Exelon Generation
4300 Winfield Road
Warrenville, IL 60555
630 657 2000 Office

RS-20-069

June 29, 2020

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Clinton Power Station, Unit 1
Facility Operating License No. NPF-62
NRC Docket No. 50-461

Subject: Additional Information Supporting Request for License Amendment Regarding Automatic Operation of Transformer Load Tap Changer

References:
1. Letter from P. R. Simpson (Exelon Generation Company, LLC) to U.S. NRC, "Request for License Amendment Regarding Automatic Operation of Transformer Load Tap Changer," dated January 14, 2020
2. Email from J. Wiebe (U.S. NRC) to K. M. Nicely (Exelon Generation Company, LLC), "Final RAIs for Clinton Load Tap Changer License Amendment Request," dated June 1, 2020

In Reference 1, Exelon Generation Company, LLC (EGC) requested approval for a change to the Updated Safety Analysis Report (USAR). The proposed change implements the use of an automatic load tap changer (LTC) on the emergency reserve auxiliary transformer (ERAT) that provides offsite power to Clinton Power Station, Unit 1.

The NRC requested additional information that is needed to complete review of the proposed change in Reference 2. In response to this request, EGC is providing the attached information.

EGC has reviewed the information supporting a finding of no significant hazards consideration, and the environmental consideration, that were previously provided to the NRC in Attachment 1 of Reference 1. The additional information provided in this submittal does not affect the bases for concluding that the proposed license amendment does not involve a significant hazards consideration. In addition, the additional information provided in this submittal does not affect the bases for concluding that neither an environmental impact statement nor an environmental assessment needs to be prepared in connection with the proposed amendment.

There are no regulatory commitments contained in this letter. Should you have any questions concerning this letter, please contact Mr. Kenneth M. Nicely at (630) 657-2803.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 29th day of June 2020.

Respectfully,

Patrick R. Simpson
Sr. Manager Licensing

Attachment: Response to Request for Additional Information

cc: NRC Regional Administrator, Region III
NRC Senior Resident Inspector – Clinton Power Station
Illinois Emergency Management Agency – Division of Nuclear Safety

NRC Request 1

On Page 2 of the LAR, Attachment 1, the licensee stated, "the proposed change requests NRC approval to operate the ERAT LTC in the automatic mode (i.e., in lieu of the static VAR compensator (SVC)) to regulate the voltage at the safety-related buses."

The location/connection of SVC is not shown in any drawings currently available in the USAR, Chapter 8. Provide a copy of Drawing E02-1AP03 referenced in USAR, Chapter 8, or any other drawing which shows location/connection of SVC.

Response

Drawing E02-1AP12, Sheet 130, "Single Line Diagram ERAT SVC System," and drawing E02-1AP12, Sheet 133, "Single Line ERAT SVC Interconnections," are provided at the end of this Attachment. These drawings show the location/connection of the SVC.

NRC Request 2

On Page 6 of the LAR, Attachment 1, the licensee stated that in the automatic mode, the LTC is controlled by a primary VRR [voltage controller] and a backup VBR [voltage controller]. The function of the VRR/VBR is to control the ERAT's secondary voltage by adjusting LTC tap position on the primary winding. The VRR/VBR gets its voltage feedback signal from a potential transformer (PT) on the LTC ERAT secondary winding. The VRR/VBR requires user input setpoints for its voltage control point (i.e., Bandcenter), and tolerance around that voltage control point (i.e., Bandwidth).

Regarding LTC and VRR/VBR, provide the following information:

