ATTACHMENT 1

CALCULATION COVER SHEET

(DCR)/ESR/TCR NO. 2527

CALC. NO. C10433 CALC. REV. Original

SYSTEM NO. 39 CALC. DATE 08/06/92

TITLE Safeguard Bus Second Level Undervoltage Relay Time Delay Setting

PURPOSE This calculation will determine the maximum allowable time delay for Bus 5 and 6 Second Level Undervoltage relays and supersede Sargent & Lundy Calc. No. 8909-EPED-2.

Computer Program Used? ______ YES __x__ NO

If yes, name and version ______

Nuclear Safety-Related __x__ YES ______ NO

	NAME	INITIAL	DATE
Performed By	AJ Will	AJW	8/6/92
Reviewed By (if required)	TJ Webber	TJW	8/6/92

Original Calculation Location: KNPP QA Vault

Copies To:

DE Cole
RP Pulec
TJ Webb

NES Library
DCR Pkg. 2527

Note: This form must be legible and suitable for microfilming.

1.0 PURPOSE

This calculation will determine the maximum allowable time delay for Bus 5 and 6 Second Level Undervoltage (UV) relays and supersede Sargent & Lundy Calc. No. 8909-EPED-2.

2.0 BACKGROUND

As discussed in the Design Description and Safety Evaluation/Safety Review Reports for DCR 2527, Rev. 1 the time delay must be short enough to remain within the 10 seconds assumed in the USAR Chapter 14 Accident Analysis. This is due to the possible non-actuation of Motor Control Center (MCC) contactors at voltages between the Second Level UV setpoint and the Primary UV setpoint. Continuous operation of the contactors at inrush on the non-actuating devices could then have caused the associated control circuit fuse to blow. With a time delay of less than 10 seconds fuse blowing is not a problem.

3.0 INPUTS AND ASSUMPTIONS

3.1 The logic string for Bus 5 Second Level UV relay actuation of diesel generator breaker 1-509 closure will be used to determine the maximum allowable time delay. The logic string for Bus 6 and therefore it's allowable time delay is assumed to be identical. (ref. 4.1)

3.2 The pick-up time for all Clark PM auxiliary relays is 0.034 seconds. (ref. 4.2)

3.3 The circuit breakers being activated by the logic have a 5 cycle (0.083 second) opening time and a 3.3 cycle (0.055 second) closing time. (ref. 4.3)

3.4 The Agastat ETR time delay relays have a ± 10% of setting error. This value is the repeat accuracy of the relay operating in an abnormal environment even though the Diesel Generator Rooms are considered a mild environment. This is because the room temperature of 60 to 104°F and relative humidty (R.H.) of 10 to 80% fall outside of the ETR relay normal ranges of 70 to 104°F and 40 to 60% R.H. The ETR abnormal environment range of 40 to 156°F and 10 to 95% R.H. does envelope the KNPP EQ Plan mild environment parameters. The 1 second ETR relays will therefore actuate in 1.1 seconds.(ref. 4.4)

3.5 Calibration accuracy, assuming use of Multi-Amp Model EPOCH-30 for calibration is ± 0.005% of reading. (ref. 4.5)

3.6 As discussed in section 2.0, the Diesel Generator breaker must be closed within 10 seconds to comply with USAR Chapter 14 Accident Analysis. The event initiating the sequence is a simultaneous Safety Injection and Degraded Grid. The Diesel Generator is therefore started by the SI signal at time 0 and for this calculation will be assumed to be at required speed and voltage when the Diesel Generator breaker closing relay (52C/1-509) actuates. (ref. 4.6)

3.7 To achieve the worst case relaying time delay and thus the maximum allowable time delay for the Second Level UV relays, the Reserve and Tertiary Auxiliary Transformers (RAT and TAT) will be assumed available at the appropriate points in the logic sequence. Their breakers will then be assumed not to close to allow the scheme to continue to eventual closing of the Diesel Generator breaker.

4.0 REFERENCES

4.1 Drawings E1872R, E1873L, E1874P, E1634P.

4.2 Letter dated 19 May, 1992 R. Schneider to Keven Fennell and Bulletin 7304, Type PM "DC" Relay - EDS 7304-PM-1, 12/19/62 Sheet No. 3.

