Commonwealth Edison
1400 Opus Place
Downers Grove, Illinois 60515

March 21, 1990

Dr. Thomas E. Murley, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: Byron Station Unit 1
DC Battery 111
Operability Calculations
NRC Docket No. 50-454

Dear Dr. Murley:

Dr. S. Saba of your Electrical Systems Branch has requested a copy of calculations verifying the operability of the Unit 1 DC Battery 111 with only 57 of its 58 cells functional. A copy of the Architect Engineer Calculations and Byron Onsite Review notes are attached and fulfills this request.

Please address any questions that you or your staff may have concerning this response to this office.

Respectfully,

T. K. Schuster
Nuclear Licensing Administrator

Attachment

cc: Dr. S. Saba - NRR
P. C. Shemanski - NRR
Resident Inspector - Byron

0811T/TSK:wj

A001 Add: S. Saba Ltr, Encl 1 1

OSR 90-076

This On Site Review is being written to address the operability of the 111 Battery with only 57 cells. To maintain a bus voltage of 105 VDC an individual cell voltage of 1.84 is required. Sargent and Lundy performed a calculation to verify for an individual cell voltage of 1.84 that a NCX-1200 battery would meet the operability requirements(This calculation is attached). Some questions with the calculation are addressed in this On Site Review.

1) In the calculation a correction factor for temperature was used for 69 F. Technical Specification 4.8.2.1.2-b.3 defines 60 F as the minimum electrolyte temperature. With 60 F as the minimum temperature the correction factor per IEEE 450 would have been 1.11. With the correction factor for 60 F the calculation at the bottom of page 3 of 6 of the attached S&L letter is:

   4.5 * 1.11 * 1.15 * 1.25 = 7.18

   Since the NCX-1200 battery has 8 positive plates This calculation proves the battery voltage would remain above 105 during the load profile.

2) With the temperature correction factor for 60 F the calculation with the battery crosstied(page 4 of 6 of the S&L letter) is:

   5.8 * 1.11 * 1.25 = 8.04

   Since the NCX-1200 battery has only 8 positive plates the battery would not maintain the bus voltage greater than 105 VDC with the crosstie breakers closed. To insure this does not occur the Crosstie breakers will be taken OOS. The Crosstie will only be used if the actual electrolyte temperature is greater than 65 F. With the correction factor for 65 F:

   5.8 * 1.08 * 1.25 = 7.83

   The NCX-1200 battery would maintain 105 VDC during the load profile with the battery crosstied above 65 F.

3) The calculation in the S&L letter are not based on the maximum load profile in the UFSAR. S&L used the load profile reflected in the DC ELMS program. The values in the DC ELMS program reflects actual plant load. The DC ELMS program is a documented program of actual plant loads.

A concern was brought up as to would the battery meet the load profile defined in the UFSAR. The following calculation assumed 1.84 volts per cell and 60 F electrolyte temperature. The design margin correction factor was not used in this calculation since the DC ELMS program shows that BUS 111 is below the UFSAR load profile.

BATTERY 111 LOAD PROFILE WITHOUT CROSSTIE

60 F cell voltage 1.84

LOAD	CHANGE IN LOAD	AMPS/POS		POSITIVE PLATES	
617		111		5.56	
			TOTAL	5.56	
617		79.4		7.77	
354	-263	79.9			-3.29
			TOTAL	4.48	
617		43		14.35	
354	-263	43.5			-6.04
152	-202	50			-4.04
			TOTAL	4.27	
617		28		22.04	
354	-263	28			-9.39
152	-202	30.5			-6.62
55	-97	43			-2.26
			TOTAL	3.77	

5.56(positive plates) * 1.11(temperature correction for 60 F) * 1.25(aging factor for 80% minimum capacity) = 7.71(positive plates)

Since the NCX-1200 has 8 positive plates battery 111 would maintain the bus voltage above 105 VDC with 57 cells using the UFSAR load profile without the battery crosstied.

