ENTERGY

Entergy Operations, Inc.
P.O. Box B
Killona, LA 70066
Tel 504 739 6774

R. F. Burski
Director
Nuclear Safety
Waterford 3

W3F192-0329
A4.05
QA

October 15, 1992

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555

Subject: Waterford 3 SES
Docket No. 50-382
License No. NPF-38
Batteries 3A-S, 3B-S, and 3AB-S

Gentlemen:

Waterford 3 personnel have discussed with the NRC recent developments and new information regarding the Nuclear Logistics Inc. (NLI) 10 CFR 21 notification for the GNB Industrial Battery Co. (GNB) batteries. These developments and new information had a bearing on Waterford 3 existing plans, evaluations, and commitments for the 3A-S, 3B-S, and 3AB-S batteries. We have now completed our assessment of the various technical and licensing issues, and an integrated approach has been established to address the resolution of the various issues. The purpose of this letter is to inform the NRC about our integrated approach, see attachment, and how the approach provides for the resolution of the various issues for the batteries.

Please contact me or Robert J Murillo should there be any questions regarding this letter.

Very truly yours,

R.F. Burski
Director, Nuclear Safety

RFB/RJM/dc
Attachment
cc: J.L. Milhoan, NRC Region IV
W.R. Johnson, NRC Region IV
T.O. McKernon, NRC Region IV
P. Wagner, NRC Region IV
D.L. Wigginton, NRC-NRR
R.B. McGehee
N.S. Reynolds
NRC Resident Inspectors Office

IE19 1/1

Attachment to
Letter W3F192-0329

1.0 Background

The following background information about the batteries is summarized. Information about the Waterford 3 batteries was submitted to the NRC in letters W3F1-91-0387, W3F192-0015, and W3F192-0079 dated August 30, 1991, February 28, 1992, and May 29, 1992. Information about the batteries is also contained in NRC Safety Evaluation Report (SER) on Station Blackout (SBO) dated January 15, 1992 and NRC Supplemental Safety Evaluation Report (SSER) on SBO dated June 17, 1992. These documents established that Waterford 3 would replace during refuel 5 the existing batteries 3A-S, 3B-S, and 3AB-S with new batteries of a similar type and capacity. Waterford 3 committed to establish by the end of refuel 5 a reduced life for the new batteries 3A-S and 3B-S to satisfy a design margin of 1.10 at an electrolyte temperature of 70°F. Waterford 3 also committed to modify the dc system by the end of refuel 6 to satisfy a design margin of 1.10 for battery 3AB-S. Subsequent to the issuance of the foregoing documents, Nuclear Logistics Inc. (NLI) on July 9, 1992 filed with the NRC a 10CFR Part 21 notification regarding the NCX-17 battery and cells manufactured by GNB Industrial Battery Company, formerly Gould. Testing had been performed by NLI to determine a discharge rate where the cells will consistently meet the acceptance criteria of 1.75 Volts per Cell (VPC). A one minute rate of 1165 amps to 1.75 VPC was established for the NCX-17 cells as compared with the published rating of 1306 amps to 1.75 VPC. Waterford 3 personnel were informed that additional testing was planned by GNB Industrial Battery Company and NLI. The additional testing was required in order to establish the battery performance over a range of voltages and discharge rates. This data is used for battery sizing calculations performed in accordance with IEEE 485. Waterford 3 personnel performed preliminary calculations for the Design Basis Event (DBE) using extrapolated data based on the single data point of 1165 amps. The preliminary calculations established that the Waterford 3 batteries 3A-S, 3B-S, and 3AB-S have sufficient capacity for a DBE. Waterford 3 had intended to replace, during refuel 5, the existing batteries with identical batteries. However, after careful consideration of the 10CFR21 notification and other pertinent information, Waterford 3 ascertained that the long term capabilities of the new GNB batteries were indeterminate. Accordingly, an intensive and expedited effort was implemented to thoroughly evaluate alternatives. Waterford 3 has decided to obtain replacement batteries from C&D Power Systems, Inc. (C&D).