4.3 McGraw-Edison Std. No. 442.29.005 "Contact Velocity and Operating Times -- Type PSD Breakers" 9/3/70 and K144-10 pg 1 & 2 of 3.

4.4 Agastat Nuclear Qualified Control Relays (PO # 63554) pg. 4 "Operating Characteristics" and KNPP EQ Plan Table C-10, Rev. 9, 10/31/90.

4.5 Multi-Amp Model EPOCH-30 Digital Timer information.

4.6 DCR 2527, Rev. 1 Design Description, Safety Review and Safety Evaluation Reports.

4.7 KNPP Technical Specifications and Operating License (4/10/92).

4.8 Sargent & Lundy Calculation No. 8909 - EPED - 2.

5.0 CALCULATION

The following table shows time delays for the Second Level UV relay logic sequence following a simultaneous SI and Degraded Grid Voltage. The numbers listed in the first column will be placed next to the appropriate relay on the drawings listed in ref. 4.1. The maximum allowable time delay for the Second Level UV relays will be designated as x.

#	RELAY (or BKR)	RELAY TYPE	EVENT	TIME (sec.)
0	NA	NA	SI (Diesel Gen. start signal) & Bus 5 voltage <93.6%	0
1	27AY & 27CY B5 B5	ASCO	Second Level UV relays time out & actuate	x
2	27CAX B5	Clark PM	Aux. relay actuates	x + 0.034
3	83X & 52T B5 B5	Clark PM	Voltage chasing and source breaker trip relays actuate	x + 0.068
4	501, 503, 509, 510, 511	NA	Breaker feeding Bus 5 is tripped	x + 0.151
5	52Z B5	Clark PM	Relay actuates after all Bus 5 source Breakers open	x + 0.185
6	TDR - BF 1-503	Agastat ETR	RAT 1 second time delay starts	x + 0.185
7	52C 1-503	Clark PM	Relay actuates Breaker 503 close coil	x + 0.219
8	503	NA	Breaker 503 is assumed not to close	NA
9	TDR-BF 1-503	Agastat ETR	RAT 1 second time delay complete	x + 1.285
10	TDR-BFX 1-503	Clark PM	Aux. relay actuates	x + 1.319
11	TDR-BF 1-501	Agastat ETR	TAT 1 second time delay starts	x + 1.319
12	52C 1-501	Clark PM	Relay actuates Breaker 501 close coil	x + 1.353
13	501	NA	Breaker 501 is assumed not to close	NA
14	TDR-BF 1-501	Agastat ETR	TAT 1 second time delay complete	x + 2.419
15	52C 1-509	Clark PM	Relay actuates Breaker 509 close coil (Diesel Gen. A is assumed to be @ >95% voltage and >59 Hz due to SI start signal at time 0)	x + 2.453
16	509	NA	Diesel Breaker 509 closes	x + 2.508

To find x, per section 2.0 and 3.6 discussion, the Diesel Generator Breaker closing must occur by 10 seconds after time 0. Therefore:

$$x + 2.508 \text{ seconds} = 10 \text{ seconds}$$

Maximum allowable time delay for Second Level UV relays = x

$$x = 10 \text{ seconds} - 2.508 \text{ seconds} = 7.492 \text{ seconds}$$

With x = 7.492 seconds, it is recommended that the Technical Specification time delay in Table 3.5-1 and all associated basis discussion be changed to less than or equal to 7.4 seconds.

The actual setting of the Second Level UV relays at 6 $\pm$ 0.5 seconds is acceptable for the existing ASCO UV relays used. The calibration done with the Multi-Amp Model EPOCH-30 would lead to a maximum relay time delay of:

$$6.5 \text{ seconds} + (0.00005 \times 6.5 \text{ seconds}) \text{ or}$$
$$6.5 \text{ seconds} + (0.0003 \text{ seconds}) = 6.5003 \text{ seconds}$$

which is well below the proposed 7.4 second Tech. Spec. limit.