This On Site review finds that the 111 Battery is operable with 57 cells.

SARGENT & LUNDY ENGINEERS

Calcs. For 57 Cell Operation of Battery 1DC01E		Calc. No. 19-D-15
		Rev. 0 Date
X Safety-Related	Non-Safety-Related	Page 1 of 6

Client Commonwealth Edison Co.	Prepared by B.A. Kutchik	Date 5-4-89
Project Byron Station Unit 1	Reviewed by A.J. Rende	Date 6-27-89
Proj. No. B226.03 Equip. No. 1DC01E	Approved by D.R. Galvin	Date 6-27-89

Revision Summary

Rev 0 First Issue by B.A. Kutchik p1-6

SYSTEM: DC
SUBSYSTEM: N/A
COMPONENT NUMBER: 1DC01E

Jun 27 1989 0085

Purpose: The purpose of this calculation is to ensure Battery 1DC01E has sufficient capacity to supply it's loads when operating with 57 cells instead of 58 cells.

References:

1) ELMS-DC, Byron Unit 1, File # 1DC01E.E01
2) Byron / Braidwood Calculation 19-D-8, Rev. 0 + D5, R2
3) Gould Inc. Curves TC-107011 + TC-107628 + TC-107172
4) Battery Testing & Surveillance Guidelines, Byron/Bdwd, July 23, 1987
5) IEEE-450, 1987
6) Byron Station Technical Specifications 3/4.8.2, 3.8.2.1c + 4.8.2.1.b

Conclusion: Based upon the worksheets in this Calculation, for both operating scenarios, ~~of~~ DAL System Battery 1DC01E has sufficient capacity to operate with 57 cells.
This Calculation will be accurate for the loading as of 5-4-89.

7) Telephone Conversation Memos by B.A. Kutchik
to P Kajmo of GNB 6-9-89
to E. Widner of GNB 6-15-89
(Attachments A & B)

Review Method

This calculation has been reviewed by a detailed review of the original calculation. Andrew J Rende 6/27/89

SARGENT & LUNDY ENGINEERS

Calcs. For		Calc. No. 14-1-15
		Rev. 0 Date
X Safety-Related	Non-Safety-Related	Page 2 of 6

Client	Prepared by	Date
Project	Reviewed by	Date
Proj. No. 8226-03 Equip. No.	Approved by	Date

Battery 1DC01E has two operating modes
① Normal - loads as tabulated in ELMS-DC
⑤ Crosstie - loads as tabulated in ELMS-DC plus 63A. (Ref. 2 & 6)

To maintain a minimum operating voltage of 105Vdc & operate with 57 cells the final volts per cell is required to be 1.84.

$57 \times 1.84 = 104.9\ V$

Pages 3+4 of this Calc provide the sizing worksheets for both loading scenarios.
Pages 5+6 provide the ELMS-DC load data for both loading scenarios. Note: the 63A was added to the load data in ELMS to provide a consistent presentation.

The 175 vpc - 1minute rate for the NCX-1200 is 1360A. This value has been obtained from GNB. (Ref. 7) ~~BAK 6-27-89~~ To obtain readings for 1hour or less GNB recommends the use of their curve TC-107628 (published for that purpose) with the 1minute rates published in their table. (Ref. 7).

SARGENT & LUNDY ENGINEERS

Normal Operation

CELL SIZING WORKSHEET

(For Ref. See ESC-291)

Project Byron - Dresden Date 5-4-89 Page 3

Lowest Expected Electrolyte Temp °F 69 Minimum Cell Voltage 1.84 Cell Mfg Gould Cell Type NCX-1200 Sized By BAK

