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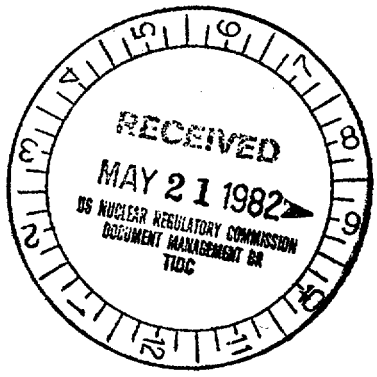
Docket No. 50-305



Mr. Eugene R. Mathews, Vice President
Power Supply and Engineering
Wisconsin Public Service Corporation
Post Office Box 1200
Green Bay, Wisconsin 54305

Dear Mr. Mathews:

The Commission has issued the enclosed Amendment No. 42 to Facility Operating License No. DPR-43 for Kewaunee Nuclear Power Plant. The amendment consists of changes to the Technical Specifications in response to your applications transmitted by letters dated August 4, 1977, as subsequently revised on January 28, 1981, May 1, 1981, November 30, 1981 and February 1, 1982.

The amendment revises the Technical Specifications in respect to Degraded Grid Voltage Protection and encloses the additional SER for the Subject of Adequacy of Station Electric Distribution System Voltages. These two SER's are cojoint as the Subject of Adequacy of Station Electric Distribution System Voltages developed as an extension of the Subject of Degraded Grid Voltage Protection; the set point levels for Degraded Grid Voltage Conditions were established by the analyses required under the Subject of Adequacy of Station Distribution System Voltages.

We note that by letter of February 1, 1982, Wisconsin Public Service Corporation has committed to implementing the proposed modifications necessary to meet the requirements of this Safety Evaluation Report before startup from the 1982 refueling outage for the Kewaunee Nuclear Power Plant.

Copies of the Safety Evaluation and the Notice of Issuance are also enclosed.

Sincerely,

ORIGINAL SIGNED

Robert B. A. Licciardo, Project Maanger
Operating Reactors Branch #1
Division of Licensing

8205280053 p

Enclosures:
1. Amendment No. 42 to DPR-43
2. Safety Evaluation
3. Notice of Issuance

cc w/enclosures:
See next page

CONCURRENCE AS TO FORM OF NOTICE AND AUDIT ONLY

*Previous concurrence see next page

OFFICE	ORB#1:DL*	ORB#1:DL*	ORB#1:DL	AD/OR:DL	OELD		
SURNAME	CParrish	RLicciardo	Varga	TNovak	BwBrinkman		
DATE	04/ /82	04/ /82:ds	04/ /82	04/ /82	04/ /82		

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Docket No. 50-305

Mr. Eugene R. Mathews, Vice President
Power Supply and Engineering
Wisconsin Public Service Corporation
Post Office Box 1200
Green Bay, Wisconsin 54305

Dear Mr. Mathews:

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The amendment revises the Technical Specifications in respect to Degraded Grid Voltage Protection and encloses the additional SER for the Subject of Adequacy of Station Electric Distribution System Voltages.

Copies of the Safety Evaluation and the Notice of Issuance are also enclosed.

Sincerely,

Robert B. A. Licciardo, Project Manager
Operating Reactors Branch #1
Division of Licensing

Enclosures:
1. Amendment No. to DPR-43
2. Safety Evaluation
3. Notice of Issuance

cc w/enclosures:
See next page

OFFICE	ORB#1:DL	ORB#1:DL	ORB#1:DL	AD/OR:DL	OELD		
SURNAME	CParrish	RLicciardo	SVarga	TNovak			
DATE	04/21/82	04/16/82:ds	04/28/82	04/ /82	04/ /82		

Mr. Eugene R. Mathews
Wisconsin Public Service Corporation

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Town of Carlton
Route 1
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Kewaunee County Board
Kewaunee County Courthouse
Kewaunee, Wisconsin 54216

Chairman
Public Service Commission of Wisconsin
Hill Farms State Office Building
Madison, Wisconsin 53702

Mr. Patrick Walsh
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U. S. Nuclear Regulatory Commission
Resident Inspectors Office
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Regional Radiation Representative
EPA Region V
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Chicago, Illinois 60604

James P. Keppler
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Glen Ellyn, Illinois 60137

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

WISCONSIN PUBLIC SERVICE CORPORATION
WISCONSIN POWER AND LIGHT COMPANY
MADISON GAS AND ELECTRIC COMPANY

DOCKET NO. 50-305

KEWAUNEE NUCLEAR PLANT

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 42
License No. DPR-43

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by Wisconsin Public Service Corporation, Wisconsin Power and Light Company and Madison Gas and Electric Company (the licensees) dated August 4, 1977, and as subsequently revised on January 28,1981, May 1, 1981, November 30, 1981 and February 1, 1982, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act) and the Commission's rules and regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisified.

2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment, and paragraph 2.C.(2) of Facility Operating License No. DPR-43 is hereby amended to read as follows:

(2) Technical Specifications

The Technical Specifications contained in Appendices A and B, as revised through Amendment No. 42 , are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of June 1, 1982.

FOR THE NUCLEAR REGULATORY COMMISSION

Steven A. Varga, Chief
Operating Reactors Branch #1
Division of Licensing

Attachment:
Changes to the Technical
Specifications

Date of Issuance: April 30, 1982

ATTACHMENT TO LICENSE AMENDMENT

AMENDMENT NO. 42 TO FACILITY OPERATING LICENSE NO. DPR-43

DOCKET NO. 50-305

Revise Appendix A as follows:

Remove Pages	Insert Pages
TS 3.5-1	TS 3.5-1
TS 3.5-5	TS 3.5-5
--------	TS 3.5-6
Table TS 3.5-1 (Page 1 of 2)	Table TS 3.5-1 (Page 1 of 2)
Table TS 3.5-1 (Page 2 of 2)	Table TS 3.5-1 (Page 2 of 2)
Table TS 3.5-5	Table TS 3.5-5 (Page 1 of 2)
--------	Table TS 3.5-5 (Page 2 of 2)
Table TS 4.1-1 (Page 1 of 4)	Table TS 4.1-1 (Page 1 of 4)
TS 4.6-1	TS 4.6-1
TS 4.6-2	TS 4.6-2
TS 4.6-3	TS 4.6-3
--------	TS 4.6-4

3.5 INSTRUMENTATION SYSTEM

Applicability

Applies to reactor protection and engineered safety features instrumentation systems.

Objective

To provide for automatic initiation of the engineered safety features in the event that principal process variable limits are exceeded, and to delineate the conditions of the reactor protection instrumentation and engineered safety features circuits necessary to ensure reactor safety.

Specification

a. Setting limits for instrumentation which initiate operation of the engineered safety features shall be as stated in Table TS 3.5-1.

b. For on-line testing or in the event of failure of a sub-system instrumentation channel, plant operation shall be permitted to continue at rated power in accordance with Tables TS 3.5-2 through TS 3.5-5.

c. If for Tables TS 3.5-2 through TS 3.5-5 the number of channels of a particular sub-system in service falls below the limits given in Column Three, or if the values in Column Four cannot be achieved, operation shall be limited according to the requirement shown in Column 6, as soon as practicable.

d. In the event of sub-system instrumentation channel failure permitted by Specification 3.5.b, Tables TS 3.5-2 through TS 3.5-5 need not be observed during the short period of time (approximately 4 hours) the operable sub-system channels are tested, where the failed channel must be blocked to prevent unnecessary reactor trip.

e. The instrumentation in Table 3.5-5 shall be operable. In the event the limits given in column 1 and 2 cannot be maintained, operator action will be in accordance with the respective notes.

6. The set points and associated ranges for the undervoltage relays have been established to always maintain motor voltages at or above 80% of their nameplate rating and to prevent prolonged operation of motors below 90% of their nameplate rating. All safeguard motors were designed to accelerate their loads to operating speed with 80% nameplate voltage, but not necessarily within their design temperature rise. Prolonged operation below 90% of nameplate voltage may result in shortening of motor insulation life, but short term operation below 90% of nameplate voltage will not result in unacceptable effects due to the service factor provided in the motors and the conservative insulation system used on the motors.

The primary safeguard buses undervoltage trip (87.5% of nominal bus voltage) is designed to protect against a loss of voltage to the safeguard bus and assures that safeguard protection action will proceed as assumed in the FSAR. The associated time delay feature prevents inadvertent actuation of the undervoltage relays from voltage dips, while assuring that the diesel generators will reach full capacity before the safety injection pump loads are sequenced on.

The safeguard buses second level undervoltage trip (95% of nominal bus voltage) is designed to protect against prolonged operation below 90% of nameplate voltage of safeguard pumps. The time delay of less than 5 minutes allows the operator time to restore voltage by minimizing or balancing loads on the safeguard buses while maintaining the preferred source of power. Up to 5 minutes of operation of safeguard pumps between 80% and 90% of nameplate voltage is acceptable due to the service factor and conservative insulation designed into the motors.

Each relay in the u rvoltage protection channels wi fail safe and is alarmed to alert the operator to the failure.