ATTACHMENT 2

To

Letter to C. A. Schrock (WPSC)

To

Document Control Desk (NRC)

Dated

December 17, 1992

Description of Methodology and Supporting Analysis Used To Determine the Proposed Setpoint of 93.6% For Safeguard Bus Second Level Undervoltage Instrumentation

Description of Methodology

As stated in our submittal for Proposed Amendment 110, proper operation of the MCC contactors is assured provided 414V or greater is maintained at the MCC's.

An additional two volt conservatism was imposed, resulting in a minimum of 416V being required at the worst case MCC.

The ENACS model which was previously utilized for load flow modeling predicted that MCC 52F would have the lowest voltage. The DAPPER load flow model also predicted that MCC 52F would have the lowest voltage.

DAPPER was used to calculate the voltage requirements necessary to maintain 416V at the most limiting MCC. DAPPER determined a minimum allowable voltage of 3860 volts (or 92.8% of nominal bus voltage) was required at 4KV bus 1-5 to ensure 416V was maintained at MCC 52F. (Bus 1-5 was found to be more limiting than Bus 1-6; however, the Bus 1-6 setpoint was made identical to that of Bus 1-5 for consistency.)

To maintain the required 3860V at Bus 1-5, the 4160V undervoltage setpoint was determined. Instrument error considerations were also included which resulted in the setpoint (multiplied by error) equaling 92.8%.

WPS determined an error of 0.991 was appropriate for the setpoint determination;
(setpoint x 0.991 = 92.8%; therefore, setpoint = 93.6%)

The 0.991 error was selected based upon historical repetitive accuracy tolerance of 0.833% with an additional margin of 0.067%, resulting in a 0.9% error limit. (Attached Calculation 8908-EPED-1 page 8 references a repetitive accuracy tolerance (based on historical data) of plus/minus 0.83333% for these relays.) WPS determined the additional margin of 0.067% was prudent for simplifying the proposed TS limits, and would eliminate potential compliance concerns with significant digits.

The following portions of the DAPPER calculation results are attached:

1) Figure 5.8.6 shows 4160V Bus 1-5 configuration. (The numbers in rectangles are the DAPPER assigned identification codes for the represented loads. For example, MCC 52F is identified as load 526 on the figure and also on page 46 of the calculation.)

2) Pages 42 through 46 inclusive and page 57 show the DAPPER calculation results for Bus 1-5.

3) Figure 5.8.7 shows 4160V Bus 1-6 configuration. (DAPPER identification codes in rectangles similar to Bus 1-5)

4) Pages 46 through 50 inclusive and pages 58 & 59 show the DAPPER calculation results for Bus 1-6.

In addition, Calculation 8908-EPED-1 is attached.