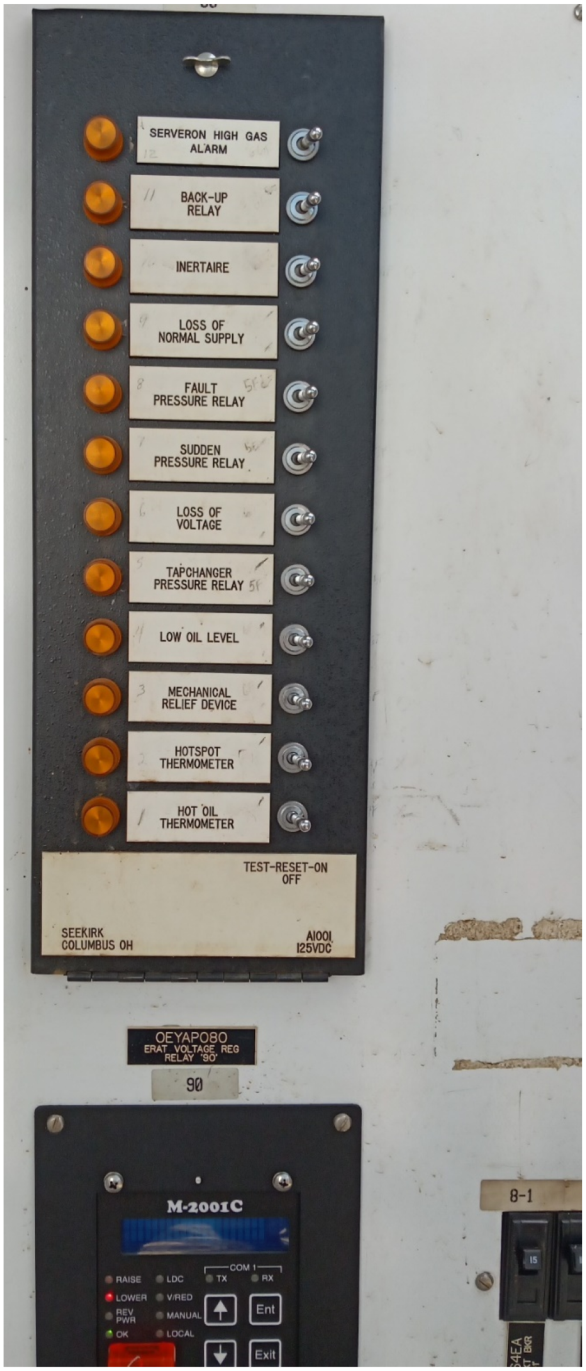
(a) Provide a frontal diagram of the LTC control panel showing location and name tag of each device.

(b) Provide the available range and actual setpoints for the VRR Bandcenter and Bandwidth to provide adequate voltage at the Class 1E 4.16 kV ESF buses (within certain design limits) for satisfactory functioning of ESF equipment.

Response

Photos showing the location and name tag of the LTC equipment are provided below.

Left and Right Sides of ERAT Control Panel



Alarm Panel

ERAT VRR

LTC Manual Control Panel

The available range and actual setpoints for the VRR bandcenter and bandwidth are provided below.

Parameter	VRR Available Range	VRR Actual Setpoint
Bandcenter	Adjustable from 100 V to 135 V in 0.1 V increments	121.9 V
Bandwidth	Adjustable from 1 V to 10 V in 0.1 V increments	3.0 V

NRC Request 3

On Page 7 of the LAR, Attachment 1, the licensee stated that in the event VRR fails, and the voltage rises or falls outside its operating voltage band, the VBR controller will take over automatic operation of the LTC. The VBR also utilizes a redundant relaying scheme to ensure the LTC does not raise or lower the voltage beyond the limits set within the VBR itself. Also, in the LAR, Attachment 1, Page 8, the licensee stated that the VBR will also lower the voltage if the regulated voltage remains above the upper voltage limit past its time delay setpoint.

Provide the available range and actual VBR limits and time delay setpoint to provide adequate voltage at the Class 1E 4.16 kV ESF buses if the VRR lowers the voltage too much and to prevent exceeding the maximum voltage requirements on the Class 1E 4.16 kV ESF buses if the VRR raises the voltage too much.

Response

The available range and actual VBR limits and time delay setpoint are provided below.

Parameter	VBR Available Range	VBR Actual Limits
Bandcenter	100 VAC to 140 VAC	121.5 V
Bandwidth	6 V to 24 V for 120 VAC	8.0 V
Time Delay	1 second to 30 second	5 second
Blocking Contacts Time Delay	0.2 second fixed	0.2 second

NRC Request 4

On Page 4 of the LAR, Attachment 1, the licensee stated that an engineering evaluation has been performed to determine the acceptability of using the ERAT LTC in automatic mode without the ERAT SVC.

Regarding the impact of LTC in automatic mode on safety-related voltages, provide the following information:

(a) The minimum steady state voltages calculated at safety-related buses in the scenario "138 kV system voltage at 0.94 pu, ERAT LTC in automatic operation with ERAT SVC out-of-service, and maximum LOOP/LOCA loading condition."

(b) The maximum steady state voltages calculated at safety-related buses in the scenario "138 kV system voltage at 1.06 pu, ERAT LTC in automatic operation with ERAT SVC out-of-service, and minimum loading condition."