2.0 Technical and Licensing Issues

The various technical and licensing issues and the planned resolutions for the batteries are the following:

2.1 NLI 10CFR 21

The applicable events are a Design Basis Event (DBE) and Station Blackout (SBO). The design basis for Waterford 3 is an event concurrent with a loss-of-offsite power and a single failure which is assumed to be a loss of one diesel or one DC bus. The Waterford 3 3A-S and 3B-S batteries are required for about 17 seconds for the DBE to provide power for essential equipment and to provide field flashing for the available diesel until at least one of the two 100% battery chargers is sequenced onto the available diesel. The 3AB-S battery is assumed to be connected to the failed diesel, and therefore the conservative assumption is made that the 3AB-S battery is required to supply loads on the AB bus for 31 minutes until operator action can be taken to connect the AB bus to the operable redundant bus. For station blackout, the batteries are required for four hours for a four hour coping plant.

The NCX-17 battery manufactured by GNB Industrial Battery Company was formerly designated NCX-1200 by Gould. Waterford 3 has two NCX-1200 and one NCX-2400 batteries supplied by Gould. While the NCX-17 battery and the NCX-1200 batteries are similar, the batteries have been manufactured under different company names, and the batteries may have minor dissimilarities, for example, degree of lead impurity. The 10CFR21 initial notification applies strictly to the NCX-17 battery. The fact that the NCX-17 battery failed to meet the one minute published rating provided an indicator that the data which Waterford 3 used to determine the capacity of batteries 3A-S, 3B-S, and 3AB-S may be in question. Preliminary calculations for operability were performed using data extrapolated from the single data point of 1165 amps. The preliminary calculations established that the Waterford 3 batteries 3A-S, 3B-S, and 3AB-S have sufficient capacity for the DBE.

The 3AB-S battery is required for 31 minutes for the DBE, and batteries 3A-S, 3B-S, and 3AB-S are required for four hours for an SBO. Thus, additional data for discharge ratings for times in excess of one minute was requested from NLI. Also, additional end VPC values were requested from NLI in order to establish the battery performance curve. Waterford 3 requested the foregoing data from NLI shortly after the issuance of the 10 CFR 21 notification to the NRC on July 8, 1992. Waterford 3 planned to finalize the preliminary calculations once the foregoing data was made available by NLI. Waterford 3 on August 31, 1992 received from NLI a letter conveying that no other rates were effected. The preliminary calculations were finalized by September 15, 1992.

The derating of the Gould batteries was also considered for impact on the SBO calculations of record. Waterford 3 requested from NLI additional data points in order to evaluate the battery performance over a four hour period. NLI initially indicated that the Coup de Fouet effect was noticeable up to the 30 minute rating of the battery and expected to change the published data for this duration. However on August 31, 1992, NLI issued letter NCR-02-30 confirming that only the 1 minute rating was affected and other rates were empirically verified to be accurate. The battery loads for SBO and DBE are similar for the first minute. The SBO calculations of record were not impacted beyond this minute. Accordingly, the SBO calculations of record were not revised as NLI maintains that the battery curves have not changed and the Coup de Fouet effect affected only the first minute rating of the Gould batteries.

2.2 Replacement of Batteries 3A-S, 3B-S, and 3AB-S

Batteries 3A-S, 3B-S, and 3AB-S will be replaced by the end of Refuel 5 with new batteries from C&D. The three new batteries will be C&D Type LCUN-33 with 16 positive plates. The ratings of the battery will be one minute rate of 2080 amps, 30 minute rate of 1472 amps, and eight hour capacity of 2320 amp-hours, all to a final terminal voltage of 1.75 volts per cell at 77°F and specific gravity of 1.215 ± 0.005 when fully charged.

The batteries and appurtenances are Class 1E. The qualified life is 20 years. Qualification testing has been performed in accordance with IEEE-323-1974. The batteries have been seismically qualified in accordance with IEEE 344-1975.

Each assembled battery has been subjected to a two hour rate battery capacity acceptance test at the factory in accordance with IEEE 450-1987. Each assembled battery is being subjected to a battery service test. The battery service test will demonstrate the batteries meet the DBE.

One hundred and twenty three (123) cells originally intended for TVA and stored at the Browns Ferry Nuclear Plant were shipped to Waterford 3. These cells underwent receipt inspection in accordance with the Entergy receipt inspection procedure. The remaining sixty three (63) cells have been shipped to Waterford 3 directly from C&D. A certificate of compliance has been obtained from C&D for all cells establishing that the cells have been provided in accordance with the Entergy procurement specification.

The 3A-S and 3B-S battery cells will be placed in new C&D Power System two-tier battery racks, model RD-15E2-18EP3. The 3AB-S battery cells will be placed in the existing Waterford 3 battery racks.