A blackout signal which occurs during the sequence loading following a safety injection signal will result in a reinitiation of the sequence loading logic at time step 0 as long as the Safety Injection signal has not been re-set. The Kewanuee Emergengy Procedures warn the operators that a Blackout Signal occurring after reset of Safety Injection will not actuate the sequence loading and instructs to re-initiate Safety Injection if needed.

Instrument Operating Conditions

During plant operations, the complete protective instrumentation systems will normally be in service. Reactor safety is provided by the Reactor Protection Systems, which automatically initiates appropriate action to prevent exceeding established limits. Safety is not compromised, however, by continuing operation with certain instrumentation channels out of service since provisions were made for this in the plant design. This specification outlines limiting conditions for operation necessary to preserve the effectiveness of the Reactor Control and Protection System when any one or more of the channels is out of service.

Almost all reactor protection channels are supplied with sufficient redundancy to provide the capability for channel calibration and test at power. Exceptions are backup channels such as reactor coolant pump breakers. The removal of one trip channel on process control equipment is accomplished by placing that channel bistable is a tripped mode; e.g., a two-out-of-three circuit becomes a one-out-of-two circuit. The source and intermediate range nuclear instrumentation system channels are not intentionally placed in a tripped mode since these are one-out-of-two trips, and the trips are therefore bypassed during testing. Testing does not trip the system unless a trip condition exists in another channel.

References:

(1) FSAR Section 7.5
(2) FSAR Section 14.3
(3) FSAR Section 14.2.5

TABLE TS 3.5-1

(Page 1 of 2)

ENGINEERED SAFETY FEATURES INITIATION INSTRUMENT SETTING LIMITS

NO.	FUNCTIONAL UNIT	CHANNEL	SETTING LIMIT
1	High Containment Pressure (Hi)	Safety Injection[1]	$\leq$ 4 psig
2	High Containment Pressure (Hi-Hi)	a. Containment Spray	$\leq$ 23 psig
		b. Steam Line Isolation of Both Lines	$\leq$ 17 psig
3	Pressurizer Low Pressure	Safety Injection[1]	$\geq$ 1815 psig
4	Low Steam Line Pressure	Safety Injection[1]	$\geq$ 500 psig
		Lead Time Constant	$\geq$ 12 seconds
		Lag Time Constant	$\leq$ 2 seconds
5	High Steam Flow in a Steam Line Coincident with Safety Injection and Low Tavg	Steam Line Isolation of Affected Line[2]	d/p corresponding to 0.745 x 10^6 lb/hr at 1005 psig
			$\geq$ 540°F
6	High-High Steam Flow in a Steam Line Coincident with Safety Injection	Steam Line Isolation of Affected Line[2]	$\leq$ d/p corresponding to 4.5 x 10^6 lb/hr at 735 psig
7	Forebay Level	Trip circ. water pumps	
8	Containment Purge and Vent System Radiation Particulate Detector Radioactive Gas Detector	Containment Ventilation Isolation	$\leq$ value of Radiation Levels in exhaust duct as defined in None[3]

TABLE TS 3.5-1 (1 of 2)

Amendment No. 42

TABLE TS 3.5-1

(Page 2 of 2)

ENGINEERED SAFETY FEATURES INITIATION INSTRUMENT SETTING LIMITS

NO.	FUNCTIONAL UNIT	CHANNEL	SETTING LIMIT
9	Safeguards Bus Undervoltage (4)	Loss of Power	87.5% ± 2% nominal bus voltage ≤ 2.5 second time delay
10	Safeguards Bus Second Level (5) Undervoltage	Degraded Grid Voltage	95% ± 2% of nominal bus voltage ≤ 5 minutes time delay

(1) Initiates containment isolation, feedwater line isolation, shield building ventilation, auxiliary building special vent, and starting of all containment fans. In addition, the signal overrides any bypass on the accumulator valves.

(2) Confirm main steam isolation valves closure within 5 seconds when tested. d/p = differential pressure.

(3) The setting limits for max radiation levels are derived from the technical specification allowable release rates found in Technical Specification 3.9.b.

(4) This undervoltage protection channel ensures ESF equipment will perform as assumed in the FSAR.

(5) This undervoltage protection channel protects ESF equipment from long term low voltage operation.

TABLE TS 3.5-5 (1 of 2)

INSTRUMENTATION OPERATING CONDITIONS FOR INDICATION

NO.	FUNCTIONAL UNIT	REQUIRED TOTAL NO. OF CHANNELS*	MINIMUM CHANNELS OPERABLE**
1	Auxiliary Feedwater Flow to Steam Generators (Narrow Range Level Indication already required operable by Tech Spec Table TS 3.5-2 Item 12).	1/steam gen	1/steam gen
2	Reactor Coolant System Subcooling Margin	2	1
3	Pressurizer Power Operated Relief Valve Position (One Common Channel Temperature, One Channel Limit Switch per Valve)	2/valve	1/valve
4	Pressurizer Power Operated Relief Block Valve Position (One Common Channel Temperature, One Channel Limit Switch per Valve)	2/valve	1/valve
5	Pressurizer Safety Valve Position (One Channel Temperature, and one Acoustic Sensor per valve)	2/valve	1/valve

* With the number of Operable monitoring instrumentation channels less than the Required Total Number of Channels shown, either restore the inoperable channels to Operable status within fourteen days, or be in at least Hot Shutdown within the next 12 hours.

**With the number of Operable event monitoring instrumentation channels less than the Minimum Channels Operable requirements, either restore the minimum number of channels to Operable status within 72 hours or be in at least Hot Shutdown within the next 12 hours.

NOTE: Technical Specification 6.9.b.2 applies only when MIMIMUM CHANNELS OPERABLE are less than shown.

TABLE TS 3.5-5 (2 of 2)

INSTRUMENT OPERATION CONDITIONS FOR SAFEGUARDS BUS POWER SUPPLY FUNCTIONS

NO.	FUNCTIONAL UNIT	1 NO. OF CHANNELS	2 NO. OF CHANNELS TO TRIP	3 MINIMUM OPERABLE CHANNELS	4 MINIMUM DEGREE OF REDUNDANCY	5 PERMISSIBLE BYPASS CONDITIONS	OPERATOR ACTION IF CONDITIONS OF COLUMN 3 OR 4 CANNOT BE MET
6	Safeguards Bus Undervoltage	2/Bus(1)	1/Bus	1/Bus(2)	--		Maintain hot shutdown or operate the diesel generator
7	Safeguards Bus Second Level Undervoltage	1/Bus(3)	1/Bus	--	--		When one of the two 6 second time delay relays is out of service, place that relay in the tripped condition.

(1) Each channel consists of one instantaneous and one time delayed relay connected in series.

(2) When one component of a channel is taken out of service, that component shall be in the TRIPPED condition.

(3) Each channel has 2 time delay relays in parallel which are in series with a third time delay relay.

TABLE TS 4.1-1

MINIMUM FREQUENCIES FOR CHECKS, CALIBRATIONS AND TEST OF INSTRUMENT CHANNELS
(Page 1 of 4)

	Channel Description	Check	Calibrate	Test	Remarks
1.	Nuclear Power Range	S (1) EFPM (3)****	D (1) EFPQ (3)****	(M) (2)***	1) Heat balance 2) Signal to ΔT; bistable action (permissive, rod stop, trips) 3) Upper and lower chambers for axial off-set using in-core detectors
2.	Nuclear Intermediate Range	*S (1)	N.A.	P (2)	1) Once/shift when in service 2) Log level; bistable action (permissive, rod stop, trips)
3.	Nuclear Source Range	*S (1)	N.A.	P (2)	1) Once/shift when in service 2) Bistable action (alarm, trips)
4.	Reactor Coolant Temperature	*S	R	M (1) M (2)	1) Overtemperature ΔT 2) Overpower ΔT
5.	Reactor Coolant Flow	S	R**	M	
6.	Pressurizer Water Level	S	R**	M	
7.	Pressurizer Pressure	S	R**	M	
8A.	4-KV Voltage & Frequency	N.A.	R	M	Reactor protection circuits only
8B.	4-KV Voltage (Loss of Voltage)	N.A.	R	M	Safeguards buses only
8C.	4-KV Voltage (Degraded Grid)	N.A.	R	R	Safeguards buses only

4.6 PERIODIC TESTING OF EMERGENCY POWER SYSTEM

Applicability

Applies to periodic testing and surveillance requirements of the emergency power system.

Objective

To verify that the emergency power sources and equipment are operable.

Specification

The following tests and surveillance shall be performed:

a. Diesel Generators

1. Manually-initiated start of each diesel generator, and assumption of load by the diesel generator. This test shall be conducted monthly in accordance with the intent of Paragraph 6.4.1 and 6.4.3 of IEEE 387-1977.
2. Automatic start of each diesel generator, load shedding, and restoration to operation of particular vital equipment, all initiated by a simulated loss of all normal a-c station service power supplies together with a simulated safety injection signal. This test will be conducted at each refueling interval to assure that each diesel generator will start and assume required loads to the extent possible within one minute, and operate for $\geq$ 5 minutes while loaded with the emergency loads.
3. Each diesel generator shall be inspected at each major refueling outage.
4. Diesel generator load rejection test in accordance with IEEE 387-1977, section 6.4.5 shall be performed at least once per 18 months.