Response

The analysis to evaluate the performance and acceptance of the LTC in "AUTO" voltage regulation mode on the ERAT was performed in the Electrical Transient Analyzer Program (ETAP). Clinton Power Station (CPS) is proposing to use the "AUTO" voltage regulation features of the ERAT LTC in lieu of the SVC to regulate the voltages at engineered safety feature (ESF) buses 1AP07E (Division 1), 1AP09E (Division 2), and 1E22-S004 (Division 3). Therefore, the ERAT SVC was disabled in the ETAP model and the ERAT LTC was placed in "AUTO."

(a) Minimum steady state voltages with 138 kV at 0.94 pu and maximum loading condition on ERAT

The most limiting case study performed in ETAP is as follows:

1) ERAT Train B: In this category, all ESF buses were aligned to the ERAT with Train B of Control Room HVAC in service.

The duration for ETAP simulations were based on Technical Specifications (TS) defined reset times of Degraded Voltage Relays for ESF buses. TS Table 3.3.8.1-1 identifies the following degraded voltage relay (2nd Level) licensing basis limits:

2nd Level [Degraded Voltage] Relays

- Division 1 and Division 2
  - Dropout: ≥ 4051 V (97.4%)
  - Reset: ≥ 4102.2 V and ≤ 4109.3 V (98.6% and 98.8%)
  - Time Delay: ≥ 14 and ≤ 16 seconds
- Division 3
  - Dropout: ≥ 4051 V (97.4%)
  - Reset: ≥ 4102.2 V and ≤ 4109.3 V (98.6% and 98.8%)
  - Time Delay: ≥ 13.2 and ≤ 16.8 seconds

For conservatism, the most limiting reset time (i.e., 13.2 seconds for Division 3) was chosen to evaluate the timely reset of degraded voltage relays on all three ESF buses. Table 1 below provides the steady state voltages after the above-mentioned transient for ERAT B with the 138 kV switchyard at 0.94 pu (138 kV Base).

Table 1: ERAT Train B and 138kV at 0.946 pu

ESF Bus	Loading	138 kV Voltage	HVAC Train	Steady State Voltage at T=13 seconds
1AP07E	LOCA	0.946 pu	B	4215.49 V
1AP09E	LOCA	0.946 pu	B	4212.66 V
1E22-S004	LOCA	0.946 pu	B	4217.40 V

(b) Maximum steady state voltages with 138 kV at 1.06 pu with minimum loading condition on ERAT

To calculate the maximum steady state voltages with minimum loading on the ERAT and 138 kV at 1.056 pu (1.06 pu), a load flow study case with only Mode 1 operating loads on the ERAT was performed. Table 2 below provides the maximum steady voltages for the above-mentioned case.

Table 2: Mode 1 Loading on ERAT, 138kV at 1.056 (1.06) pu

ESF Bus	Loading	138 kV Voltage	Steady State Voltage
1AP07E	Mode 1	1.056 pu	4150 V
1AP09E	Mode 1	1.056 pu	4150 V
1E22-S004	Mode 1	1.056 pu	4151 V

NRC Request 5

On Page 9 of the LAR, Attachment 1, the licensee stated that the failure probability of the ERAT LTC to spuriously operate or to have a failure of both controllers due to a failure common to both of the controllers was calculated to be 9.77E-07.

Provide a summary of the relevant calculation information that determined the failure probability of the ERAT LTC to spuriously operate or to have a failure of both controllers due to a common failure to be 9.77E-07, very low and acceptable.

Response

A summary of the probability calculation was provided on page 9 of Attachment 1 to Reference 1. The summary described the assumptions used in the probability calculation, as well as the sources used for the failure data. Specific inputs and results are shown in the following table.

BASIC EVENT INFORMATION		**INDEPENDENT INPUTS**		**CCF INPUTS**		**RESULTS**
	DESCRIPTION	**GENERIC FAILURE RATE (/HR)**	**MISSION TIME (HOURS)**	**ALPHA**	**COEFFICIENT**	**TOTAL PROB**
A	ERAT LTC DRIVE MOTOR FAILS	3.24E-08	24	-	-	7.78E-07
B	PRIMARY ERAT LTC CONTROLLER FAILS	4.28E-07	24	-	-	1.03E-05
C	BACKUP ERAT LTC CONTROLLER FAILS	1.15E-07	24	-	-	2.76E-06
D	CC FAILURE OF PRIMARY & BACKUP ERAT LTC CONTROLLER	2.72E-07	24	3.05E-02	1	1.99E-07(1)
Cumulative Failure Probability for ERAT LTC **A + [((B * C) + D) - (B * C * D)] - [[A * [((B * C) + D) - (B * C * D)]]]**						**9.77E-07**

