Duke Power.
A Duke Energy Company

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August 5, 2004

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

Subject: Duke Energy Corporation
Catawba Nuclear Station, Units 1 and 2
Docket Numbers 50-413 and 50-414
Reply to Request for Addition Information
on Proposed Technical Specifications (TS)
Amendments to Sections 3.8.4, "DC Sources
- Operating"; 3.8.5 - "DC Sources -
Shutdown"; and 3.8.6, "Battery Cell
Parameters" and Associated TS Bases
(TAC Numbers MC2618 and MC2619)

Please find Catawba's reply to a Request for Additional Information discussed via a teleconference with the NRC on June 22, 2004. The format of the reply is to restate the NRC question followed by Catawba's response.

There are no regulatory commitments contained in this letter or its attachment.

If you have any questions concerning this material, please call A.P. Jackson at (803) 831-3084.

Very truly yours,

Dhiaa M. Jamil

APJ/apj

A001

Dhiaa M. Jamil affirms that he is the person who subscribed his name to the foregoing statement, and that all the matters and facts set forth herein are true and correct to the best of his knowledge.

Dhiaa M. Jamil, Site Vice President, Catawba Nuclear Station

Subscribed and sworn to me: 8-5-2004
Date

Notary Public

My commission expires: 7-10-2012
Date

SEAL

xc (with attachments):

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REQUEST FOR ADDITIONAL INFORMATION
DUKE ENERGY CORPORATION
CATAWBA NUCLEAR STATION, UNITS 1 AND 2
DOCKET NUMBERS 50-413 AND 50-414

The Nuclear Regulatory Commission (NRC) staff reviewed the licensee's license amendment submittal dated April 6, 2004 regarding diesel generator battery cell parameters and identified that additional information was required to enable the continuation of the review. The questions and licensee responses are listed below:

1. Attachment 5 to the "Technical Specifications (TS) Amendment Request" provides Diesel Generator (DG) battery sizing calculations for various load profiles. The worst case is observed to be 1DGBA LOCA-BO with first minute loading as 178.61A. However, per section SR 3.8.4 (marked as SR 3.8.4.7) of TS bases B3.8.4, the DG batteries are tested for 218.5A for the first minute. Also, according to Figure 8-27 of UFSAR, the load for DG batteries is 214.6A for the first minute. Similar differences are observed for the remainder of the load profile between the DG batteries sizing calculation, TS bases, and UFSAR. Please explain why there are differences between the load profiles considered in the calculations for sizing the batteries, TS bases, and the load profile considered for testing of the batteries.

   Duke Energy Corporation Response:

   The UFSAR Figure 8-27 load value of 214.6A is from the October 1993 revision of the UFSAR. Figure 8-27 has since been revised, and the current October 2001 revision shows a value of 273.1A for the first minute.

   The load profile (duty cycle) described in TS bases B3.8.4.8 conservatively envelopes the load profile shown for all four DG batteries, 1DGBA, 1DGBB, 2DGBA and 2DGBB, in the battery sizing calculation. The design basis load profile for each battery is slightly different due to minor load differences between trains A and B and units 1 and 2. For this reason, the battery sizing calculation determines the required capacity for each battery on an individual basis. From an overall size requirement standpoint, DG battery 1DGBA is the worst-case battery. To avoid becoming overly complex, one load profile, which envelopes the load

profile for all four DG batteries, was developed and incorporated into the TS bases. The load profile represents the total design basis load adjusted for a design basis minimum cell temperature of 60 °F and a 15% Design Margin. The load profile in the TS bases is the profile used to perform the battery service test; therefore, the load profile does not include correction for battery aging. The load profile shown in the October 2001 revision of UFSAR Figure 8-27 is consistent with the load profile in the TS basis except that the load profile in Figure 8-27 includes an Aging Factor adjustment of 1.25 to account for normal age-related battery capacity degradation (to a minimum of 80% of the rated capacity).

2. Please provide the following calculations for staff review:

- Worst case DG battery load profile calculation (load profile should agree with load profiles considered in other documents)
- DG battery sizing calculation for the worst case load profile with no cell reversal

Duke Energy Corporation Response:

Please refer to Attachment B for a preliminary copy of the battery load profile and sizing calculations for 1DGBA, assuming no cell reversal. The copy is preliminary due to periodic revisions unrelated to the question above. The portions included in the attachment deal with the worst-case DG battery, which is 1DGBA. These portions of the calculation have been checked and are included on Attachment B. The revision did not change the battery load profile. No significant changes are expected to be made to this portion of the calculation. The calculation revision is expected to be fully checked and approved by the September 9, 2004. A final copy of the calculation for DG Battery 1DGBA can be provided at that time, if desired.