5. Safeguard Bus Undervoltage and Safeguard Bus Second Level Undervoltage relays shall be calibrated at least once per refueling cycle (not to exceed 18 months).

6. During each refueling, a checkout of emergency lighting will be performed.

b. Station Batteries

1. The voltage of each cell shall be measured to the nearest hundredth volt each month. An equalizing charge shall be applied if the lowest cell in the battery falls below 2.13 volts. The temperature and specific gravity of a pilot cell in each battery shall be measured.

2. The following additional measurements shall be made every three months: the specific gravity and height of electrolyte in every cell and the temperature of every fifth cell.

3. All measurements shall be recorded and compared with previous data to detect signs of deterioration.

4. The batteries shall be subjected to a load test during the first refueling and once every five years thereafter. Battery voltage shall be monitored as a function of time to establish that the battery performs as expected during heavy discharge and that all electrical connections are tight.

Basis

The monthly tests specified for the diesel generators will demonstrate their continued capability to start and carry rated load. The fuel supplies and starting circuits and controls are continuously monitored, and abnormal conditions in these systems would be indicated by an alarm without need for test startup.

The less frequent overall system test will demonstrate that the emergency power system and the control system for the engineered safety features equipment will function automatically in the event of loss of all other sources of a-c power, and that the diesel generators will start automatically in the event of a loss-of-coolant accident. This test will demonstrate proper tripping of motor feeder breakers, main supply and tie breakers on the affected bus, and sequential starting of essential equipment, to the extent possible, as well as the operability of the diesel generators. A separate test will demonstrate that the emergency lighting system functions properly.

The specified test frequencies provide reasonable assurance that any mechanical or electrical deficiency will be detected and corrected before it can result in failure of one emergency power supply to respond when called upon to function. Its possible failure to respond is, of course, anticipated by providing two diesel generators, each supplying through an independent bus, a complete and adequate set of engineered safety features equipment. Further, both diesel generators are provided as backup to multiple sources of external power, and this multiplicity of sources should be considered with regard to adequacy of test frequency.

Each diesel generator can start and be ready to accept full load within 10 seconds, and will sequentially start and supply the power requirements for one complete set of engineered safety features equipment in approximately one minute. (1)

Reference:

(1) FSAR Section 8.2

Station batteries will deteriorate with time, but precipitous failure is extremely unlikely. The surveillance specified is that which has been demonstrated over the years to provide indication of a cell becoming unserviceable long before it fails.

If a battery cell has deteriorated, or if a connection is loose, the voltage under load will drop excessively, indicating need for replacement or maintenance.

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 42 TO FACILITY OPERATING LICENSE NO. DPR-43

WISCONSIN PUBLIC SERVICE CORPORATION

WISCONSIN POWER AND LIGHT COMPANY

MADISON GAS AND ELECTRIC COMPANY

KEWAUNEE NUCLEAR POWER PLANT

DOCKET NO. 50-305

DEGRADED GRID VOLTAGE PROTECTION
FOR THE CLASS IE SYSTEMS

AND

ADEQUACY OF STATION ELECTRIC DISTRIBUTION
SYSTEM VOLTAGES

I. Introduction

By letter dated August 4, 1977, and as subsequently revised on January 28, 1981, May 1, 1981, November 30, 1981 and February 1, 1982, the Wisconsin Public Service Corporation (the licensee) submitted their proposed Amendment No. 29, as revised through 29b, to the Technical Specifications for the Kewanuee Nuclear Power Plant on the subject of "Degraded Grid Voltage Protection for the Class IE Systems."

In addition, by letter dated August 8, 1979, the NRC requested Wisconsin Public Service Corporation to expand the review of the electric power system at the Kewaunee Nuclear Power Plant with respect to the subject of the "Adequacy of Station Electric Distribution System Voltages." The Wisconsin

Public Service Corporation responded by letters dated October 11, 1979, December 22, 1980, May 1, 1981, November 30, 1981 and February 1, 1982.

Each of these Subject submittals has been evaluated to establish its particular features, and related safety and environmental impacts, and the necessary safety conclusions have been drawn. The results are presented in the following section. Changes to the license, in the form of proposed amendments to the Technical Specifications, were required only for the subject of "Degraded Grid Voltage Protection for the Class IE Systems."

II. DEGRADED GRID VOLTAGE PROTECTION FOR THE CLASS IE SYSTEMS

Background

The criteria and staff positions pertaining to degraded grid voltage protection were transmitted to Wisconsin Public Service Corporation by NRC Generic Letter dated June 3, 1977. In response to this by letters dated August 4, 1977, September 19, 1979, October 11, 1979, October 14, 1980, January 28, 1981, May 1, 1981 and February 1, 1982, the licensee proposed certain design modifications and changes to the Technical Specifications. A detailed review and technical evaluation of these proposed modifications and changes to the Technical Specifications was performed by EG&G, under contract to the NRC, and with general supervison by NRC staff. This work is reported by EG&G in "Degraded Grid Protection for Class 1E Power Systems Kewaunee Nuclear Power Plant" (attached). We have reviewed this technical evaluation report and concur in conclusion that the proposed electrical design modifications and Technical Specification changes are acceptable.

EVALUATION CRITERIA

The criteria used by EG&G in its technical evaluation of the proposed changes include GDC-17 ("Electric Power Systems") of Appendix A to 10 CFR 50; IEEE Standard 279-1971 ("Criteria for Protection Systems for Nuclear Power Generating Stations"); IEEE Standard 308-1977 ("Voltage Ratings for Electrical Power Systems and Equipment - 60 Hz"); and staff positions defined in NRC Generic Letter to WPSCo dated June 3, 1977.

PROPOSED CHANGES, MODIFICATIONS AND EVALUATION

The following electrical system design modifications and technical specification changes were proposed by WPSCo:

1. Installation of a second level of undervoltage protection relays on each 4160 volt Class 1E bus. This protective relaying will consist of relays connected in a two-out-of-two logic (per bus) such that when the 4160 volt Class 1E bus voltage falls below 95 ($\pm$ 2)% of 4160 volts for 6 ($\pm$ 0.5) seconds it will deenergize the second level undervoltage relays and activate a series connected timer(setpoint $\pm$5 minutes). Should a subsequent SI occur during the operation of the five minute timer, the setpoint (87.5%) of the first level loss of voltage relays will ensure that adequate voltage is provided to start accelerate and operate all safety equipment required to mitigate the consequences of the accident. If the voltage should fall below the first level relay setpoint for longer than 2 1/2 seconds during this five minutes, or if the degraded condition should continue for five minutes, the offsite power source breaker would be tripped and the loads applied to the alternate source or sequenced onto the emergency diesel generator. The

above SI signal will additionally start the emergency diesel generator and it will remain in a standby status. Should the voltage recover above the 95% setpoint before five minutes have elapsed the timer and second level voltage relays will reset. Operation of either of the two second level relays will annunciate in the control room.

2. Raising the setpoint of the existing first level loss of voltage relays to 87.5 (+ 2%) of 4160 volts with a time delay of equal to or less than 2 1/2 seconds.

3. Resizing, adjustment and replacement of Thermal Overload Relays protecting Class IE equipment on Safety Systems and Components. The licensee has provided realistic analyses which show that no failure of Class IE equipment on safety systems and components will occur during the five minutes that this equipment may be exposed to voltage levels down to the first loss of voltage relay set point at 87.5%. However, to fully satisfy the staffs concern with respect to degraded grid conditions, further changes may be needed to satisfy the assumptions of a conservative analysis required and approved by the NRC; this analysis and related heating sizing was completed by the licensee in the middle of February 1982, necessary replacements have been acquired, and by letter of February 1, 1982, the licensee has committed to complete the necessary modifications at the facility before startup from the 1982 refueling outage.

The five minute time delay referenced in this section (3), is of sufficient duration to prevent spurious operation of the second level of loss voltage during short duration disturbances, such as starting reactor coolant pumps or other large motors.

4. Additions and changes to the plant technical specifications including the surveillance requirements, allowable limits for the relay setpoints and time delays, and limiting conditions for operation have been provided by the licensee. Analyses to substantiate the limiting conditions for operation and minimum and maximum relay setpoint limits were included as part of the modification proposal. The changes and additions to technical specification have been reviewed and found acceptable.
5. The existing design at Kewaunee will bypass load shedding when the onsite emergency diesel generator is supplying power to the Class 1E loads. Should the onsite emergency diesel generator be interrupted the load shedding will be re-instated.

SUMMARY

We have reviewed the EG&G Technical Evaluation Report (EGG-EA-5701, Attachment 1) and concur in its findings:

1. The proposed degraded grid modifications will protect the Class IE equipment and systems from sustained degraded voltage of the offsite power system.
2. The proposed Technical Specification changes are acceptable; these have been incorporated on the pages listed on the "Attachment to License Amendment" describing the Revisions to Appendix A.
3. Spurious operation of the second level degraded grid voltage relays will not occur during the starting of a reactor coolant pump or other large motor.

