

ATTACHMENT 2

LIMERICK GENERATING STATION  
Units 1 and 2

Docket Nos. 50-352  
50-353

License Nos. NPF-39  
NPF-85

Response to Request For Additional Information  
Battery Surveillance Extensions Included in  
Technical Specifications Change Request to  
Support 24-Month Refueling Cycles

PROPOSED TECHNICAL SPECIFICATION CHANGES

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## ELECTRICAL POWER SYSTEMS

### SURVEILLANCE REQUIREMENTS (Continued)

- b. At least once per 92 days and within 7 days after a battery discharge with battery terminal voltage below 105 volts or battery overcharge with battery terminal voltage above 150 volts, by verifying that:
1. The parameters in Table 4.8.2.1-1 meet the Category B limits,
  2. There is no visible corrosion at either terminals or connectors, or the connection resistance of these items is less than  $150 \times 10^{-6}$  ohm, and
  3. The average electrolyte temperature of each sixth cell is  $\geq 60^{\circ}\text{F}$ .
- c. By verifying that:
1. At least once per 18 months the cells, cell plates and battery racks show no visual indication of physical damage or abnormal deterioration,
  2. At least once per 18 months the cell-to-cell and terminal connections are clean, tight, free of corrosion and coated with anticorrosion material,
  3. At least once per 18 months the resistance of each cell-to-cell and terminal connection is less than or equal to  $150 \times 10^{-6}$  ohm excluding cable intercell connections, and
  4. At least once per 24 months the battery chargers will supply the currents listed below at a minimum of 132 volts for at least 8 hours.

<u>Charger</u>	<u>Current (Amperes)</u>
1BCA1	300
1BCA2	300
1BCB1	300
1BCB2	300
1BCC	75
1BCD	75

- d. At least once per 24 months by verifying that either:
1. The battery capacity is adequate to supply and maintain in OPERABLE status all of the actual emergency loads for the design duty cycle when the battery is subjected to a battery service test, or
  2. The battery capacity is adequate to supply a dummy load of the following profile while maintaining the battery terminal voltage greater than or equal to 105 volts for the nominal 125-volt batteries and 210 volts for the nominal 125/250-volt batteries:

## ELECTRICAL POWER SYSTEMS

### SURVEILLANCE REQUIREMENTS (Continued)

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#### LOAD CYCLE (amps)

<u>Division</u>	<u>Battery</u>	<u>0-1 Min.</u>	<u>1-239 Min.</u>	<u>239-240 Min.</u>
I	1A1	546	168	187
	1A2	449	129	147
II	1B1	889	158	321
	1B2	823	119	282
III	1C	193	31	31
IV	1D	169	21	21

Each 125/250-volt battery is rated at 1500 ampere-hours at an 8-hour discharge rate, based on a terminal voltage of 1.75 volts-per-cell at 77°F.

Each 125-volt battery is rated at 250 ampere-hours at an 8-hour discharge rate, based on a terminal voltage of 1.75 volts-per-cell at 77°F.

- e. At least once per 60 months by verifying that the battery capacity is at least 80% of the manufacturer's rating when subjected to a performance discharge test. At this once per 60 month interval, this performance discharge test may be performed in lieu of the battery service test (Specification 4.8.2.1.d).
- f. At least once per 18 months performance discharge tests of battery capacity shall be given to any battery that shows signs of degradation or has reached 85% of the service life expected for the application. Degradation is indicated when the battery capacity drops more than 10% of rated capacity from its average on previous performance tests, or is below 90% of the manufacturer's rating.

## ELECTRICAL POWER SYSTEMS

### BASES

#### A.C. SOURCES, D.C. SOURCES, and ONSITE POWER DISTRIBUTION SYSTEMS (Continued)

"Periodic Testing of Diesel Generator Units Used as Onsite Electric Power Systems at Nuclear Power Plants," Revision 1, August 1977 except for paragraphs C.2.a(3), C.2.c(1), C.2.c(2), C.2.d(3) and C.2.d(4), and the periodic testing will be performed at least once per 24 months. The exceptions to Regulatory Guide 1.108 allow for gradual loading of diesel generators during testing and decreased surveillance test frequencies (in response to Generic Letter 84-15).