(1) Period	(2) Load (amperes)	(3) Change in Load (amperes)	(4) Duration of Period (minutes)	(5) Time to End of Section (minutes)	(6) Capacity at T Min Rate (6A) Amps/Pos (K_T) or (6B) K Factor (K_T)	(7) Required Section Size (3) ÷ (6A) = Positive Plates or (3) ÷ (6B) = Rated Amp Hr	
						Pos Values	Neg Values
Section 1 — First Period Only — If A2 is greater than A1 go to Section 2							
1	A1 499.1	A1-0 499.1	M1 1	T·M1		4.5	***
					Sec 1 Total	4.5	***
Section 2 — First Two Periods Only — If A3 is greater than A2 go to Section 3							
1	A1 499.1	A1-0 499.1	M1 1	T·M1·M2	79.4	6.29	-2.35
2	A2 344.7	A2-A1 -154.4	M2 .29	T·M2	79.4		+1.32
					Sec 2 Sub Tot Total	6.29 3.44	***
Section 3 — First Three Periods Only — If A4 is greater than A3 go to Section 4							
1	A1 499.1	A1-0 499.1	M1 1	T·M1·M2·M3·M4	73	11.61	-4.31
2	A2 344.7	A2-A1 -154.4	M2 .29	T·M2·M3·M4	73		-3.43
3	A3 128.7	A3-A2 -216	M3 .16	T·M3·M4	56		-1.87
					Sec 3 Sub Tot Total	11.61 3.65	***
Section 4 — First Four Periods Only — If A5 is greater than A4 go to Section 5							
1	A1 499.1	A1-0 499.1	M1 1	T·M1·M2·M3·M4	28	17.83	-6.3
2	A2 344.7	A2-A1 -154.4	M2 .29	T·M2·M3·M4	28		-5.99
3	A3 128.7	A3-A2 -216	M3 .90	T·M3·M4	56.5		-1.52
4	A4 66.7	A4-A3 -62	M4 .160	T·M4	63		-2.54
					Sec 4 Sub Tot Total	17.83 3.56	***
Section 5 — First Five Periods Only — If A6 is greater than A5 go to Section 6							
1	A1	A1-0	M1	T·M1·M2			
2	A2	A2-A1	M2	T·M2·M3			
3	A3	A3-A2	M3	T·M3·M4			
4	A4	A4-A3	M4	T·M4·M5			
5	A5	A5-A4	M5	T·M5			
					Sec 5 Sub Tot Total		***
Section 6 — First Six Periods Only — If A7 is greater than A6 go to Section 7							
1	A1	A1-0	M1	T·M1·M6			
2	A2	A2-A1	M2	T·M2·M6			
3	A3	A3-A2	M3	T·M3·M6			
4	A4	A4-A3	M4	T·M4·M5·M6			
5	A5	A5-A4	M5	T·M5·M6			
6	A6	A6-A5	M6	T·M6			
					Sec 6 Sub Tot Total		***
Section 7 — First Seven Periods Only — If A8 is greater than A7 go to Section 8							
1	A1	A1-0	M1	T·M1·M7			
2	A2	A2-A1	M2	T·M2·M7			
3	A3	A3-A2	M3	T·M3·M7			
4	A4	A4-A3	M4	T·M4·M7			
5	A5	A5-A4	M5	T·M5·M6·M7			
6	A6	A6-A5	M6	T·M6·M7			
7	A7	A7-A6	M7	T·M7			
					Sec 7 Sub Tot Total		***
Random Equipment Load Only (if needed)							
R	AR	AR 0	MR	T·MR			***

Maximum Section Size (8) 4.5 × Random Section Size (9) N/A × Uncorrected Size (US) (10) 4.5
US (11) 4.5 × Temp Corr (12) 1.05 × Design Marg (13) 1.15 × Aging Factor (14) 1.05 = (15) 6.28

When the cell size (15) is greater than a standard cell size, the next larger cell is required.