III. ADEQUACY OF STATION ELECTRIC DISTRIBUTION SYSTEM VOLTAGES

Background

Wisconsin Public Service Corporation was requested by NRC letter dated August 8, 1979 to review the electric power system at Kewanuee Nuclear Power Plant. The review was to consist of:

a) Determining analytically the capacity and capability of the offsite power system and onsite distribution system to automatically start as well as operate all required loads within their required voltage ratings in the event of 1) an anticipated transient, or 2) an accident (such as LOCA) without manual shedding of any electric loads.

b) Determining if there are any events or conditions which could result in the simultaneous or, consequential loss of both required circuits from the offsite network to the onsite electric distribution system and thus violating the requirements of GDC 17.

The August 8, 1979 letter included staff guidelines for performing the required voltage analysis and the licensee was further required to perform a test in order to verify the validity of the analytical results. WPSCo responded by letters dated October 11, 1979, December 22, 1980, May 1, 1981, November 30, 1981 and February 1, 1982. A detailed review and technical evaluation of the submittals was performed by EG&G under contract to the NRC, with general supervision by NRC staff. This work is reported by EG&G in Technical Evaluation Report (TER), "Adequacy of Station Electric

Distribution Systems Voltages, Kewaunee Nuclear Power Plant," dated February 1982 (attached). We have reviewed this report and concur in the conclusions that the offsite power system and the onsite distribution system are capable of providing acceptable voltages for worst case station electric load and grid voltages.

EVALUATION CRITERIA

The criteria used by EG&G in this technical evaluation of the analysis includes GDC 5 ("Sharing of Structures, Systems, and Components"), GDC 13 ("Instrumentation and Control"), GDC 17 ("Electric Power Systems") of Appendix A to 10 CFR 50; IEEE Standard 308-1974 ("Class 1E Power Systems for Nuclear Power Generating Stations"), ANSI C84.1-1977 ("Voltage Ratings for Electric Power Systems and Equipment - 60 Hz"), and the staff positions and guidelines in NRC letter to WPSCo dated August 8, 1979.

ANALYSIS AND TEST FEATURES

The analysis was performed using each source of offsite power under extremes of loading conditions with the maximum and minimum switchyard (grid) voltages (141.6 kv and 134.4 kv in the 138 kv switchyard) (14.2 kv and 13.8 kv on the 13.8 kv Tertiary Reserve Transformer Source). The worst case Class 1E equipment voltages occur under the following conditions:

a) The minimum steady state voltage occurs immediately after a unit trip from full power operation coincident with a safety injection and with the 138 kv grid at its minimum expected voltage of 134.4 kv supplying the onsite distribution system.

b) The maximum steady state voltage occurs when the grid is at the maximum expected voltage and normal auxiliary loads are operating. This results in the lightest loading on the Class 1E buses.

c) The minimum expected transient voltage occurs during the start of a reactor coolant pump under the conditions of (a) above.

Evaluation

The analysis results indicate that under the minimum voltage maximum loading condition, the voltage to the 480 volt battery chargers could fall to 86.2% of normal value. Should this occur, the output of the battery chargers would be 1 1/2 volts less than nominal battery voltage. As the battery discharges, or if the input voltage to the battery charger is improved, the battery chargers will again automatically pick up the load on the DC bus. Since the battery chargers are diode isolated from the DC bus no damage would occur to them under the above condition and therefore we find this acceptable. Other than the above, it has been established that the 4160 volt and 480 volt emergency loads will operate within allowable limits over the range of grid voltage variations analysed.

The voltage analysis was verified by isolating a safety train and taking voltage measurements on the bus and at selected Class 1E equipment. The measurements were than compared with the voltages determined in the analysis for the same plant conditions and bus loading. The test verification showed the analysis values to be within 0.55% of the actual voltage. This close correlation verifies the accuracy of the analysis submitted.

SUMMARY

We have reviewed the EG&G Technical Evaluation Report (EGG-EA-5694, Attachment 2) and concur in the findings that:

1) WPSCo has provided verified voltage analyses to demonstrate that Class 1E equipment voltages will remain within acceptable operating limits for the worst case analyzed conditions.

2) The test used to verify the analysis was valid and showed the analysis to be acceptable.

3) WPSCo reaffirmation of compliance to GDC 17 requirements are acceptable.

We therefore find the Kewaunee Nuclear Power Plant design acceptable with respect to the adequacy of station electric distribution system voltage.

IV. Environmental Consideration

We have determined that the amendment does not authorize a change in effluent types or total amounts nor an increase in power level and will not result in any significant environmental impact. Having made this determination, we have further concluded that the amendment involves an action which is insignificant from the standpoint of environmental impact and, pursuant to 10 CFR §51.5(d)(4), that an environmental impact statement or negative declaration and environmental impact appraisal need not be prepared in connection with the issuance of this amendment.

V. Conclusion

We have concluded, based on the considerations discussed above, that: (1) because the amendment does not involve a significant increase in the probability or consequences of accidents previously considered and does not involve a significant decrease in a safety margin, the amendment does not involve a significant hazards consideration, (2) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, and (3) such activities will be conducted in compliance with the Commission's regulations and the issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public.

Date: April 30, 1982

List of Contributors (NRC)
R. Prevatte
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ATTACHMENT 1

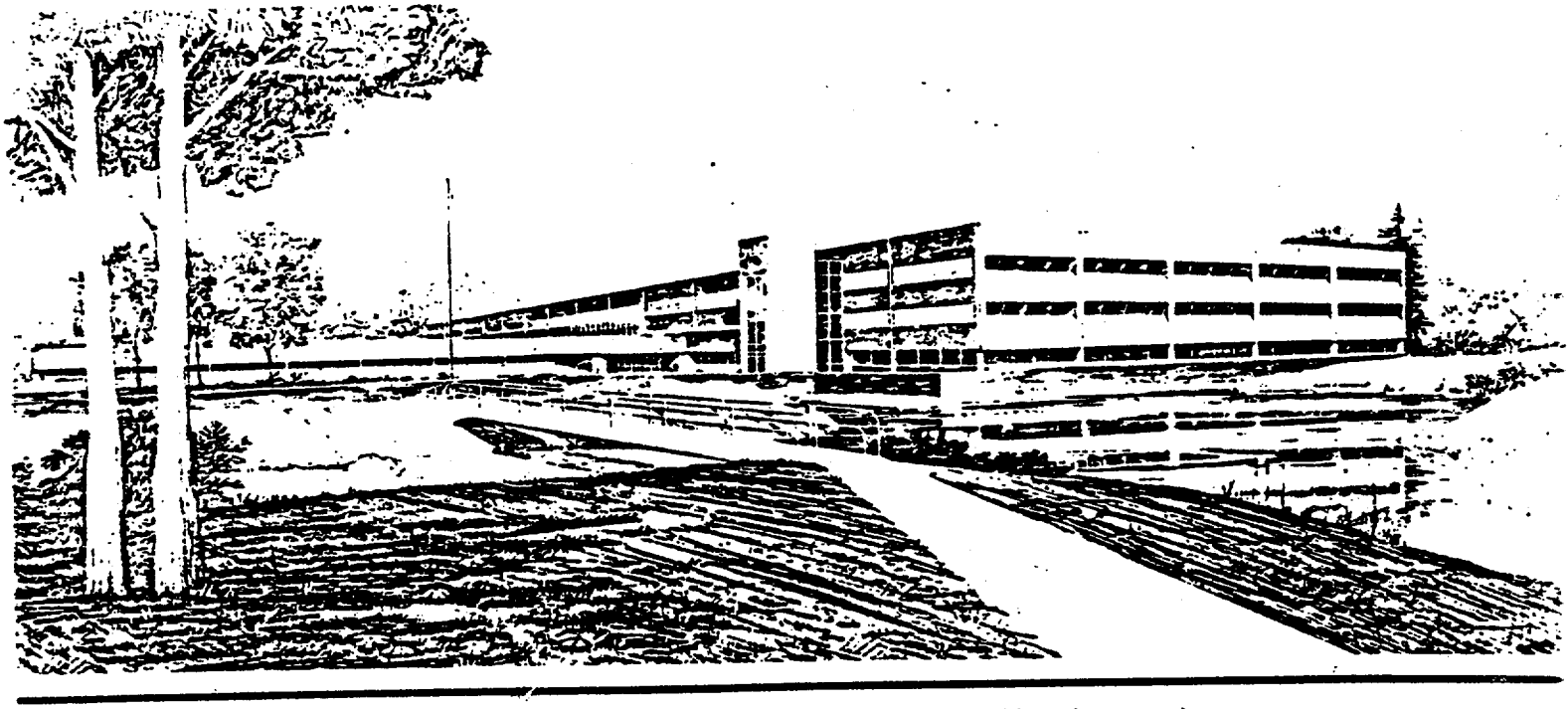
EGG-EA-5701

FEBRUARY 1982

DEGRADED GRID PROTECTION FOR CLASS 1E POWER SYSTEMS, KEWAUNEE NUCLEAR POWER PLANT

A. C. Udy

U.S. Department of Energy
Idaho Operations Office • Idaho National Engineering Laboratory



This is an informal report intended for use as a preliminary or working document

Prepared for the
U. S. Nuclear Regulatory Commission
Under DOE Contract No. DE-AC07-76ID01570
FIN No. A6429

EG&G Idaho

EG&G Idaho, Inc.