The circuit breakers for the 3A-S and 3B-S dc system will be replaced. The new batteries have a higher available fault current. The existing breakers are rated at 10 kilo-amps, and those breakers in service will be replaced with breakers rated at greater than 20 kilo-amps.

2.3 Equalizing Voltage

The 3AB-S battery will have 62 cells to provide a better voltage profile during loss of AC power. The 62 cells affect the equalizing voltage requirements. The float voltage will remain below the maximum allowable of 137.5V. The C&D recommended equalizing voltage range is 2.33 to 2.38 volts per cell. The equalizing voltage range corresponds to a minimum voltage of 139.8V for the 3A-S and 3B-S batteries and 144.5V for the 3AB-S battery. These voltage levels are above the maximum allowable system voltage of 137.5V, and therefore, Waterford 3 will equalize the individual cells that show weakness. Should there be a need to equalize individual cells, then the non-1E individual cell charging unit will be seismically restrained, and the unit will have adequate electrical isolation capabilities to ensure it does not degrade the 1E batteries during a postulated event.

2.4 Battery Chargers

The charging requirements and capabilities of the chargers were reviewed. Batteries 3A-S and 3B-S each have two 150 amp chargers. The chargers satisfy the sizing requirement of section 5.3.4 of IEEE 308-1971 and regulatory guide 1.32, 1972. The chargers supply steady state loads during normal operation and post accident conditions. One charger can recharge the existing 3A-S or 3B-S 1200 AH battery within 12 hours. The two chargers for the 3A-S or 3B-S DC system operating in the normal and load sharing mode can recharge the existing 3A-S or 3B-S battery in less than five hours. One charger will take approximately 22 hours, and two chargers in parallel will take less than 10 hours to recharge the replacement 3A-S or 3B-S 2320 AH battery.

The replacement battery is essentially equivalent in size to the existing battery, and the recharge time is not significantly impacted. The existing 200 amp battery charger will take less than 16 hours, and two parallel normally operating chargers will take approximately seven hours to recharge the fully discharged 3AB-S battery.

The recharge time is a function of the tolerable downtime of the battery and the preferred slow trickle charge time which are competing objectives. High discharge currents can lead to excessive heat-up of the batteries, and a slow charging may take unnecessarily long to equalize the batteries. The discharging load which is applied to the 3A-S or 3B-S batteries for 17 seconds during a DBE concurrent with a loss of offsite power will drain the batteries less than 0.5% of their capacity.

A total discharge of the batteries will occur during the performance test. This test will be carefully planned and executed during plant outages to minimize the shutdown risks associated with the unavailability of any of the DC equipment.

2.5 Affected Commitments

The affected commitments and the impact or resolution is the following:

A17626 and A20015

These commitments resulted from the Electrical Distribution System Functional Inspection (EDSFI). The commitments apply to the Elgar SUPS 3A-S and 3B-S and SCI SUPS 3MA, 3MB, 3MC, and 3MD and require consideration for lowering the trip setpoint to a value below 105V DC and verification of the ability of the SUPS to provide regulated output current at the lower input voltage of 101 V DC. The new 3A-S and 3B-S battery systems will have a significantly increased battery capacity. The increased capacity will ensure that the terminal voltage at the SUPS is maintained at or above 105V during all postulated events. There is no longer a necessity to consider operation of the SUPS at voltages below the design value of 105V. Waterford 3 will test by the end of refuel 5 the shutdown features of SUPS 3A-S and 3B-S at 105V. Waterford 3 will test, by the end of

Refuel 5, the alarm features of SUPS 3MA, 3MB, 3MC, and 3MD. The commitments for lowering of the setpoint no longer apply, and they will be closed.

A17962, A17992, and A20046

These commitments require replacement of batteries 3A-S, 3B-S, and 3AB-S; establishment of a reduced life for batteries 3A-S and 3B-S; development of approach for ascertaining early replacement; revision of calculations of record to reflect a design margin of 1.10 for batteries 3A-S and 3B-S and the available design margin for battery 3AB-S; and modification of 3AB-S system by refuel 6 to satisfy a design margin of 1.10. The commitments, regarding the establishment of a reduced life and the development of an approach for ascertaining early replacement are no longer applicable, and they will be closed. New commitments will be established to reflect the replacement of the existing batteries with the new C&D batteries with the 3A-S and 3B-S C&D batteries having a design margin of 1.10 and an aging factor of 1.25. The 3AB-S dc system will be modified by the end of refuel 6 to satisfy a design margin of 1.10.