LIC\NRC\PA110A.WP

NT&LUNDY
ENGINEERS
CHICAGO

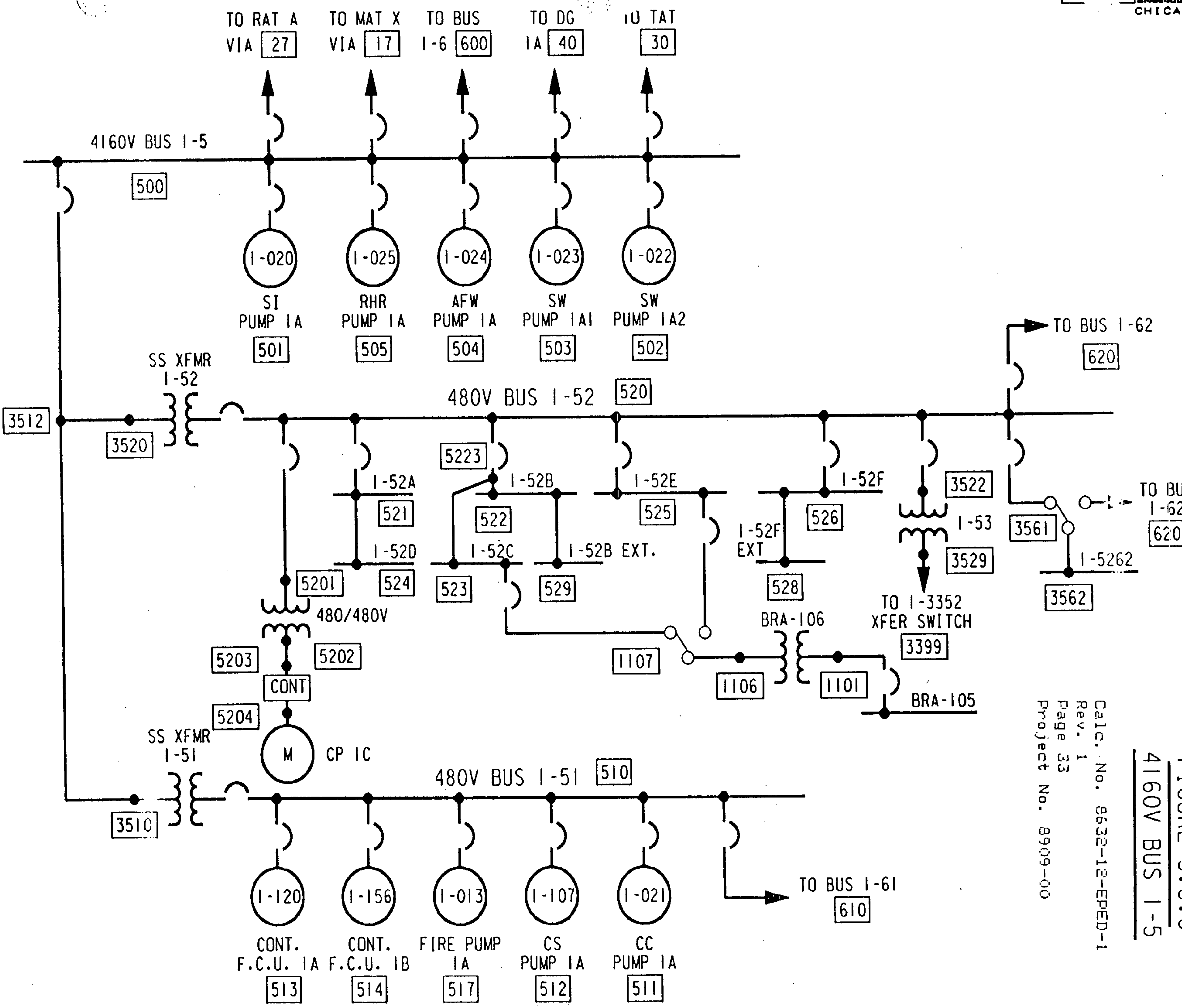

FIGURE 5.8.6
4160V BUS 1-5

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Auxiliary Electrical System Study - Safety Injection Condition

WISCONSIN PUBLIC SERVICE CORPORATION - KEWAUNEE NUCLEAR PLANT

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS (BRANCH LOAD REPORT)

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VOLTAGE EFFECT ON LOADS MODELED TRANSFORMER VOLTAGE DROP MODELED
VOLTAGE DROP CRITERIA: BRANCH = 3.75 % BUS = 10.00
PER UNIT DRIVING VOLTAGE = .9965

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LOAD BUS: 461 MCC 1-46A DESIGN VOLTAGE: 480 LOAD VOLTAGE: 432 %VD: 9.9
VOLTAGE ANGLE: -8.7 DEGREES
NET BRANCH DIVERSITY LOAD: 112. KW 37. KVAR
LOAD FROM: 460 BUS 1-46 FEEDER AMPS: 157 VOLTAGE DROP: 1. %VD: .18
PROJECTED POWER FLOW: 112. KW 37. KVAR 118. KVA PF: .95 LAGGING
LOSSES THRU FEEDER: 0. KW 0. KVAR 0. KVA

LOAD BUS: 462 MCC 1-46B DESIGN VOLTAGE: 480 LOAD VOLTAGE: 432 %VD: 10.0$
VOLTAGE ANGLE: -8.7 DEGREES
NET BRANCH DIVERSITY LOAD: 181. KW 52. KVAR
LOAD FROM: 460 BUS 1-46 FEEDER AMPS: 252 VOLTAGE DROP: 1. %VD: .27
PROJECTED POWER FLOW: 181. KW 52. KVAR 188. KVA PF: .96 LAGGING
LOSSES THRU FEEDER: 0. KW 0. KVAR 1. KVA