(1)Note: The common cause failure probability is calculated using the following equation:

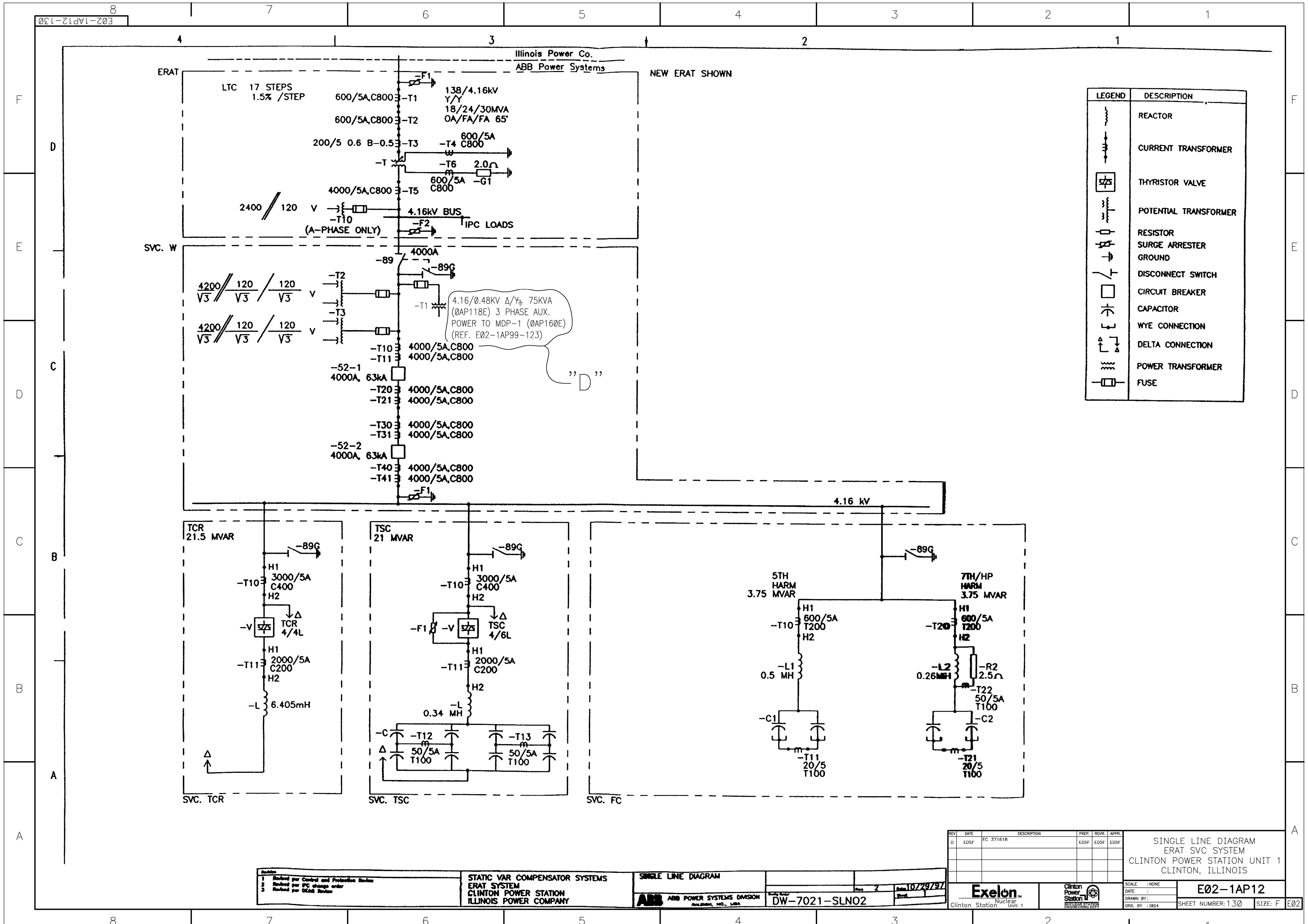
$$Prob_{CCF} = \frac{Prob_{Indep} * t_{mission} * Alpha_{CC}}{C}$$