Required cell size (16) 7 (A) - Positive Plates

(B) - Ampere Hours Therefore cell (17) NCA 1200 is acceptable

Preliminary Only

RBW

SARGENT & LUNDY ENGINEERS

Create

R22603

CELL SIZING WORKSHEET

(For Ref. See ESC-291)

Project Byron; 1PC01E Date 5-4-89 Page 4

Lowest Expected Electrolyte Temp °F 64 Minimum Cell Voltage 1.84 Cell Mfg Gould Cell Type NCX-1200 Sized By BAK

(1) Period	(2) Load (amperes)	(3) Change in Load (amperes)	(4) Duration of Period (minutes)	(5) Time to End of Section (minutes)	(6) Capacity at T Min Rate (6A) Amps/Pos (R_T) or (6B) K Factor (K_T)	(7) Required Section Size (3) ÷ (6A) = Positive Plates or (3) × (6B) = Rated Amp Hrs Pos Values	Neg Values
Section 1 — First Period Only — If A2 is greater than A1, go to Section 2							
1	A1 502	A1−0= 502	M1	T=M1=		506	***
					Sec 1 Total	506	***
Section 2 First Two Periods Only If A3 is greater than A2 go to Section 3							
1	A1 502	A1−0= 502	M1	T=M1+M2= 4	294	208	
2	A2 357.5	A2−A1= 144.5	M2	T=M2= 39	29.6		-235
					Sec 2 Sub Tot Total	2.65 4.73	-235 ***
Section 3 First Three Periods Only If A4 is greater than A3 go to Section 4							
1	A1 502	A1−0= 502	M1	T=M1+M2+M3= 4	63	7.97	
2	A2 357.5	A2−A1= 144.5	M2	T=M2+M3= 39	22		-7.31
3	A3 [illegible]	A3−A2= [illegible]	M3	T=M3= 4	26		-5.63
					Sec 3 Sub Tot Total	5.11	-12.78 ***
Section 4 First Four Periods Only If A5 is greater than A4 go to Section 5							
1	A1 502	A1−0= 502	M1	T=M1+M2+M3+M4= 39	29	20.07	
2	A2 144.5	A2−A1= 144.5	M2	T=M2+M3+M4= 39	22		-6.7
3	A3 [illegible]	A3−A2= [illegible]	M3	T=M3+M4= 20	20.5		-5.99
4	A4 [illegible]	A4−A3= [illegible]	M4	T=M4= 4	43		-1.58
					Sec 4 Sub Tot Total	26.67 5.8	-14.27 ***
Section 5 First Five Periods Only If A6 is greater than A5 go to Section 6							
1	A1	A1−0	M1	T=M1+M2+M3+M4+M5			
2	A2	A2−A1	M2	T=M2+M3+M4+M5			
3	A3	A3−A2	M3	T=M3+M4+M5			
4	A4	A4−A3	M4	T=M4+M5			
5	A5	A5−A4	M5	T=M5			
					Sec 5 Sub Tot Total		***
Section 6 First Six Periods Only If A7 is greater than A6 go to Section 7							
1	A1	A1−0	M1	T=M1+M6			
2	A2	A2−A1	M2	T=M2+M6			
3	A3	A3−A2	M3	T=M3+M6			
4	A4	A4−A3	M4	T=M4+M5+M6			
5	A5	A5−A4	M5	T=M5+M6			
6	A6	A6−A5	M6	T=M6			
					Sec 6 Sub Tot Total		***
Section 7 First Seven Periods Only If A8 is greater than A7 go to Section 8							
1	A1	A1−0	M1	T=M1+M7			
2	A2	A2−A1	M2	T=M2+M7			
3	A3	A3−A2	M3	T=M3+M7			
4	A4	A4−A3	M4	T=M4+M7			
5	A5	A5−A4	M5	T=M5+M6+M7			
6	A6	A6−A5	M6	T=M6+M7			
7	A7	A7−A6	M7	T=M7			
					Sec 7 Sub Tot Total		***
Random Equipment Load Only (if needed)							
R	AR	AR 0	MR	T=MR			***

Maximum Section Size (4) 5.8 × Random Section Size (9) N/A = Uncorrected Size (US)(10) 5.8
US (11) 5.8 × Temp Corr (12) 1.09 × Design Marg (13) 1.0 × Aging Factor (14) 1.25 = (15) 7.61
When the cell size (15) is greater than a standard cell size, the next larger cell is required.