The battery sizing calculation previously provided for the cell-reversal scenario did not change as a result of the revision described above.

3. It is stated on Page 1 of Attachment 3, that the proposed TS amendment does not involve a significant reduction in margin of safety. The staff believes that the proposed change would reduce the margin of safety by allowing one cell to be in a condition where cell reversal is likely. This condition would not occur with the current TS. Please clarify.

Duke Energy Corporation Response:

Catawba's batteries are sized in accordance with IEEE Std. 485-1983 where the batteries are sized based on a design minimum temperature of 60 °F and a 1.25 aging factor in addition to design margin. The design margin is over and above the design basis requirements. Catawba's DG batteries (94 cells, 277 Ah) are sized with a significant design margin. Assuming the battery is at an end-of-life capacity of 80%, the electrolyte temperature is at the design minimum of 60F, and that no cells are jumpered out, the design margin is 37%. With the worst-case assumption that one cell is in full reversal (-1.8 volts), the design margin is still 34%.

4. It is not clear to the staff how long the plant will be operated with the battery in the degraded condition with one cell in reverse polarity. Please clarify.

Duke Energy Corporation Response:

Based on the discussions in Attachment 2 of the April 6, 2004 submittal, pages 7 and 8 and the results of the battery sizing calculations in Attachment 5 of the same submittal, a DG battery can remain operable and fully capable of satisfying its design requirements indefinitely with one cell <1.36 V. Catawba will increase awareness when the cell is <1.36V and administratively plan replacement of the cell during the next respective DG Work Day. On-line work is scheduled by trains to minimize equipment unavailability time and thus the replacement of the cell would be scheduled accordingly.

5. Provide justification for moving SR 3.8.4.2 to new SR 3.8.6.5 location.

Duke Energy Corporation Response:

This change was simply relocating this surveillance from TS 3.8.4, "DC Sources-Operating" to a more appropriate Technical Specification. TS 3.8.6, "Battery Cell Parameters". Upon further review, this change may cause more confusion since it will vary from the standard TS and we currently have another TS amendment which affects these same Technical Specifications in progress. Thus, Duke is agreeable with not moving the SR 3.8.4.2 to SR 3.8.6.5.

Figure 1: 125VDC Diesel Auxiliary Power Battery 1DGBA Load Profile During a LOCA/ Blackout

		LOCA/Blackout Duty Cycle Time Period																
Bus/Compt.	**Load Title**	**T = 0 -**	**0- 1 sec.**	**1- 2 sec.**	**2- 3 sec.**	**3- 8.5 sec.**	**8.5- 10 sec.**	**10- 11 sec.**	**11- 12 sec.**	**12- 13 sec.**	**14- 15 sec.**	**15- 16 sec.**	**16- 17 sec.**	**17- 20 sec.**	**20- 21 sec.**	**21- 22 sec.**	**22- 25 sec.**	**25- 26 sec.**
1EDE/F01C	1ETA Switchgear Control Power	6.00	21.00	6.00	6.00	6.00	56.00	6.00	76.00	86.00	16.00	76.00	16.00	6.00	76.00	16.00	6.00	76.00
1EDE/Rem.	Balance of 1EDE Loads	26.62	26.62	26.62	26.62	26.62	26.62	26.62	26.62	26.62	26.62	26.62	26.62	26.62	26.62	26.62	26.62	26.62
1VADA	Low Voltage Detection Isol. on 1VADA	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Direct Feed	Diesel Engine Control Panel 1DECPA and Diesel Generator Control Panel 1DGCPA	0.71	17.61	17.61	17.61	20.69	5.53	5.53	6.98	5.97	5.97	5.97	5.97	5.97	5.97	5.97	5.97	5.97
Direct Feed	Diesel Generator 2A Field Flash	0.00	0.00	0.00	0.00	45.00	45.00	45.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1DGDA	Various loads on F01B, F01C, F01D, F01E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total	**33.35**	**65.25**	**50.25**	**50.25**	**98.33**	**133.16**	**83.16**	**109.62**	**118.61**	**48.61**	**108.61**	**48.61**	**38.61**	**108.61**	**48.61**	**38.61**	**108.61**