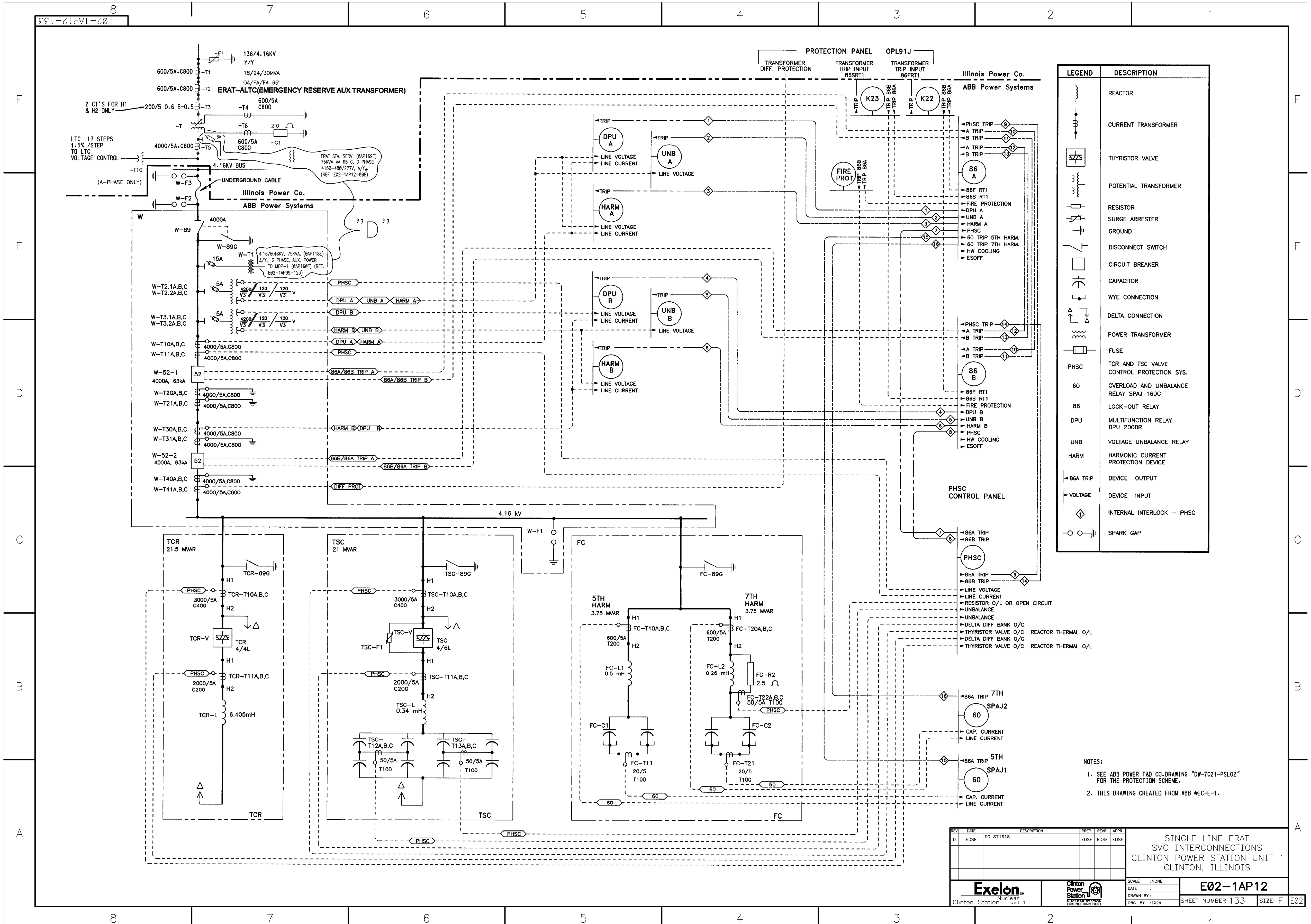
Where:

- $Prob_{CCF}$ = common cause failure probability
- $Prob_{Indep}$ = independent failure rate of the component (/hour)
- $t_{mission}$ = mission time (hours)
- $Alpha_{CC}$ = common cause Alpha factor for two failures in a group of two components
- *Coefficient (C)* = Alpha factor coefficient for two failures in a group of two components

Reference

1. Letter from P. R. Simpson (Exelon Generation Company, LLC) to U.S. NRC, "Request for License Amendment Regarding Automatic Operation of Transformer Load Tap Changer," dated January 14, 2020