Required cell size (16) 7 (A) – Positive Plates. Acceptable

(B) – Ampere Hours. Therefore cell (17) NCX-1400 is required.

INFORMATION ONLY

INFORMATION ONLY

SARGENT & LUNDY -- ELMS-DC VER 1.20
BATTERY SIZING CALCULATION

Work sheet output using IEEE std 485 worksheet format

UTILITY : COMMONWEALTH EDISON PROJECT NO. ~~7344-30~~
STATION : BYRON UNIT 1

BATTERY NAME : 111 1DC01E DATE : BAK PAGE : 1 OF 1

1 PER-IOD	2 LOAD IN AMPERES	3 CHANGE IN LOAD	4 DURATION OF PERIOD	5 TIME TO END OF SECTION	6 MIN RATE R(T) AMP/POS	7 SIZE (3)/(6) POS. PLATES
LOWEST EXPECTED ELECTROLYTE TEMPERATURE 69. Degrees F		MIN CELL VOLT: 1.81 Voc		CELL MFG: GNB (GOULD)	CELL TYPE: NCX	SIZED BY:
1	A 1= 499.1	A 1- 0 = 499.1	M1= 1	T=M1= 1	R(T)=128.0	3.899
					TOTAL =	3.899
2	A 1= 499.1	A1- 0 = 499.1	M1= 1	T=M 1+..+M 2= 30	R(T)= 85.0	5.872
	A 2= 311.5	A 2-A 1= -187.6	M 2= 29	T=M 2+..+M 2= 29	R(T)= 86.3	-2.175
					TOTAL =	3.697
3	A 1= 499.1	A1- 0 = 499.1	M1= 1	T=M 1+..+M 3=120	R(T)= 46.0	10.851
	A 2= 311.5	A 2-A 1= -187.6	M 2= 29	T=M 2+..+M 3=119	R(T)= 46.3	-4.059
	A 3= 128.7	A 3-A 2= -182.7	M 3= 90	T=M 3+..+M 3= 90	R(T)= 50.0	-3.448
					TOTAL =	3.344
4	A 1= 499.1	A1- 0 = 499.1	M1= 1	T=M 1+..+M 4=240	R(T)= 29.0	17.211
	A 2= 311.5	A 2-A 1= -187.6	M 2= 29	T=M 2+..+M 4=239	R(T)= 29.1	-6.445
	A 3= 128.7	A 3-A 2= -182.7	M 3= 90	T=M 3+..+M 4=210	R(T)= 32.5	-5.623
	A 4= 60.7	A 4-A 3= -68.0	M 4=120	T=M 4+..+M 4=120	R(T)= 46.0	-1.478
					TOTAL =	3.664