		LOCA/Blackout Duty Cycle Time Period																
Bus/Compt.	**Load Title**	**26- 27 sec.**	**27- 30 sec.**	**30- 31 sec.**	**31- 32 sec.**	**32- 35 sec.**	**35- 36 sec.**	**36- 37 sec.**	**37- 40 sec.**	**40- 41 sec.**	**41- 42 sec.**	**42- 1 min.**	**1- 1min.+1s**	**1min+1s 2 min.**	**2- 10 min.**	**10- 11 min.**	**11- 11min+1s**	**11min+1s 11min+2s**
1EDE/F01C	1ETA Switchgear Control Power	16.00	6.00	146.00	26.00	6.00	76.00	16.00	6.00	76.00	16.00	6.00	6.00	6.00	6.00	6.00	76.00	16.00
1EDE/Rem.	Balance of 1EDE Loads	26.62	26.62	26.62	26.62	26.62	26.62	26.62	26.62	26.62	26.62	26.62	15.11	15.11	15.11	15.54	15.54	15.54
1VADA	Low Voltage Detection Isol. on 1VADA	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Direct Feed	Diesel Engine Control Panel 1DECPA and Diesel Generator Control Panel 1DGCPA	5.97	5.97	5.97	5.97	5.97	5.97	5.97	5.97	5.97	5.97	5.97	7.31	6.09	6.09	6.09	6.09	6.09
Direct Feed	Diesel Generator 1A Field Flash	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1DGDA	Various loads on F01B, F01C, F01D, F01E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.23	0.23	0.23	0.23	0.23
	Total	**48.61**	**38.61**	**178.61**	**58.61**	**38.61**	**108.61**	**48.61**	**38.61**	**108.61**	**48.61**	**38.61**	**28.67**	**27.44**	**27.44**	**27.87**	**97.87**	**37.87**

Figure 1: 125VDC Diesel Auxiliary Power Battery 1DGBA Load Profile During a LOCA/ Blackout

Bus/Compt.	Load Title	LOCA/Blackout Duty Cycle Time Period 11min+2s 12 min.	12 min.- 12min+1s	12min+1s 12min+2s	12min+2s 13 min	13- 20 min.	20- 60 min.	60- 61 min.	61 min. 120 min.
1EDE/F01C	1ETA Switchgear Control Power	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
1EDE/Rem.	Balance of 1EDE Loads	15.54	15.54	15.54	15.54	15.54	13.98	13.98	13.98
1VADA	Low Voltage Detection Isol. on 1VADA	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Direct Feed	Diesel Engine Control Panel 1DECPA and Diesel Generator Control Panel 1DGCPA	6.09	6.09	6.09	6.09	6.09	6.09	5.69	5.53
Direct Feed	Diesel Generator 1A Field Flash	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1DGDA	Various loads on F01B, F01C, F01D, F01E	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
	Total	27.87	27.87	27.87	27.87	27.87	26.31	25.91	25.75

