold Edison for

Robert M. Bernero, Director
Division of Systems and Reliability Research
Office of Nuclear Regulatory Research

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ENCLOSURE 2

TO: ALL LICENSEES OF OPERATING NUCLEAR POWER REACTORS AND APPLICANTS FOR OPERATING LICENSES

SUBJECT: EMERGENCY PROCEDURES AND TRAINING FOR STATION BLACKOUT EVENTS

A recent decision by the Atomic Safety Licensing and Appeal Board (ALAB-603) concluded that station blackout (i.e., loss of all AC power) should be considered a design basis event for St. Lucie Unit 2. An amendment to the Construction Permit for St. Lucie Unit 2 was subsequently issued on September 18, 1980. The NRC staff is currently assessing station blackout events on a generic basis (Generic Task A-44). The results of this study, which is scheduled to be completed in 1982, will identify the extent to which design provisions should be included to reduce the potential for or consequences of a station blackout event.

However, the Board has recommended that more immediate measures be taken to ensure that station blackout events can be accommodated while Task A-44 is being conducted. Although we believe that, qualitatively, there appears to be sufficient time available following a station blackout event to restore AC power, we concur that some interim measures should be taken.

Consequently, we require that you promptly implement interim emergency procedures and a training program for the existing systems in your facility for station blackout events, if such procedures and training do not already exist. The emergency procedures should consider, but are not limited to:

a. The actions and equipment necessary to maintain the reactor coolant inventory and heat removal with only DC power available, including consideration of the unavailability of auxiliary systems such as ventilation and component cooling.
b. The estimated limiting time to restore AC power and its basis.
c. The actions for restoring offsite AC power in the event of a loss of the grid.
d. The actions for restoring offsite AC power when its loss is due to postulated onsite equipment failures.
e. The actions necessary to restore emergency onsite AC power. The actions required to restart diesel generators should include consideration of the unavailability of AC power. For example, unsuccessful attempts to start diesel generators may result in depletion of the compressed air tanks. After repairs or adjustments, further attempts to start the diesels may not be possible without recharging the air tanks. In the absence of AC power, provisions may be necessary for portable air tanks, manual air pumps, DC compressors, etc.
f. Consideration of the availability of emergency lighting, and any actions required to provide such lighting, in equipment areas where operator or maintenance actions may be necessary.

g. Precautions to prevent equipment damage during the return to normal operating conditions following restoration of AC power. For example, the limitations and operating sequence requirements which must be followed to restart the reactor coolant pumps following an extended loss of seal injection water should be considered in the recovery procedures.

The annual requalification training program should consider the emergency procedures and include simulator exercises involving the postulated loss of all AC power and decay heat removal accomplished by natural circulation and the steam-driven auxiliary feedwater system for PWR plants, and by the steam-driven RCIC and/or HPCI and the safety-relief valves in BWR plants.

We require that the actions described above be completed by June 1, 1981 for the licensed nuclear power reactors and plants licensed before that date, or prior to licensing for plants licensed after that date. The staff's review of these actions will be accomplished as part of the implementation of the recommendations which evolve from Task A-44 and implementation of the long-term programs related to emergency procedures and training in the TMI-2 Action Plan (NUREG-0660). The interim procedures developed in response to this request will eventually be placed by the final procedures which evolve from Tasks I.C.1 (3) and I.C.9 of the TMI-2 Action Plan.

Accordingly, pursuant to 10 CFR 50.54(f) licensees are requested to furnish, within forty-five (45) days of this letter, confirmation that the implementation date of June 1, 1981 will be met. For plants licensed after this letter, these actions and the implementation schedule will be incorporated as license conditions. In the event that the completion date cannot be met, furnish a proposed revised date, justification for the delay, and any planned compensating safety actions during the interim. After our evaluation of your response, the NRC staff will take action, as necessary, to assure that such requirements and commitments are appropriately enforceable. This may include, as needed, issuance of a Confirmatory or Show-Cause Order.

Darrell G. Eisenhut, Director
Division of Licensing

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555

OFFICE OF THE
COMMISSIONER

November 26, 1980

MEMORANDUM FOR: Chairman Ahearne
Commissioner Gilinsky
Commissioner Bradford

FROM: Joseph M. Hendrie

SUBJECT: ALAB-603 -- (SECY-A-80-140)

On October 14th, three of us voted for no review on ALAB-603 (St. Lucie-2) and the Commission's review period ended. Commissioner Gilinsky did not participate but had indicated his preference for Commission review. There is now running the 60-day period in which the Commission might reconsider its no-review decision. The 60-day period will end about December 14th.

Denton's memorandum of November 10th to the Chairman on station blackout, discussing proposed staff actions related to ALAB-603, and the attached memo from Bernero, set me to reviewing the whole business. I conclude my vote not to review ALAB-603 was in error. There are some generic aspects of ALAB-603 that I think the Commission should consider very carefully. These are the use of probability numbers in the site review section of the Standard Review Plan to determine what events should be within the design basis of a plant and the way in which station blackout is framed as a design basis event.

I solicit your votes, first to reconsider the no-review decision, and second to take review of ALAB-603. SECY will please poll the Commission.

cc: SECY
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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the Matter of	)	
	)	
FLORIDA POWER AND LIGHT COMPANY	)	Docket No.(s) 50-389
	)	
(St. Lucie Plant, Unit No. 2)	)	
	)	
	)	
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CERTIFICATE OF SERVICE

I hereby certify that I have this day served the foregoing document (s) upon each person designated on the official service list compiled by the Office of the Secretary of the Commission in this proceeding in accordance with the requirements of Section 2.712 of 10 CFR Part 2 - Rules of Practice, of the Nuclear Regulatory Commission's Rules and Regulations.

Dated at Washington, D. C. this
1ST day of December, 1980.

Office of the Secretary of the Commission

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NUCLEAR REGULATORY COMMISSION

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	)	

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