LOAD BUS: 463 MCC 1-46C DESIGN VOLTAGE: 480 LOAD VOLTAGE: 426 %VD: 11.3$
VOLTAGE ANGLE: -9.0 DEGREES
NET BRANCH DIVERSITY LOAD: 110. KW 45. KVAR
LOAD FROM: 460 BUS 1-46 FEEDER AMPS: 161 VOLTAGE DROP: 8. %VD: 1.58
PROJECTED POWER FLOW: 110. KW 45. KVAR 118. KVA PF: .93 LAGGING
LOSSES THRU FEEDER: 2. KW 1. KVAR 2. KVA

LOAD BUS: 464 MCC 1-46D DESIGN VOLTAGE: 480 LOAD VOLTAGE: 426 %VD: 11.2$
VOLTAGE ANGLE: -8.8 DEGREES
NET BRANCH DIVERSITY LOAD: 168. KW 75. KVAR
LOAD FROM: 460 BUS 1-46 FEEDER AMPS: 249 VOLTAGE DROP: 7. %VD: 1.46
PROJECTED POWER FLOW: 168. KW 75. KVAR 184. KVA PF: .91 LAGGING
LOSSES THRU FEEDER: 3. KW 2. KVAR 3. KVA

Start

LOAD BUS: 500 BUS 1-5 DESIGN VOLTAGE: 4160 LOAD VOLTAGE: 3860 %VD: 7.2
VOLTAGE ANGLE: -6.0 DEGREES
LOAD FROM: 27 RATA 345 FEEDER AMPS: 507 VOLTAGE DROP: 1. %VD: .02
PROJECTED POWER FLOW: 2954. KW 1657. KVAR 3387. KVA PF: .87 LAGGING
LOSSES THRU FEEDER: 0. KW 1. KVAR 1. KVA

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Auxiliary Electrical System Study - Safety Injection Condition

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BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS (BRANCH LOAD REPORT)
****
VOLTAGE EFFECT ON LOADS MODELED TRANSFORMER VOLTAGE DROP MODELED
VOLTAGE DROP CRITERIA: BRANCH = 3.75 % BUS = 10.00
PER UNIT DRIVING VOLTAGE = .9965

LOAD BUS: 501 MT SIP 1A DESIGN VOLTAGE: 4160 LOAD VOLTAGE: 3844 %VD: 7.6
VOLTAGE ANGLE: -6.0 DEGREES
NET BRANCH DIVERSITY LOAD: 656. KW 318. KVAR
LOAD FROM: 500 BUS 1-5 FEEDER AMPS: 109 VOLTAGE DROP: 16. %VD: .39
PROJECTED POWER FLOW: 656. KW 318. KVAR 729. KVA PF: .90 LAGGING
LOSSES THRU FEEDER: 3. KW 1. KVAR 3. KVA

LOAD BUS: 502 MT SWP 1A2 DESIGN VOLTAGE: 4160 LOAD VOLTAGE: 3848 %VD: 7.5
VOLTAGE ANGLE: -6.0 DEGREES
NET BRANCH DIVERSITY LOAD: 324. KW 157. KVAR
LOAD FROM: 500 BUS 1-5 FEEDER AMPS: 54 VOLTAGE DROP: 13. %VD: .31
PROJECTED POWER FLOW: 324. KW 157. KVAR 360. KVA PF: .90 LAGGING
LOSSES THRU FEEDER: 1. KW 0. KVAR 1. KVA

LOAD BUS: 503 MT SWP 1A1 DESIGN VOLTAGE: 4160 LOAD VOLTAGE: 3849 %VD: 7.5
VOLTAGE ANGLE: -6.0 DEGREES
NET BRANCH DIVERSITY LOAD: 324. KW 157. KVAR
LOAD FROM: 500 BUS 1-5 FEEDER AMPS: 54 VOLTAGE DROP: 12. %VD: .28
PROJECTED POWER FLOW: 324. KW 157. KVAR 360. KVA PF: .90 LAGGING
LOSSES THRU FEEDER: 1. KW 0. KVAR 1. KVA