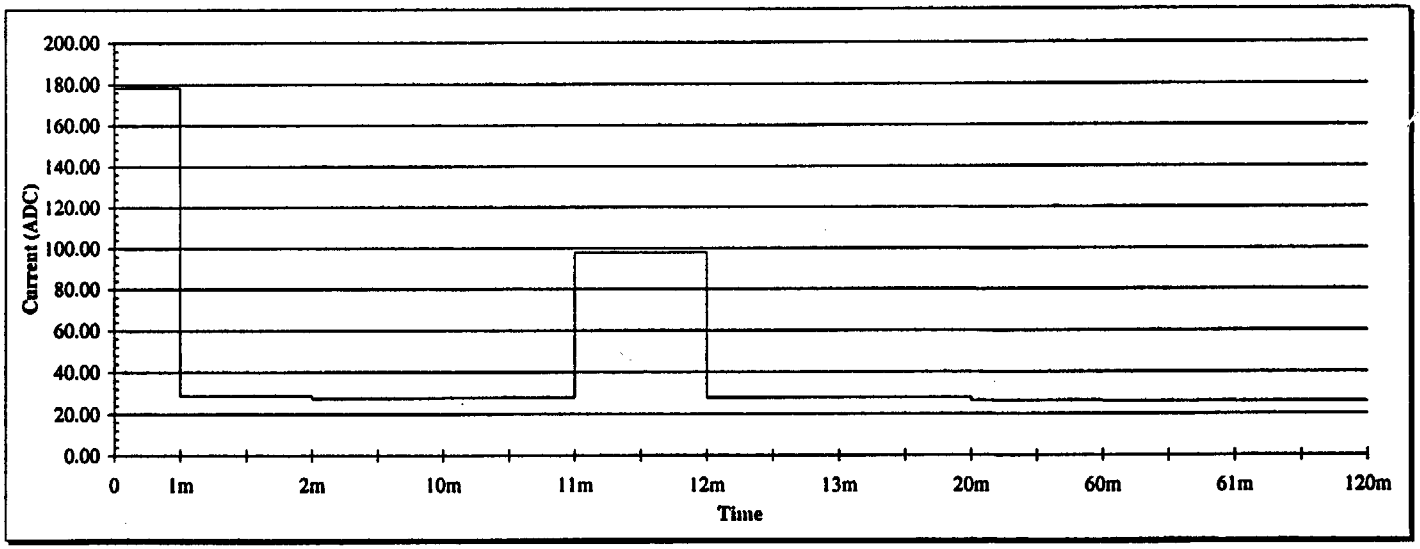

Figure 5: 125VDC Diesel Auxiliary Power Battery 1DGBA Load Profile Adjustments for Aging

Description	LOCA/Blackout Duty Cycle Time Period 0-1 sec.	1-2 sec.	2-3 sec.	3-8.5 sec.	8.5-10 sec.	10-11 sec.	11-12 sec.	12-13 sec.	14-15 sec.	15-16 sec.	16-17 sec.	17-20 sec.	20-21 sec.	21-22 sec.	22-25 sec.	25-26 sec.
Unadj. Load Current (ADC)	65.25	50.25	50.25	98.33	133.16	83.16	109.62	118.61	48.61	108.61	48.61	38.61	108.61	48.61	38.61	108.61
80% Aging Factor	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
Adj. Load Current (ADC)	81.56	62.81	62.81	122.91	166.45	103.95	137.02	148.26	60.76	135.76	60.76	48.26	135.76	60.76	48.26	135.76

Description	LOCA/Blackout Duty Cycle Time Period 26-27 sec.	27-30 sec.	30-31 sec.	31-32 sec.	32-35 sec.	35-36 sec.	36-37 sec.	37-40 sec.	40-41 sec.	41-42 sec.	42-1 min.	1-1min.+1s	1min+1s 2 min.	2-10 min.	10-11 min.	11-11min+1s
Unadj. Load Current (ADC)	48.61	38.61	178.61	58.61	38.61	108.61	48.61	38.61	108.61	48.61	38.61	28.67	27.44	27.44	27.87	97.87
80% Aging Factor	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
Adj. Load Current (ADC)	60.76	48.26	223.26	73.26	48.26	135.76	60.76	48.26	135.76	60.76	48.26	35.83	34.30	34.30	34.84	122.34

Description	LOCA/Blackout Duty Cycle Time Period 11min+1s 11min+2s	11min+2s 12 min.	12 min.-12min+1s	12min+1s 12min+2s	12min+2s 13 min	13-20 min.	20-60 min.	60-61 min.	61-120 min.
Unadj. Load Current (ADC)	37.87	27.87	27.87	27.87	27.87	27.87	26.31	25.91	25.75
80% Aging Factor	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
Adj. Load Current (ADC)	47.34	34.84	34.84	34.84	34.84	34.84	32.89	32.39	32.19

Figure 5: 125VDC Diesel Auxiliary Power Battery 1DGBA Load Profile Adjustments for Aging