A17960, A17961, and A20049

These commitments resulted from the EDSFI and require the FSAR to be changed to document the battery DBE and SBO load profiles for batteries 3A-S, 3B-S, and 3AB-S. These commitments still apply, however, the information cannot be processed for incorporation in the FSAR until the batteries have been installed, tested, and the design change documentation is closed. Therefore, these commitments will be changed to reflect a schedule for the information being incorporated not in the 1992 FSAR update but in the next scheduled FSAR update.

2.6 Technical Specification Surveillance Requirements 4.8.2.1.e. and f

Technical Specification section 4.8.2.1, paragraphs e and f, discusses the performance test requirements for batteries approaching 80% capacity or indicating sudden degradation. This section is based on the premise that battery performance is predictable up to 80% capacity. Typically, batteries show a tendency to have sharper degradation below 80% capacity or towards the end of useful life. Hence, the intent of this section is to ensure that the available battery capacity between successive tests is adequate for coping with the design basis event. The replacement 3AB-S battery will be at 100%. However, the replacement battery is not sized to meet design requirements up to 80% capacity. The replacement 3AB-S battery has to have approximately 91% capacity to satisfy SBO and DBE requirements. This battery has had a two hour battery acceptance test to ensure 100% capacity is available. After installation, a service test will be performed to DBE requirements. This new battery is expected to remain at (or above) 100% for greater than 10 years. The higher capacity requirements are necessary for 1 fuel cycle only. During Refuel 6, the 3AB-S DC system will be modified to ensure that the design margin requirements are satisfied. The intent of technical specification section 4.8.2.1 is satisfied through cycle 6.

2.7 SER and SSER on Station Blackout

Waterford 3 has reviewed the SER and the SSER as well as the Waterford 3 SBO documentation on SBO, and we believe the evaluations and conclusions in the SER and SSER are still applicable and valid. Waterford 3 will replace by the end of refuel 5 the 3A-S, 3B-S, and 3AB-S batteries with new C&D batteries. Calculations will be finalized by the end of Refuel 5 verifying the new 3A-S, 3B-S, and 3AB-S batteries have sufficient capacity for a DBE and SBO. The calculations of record, by the end of Refuel 5, will be based on a design margin of 1.10 and an aging factor of 1.25 for batteries 3A-S and 3B-S. The calculation of record, by the end of Refuel 5, for battery 3AB-S will be based on a combined design margin and aging factor of 1.05 or greater. The dc system for battery 3AB-S will be modified by the end of refuel 6 to satisfy a design margin of 1.10, and the aging factor will be established once the final modification is determined. Load shedding of the batteries will be implemented as documented in Waterford 3 letter W3F192-0079 and NRC SSER. The calculations of record will be based on an electrolyte temperature of 70°F. The modification to the 3AB-S dc system will be completed by the end of refuel 6 which is within the two year time period of 10CFR50.63 commencing with the date of the SSER. Accordingly, the provisions in the SER and SSER are met, and thus the SER and SSER are considered still applicable and valid.

3.0 Conclusion

Recent developments and new information had a bearing on Waterford 3 existing plans, evaluations, and commitments for the batteries. The various technical and licensing issues were identified, and an integrated approach was established to address the resolution of the various issues. The resolutions are in accordance with the provisions contained in the SER and SSER for station blackout, and thus the SER and SSER are considered still applicable and valid.

We believe this resolution of the battery issues represents an enhanced approach for the operation of Waterford 3. The 3A-S and 3B-S batteries have about twice the capacity of the existing batteries. The 3A-S and 3B-S batteries, by the end of Refuel 5, will have a design margin of 1.10 and an aging factor of 1.25. The 3AB-S battery, by the end of Refuel 5, will have a combined design margin and aging factor of 1.05 or greater. The 3AB-S battery, by the end of Refuel 6, will have a design margin of 1.10. Although the NLI 10CFR21 notification and other pertinent information adversely impacted Waterford 3 existing evaluations and plans for the batteries, an integrated approach was established which has minimal impact on the plant configuration, which preserves existing regulatory evaluations, and which will enhance the operation of Waterford 3.