LOAD BUS: 504 MT AFWP 1A DESIGN VOLTAGE: 4160 LOAD VOLTAGE: 3854 %VD: 7.3
VOLTAGE ANGLE: -6.0 DEGREES
NET BRANCH DIVERSITY LOAD: 254. KW 123. KVAR
LOAD FROM: 500 BUS 1-5 FEEDER AMPS: 42 VOLTAGE DROP: 6. %VD: .14
PROJECTED POWER FLOW: 254. KW 123. KVAR 282. KVA PF: .90 LAGGING
LOSSES THRU FEEDER: 0. KW 0. KVAR 0. KVA

LOAD BUS: 505 MT RHRP 1A DESIGN VOLTAGE: 4160 LOAD VOLTAGE: 3847 %VD: 7.5
VOLTAGE ANGLE: -6.0 DEGREES
NET BRANCH DIVERSITY LOAD: 144. KW 70. KVAR
LOAD FROM: 500 BUS 1-5 FEEDER AMPS: 24 VOLTAGE DROP: 14. %VD: .33
PROJECTED POWER FLOW: 144. KW 70. KVAR 160. KVA PF: .90 LAGGING
LOSSES THRU FEEDER: 1. KW 0. KVAR 1. KVA

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 Auxiliary Electrical System Study - Safety Injection Condition

 WISCONSIN PUBLIC SERVICE CORPORATION - KEWAUNEE NUCLEAR PLANT

      BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS (BRANCH LOAD REPORT)
 ***************************************************************************
 VOLTAGE EFFECT ON LOADS MODELED       TRANSFORMER VOLTAGE DROP MODELED
 VOLTAGE DROP CRITERIA: BRANCH =  3.75 %    BUS = 10.00
 PER UNIT DRIVING VOLTAGE =  .9965


 LOAD BUS:  510 BUS 1-51    DESIGN VOLTAGE:   480 LOAD VOLTAGE:   431 %VD: 10.1
 -------------------------                         VOLTAGE ANGLE:  -9.6 DEGREES
 LOAD FROM:  517 MT FP 1A      FEEDER AMPS:        VOLTAGE DROP:    0. %VD:  .00
 PROJECTED POWER FLOW:      0. KW      0. KVAR     0. KVA     PF:    .00   LAGGING
 LOSSES THRU FEEDER:        0. KW       0. KVAR        0. KVA

 LOAD FROM: 3510 SST 1-51      TRANSF AMPS:     876 VOLTAGE DROP:   14. %VD: 2.87
 PROJECTED POWER FLOW:    576. KW    312. KVAR   655. KVA     PF:    .88   LAGGING
 LOSSES THRU TRANSF:      12.0 KW    55.3 KVAR   56.6 KVA ***XFMR TAPS  -2.5%***


 LOAD BUS:  511 MT CCP 1A   DESIGN VOLTAGE:   480 LOAD VOLTAGE:   427 %VD: 11.1$
 -------------------------                         VOLTAGE ANGLE:  -9.8 DEGREES
                    NET BRANCH DIVERSITY LOAD:    176. KW     109. KVAR
 LOAD FROM:  510 BUS 1-51      FEEDER AMPS:     280 VOLTAGE DROP:    5. %VD: 1.00
 PROJECTED POWER FLOW:    176. KW    109. KVAR   207. KVA     PF:    .85   LAGGING
 LOSSES THRU FEEDER:        1. KW       2. KVAR        3. KVA


 LOAD BUS:  512 MT CSP 1A   DESIGN VOLTAGE:   480 LOAD VOLTAGE:   426 %VD: 11.2$
 -------------------------                         VOLTAGE ANGLE: -10.0 DEGREES
                    NET BRANCH DIVERSITY LOAD:    172. KW      78. KVAR
 LOAD FROM:  510 BUS 1-51      FEEDER AMPS:     256 VOLTAGE DROP:    5. %VD: 1.04
 PROJECTED POWER FLOW:    172. KW     78. KVAR   189. KVA     PF:    .91   LAGGING
 LOSSES THRU FEEDER:        1. KW       2. KVAR        3. KVA


 LOAD BUS:  513 MT CFCU 1A  DESIGN VOLTAGE:   480 LOAD VOLTAGE:   419 %VD: 12.6$
 -------------------------                         VOLTAGE ANGLE:  -9.4 DEGREES
                    NET BRANCH DIVERSITY LOAD:    109. KW      59. KVAR
 LOAD FROM:  510 BUS 1-51      FEEDER AMPS:     171 VOLTAGE DROP:   12. %VD: 2.53
 PROJECTED POWER FLOW:    109. KW     59. KVAR   124. KVA     PF:    .88   LAGGING
 LOSSES THRU FEEDER:        3. KW       1. KVAR        4. KVA