MAXIMUM SECTION SIZE = UNCORRECTED SIZE (US)
3.90 = 3.90

US	X TEMP. CORR.	X DESIGN MARGIN	X AGING FACTOR	= MINIMUM REQUIRED SIZE
3.90	X 1.05	X 1.15	X 1.25	= 5.87

MINIMUM REQUIRED BATTERY SIZE	ACTUAL BATTERY SIZE	REMAINING MARGIN
6 POSITIVE PLATES	8 POSITIVE PLATES	36.2 %

Calc 14-D-15
Rev 0
Pg. 5 of 6
8236-03

Normal Operation

SARGENT & LUNDY -- ELMS-DC VER 1.20
BATTERY SIZING CALCULATION

Work sheet output using IEEE std 485 worksheet format

UTILITY : COMMONWEALTH EDISON — PROJECT NO. ~~7344-30~~
STATION : BYRON — UNIT 1

BATTERY NAME : 111 1DC01E — DATE : BAK — PAGE : 1 OF 1

1 PER-IOD	2 LOAD IN AMPERES	3 CHANGE IN LOAD	4 DURATION OF PERIOD	5 TIME TO END OF SECTION	6 T MIN RATE R(T) AMP/POS	7 SIZE (3)/(6) POS. PLATES
LOWEST EXPECTED ELECTROLYTE TEMPERATURE 69. Degrees F		MIN CELL VOLT: 1.81 Voc	CELL MFG: GNB (GOULD)	CELL TYPE: NCX	SIZED BY:	
1	A 1= 562.1	A 1- 0 = 562.1	M1= 1	T=M1= 1	R(T)=128.0	4.392
					TOTAL =	4.392
2	A 1= 562.1	A1- 0 = 562.1	M1= 1	T=M 1+..+M 2= 30	R(T)= 85.0	6.613
	A 2= 374.5	A 2-A 1= -187.6	M 2= 29	T=M 2+..+M 2= 29	R(T)= 86.3	-2.175
					TOTAL =	4.438
3	A 1= 562.1	A1- 0 = 562.1	M1= 1	T=M 1+..+M 3=120	R(T)= 46.0	12.220
	A 2= 374.5	A 2-A 1= -187.6	M 2= 29	T=M 2+..+M 3=119	R(T)= 46.2	-4.059
	A 3= 191.7	A 3-A 2= -182.7	M 3= 90	T=M 3+..+M 3= 90	R(T)= 52.0	-3.448
					TOTAL =	4.714
4	A 1= 562.1	A1- 0 = 562.1	M1= 1	T=M 1+..+M 4=240	R(T)= 29.0	19.384
	A 2= 374.5	A 2-A 1= -187.6	M 2= 29	T=M 2+..+M 4=239	R(T)= 29.1	-6.445
	A 3= 191.7	A 3-A 2= -182.7	M 3= 90	T=M 3+..+M 4=210	R(T)= 32.5	-5.623
	A 4= 123.7	A 4-A 3= -68.0	M 4=120	T=M 4+..+M 4=120	R(T)= 46.0	-1.478
					TOTAL =	5.838

MAXIMUM SECTION SIZE = UNCORRECTED SIZE (US)
5.84 = 5.84

US	X TEMP. CORR.	X DESIGN MARGIN	X AGING FACTOR	= MINIMUM REQUIRED SIZE
5.84	X 1.05	X 1.00	X 1.25	= 7.65

MINIMUM REQUIRED BATTERY SIZE	ACTUAL BATTERY SIZE	REMAINING MARGIN
8 POSITIVE PLATES	8 POSITIVE PLATES	4.6 %

INFORMATION ONLY

Calc 19-D-15
Rev 0
Pg 6 of 6
8236.03

Crosstie Operation

JUN 2 7 1989

SARGENT & LUNDY ENGINEERS

TRANSMITTAL OF QA RECORDS

To: QA RECORDS SECTION, Rm. 31V33

From D. P. GALANIS

Division EPED

Project No. 4391 Date 6-27-89

Routing	
Name	Room No.
D.J. GRANDYS	25P49

Transmitted herewith are QA records in the quantities indicated below:

QUANTITY		TYPE OF RECORD	(FOR QAD USE ONLY) QTY. REC'D. BY QAD
8	(Pages)	CALC # 19D-15 REV. 0 Hard Copy Records	8
		S&L Aperture	
		Microfiche	
		Jackets	

If project number above is non-billable or closed, charge this transaction to 8226-D3.

NOTE: Each record shall be identified by project number, name or acronym of the division responsible for the record, file index number, title, date (approval date or date of issue). The system, subsystem, and component number, if applicable, and the safety-related identification, if required, shall also be identified.

(FOR QAD USE ONLY)

- [x] Attached records have been microfilmed, indexed, and stored.
- [ ] Transmitted quantity not received as indicated.
- [ ] Transmitted records not properly identified.
- [ ] Transmitted records not legible for filming.
- [ ] Transmitted records not silver halide.