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INTERIM REPORT

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A. C. Udy

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February 1982

Responsible NRC/DOE Individual and NRC/DOE Office or Division:

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This document was prepared primarily for preliminary or internal use. It has not received full review and approval. Since there may be substantive changes, this document should not be considered final.

EG&G Idaho, Inc.
Idaho Falls, Idaho 83415

Prepared for the
U.S. Nuclear Regulatory Commission
Washington, D.C.
Under DOE Contract No. DE-AC07-76ID01570
NRC FIN No. A6429

INTERIM REPORT

0411J

DEGRADED GRID PROTECTION FOR CLASS 1E POWER SYSTEMS

KEWAUNEE NUCLEAR POWER PLANT

February 1982

A. C. Udy
Reliability and Statistics Branch
Engineering Analysis Division
EG&G Idaho, Inc.

TAC No. 10030
Docket No. 50-305

ABSTRACT

This EG&G Idaho, Inc. report reviews the susceptibility of the safety-related electrical equipment, at the Kewaunee Nuclear Power Plant, to a sustained degradation of the offsite power sources.

FOREWORD

This report is supplied as part of the "Selected Operating Reactor Issues Program (III)" being conducted for the U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, Division of Licensing, by EG&G Idaho, Inc., Reliability and Statistics Branch.

The U.S. Nuclear Regulatory Commission funded the work under the authorization, B&R 20 19 01 16, FIN No. A6429.

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DEGRADED GRID PROTECTION FOR CLASS 1E POWER SYSTEMS

KEWAUNEE NUCLEAR POWER PLANT

1.0 INTRODUCTION

On June 3, 1977, the NRC requested the Wisconsin Public Service Corporation (WPSCo) to assess the susceptibility of the safety-related electrical equipment at the Kewaunee Nuclear Power Plant to a sustained voltage degradation of the offsite source and interaction of the offsite and onsite emergency power systems.[1] The letter contained three positions with which the current design of the plant was to be compared. After comparing the current design to the staff positions, WPSCo was required to either propose modifications to satisfy the positions and criteria or furnish an analysis to substantiate that the existing facility design has equivalent capabilities.

WPSCo responded initially on August 4, 1977[2] with proposed technical specification amendment No. 29. WPSCo responded to questions on their submittal on September 19, 1979,[3] on October 11, 1979[4] and on October 14, 1980.[5] On January 28, 1981, WPSCo submitted revised proposed technical specification amendment No. 29a.[6] Telephone conversations in Feburary and March of 1981 resulted in revised proposed technical specification amendment No. 29b, dated May 1, 1981.[7] This also provided information for a related review (TAC 12994).

WPSCo met with the NRC to provide additional information.[8] The meeting concluded that WPSCo would docket some of this information. This was done on November 30, 1981.[9] This also modified technical specification table TS 4.1.1. A telephone call on December 16, 1981 provided additional information.[10] An additional change to technical specifications was made on February 1, 1982.[11]

This report reviews the above submittals, and in particular, the proposed technical specification amendment 29b, as modified on November 30, 1981 and February 1, 1982.

2.0 DESIGN BASE CRITERIA

The design base criteria that were applied in determining the acceptability of the system modifications to protect the safety-related equipment from a sustained degradation of the offsite grid are:

1. General Design Criterion 17 (GDC 17), "Electrical Power Systems," of Appendix A, "General Design Criteria for Nuclear Power Plants," of 10 CFR 50.[12]

2. IEEE Standard 279-1971, "Criteria for Protection Systems for Nuclear Power Generating Stations."[13]

3. IEEE Standard 308-1974, "Class 1E Power Systems for Nuclear Power Generating Stations."[14]

4. Staff positions as detailed in a letter sent to the licensee, dated June 3, 1977.[1]

5. ANSI Standard C84.1-1977, "Voltage Ratings for Electrical Power Systems and Equipment (60 Hz)."[15]

3.0 EVALUATION

This section provides, in Subsection 3.1, a brief description of the existing undervoltage protection at Kewaunee; in Subsection 3.2, a description of the licensee's proposed modifications for the second-level undervoltage protection; and in Subsection 3.3, a discussion of how the proposed modifications meet the design base criteria.

3.1 Existing Undervoltage Protection. Each Class 1E bus (1-5 and 1-6) at Kewaunee has four loss of voltage relays. Initially these were set at 68% (of 4160V), and after September 15, 1976 were changed to trip at 80%. Each bus then had two channels of relays consisting of one instantaneous relay and one time delay relay in series. Additionally, the output of the reserve auxiliary transformer, the tertiary auxiliary transformer and the main auxiliary transformer were monitored by two voltage relays. Only the bus relays, at 80%, automatically start the diesel-generators.

3.2 Modifications. The modification proposed by the licensee for second-level undervoltage protection will consist of two undervoltage relays (set at 95% of 4160V, ±2%) either of which alarms a common annunciator after 6 ±0.5 seconds with the bus voltage below the setpoint. Should both relays trip, they initiate a common timer with a time delay (before automatic bus stripping and diesel-generator loading) of less than or equal to 5 minutes. Should the bus voltage recover within this time delay, the system will reset itself. Additionally, the loss of voltage relays are to be set at 87.5 ±2% (of 4160V) with less than or equal to 2-1/2 seconds time delay.

Changes to the unit technical specifications[7] added a requirement to test and calibrate the new relays. When one of the undervoltage-six second time delay relays is out of service, it is required to be placed in the tripped condition.

3.3 Discussion. The first position of the NRC staff letter[1] required that a second level of undervoltage protection system for the onsite power system be provided. The letter stipulates other criteria that the undervoltage protection system must meet. Each criterion is restated below followed by a discussion regarding the licensee's compliance with that criterion.

1. "The selection of voltage and time setpoints shall be determined from an analysis of the voltage requirements of the safety-related loads at all onsite distribution system levels."

   The licensee proposed setpoint of 95 ±2% is in accordance with the analysis submitted on October 11, 1979.[4] All Class 1E motors are identified as having a service factor of 1.15. This

effectively allows them to operate at a lower terminal voltage than the rated limit. This allows some margin between the set-point, as reflected down to low voltage (less than 600V) loads and the load required voltage.

2. "The voltage protection shall include coincidence logic to preclude spurious trips of the offsite power sources."

   The proposed modification incorporates a one-out-of-two logic to alarm, a two-out-of-two logic, with a common time delay relay to actuate bus shedding and diesel generator loading.

3. "The time delay selected shall be based on the following conditions:"

   a. "The allowable time delay, including margin, shall not exceed the maximum time delay that is assumed in the FSAR accident analysis."

      The proposed maximum time delay of the second-level undervoltage relay channels exceeds the maximum time delay that is assumed in the FSAR. WPSCo states that "continued operation of these loads at a condition above the first level (87.5% ±2%) will not unacceptably degrade the equipment required to mitigate a Design Basis Accident."[7] This was further substantiated in a WPSCo meeting with the NRC.[8] Some 480V MCC heaters are being replaced as a result of the investigation required by the NRC to verify this statement.[9] A schedule for this replacement will be agreed to between WPSCo, the Office of Nuclear Reactor Regulation and the Office of Inspection and Enforcement.[10]

   b. "The time delay shall minimize the effect of short-duration disturbances from reducing the unavailability of the offsite power source(s)."

      The licensee proposed minimum time delay of five minutes is sufficient to ride through the start of a reactor coolant pump with the grid in a degraded condition. The licensee's proposed minimum time delay is long enough to override any short, inconsequential grid disturbances or motor starting transients in the station.

   c. "The allowable time duration of a degraded voltage condition at all distribution system voltage levels shall not result in failure of safety systems or components."

      The licensee maintains that the systems and components will not fail in the time period needed for the automatic operation of the second-level undervoltage channels.

4. "The voltage monitors shall automatically initiate the disconnection of offsite power sources whenever the voltage setpoint and time-delay limits have been exceeded."

A review of the licensee's proposal substantiates that this criterion is met.

5. "The voltage monitors shall be designed to satisfy the requirements of IEEE Standard 279-1971."

   The licensee has stated in his proposal that the modifications are designed to meet or exceed IEEE Standard 279.[3]

6. "The technical specifications shall include limiting conditions for operation, surveillance requirements, trip setpoints with minimum and maximum limits, and allowable values for the second-level voltage protection monitors."

   Calibration is once per operating cycle as required by the NRC[1] and in proposed technical specification section 4.6.a.5 and Table 4.1-1. The new limiting condition for operation proposed by the licensee consists of placing the six-second time delay relay in a tripped condition if it is out of service. There is no requirement for a channel check as WPSCo indicates that this is not practical.[9] A channel functional test is called for in Table TS 4.1-1 as requested by the NRC. Thus, the surveillance requirements, where allowed by system design, meet this NRC position. The allowable tolerance of the degraded voltage time delay relays, while not placed in technical specifications, are docketed, and this is acceptable to the NRC.[8]

The second NRC staff position requires that the system design automatically prevent load shedding of the emergency buses once the onsite sources are supplying power to all sequenced loads. The load shedding must also be reinstated if the onsite breakers are tripped.