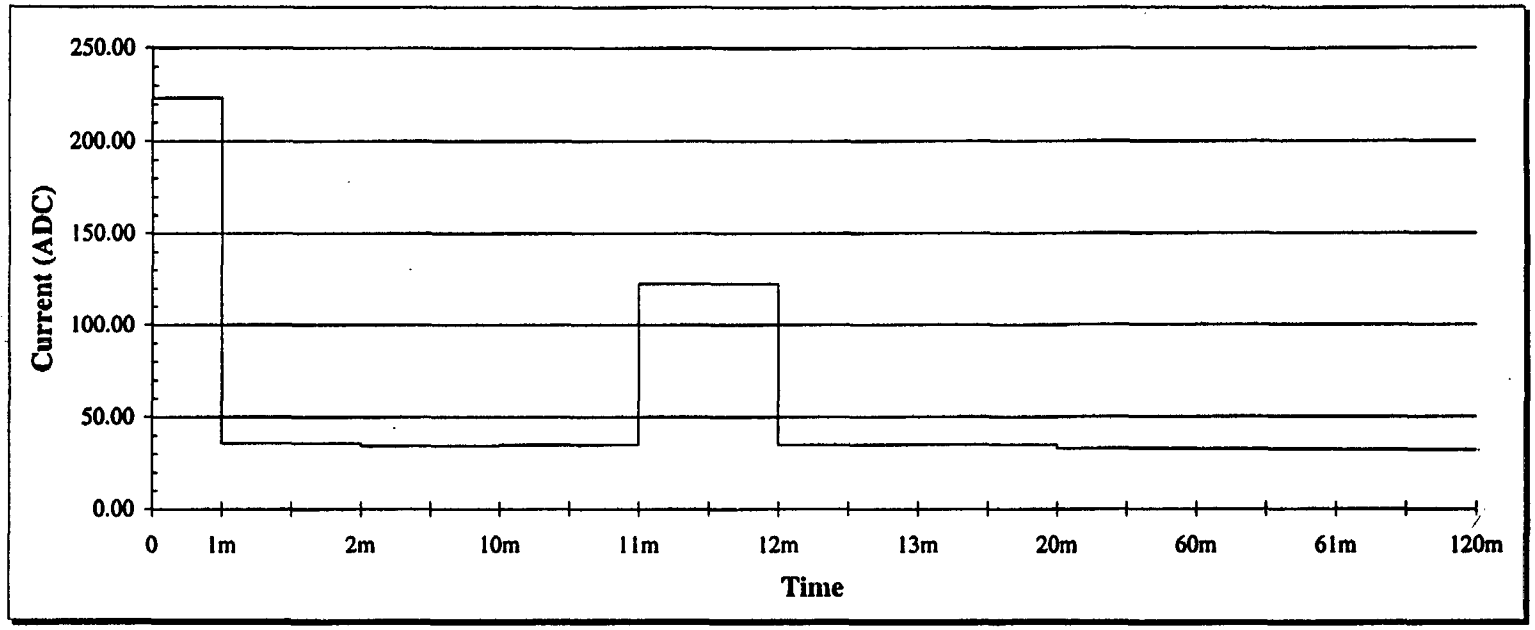

Table 1
SAFT Nife, Inc. SBM277-2 Capacity Factors

Time to End of Section (Min.)	Uncorrected Disch. Current (ADC)	Capacity Factor Kt (Ah/A)	Capacity Factor Rt (A/mp)	5-hour Capacity (Ah)
1 sec.	505.00	0.55	42.08	277
5 sec.	490.00	0.57	40.83	277
30 sec.	425.00	0.65	35.42	277
1.00	382.00	0.73	31.83	277
1.50	273.00	1.01	22.75	277
2.00	273.00	1.01	22.75	277
3.00	273.00	1.01	22.75	277
4.00	273.00	1.01	22.75	277
5.00	273.00	1.01	22.75	277
6.00	228.00	1.21	19.00	277
7.00	228.00	1.21	19.00	277
8.00	228.00	1.21	19.00	277
9.00	228.00	1.21	19.00	277
10.00	228.00	1.21	19.00	277
11.00	200.00	1.39	16.67	277
12.00	200.00	1.39	16.67	277
13.00	200.00	1.39	16.67	277
14.00	200.00	1.39	16.67	277
15.00	200.00	1.39	16.67	277
16.00	185.00	1.50	15.42	277
17.00	185.00	1.50	15.42	277
18.00	185.00	1.50	15.42	277
19.00	185.00	1.50	15.42	277
20.00	185.00	1.50	15.42	277
21.00	161.00	1.72	13.42	277
22.00	161.00	1.72	13.42	277
23.00	161.00	1.72	13.42	277
24.00	161.00	1.72	13.42	277
25.00	161.00	1.72	13.42	277
27.00	161.00	1.72	13.42	277
29.00	161.00	1.72	13.42	277
30.00	161.00	1.72	13.42	277
31.00	126.00	2.20	10.50	277
35.00	126.00	2.20	10.50	277
36.00	126.00	2.20	10.50	277
37.00	126.00	2.20	10.50	277
38.00	126.00	2.20	10.50	277
39.00	126.00	2.20	10.50	277
40.00	126.00	2.20	10.50	277
41.00	126.00	2.20	10.50	277
45.00	126.00	2.20	10.50	277
47.00	126.00	2.20	10.50	277
48.00	126.00	2.20	10.50	277
49.00	126.00	2.20	10.50	277
50.00	126.00	2.20	10.50	277
51.00	126.00	2.20	10.50	277
54.00	126.00	2.20	10.50	277