(Correct and Resubmit)

- [ ] Records scheduled for processing.
- [ ] Other:

Signature A. Lilla (QAD Records Section) Date JUN [illegible] 1989

Form GQ-17.02.1 Rev. 6 (06-24-88)

F1324 06-88

SARGENT & LUNDY

MEMORANDUM OF
TELEPHONE CONVERSATION

Date: 6-9-89

Time: 3:00

Person Called: Paul Kajmo (Name) of GNB (Company)

Person Calling: Barb Kulchik (Name) of S&L (Company)

Project: Byron / Braidwood Project No. 8226-03

Subject Discussed: NC.X - 1200 Battery

Summary of Discussion, Decisions and Commitments:

GNB Drawing TC- 107172 indicates the 1 minute rate to 1.75V pc for the subject battery to be 1360A. The catalog data indicates 1306A.

Paul informed me that 1306A is a typo, 1360 A is the correct value.

cc: B. G. Treece
A. Runde

Signature

File: 7A

Memorandum of Telephone Conversation **SARGENT & LUNDY**

Date 6-15-89 Time 11:30

Person Called	Company
Everett Widner	GNB (215) 750-2748
Person Calling	Company
Barbara Kutchik	S&L (312) 269-7018
Project	Project No
Byron & Braidwood	8226-03

Subject Discussed
Battery Type NCX-1200 Characteristic Curves TC-107011

Summary of Discussion, Decisions and Commitments

I asked Mr. Widner if he would explain why the two curves do not provide the same values for areas in which they overlap (i.e., below a 1 hour duration).

He stated that curve TC-107628 was developed using a pilot cell, whereas the curve is utilized for the entire NCX line, and therefore, inaccuracies can be expected. In part due to the effects of intercell resistances at the higher discharge currents (lower time durations).

In addition, the TC-107628 curve was developed to enable GNB battery users to obtain intermediate discharge currents (e.g., a 8 minute rate or 6 minute rate). Since this curve is based upon percent of the 1 minute rate to 1.75vpc, GNB recommends that the 1 minute rate be obtained from their published tables and not be extracted from the curves. Again, at high discharge rates, various resistances can significantly affect the data.

Finally, curve TC-107011 also utilized a pilot cell, although the curve is for both the NAX and NCX cell lines, and the same explanations apply.