The Kewaunee station utilizes load-shedding on loss of offsite power. Once onsite sources supply the Class 1E buses, load shedding will not occur, however, it is reinstated for certain (non-diesel failure) trips of the onsite breakers.[2]

The third NRC staff position requires that certain test requirements be added to the technical specifications. These tests were to demonstrate the full-functional operability and independence of the onsite power sources, and are to be performed at least once per 18 months during shutdown. The tests are to simulate loss of offsite power in conjunction with a safety-injection actuation signal, and to simulate interruption and subsequent reconnection of onsite power sources. These tests verify the proper operation of the load-shed system, the load-shed bypass when the emergency diesel generators are supplying power to their respective buses, and that there is no adverse interaction between the onsite and offsite power sources.

The proposed technical specifications comply with the requirement to test by simulated loss of offsite power in conjunction with a safety injection signal for 5 minutes or more under load. Interruption and subsequent reconnection of the onsite power sources is not tested because interruption

would occur only on a bus fault or mechancial failure of the diesel. In either case, the automatic reconnection of a diesel generator to the Class 1E distribution system would not occur.

4.0 CONCLUSION

Based on the information provided by WPSCo, I find that the proposed modifications and technical specification revision 29b as modified on November 30, 1981, and February 1, 1982, comply with the first NRC position.

I also find that the second position is complied with and that the revised technical specifications comply with the third position.

5.0 REFERENCES

1. NRC letter, A. Schwencer to E. W. James, WPSCo, dated June 3, 1977.

2. WPSCo letter, E. W. James to A. Schwencer, NRC, August 4, 1977.

3. WPSCo letter, E. R. Mathews to A. Schwencer, NRC, "Degraded Grid Voltage Questions," September 11, 1979.

4. WPSCo letter, E. R. Mathews to A. Schwencer, NRC, "Adequacy of Station Electric Distribution Systems Voltages," October 11, 1979.

5. WPSCo letter, E. R. Mathews to S. A. Varga, NRC, October 14, 1980.

6. WPSCo letter, E. R. Mathews to S. A. Varga, NRC, "Degraded Grid Voltage Protection Technical Specifications," January 28, 1981, NRC-81-10.

7. WPSCo letter, E. R. Mathews to S. A. Varga, NRC, "Degraded Grid Voltage Protection Technical Specifications and Responses to March 13, 1981, letter from S. A. Varga to E. R. Mathews," May 1, 1981, NRC-81-64.

8. Interoffice memo, S. Maskell, NRC to R. Licciardo, NRC, "Conference on Degraded Grid Voltage Protection for the Kewaunee Nuclear Power Plant," October 22, 1981.

9. WPSCo letter, E. R. Mathews to S. A. Varga, NRC, "Degraded Grid Voltage," November 30, 1981, NRC-81-192.

10. Telecon, R. Licciardo, NRC, C. Schrock, WPSCo, A. Udy, EG&G Idaho, Inc., December 16, 1981.

11. WPSCo letter, E. R. Mathews to S. A. Varga, NRC, February 1, 1982, NRC-82-19.

12. General Design Criterion 17, "Electric Power Systems," of Appendix A, "General Design Criteria for Nuclear Power Plants," to 10 CFR 50, "Domestic Licensing of Production and Utilization Facilities."

13. IEEE Standard 279-1971, "Criteria for Protection Systems for Nuclear Power Generating Stations."

14. IEEE Standard 308-1974, "Standard Criteria for Class 1E Power Systems for Nuclear Power Generating Stations."

15. ANSI C84.1-1977, "Voltage Ratings for Electric Power Systems and Equipment (60 Hz)."

16. WPSCo letter, E. W. James to A. Schwencer, NRC, September 15, 1976.

ATTACHMENT 2

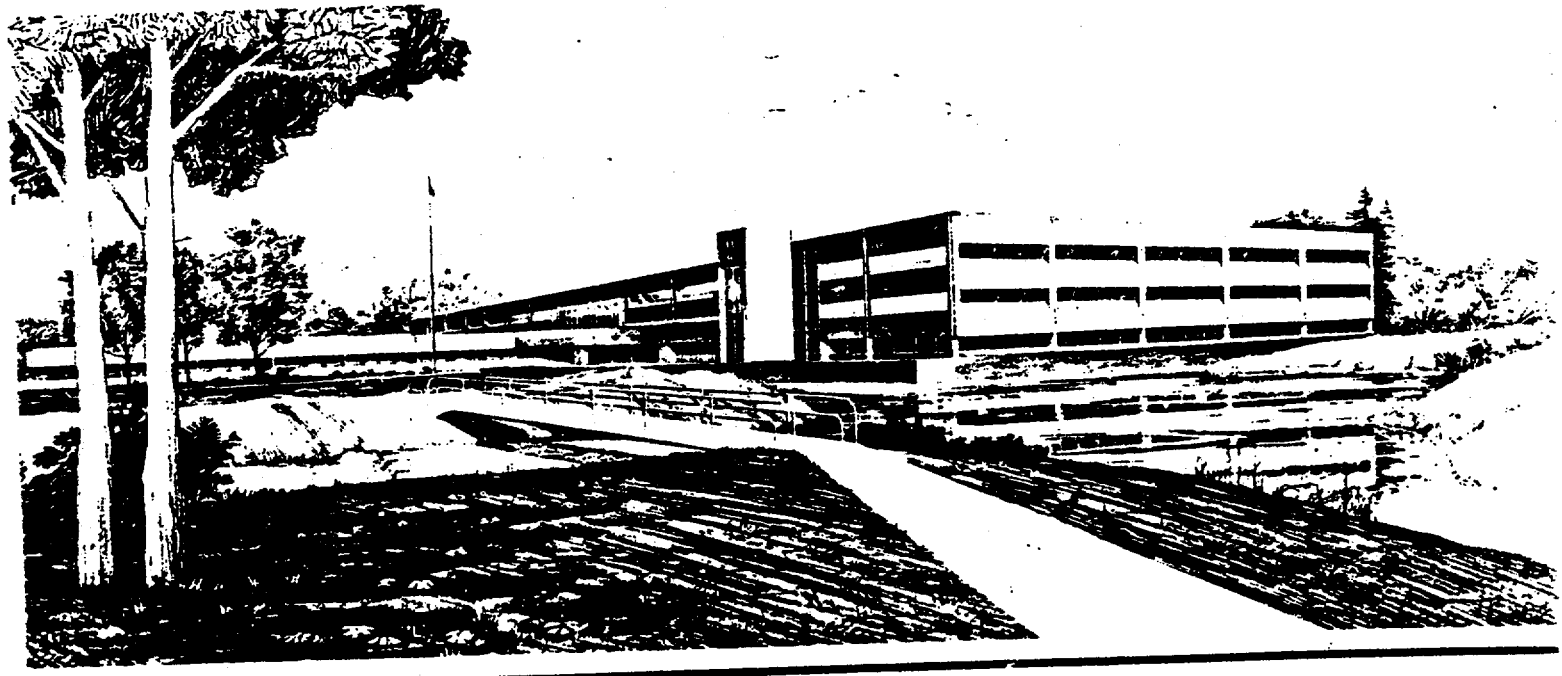
EGG-EA-5694

FEBRUARY 1982

ADEQUACY OF STATION ELECTRIC DISTRIBUTION SYSTEM VOLTAGES, KEWAUNEE NUCLEAR POWER PLANT

A. C. Udy

U.S. Department of Energy
Idaho Operations Office • Idaho National Engineering Laboratory



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Under DOE Contract No. DE-AC07-76ID01570
FIN No. A6429

EG&G Idaho

EG&G Idaho, Inc

FORM EG&G-398
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INTERIM REPORT

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INTERIM REPORT

0408J

ADEQUACY OF STATION ELECTRIC DISTRIBUTION SYSTEM VOLTAGES

KEWAUNEE NUCLEAR POWER PLANT

February 1982

A. C. Udy
Reliability and Statistics Branch
Engineering Analysis Division
EG&G Idaho, Inc.

TAC No. 12994
Docket No. 50-305

ABSTRACT

The EG&G Idaho, Inc. report reviews the capacity and the capability of the onsite distribution system at the Kewaunee Nuclear Power Plant, in conjunction with the offsite power sources, to automatically start and continuously operate all required safety loads.

FOREWORD

This report is supplied as part of the "Selected Operating Reactor Issues Program (III)" being conducted for the U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, Division of Licensing, by EG&G Idaho, Inc., Reliability and Statistics Branch.

The U.S. Nuclear Regulatory Commission funded the work under B&R 20 19 01 16, FIN No. A6429.