Table 1
SAFT Nife, Inc. SBM277-2 Capacity Factors

55.00	126.00	2.20	10.50	277
56.00	126.00	2.20	10.50	277
57.00	126.00	2.20	10.50	277
58.00	126.00	2.20	10.50	277
59.00	126.00	2.20	10.50	277
60.00	126.00	2.20	10.50	277
61.00	115.33	2.40	9.61	277
90.00	107.00	2.59	8.92	277
100.00	89.60	3.09	7.47	277
107.00	89.60	3.09	7.47	277
108.00	89.60	3.09	7.47	277
109.00	89.60	3.09	7.47	277
110.00	89.60	3.09	7.47	277
117.00	89.60	3.09	7.47	277
118.00	89.60	3.09	7.47	277
119.00	89.60	3.09	7.47	277
120.00	89.60	3.09	7.47	277

Table 1
SAFT Nife, Inc. SBM 277-2 Capacity Factors

The uncorrected discharge current values for time periods which were not explicitly listed in Attachment 2 (page 13) were conservatively assumed to be the next largest time interval listed. For example, the time period of 6 minutes is not listed in Attachment 2 and would fall between the value for 5 minutes and 10 minutes. Since the discharge current value for 10 minutes represents a lower battery capacity than the 5 minutes discharge value, it is assumed that this value also holds for the 6 minute discharge current. In this manner, the discharge currents used in the table are assured of enveloping the actual discharge curve, provided the curve always has a downward slope (obviously a valid assumption).

The one exception to the above philosophy is the 61 minute discharge value. Here, linear regression was used to determine a curve fit for the discharge current function. In particular, the discharge current was assumed to be a function of the log of time period. A linear curve fit was performed using the discharge currents corresponding to 20, 30, 60, 90, and 120 minutes, with log(time) used as the independent variable. The LINEST function in Microsoft Excel was used to perform the regression. The results are as follows:

$y = m * \log(x) + b$ where $m = -120.13$
$b = 340.09$

The regression statistics are as follows:

R-sqr = 0.9987 Standard Error = 1.6014
F-statistic = 2373.39 Degrees of Freedom = 3
Regression SS = 6086.3 Residual SS = 7.693
p-value = 0.0000109

This can be interpreted as follows:

1) The R-sqr statistic indicates that 99.87% of the variation between the predicted value and actual value is captured by the regression equation.
2) The p-value statistic indicates the there is a 0.00147% chance the regression analysis results are due to the random variation of the actual values instead of representing a true relationship to the actual values. Or, put another way, there is a 99.9987% probability the regression equation represents the true behavior of the dicharge current values.

Time to End of Section (Min.)	Log of Time to End of Section (Min.)	Actual Disc. Curr. (ADC)	Predicted Disc. Curr. (ADC)	Residual (Actual minus Predicted)
20.00	1.30	185.00	183.80	1.20
30.00	1.48	161.00	162.65	-1.65
60.00	1.78	126.00	126.49	-0.49
90.00	1.95	107.00	105.33	1.67
120.00	2.08	89.60	90.33	-0.73

Table 1
SAFT Nife, Inc. SBM 277-2 Capacity Factors

Since this is obviously an excellent fit, the next step is to construct a prediction interval for the 61 minute value which the equation will be used to predict. This is done using the following equation from Attachment 7, page 1:

confidence interval = predicted value +/- t*(predse)

where t = t-distribution value corresponding to n degrees of freedom and x desired percentile

predse = prediction standard error (see Attachment 7, page 1)