The surveillance requirements for demonstrating the OPERABILITY of the unit batteries are in accordance with the recommendations of Regulatory Guide 1.129 "Maintenance Testing and Replacement of Large Lead Storage Batteries for Nuclear Power Plants," February 1978 and IEEE Std 450-1980, "IEEE Recommended Practice for Maintenance, Testing, and Replacement of Large Lead Storage Batteries for Generating Stations and Substations," except that certain tests will be performed at least once every 24 months.

Verifying average electrolyte temperature above the minimum for which the battery was sized, total battery terminal voltage on float charge, connection resistance values and the performance of battery service and discharge tests ensures the effectiveness of the charging system, the ability to handle high discharge rates and compares the battery capacity at that time with the rated capacity.

Table 4.8.2.11 specifies the normal limits for each designated pilot cell and each connected cell for electrolyte level, float voltage and specific gravity. The limits for the designated pilot cells float voltage and specific gravity, greater than 2.13 volts and 0.015 below the manufacturer's full charge specific gravity or a battery charger current that had stabilized at a low value, is characteristic of a charged cell with adequate capacity. The normal limits for each connected cell for float voltage and specific gravity, greater than 2.13 volts and not more than 0.020 below the manufacturer's full charge specific gravity with an average specific gravity of all the connected cells not more than 0.010 below the manufacturer's full charge specific gravity, ensures the OPERABILITY and capability of the battery.

Operation with a battery cell's parameter outside the normal limit but within the allowable value specified in Table 4.8.2.1-1 is permitted for up to 7 days. During this 7-day period: (1) the allowable value for electrolyte level ensures no physical damage to the plates with an adequate electron transfer capability; (2) the allowable value for the average specific gravity of all the cells, not more than 0.020 below the manufacturer's recommended full charge specific gravity ensures that the decrease in rating will be less than the safety margin provided in sizing; (3) the allowable value for an individual cell's specific gravity, ensures that an individual cell's specific gravity will not be more than 0.040 below the manufacturer's full charge specific gravity and that the overall capability of the battery will be maintained within an acceptable limit; and (4) the allowable value for an individual cell's float voltage, greater than 2.07 volts, ensures the battery's capability to perform its design function.

## ELECTRICAL POWER SYSTEMS

### SURVEILLANCE REQUIREMENTS (Continued)

- b. At least once per 92 days and within 7 days after a battery discharge with battery terminal voltage below 105 volts or battery overcharge with battery terminal voltage above 150 volts, by verifying that:
1. The parameters in Table 4.8.2.1-1 meet the Category B limits,
  2. There is no visible corrosion at either terminals or connectors, or the connection resistance of these items is less than  $150 \times 10^{-6}$  ohm, and
  3. The average electrolyte temperature of each sixth cell is  $\geq 60^{\circ}\text{F}$ .
- c. By verifying that:
1. At least once per 18 months the cells, cell plates and battery racks show no visual indication of physical damage or abnormal deterioration,
  2. At least once per 18 months the cell-to-cell and terminal connections are clean, tight, free of corrosion and coated with anticorrosion material,
  3. At least once per 18 months the resistance of each cell-to-cell and terminal connection is less than or equal to  $150 \times 10^{-6}$  ohm excluding cable intercell connections, and
  4. At least once per 24 months the battery chargers will supply the currents listed below at a minimum of 132 volts for at least 8 hours:

<u>Charger</u>	<u>Current (Amperes)</u>
2BCA1	300
2BCA2	300
2BCB1	300
2BCB2	300
2BCC	75
2BCD	75