E02-1AP12-130
Illinois Power Co.
ABB Power Systems
ERAT
NEW ERAT SHOWN
LTC 17 STEPS 1.5% /STEP
600/5A,C800 -T1
138/4.16kV
Y/Y
18/24/30MVA
OA/FA/FA 65°
600/5A,C800 -T2
200/5 0.6 B-0.5 -T3
-T4 600/5A C800
-T6 2.0Ω
600/5A C800 -G1
4000/5A,C800 -T5
2400 / 120 V
-T10
(A-PHASE ONLY)
4.16kV BUS
-F2
IPC LOADS
SVC. W
4000A
-89
-89G
4.16/0.48KV Δ/Y 75KVA
(0AP118E) 3 PHASE AUX.
POWER TO MDP-1 (0AP160E)
(REF. E02-1AP99-123)
"D"
-T10 4000/5A,C800
-T11 4000/5A,C800
-52-1 4000A, 63kA
-T20 4000/5A,C800
-T21 4000/5A,C800
-T30 4000/5A,C800
-T31 4000/5A,C800
-52-2 4000A, 63kA
-T40 4000/5A,C800
-T41 4000/5A,C800
4.16 kV
TCR 21.5 MVAR
3000/5A C400
TCR 4/4L
2000/5A C200
6.405mH
SVC. TCR
TSC 21 MVAR
TSC 4/6L
0.34 MH
50/5A T100
SVC. TSC
5TH HARM 3.75 MVAR
600/5A T200
0.5 MH
20/5 T100
7TH/HP HARM 3.75 MVAR
0.26MH
-R2 2.5Ω
SVC. FC
LEGEND
DESCRIPTION
REACTOR
CURRENT TRANSFORMER
THYRISTOR VALVE
POTENTIAL TRANSFORMER
RESISTOR
SURGE ARRESTER
GROUND
DISCONNECT SWITCH
CIRCUIT BREAKER
CAPACITOR
WYE CONNECTION
DELTA CONNECTION
POWER TRANSFORMER
FUSE
STATIC VAR COMPENSATOR SYSTEMS
ERAT SYSTEM
CLINTON POWER STATION
ILLINOIS POWER COMPANY
SINGLE LINE DIAGRAM
ABB POWER SYSTEMS DIVISION
DW-7021-SLNO2
10/29/97
SINGLE LINE DIAGRAM
ERAT SVC SYSTEM
CLINTON POWER STATION UNIT 1
CLINTON, ILLINOIS
Exelon Nuclear
Clinton Station
E02-1AP12
SHEET NUMBER: 130
SIZE: F


ERAT-ALTC(EMERGENCY RESERVE AUX TRANSFORMER)
4.16KV BUS
UNDERGROUND CABLE
Illinois Power Co.
ABB Power Systems
PROTECTION PANEL OPL91J
TRANSFORMER DIFF. PROTECTION
TRANSFORMER TRIP INPUT 86SRT1
TRANSFORMER TRIP INPUT 86FRT1
4.16 kV
TCR 21.5 MVAR
TSC 21 MVAR
FC
5TH HARM 3.75 MVAR
7TH HARM 3.75 MVAR
PHSC CONTROL PANEL
LEGEND
DESCRIPTION
REACTOR
CURRENT TRANSFORMER
THYRISTOR VALVE
POTENTIAL TRANSFORMER
RESISTOR
SURGE ARRESTER
GROUND
DISCONNECT SWITCH
CIRCUIT BREAKER
CAPACITOR
WYE CONNECTION
DELTA CONNECTION
POWER TRANSFORMER
FUSE
PHSC
TCR AND TSC VALVE CONTROL PROTECTION SYS.
60
OVERLOAD AND UNBALANCE RELAY SPAJ 160C
86
LOCK-OUT RELAY
DPU
MULTIFUNCTION RELAY DPU 2000R
UNB
VOLTAGE UNBALANCE RELAY
HARM
HARMONIC CURRENT PROTECTION DEVICE
DEVICE OUTPUT
DEVICE INPUT
INTERNAL INTERLOCK - PHSC
SPARK GAP
NOTES:
1. SEE ABB POWER T&D CO.DRAWING "DW-7021-PSL02" FOR THE PROTECTION SCHEME.
2. THIS DRAWING CREATED FROM ABB #EC-E-1.
SINGLE LINE ERAT
SVC INTERCONNECTIONS
CLINTON POWER STATION UNIT 1
CLINTON, ILLINOIS
E02-1AP12
SHEET NUMBER: 133
SIZE: F
Exelon Nuclear
Clinton Station Unit 1