From the regression statistics above, there are three degrees of freedom associated with the data set used in the analysis. If a prediction interval of 99.5% is desired, then from Attachment 7, page 2, the corresponding t-value is 5.841. Using this value of t, and an s value of 1.6104 (the standard error of estimate from the regression statistics above), the following prediction interval upper and lower bounds are computed for each predicted value of discharge current

Time to End of Section (Min.)	Actual Disc. Curr. (ADC)	Predicted Disc. Curr. (ADC)	99.5% Prediction Interval Lower Bound (ADC)	99.5% Prediction Interval Upper Bound (ADC)
20.00	185.00	183.80	171.93	195.68
30.00	161.00	162.65	151.83	173.47
60.00	126.00	126.49	116.20	136.77
61.00	N/A	125.63	115.33	135.92
90.00	107.00	105.33	94.54	116.13
120.00	89.60	90.33	78.83	101.82

From the above table, the lower bound for the 61 minute discharge current is 115.33 ADC. This means there is a 99.5% probability the actual discharge current will be higher than this value. It should be noted that the confidence intervals used in loop accuracy calculations is typically 95%. Additionally, the resolution of the discharge current values used in the regression is a maximum of 1/185, or 99.5%. Based on these two observations, a 99.5% prediction interval is considered conservative. Consequently, the lower bound of 115.33 ADC for the uncorrected discharge current for 61 minutes will be used in the appropriate entry in the Table.

Table 2
SAFT Nife, Inc. SBM277-2 Temperature Correction Factors

Time to End of Section (Min.)	Temp Correction*
1	1.07
2	1.07
3	1.06
4	1.06
6	1.06
7	1.06
8	1.06
9	1.06
10	1.06
11	1.06
12	1.06
13	1.06
14	1.06
17	1.06
18	1.06
19	1.06
20	1.06
21	1.06
22	1.06
23	1.06
24	1.06
27	1.06
29	1.06
30	1.06
31	1.06
36	1.06
37	1.06
38	1.06
39	1.06
40	1.06
41	1.06
47	1.06
48	1.06
49	1.06
50	1.06
51	1.05
57	1.05
58	1.05
59	1.05
60	1.05
61	1.05
100	1.04
107	1.04
108	1.04

Table 2
SAFT Nife, Inc. SBM277-2 Temperature Correction Factors

109	1.04
110	1.04
118	1.04
119	1.04
120	1.04
169	1.04
170	1.04
178	1.04
179	1.04
180	1.04
200	1.04
206	1.04
208	1.04
209	1.04
210	1.04
215	1.04
216	1.04
217	1.04
218	1.04
219	1.04
220	1.04
227	1.03
229	1.03
230	1.03
236	1.03
237	1.03
238	1.03
239	1.03
240	1.03

*** Data from SAFT Calc (Attachment 9) & Jim McDowall (Attachment 10)**

Figure 9

125VDC Diesel Auxiliary Power Battery 1DGBA Cell Sizing Work Sheet Using Kt Capacity Factor