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ADEQUACY OF STATION ELECTRIC DISTRIBUTION SYSTEM VOLTAGES

KEWAUNEE NUCLEAR POWER PLANT

1.0 INTRODUCTION

An event at the Arkansas Nuclear One station on September 16, 1978 is described in NRC IE Information Notice No. 79-04. As a result of this event, station conformance to General Design Criteria (GDC) 17 is being questioned at all nuclear power stations. The NRC, in the generic letter of August 8, 1979, "Adequacy of Station Electric Distribution Systems Voltages," [1] required each licensee to confirm, by analysis, the adequacy of the voltage at the Class 1E loads. This letter included 13 specific guidelines to be followed in determining if the load terminal voltage is adequate to start and continuously operate the Class 1E loads.

Wisconsin Public Service Company (WPSCo) responded with an analysis on October 11, 1979.[2] WPSCo clarified and enlarged their response with a letter dated December 22, 1980.[3] An additional submittal, dated May 1, 1981[4] resulted from further NRC questioning. Letters of September 19, 1979[5] and September 15, 1976[6] also contain information on equipment ratings and voltage conditions.

A meeting between WPSCo and the NRC on October 14, 1981 provided further information for this report.[7]. WPSCo provided additional information requested at this meeting on November 30, 1981,[8] with additional follow-up material submitted on Feburary 1, 1982.[9]

Based on the information supplied by WPSCo, this report addresses the capacity and capability of the onsite distribution system of the Kewaunee Nuclear Power Plant, in conjunction with the offsite power system, to maintain the voltage for the required Class 1E equipment within acceptable limits for the worst-case starting and load conditions.

2.0 DESIGN BASIS CRITERIA

The positions applied in determining the acceptability of the offsite voltage conditions in supplying power to the Class 1E equipment are derived from the following:

1. General Design Criterion 17 (GDC 17), "Electrical Power Systems," of Appendix A, "General Design Criteria for Nuclear Power Plants," of 10 CFR 50.

2. General Design Criterion 5 (GDC 5), "Sharing of Structures, Systems, and Components," of Appendix A, "General Design Criteria for Nuclear Power Plants," of 10 CFR 50.

3. General Design Criterion 13 (GDC 13), "Instrumentation and Control," of Appendix A, "General Design Criteria for Nuclear Power Plants," of 10 CFR 50.

4. IEEE Standard 308-1974, "Class 1E Power Systems for Nuclear Power Generating Stations."

5. Staff positions as detailed in a letter sent to the licensee, dated August 8, 1979.[1]

6. ANSI C84.1-1977, "Voltage Ratings for Electric Power Systems and Equipment (60 Hz)."

Six review positions have been established from the NRC analysis guidelines[1] and the above-listed documents. These positions are stated in Section 5.0.

3.0 SYSTEM DESCRIPTION

Figure 1 is a simplified sketch of the unit one-line diagram taken from Figure 8.2-2 of the Kewaunee Final Safety Analysis Report (FSAR). It shows that the 4160V Class 1E buses can be supplied offsite power by either the Reserve Auxillary Transformer (RAT) or the Tertiary Reserve Transformer (TAT). Additionally, there is a tie between buses 1-5 and 1-6. This bus tie is controlled by interlocks and administrative procedures, and is used only when all power sources to a bus, including the diesel-generator, are lost[3].

Buses 1-5 and 1-6 each supply power to two 480V Class 1E buses by separate transformers. Buses 1-51 and 1-61 can also be connected together, as can buses 1-52 and 1-62. However, technical specifications 3.7.a.4 and 3.7.a.5 prevent use of the 480V bus ties during operation.

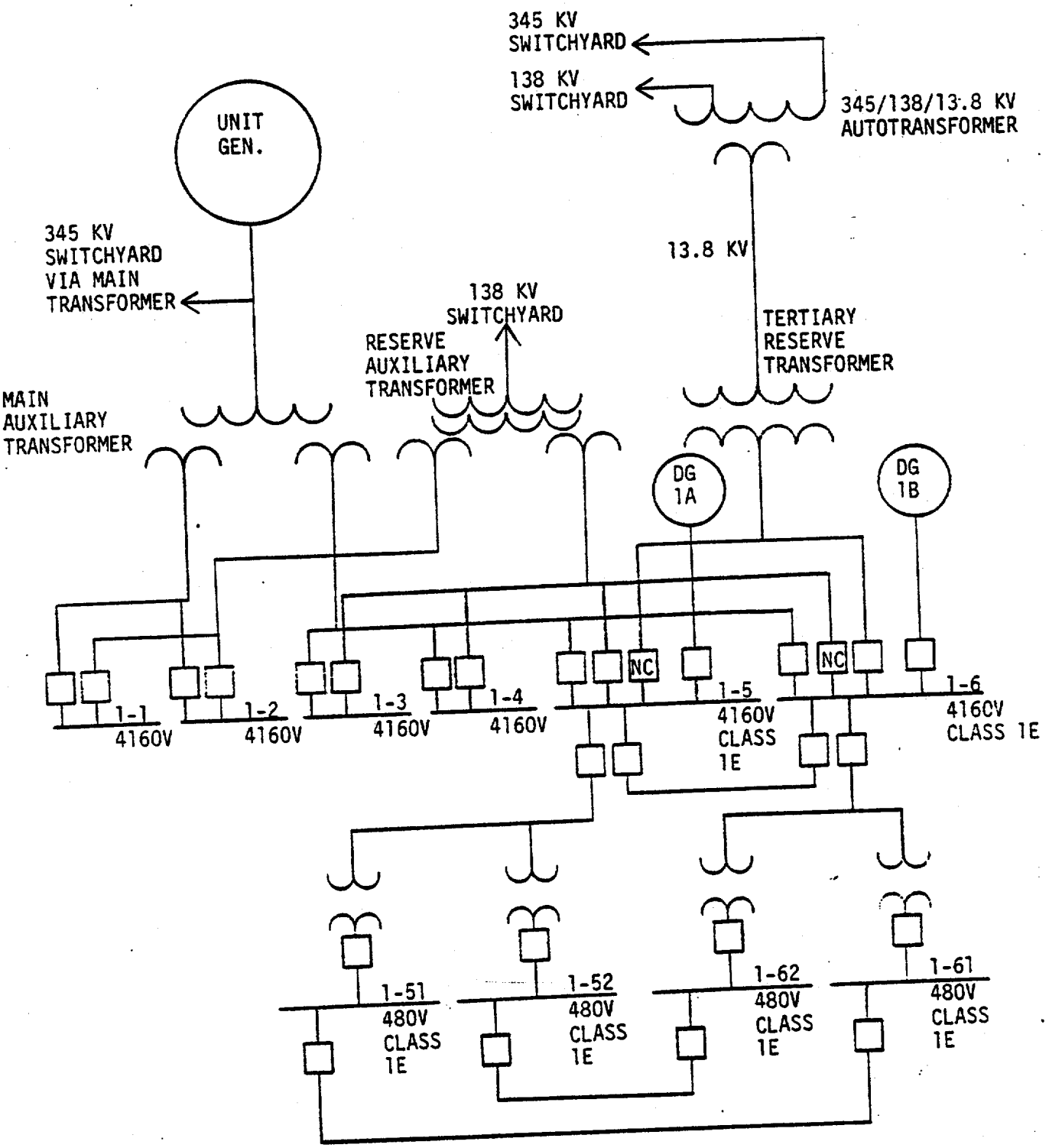
FSAR Figure 8.2-3 shows that the 120V instrument buses that use inverters for their normal power source can be powered, as an alternate source, from instrument transformers by Class 1E buses 1-52 and 1-62. These instrument transformers normally supply one independent 120V AC instrument bus.

4.0 ANALYSIS DESCRIPTION

4.1 Analysis Conditions. WPSCo has determined by analysis that the maximum expected offsite grid voltage for the Reserve Auxiliary Transformer is 141.6kV and the minimum is 134.4kV. WPSCo has also determined that the maximum expected grid voltage for the Tertiary Reserve Transformer is 14.2kV and the minimum is 13.4kV.

WPSCo has analyzed each offsite source to the onsite distribution system under extremes of load and offsite voltage conditions to determine the terminal voltages to the Class 1E equipment. The worst case Class 1E equipment terminal voltages occur under the following conditions:

a) The minimum steady state voltage occurs just after a unit trip from full power operation coincident with a safety injection, with only the 138kV grid available at a minimum expected voltage of 134.4kV.



KEWAUNEE
UNIT ONE LINE DIAGRAM
FIGURE 1

b) The maximum steady state voltage occurs with normal operating loads and both offsite power grids at their maximum expected voltages. This results in the lightest loading of the Class 1E buses.

c) The minimum expected transient voltage occurs with the manual start of a reactor coolant pump under the same conditions in a).

WPSCo assumed that there would be no voltage drop in the equipment feeder cables.