- d. At least once per 24 months by verifying that either:
1. The battery capacity is adequate to supply and maintain in OPERABLE status all of the actual emergency loads for the design duty cycle when the battery is subjected to a battery service test, or
  2. The battery capacity is adequate to supply a dummy load of the following profile while maintaining the battery terminal voltage greater than or equal to 105 volts for the nominal 125-volt batteries and 210 volts for the nominal 125/250-volt batteries:



## ELECTRICAL POWER SYSTEMS

### SURVEILLANCE REQUIREMENTS (Continued)

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#### LOAD CYCLE (amps)

<u>Division</u>	<u>Battery</u>	<u>0-1 Min.</u>	<u>1-239 Min.</u>	<u>239-240 Min.</u>
I	2A1	546	168	187
	2A2	449	129	147
II	2B1	889	158	321
	2B2	823	119	282
III	2C	193	31	31
IV	2D	169	21	21

Each 125/250-volt battery is rated at 1500 ampere-hours at an 8-hour discharge rate, based on a terminal voltage of 1.75 volts-per-cell at 77°F.

Each 125-volt battery is rated at 250 ampere-hours at an 8-hour discharge rate, based on a terminal voltage of 1.75 volts-per-cell at 77°F.

- e. At least once per 60 months by verifying that the battery capacity is at least 80% of the manufacturer's rating when subjected to a performance discharge test. At this once per 60 month interval, this performance discharge test may be performed in lieu of the battery service test (Specification 4.8.2.1.d).
- f. At least once per 18 months performance discharge tests of battery capacity shall be given to any battery that shows signs of degradation or has reached 85% of the service life expected for the application. Degradation is indicated when the battery capacity drops more than 10% of rated capacity from its average on previous performance tests, or is below 90% of the manufacturer's rating.

## ELECTRICAL POWER SYSTEMS

### BASES

#### A.C. SOURCES, D.C. SOURCES, and ONSITE POWER DISTRIBUTION SYSTEMS (Continued)

Supplies," March 10, 1971, Regulatory Guide 1.137, "Fuel-Oil Systems for Standby Diesel Generators," Revision 1, October 1979 and Regulatory Guide 1.108, "Periodic Testing of Diesel Generator Units Used as Onsite Electric Power Systems at Nuclear Power Plants," Revision 1, August 1977 except for paragraphs C.2.a(3), C.2.c(1), C.2.c(2), C.2.d(3) and C.2.d(4), and the periodic testing will be performed at least once per 24 months. The exceptions to Regulatory Guide 1.108 allow for gradual loading of diesel generators during testing and decreased surveillance test frequencies (in response to Generic Letter 84-15).

The surveillance requirements for demonstrating the OPERABILITY of the unit batteries are in accordance with the recommendations of Regulatory Guide 1.129 "Maintenance, Testing and Replacement of Large Lead Storage Batteries for Nuclear Power Plants," February 1978 and IEEE Std 450-1980, "IEEE Recommended Practice for Maintenance, Testing, and Replacement of Large Lead Storage Batteries for Generating Stations and Substations," except that certain tests will be performed at least once every 24 months.

Verifying average electrolyte temperature above the minimum for which the battery was sized, total battery terminal voltage on float charge, connection resistance values and the performance of battery service and discharge tests ensures the effectiveness of the charging system, the ability to handle high discharge rates and compares the battery capacity at that time with the rated capacity.

Table 4.8.2.1-1 specifies the normal limits for each designated pilot cell and each connected cell for electrolyte level, float voltage and specific gravity. The limits for the designated pilot cells float voltage and specific gravity, greater than 2.13 volts and 0.015 below the manufacturer's full charge specific gravity or a battery charger current that had stabilized at a low value, is characteristic of a charged cell with adequate capacity. The normal limits for each connected cell for float voltage and specific gravity, greater than 2.13 volts and not more than 0.020 below the manufacturer's full charge specific gravity with an average specific gravity of all the connected cells not more than 0.010 below the manufacturer's full charge specific gravity, ensures the OPERABILITY and capability of the battery.