PERIOD	LOAD (AMPS)	CHANGE IN LOAD (AMPS)	DURATION OF PERIOD (MIN)	TIME TO END OF SECT (MIN)	CAPACITY AT T MIN RATE K Factor (Kt)	TEMPERATURE DERATING FACTOR (MIN)	REQUIRED SECTION SIZE
Section 1- First Period Only - If A2 is greater than A1, go to Section 2.							
1	223.26	223.26	1	1	0.73	1.070	173.23
					SECT 1 TOTAL		173.23
Section 2 - First Two Periods Only - If A3 is greater than A2, go to section 3.							
1	223.26	223.26	1	2	1.01	1.070	242.39
2	35.83	-187.43	1	1	0.73	1.070	-145.42
					SECT SUB TOT		
					SECT 2 TOTAL		96.97
Section 3 - First Three Periods Only - If A4 is greater than A3, go to Section 4.							
1	223.26	223.26	1	10	1.21	1.060	287.52
2	35.83	-187.43	1	9	1.21	1.060	-241.37
3	34.30	-1.53	8	8	1.21	1.060	-1.97
					SECT SUB TOT		
					SECT 3 TOTAL		44.17
Section 4 - First Four Periods Only - If A5 is greater than A4, go to section 5.							
1	223.26	223.26	1	11	1.39	1.060	327.77
2	35.83	-187.43	1	10	1.21	1.060	-241.37
3	34.30	-1.53	8	9	1.21	1.060	-1.97
4	34.84	0.54	1	1	0.73	1.070	0.42
					SECT SUB TOT		
					SECT 4 TOTAL		84.84
Section 5 - First Five Periods Only - If A6 is greater than A5, go to Section 6.							
1	223.26	223.26	1	12	1.39	1.060	327.77
2	35.83	-187.43	1	11	1.39	1.060	-275.16
3	34.30	-1.53	8	10	1.21	1.060	-1.97
4	34.84	0.54	1	2	1.01	1.070	0.58
5	122.34	87.50	1	1	0.73	1.070	67.89
					SECT SUB TOT		
					SECT 5 TOTAL		119.11
Section 6 - First Six Periods Only - If A7 is greater than A6, go to section 7.							
1	223.26	223.26	1	13	1.39	1.060	327.77
2	35.83	-187.43	1	12	1.39	1.060	-275.16
3	34.30	-1.53	8	11	1.39	1.060	-2.25
4	34.84	0.54	1	3	1.01	1.060	0.58
5	122.34	87.50	1	2	1.01	1.070	95.00
6	34.84	-87.50	1	1	0.73	1.070	-67.89
					SECT SUB TOT		
					SECT 6 TOTAL		78.04
Section 7 - First Seven Periods Only - If A8 is greater than A7, go to Section 8.							
1	223.26	223.26	1	20	1.50	1.060	354.35
2	35.83	-187.43	1	19	1.50	1.060	-297.47
3	34.30	-1.53	8	18	1.50	1.060	-2.43
4	34.84	0.54	1	10	1.21	1.060	0.69
5	122.34	87.50	1	9	1.21	1.060	112.68
6	34.84	-87.50	1	8	1.21	1.060	-112.68
7	34.84	0.00	7	7	1.21	1.060	0.00

Figure 9

125VDC Diesel Auxiliary Power Battery 1DGBA Cell Sizing Work Sheet Using Kt Capacity Factor

					SECT SUB TOT		
					SECT 7 TOTAL		55.13

Section 8 - First Eight Periods Only - If A9 is greater than A8, go to Section 9.

1	223.26	223.26	1	60	2.20	1.050	515.36
2	35.83	-187.43	1	59	2.20	1.050	-432.65
3	34.30	-1.53	8	58	2.20	1.050	-3.54
4	34.84	0.54	1	50	2.20	1.060	1.25
5	122.34	87.50	1	49	2.20	1.060	203.90
6	34.84	-87.50	1	48	2.20	1.060	-203.90
7	34.84	0.00	7	47	2.20	1.060	0.00
8	32.89	-1.95	40	40	2.20	1.060	-4.54
					SECT SUB TOT		
					SECT 8 TOTAL		75.88

Section 9 - First Nine Periods Only - If A10 is greater than A9, go to Section 10.

1	223.26	223.26	1	61	2.40	1.050	563.03
2	35.83	-187.43	1	60	2.20	1.050	-432.65
3	34.30	-1.53	8	59	2.20	1.050	-3.54
4	34.84	0.54	1	51	2.20	1.050	1.24
5	122.34	87.50	1	50	2.20	1.060	203.90
6	34.84	-87.50	1	49	2.20	1.060	-203.90
7	34.84	0.00	7	48	2.20	1.060	0.00
8	32.89	-1.95	40	41	2.20	1.060	-4.54
9	32.39	-0.50	1	1	0.73	1.070	-0.39
					SECT SUB TOT		
					SECT 9 TOTAL		123.15

Section 10 - Final Section

1	223.26	223.26	1	120	3.09	1.040	717.82
2	35.83	-187.43	1	119	3.09	1.040	-602.62
3	34.30	-1.53	8	118	3.09	1.040	-4.93
4	34.84	0.54	1	110	3.09	1.040	1.73
5	122.34	87.50	1	109	3.09	1.040	281.33
6	34.84	-87.50	1	108	3.09	1.040	-281.33
7	34.84	0.00	7	107	3.09	1.040	0.00
8	32.89	-1.95	40	100	3.09	1.040	-6.27
9	32.39	-0.50	1	60	2.20	1.050	-1.15
10	32.19	-0.20	59	59	2.20	1.050	-0.46
					SECT SUB TOT		
					SECT 9 TOTAL		104.12