4.2 Analysis Results. Table 1 shows the projected worst case Class 1E equipment terminal voltages.

TABLE 1. CLASS 1E EQUIPMENT VOLTAGE RATINGS AND ANALYZED WORST CASE TERMINAL VOLTAGES (% of nominal voltage)

		Maximum		Minimum		
					Analyzed	
Equipment	Condition	Rated	Analyzed	Rated	Steady State	Transient
4000V Motors	Start	--	--	80	--	93.7
	Operate	110	109.5	90	98.8	--
460V Motors	Start	--	--	80	--	a
	Operate	110	109.8	90	90	--
440V Motors	Start	--	--	80	--	a
	Operate	110	110.5[b]	90	94.1	--
480V Starters	Pickup	--	--	a	--	a
	Dropout	--	--	a	--	a
	Operate	a	105.2	a	86.2	--
Other Equipment 115V AC instruments	Operate	110	104.4	90	90	--

a. In lieu of analyzed voltage, WPSCo states that the transient voltage dips during analyzed conditions are less severe than transient voltage dips when sequence loading the diesel generators.[4] It is shown that all motors start, and the 480V starters do not drop out under more restrictive voltage conditions than analyzed.

b. This is in excess of the equipment rating, however it neglects the feeder cable voltage drop. With this voltage drop, the equipment would not be connected to a voltage in excess of its rating.

Additionally, the 480V battery chargers are rated to 90% of 480V. The voltage they can be supplied with is 90% of 460V (86.2% of 480V), without challenging the degraded voltage relays. This could draw upon the capacity of the station batteries. The DC output of the battery chargers is diode isolated from the DC bus and the lowest expected charger output voltage is 1-1/2 volts less than the nominal battery voltage.[7] As the battery discharges, or the input voltage to the battery charger is improved, the battery charger would again pick up the load on the DC bus.[7] Failure of the battery chargers does not occur under minimum analyzed voltages.

As a result of this review, WPSCo is verifying (replacing as necessary) that the safeguard motor MCC heaters will not trip their load during the worst postulated voltage and time associated with the undervoltage relaying at the Kewaunee Station.

4.3 Analysis Verification. WPSCo has tested to verify the accuracy of the analysis assumptions.[8] 480V Motor Control Center (MCC) 1-52F was loaded at 160 amperes. The bus voltage at 480V bus 1-52 and the MCC was measured. The motor terminal voltage at selected energized loads was also measured.

The measured voltages were then compared with calculated voltages using the same analysis methods used in the analysis. The test verification showed the analysis values to be within 0.55% of the actual voltage.

5.0 EVALUATION

Six review positions have been established from the NRC analysis guidelines[1] and the documents listed in Section 2.0 of this report. Each review position is stated below followed by an evaluation of the licensee submittals.

Position 1--With the minimum expected offsite grid voltage and maximum load condition, each offsite source and distribution system connection combination must be capable of starting and of continuously operating all Class 1E equipment within the equipment voltage ratings.

WPSCo has shown, by analysis, that the Kewaunee Station has sufficient capability and capacity for continuously operating the Class 1E loads within the equipment voltage ratings (Table 1).

Position 2--With the maximum expected offsite grid voltage and minimum load condition, each offsite source and distribution system connection combination must be capable of continuously operating the required Class 1E equipment without exceeding the equipment voltage ratings.

WPSCo has shown, by analysis, that the voltage ratings of the Class 1E equipment will not be exceeded.

Position 3--Loss of offsite power to either of the redundant Class 1E distribution systems due to operation of voltage protection relays, must not occur when the offsite power source is within expected voltage limits.

As shown in Table 2, undervoltage relays will not cause the loss of the Class 1E distribution system when the offsite grid voltage is within the expected voltage limits.

TABLE 2. COMPARISON OF ANALYZED VOLTAGES AND UNDERVOLTAGE RELAY SETPOINTS (% of nominal voltage)

Location/Relays	Minimum Analyzed[a] Voltage	Minimum Analyzed[a] Time	Relay Setpoint Voltage (Tolerance)	Relay Setpoint Time
4160V bus				
Degraded grid	98.8	continuous	95 (±2)	5 m
Loss of grid	93.7	20s	87.5 (±2)	2-1/2 s

a. Licensee has determined by analysis the minimum bus voltages with the offsite grid at the minimum expected voltage and the worst case plant and Class 1E loads.

Position 4--The NRC letter[1] requires that test results verify the accuracy of the voltage analyses supplied.

WPSCo has performed an acceptable test of their Class 1E distribution system that verifies the accuracy of their analysis assumptions.

Position 5--No event or condition should result in the simultaneous or consequential loss of both required circuits from the offsite power network to the onsite distribution system (GDC 17).

WPSCo has analyzed the connections of the Kewaunee station to the offsite power grid, and has determined that no potential exists for the simultaneous or consequential loss of both circuits from the offsite grid.

Position 6--As required by GDC 5, each offsite source shared between units in a multi-unit station must be capable of supplying adequate starting and operating voltage for all required Class 1E loads with an accident in one unit and an orderly shutdown and cooldown in the remaining units.

This applies to multi-unit stations. It does not apply to Kewaunee, a single-unit station.

6.0 CONCLUSIONS

The voltage analyses submitted by WPSCo for the Kewaunee Plant were evaluated in Section 5.0 of this report. It was found that:

1. Voltages within the operating limits of the Class 1E equipment are supplied for all projected combinations of plant load and offsite power grid conditions.

2. The test used to verify the analysis shows the analysis to be an accurate representation of the worst case conditions analyzed.

3. WPSCo has determined that no potential for either a simultanous or consequential loss of both offsite power sources exists.

4. Loss of offsite power to Class 1E buses, due to spurious operation of voltage protection relays, will not occur with the offsite grid voltage within its expected limits.

7.0 REFERENCES

1. NRC letter, William Gammill, to All Power Reactor Licensees (Except Humboldt Bay), "Adequacy of Station Electric Distribution Systems Voltage," August 8, 1979.

2. WPSCo letter, E. R. Mathews to A. Schwencer, NRC, "Adequacy of Station Electric Distribution Systems Voltages," October 11, 1979.

3. WPSCo letter, E. R. Mathews to S. A. Varga, NRC, "Letter from Mr. Varga to Mr. E. R. Mathews dated August 21, 1980," December 22, 1980.

4. WPSCo letter, E. R. Mathews to S. A. Varga, NRC, "Degraded Grid Voltage Protection Technical Specifications and Responses to March 13, 1981, Letter from S. A. Varga to E. R. Mathews," May 1, 1981, NRC-81-64.

5. WPSCo letter, E. R. Mathews to A. Schweneer, NRC, "Degraded Grid Voltage Questions," September 19, 1979.

6. WPSCo letter, E. W. James to Office of Nuclear Reactor Regulation, NRC, September 15, 1976.

7. NRC Memorandum, S. Maskell to R. Licciardo, "Conference on Degraded Grid Voltage Protection for the Kewaunee Nuclear Power Plant," October 22, 1981.

8. WPSCo letter, E. R. Mathews to S. A. Varga, NRC, "Degraded Grid Voltage," November 30, 1981, NRC-81-192.

9. WPSCo letter, E. R. Mathews to S. A. Varga, NRC, February 1, 1982, NRC-82-19.

UNITED STATES NUCLEAR REGULATORY COMMISSION

DOCKET NO. 50-305

WISCONSIN PUBLIC SERVICE CORPORATION

WISCONSIN POWER AND LIGHT COMPANY

MADISON GAS AND ELECTRIC COMPANY

NOTICE OF ISSUANCE OF AMENDMENT TO FACILITY OPERATING LICENSE

The U. S. Nuclear Regulatory Commission (the Commission) has issued Amendment No. 42 to Facility Operating License No. DPR-43, issued to Wisconsin Public Service Corporation, Wisconsin Power and Light Company, and Madison Gas and Electric Company (the licensees), which revised Technical Specifications for operation of the Kewaunee Nuclear Plant (the facility) located in Kewaunee, Wisconsin. The amendment is effective as of June 1, 1982.

This amendment changes the Technical Specifications to reflect modifications to the plant electrical distribution systems and to resolve the generic issues related to the Subjects of Degraded Grid Voltage Protection and Adequacy of Station Electric Distribution System Voltages.

The application for the amendment complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations. The Commission has made appropriate findings as required by the Act and the Commission's rules and regulations in 10 CFR Chapter I, which are set forth in the license amendment. Prior public notice of this amendment was not required since this amendment does not involve a significant hazards consideration.

The Commission has determined that the issuance of this amendment will not result in any significant environmental impact and that pursuant to 10 CFR §51.5(d)(4) an environmental impact statement or negative declaration and environmental impact appraisal need not be prepared in connection with issuance of this amendment.

For further details with respect to this action, see (1) the application for amendment dated August 4, 1977 and as subsequently revised on January 28, 1981, May 1, 1981, November 30, 1981 and February 1, 1982, (2) Amendment No. 42 to License No. DPR-43 and (3) the Commission's related Safety Evaluation. All of these items are available for public inspection at the Commission's Public Document Room, 1717 H Street, N.W., Washington, D.C. and at the Kewaunee Public Library, 314 Milwaukee Street, Kewanuee, Wisconsin 54216. A copy of items (2) and (3) may be obtained upon request addressed to the U. S. Nuclear Regulatory Commission, Washington, D.C. 20555, Attention: Director, Division of Licensing.

Dated at Bethesda, Maryland, this 30th day of April, 1982.

FOR THE NUCLEAR REGULATORY COMMISSION

Steven A. Varga, Chief
Operating Reactors Branch #1
Division of Licensing