Operation with a battery cell's parameter outside the normal limit but within the allowable value specified in Table 4.8.2.1-1 is permitted for up to 7 days. During this 7-day period: (1) the allowable value for electrolyte level ensures no physical damage to the plates with an adequate electron transfer capability; (2) the allowable value for the average specific gravity of all the cells, not more than 0.020 below the manufacturer's recommended full charge specific gravity ensures that the decrease in rating will be less than the safety margin provided in sizing; (3) the allowable value for an individual cell's specific gravity, ensures that an individual cell's specific gravity will not be more than 0.040 below the manufacturer's full charge specific gravity and that the overall capability of the battery will be maintained within an acceptable limit; and (4) the allowable value for an individual cell's float voltage, greater than 2.07 volts, ensures the battery's capability to perform its design function.

ATTACHMENT 3

LIMERICK GENERATING STATION  
Units 1 and 2

Docket Nos. 50-352  
50-353

License Nos. NPF-39  
NPF-85

Response to Request For Additional Information  
Battery Surveillance Extensions Included in  
Technical Specifications Change Request to  
Support 24-Month Refueling Cycles

Sample of Battery Service Test Results



HISTORICAL SURVEILLANCE DATA  
LIMERICK GENERATING STATION UNIT 1  
DIVISION 1 BATTERIES  
SERVICE TEST RESULTS

BATTERY 1A1D101

DATE	TEST TIME ELAPSED	VOLTAGE *
7-12-85	0 hrs 0 mins	119.2 Vdc
	0 hrs 1 mins	118.6 Vdc
	0 hrs 30 mins	119.7 Vdc
	1 hrs 53 mins	119 Vdc
	3 hrs 3 mins	118 Vdc
	3 hrs 59 mins	116.8 Vdc
5-24-86	0 hrs 0 mins	118.2 Vdc
	0 hrs 1 mins	118.4 Vdc
	0 hrs 15 mins	119.8 Vdc
	1 hrs 57 mins	119 Vdc
	3 hrs 11 mins	118 Vdc
	3 hrs 59 mins	117 Vdc
5-22-87	0 hrs 14 mins	119.8 Vdc
	1 hrs 4 mins	119 Vdc
	2 hrs 19 mins	118 Vdc
	3 hrs 33 mins	117 Vdc
	3 hrs 59 mins	116.3 Vdc
6-25-87	0 hrs 20 mins	119.7 Vdc
	1 hrs 20 mins	119 Vdc
	2 hrs 27 mins	118 Vdc
	3 hrs 26 mins	117 Vdc
10-1-90	0 hrs 15 mins	119.3 Vdc
	1 hrs 11 mins	119 Vdc
	2 hrs 40 mins	118 Vdc
	3 hrs 51 mins	117 Vdc
	4 hrs 0 mins	118.5 Vdc

BATTERY 1A2D101

DATE	TEST TIME ELAPSED	VOLTAGE *
7-12-85	0 hrs 0 mins	120 Vdc
	0 hrs 40 mins	120.3 Vdc
	1 hrs 25 mins	120 Vdc
	3 hrs 12 mins	119 Vdc
	3 hrs 55 mins	119.8 Vdc
5-31-86	0 hrs 0 mins	121.6 Vdc
	0 hrs 1 mins	115.6 Vdc
	0 hrs 1 mins 25 secs	119.6 Vdc
	0 hrs 21 mins	120.7 Vdc
	1 hrs 16 mins	120 Vdc
	3 hrs 1 mins	119 Vdc
	3 hrs 58 mins	118.4 Vdc
	3 hrs 59 mins	118.1 Vdc
	4 hrs 0 mins	119.6 Vdc
5-23-87	0 hrs 28 mins	119.8 Vdc
	2 hrs 40 mins	119 Vdc
	3 hrs 59 mins	118 Vdc
6-25-87	0 hrs 34 mins	119.9 Vdc
	2 hrs 39 mins	119 Vdc
	3 hrs 59 mins	118 Vdc

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\* surveillance test acceptance criterion = 105 Vdc