[redacted]:scr

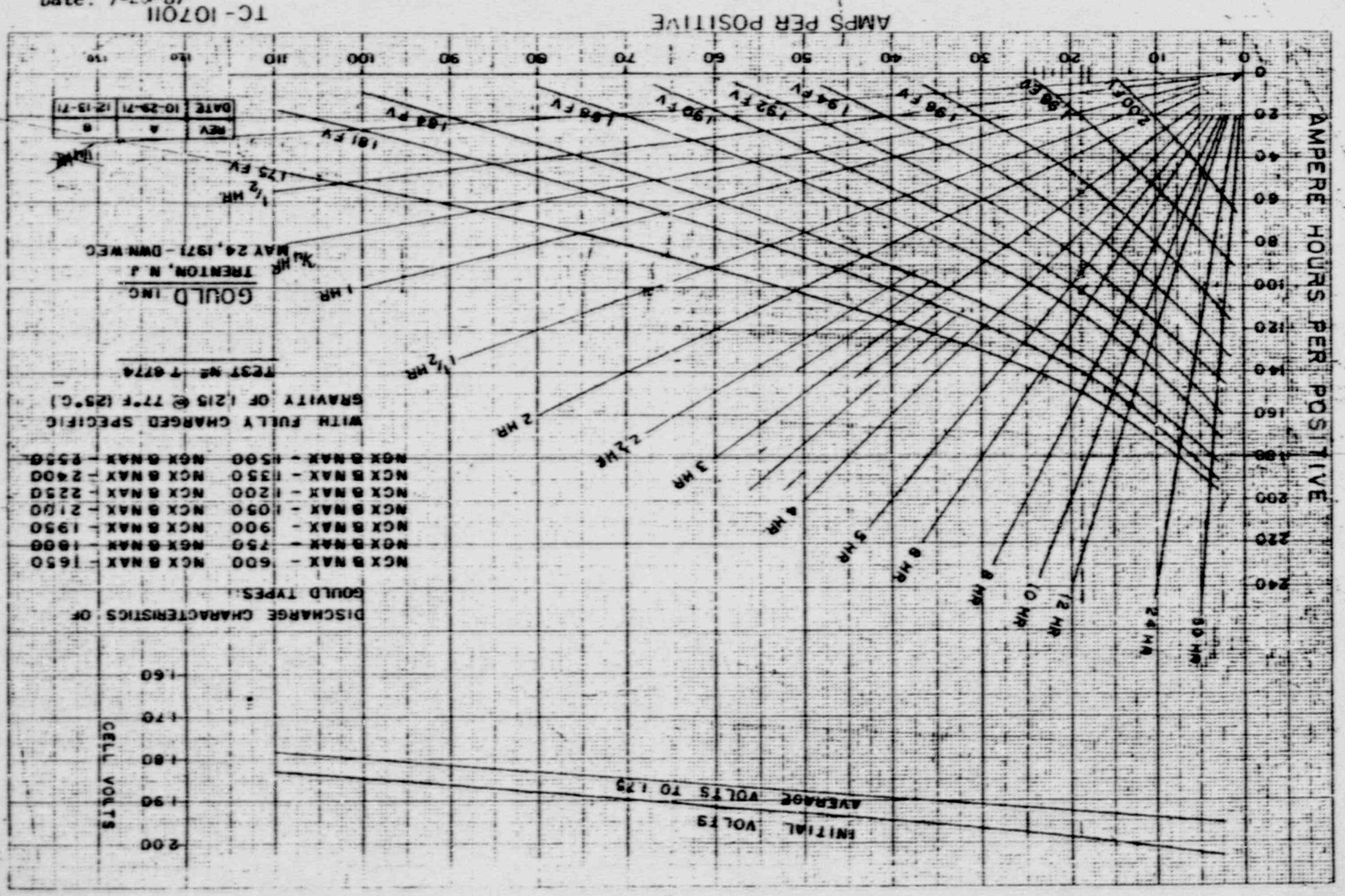
cc A. Runde

File 7A

Signature B. A. Kutchik

SL-F713 10 84—F3

PAGE 1 OF 1


TC-10701
AMPS PER POSITIVE
AMPERE HOURS PER POSITIVE
CELL VOLTS
INITIAL VOLTS
AVERAGE VOLTS TO 1.73
1 HR
2 HR
3 HR
4 HR
5 HR
6 HR
8 HR
10 HR
12 HR
24 HR
60 HR
DISCHARGE CHARACTERISTICS OF
GOULD TYPES
NCX 8 MAX - 600 NCX 8 MAX - 1650
NGX 8 MAX - 750 NGX 8 MAX - 1800
NCX 8 MAX - 900 NCX 8 MAX - 1950
NCX 8 MAX - 1050 NCX 8 MAX - 2100
NCX 8 MAX - 1200 NCX 8 MAX - 2250
NCX 8 MAX - 1350 NCX 8 MAX - 2400
NGX 8 MAX - 1500 NGX 8 MAX - 2550
WITH FULLY CHARGED SPECIFIC
GRAVITY OF 1.215 @ 77°F (25°C)
TEST № T-6774
GOULD INC
TRENTON, N.J.
MAY 24, 1973 - DWN WEC
REV A 10-29-71 12-13-71
DATE

BATTERY TESTING & SURVEILLANCE
GUIDELINES, PROJECT NO. 7500-94
Date: 7-23-87