 LOAD BUS:  514 MT CFCU 1B  DESIGN VOLTAGE:   480 LOAD VOLTAGE:   420 %VD: 12.5$
 -------------------------                         VOLTAGE ANGLE:  -9.4 DEGREES
                    NET BRANCH DIVERSITY LOAD:    109. KW      59. KVAR
 LOAD FROM:  510 BUS 1-51      FEEDER AMPS:     171 VOLTAGE DROP:   12. %VD: 2.43
 PROJECTED POWER FLOW:    109. KW     59. KVAR   124. KVA     PF:    .88   LAGGING
 LOSSES THRU FEEDER:        3. KW       1. KVAR        3. KVA
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WISCONSIN PUBLIC SERVICE CORPORATION - KEWAUNEE NUCLEAR PLANT

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS (BRANCH LOAD REPORT)

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VOLTAGE EFFECT ON LOADS MODELED TRANSFORMER VOLTAGE DROP MODELED
VOLTAGE DROP CRITERIA: BRANCH = 3.75 % BUS = 10.00
PER UNIT DRIVING VOLTAGE = .9965

LOAD BUS: 517 MT FP 1A *** NO LOAD SPECIFIED ***

LOAD BUS: 520 BUS 1-52 DESIGN VOLTAGE: 480 LOAD VOLTAGE: 425 %VD: 11.4%
VOLTAGE ANGLE: -9.9 DEGREES

LOAD FROM: 3520 SST 1-52 TRANSF AMPS: 1018 VOLTAGE DROP: 20. %VD: 4.12$
PROJECTED POWER FLOW: 640. KW 390. KVAR 750. KVA PF: .85 LAGGING
LOSSES THRU TRANSF: 17.1 KW 74.1 KVAR 76.0 KVA ***XFMR TAPS -2.5%***

LOAD FROM: 3522 TRANS 1-53 FEEDER AMPS: VOLTAGE DROP: 0. %VD: .00
PROJECTED POWER FLOW: 0. KW 0. KVAR 0. KVA PF: .00 LAGGING
LOSSES THRU FEEDER: 0. KW 0. KVAR 0. KVA

LOAD BUS: 521 MCC 1-52A DESIGN VOLTAGE: 480 LOAD VOLTAGE: 424 %VD: 11.6$
VOLTAGE ANGLE: -9.9 DEGREES

NET BRANCH DIVERSITY LOAD: 123. KW 81. KVAR
LOAD FROM: 5214 MCC 1-52AD FEEDER AMPS: 200 VOLTAGE DROP: 0. %VD: .00
PROJECTED POWER FLOW: 123. KW 81. KVAR 147. KVA PF: .83 LAGGING
LOSSES THRU FEEDER: 0. KW 0. KVAR 0. KVA

LOAD BUS: 522 MCC 1-52B DESIGN VOLTAGE: 480 LOAD VOLTAGE: 422 %VD: 12.1$
VOLTAGE ANGLE: -10.0 DEGREES

NET BRANCH DIVERSITY LOAD: 92. KW 53. KVAR
LOAD FROM: 5229 MCC 1-52BB FEEDER AMPS: 145 VOLTAGE DROP: 0. %VD: .00
PROJECTED POWER FLOW: 92. KW 53. KVAR 106. KVA PF: .86 LAGGING
LOSSES THRU FEEDER: 0. KW 0. KVAR 0. KVA

LOAD BUS: 523 MCC 1-52C DESIGN VOLTAGE: 480 LOAD VOLTAGE: 424 %VD: 11.6$
VOLTAGE ANGLE: -10.0 DEGREES

NET BRANCH DIVERSITY LOAD: 19. KW 8. KVAR
LOAD FROM: 5223 BUS 1-52BC FEEDER AMPS: 58 VOLTAGE DROP: 1. %VD: .19
PROJECTED POWER FLOW: 40. KW 15. KVAR 43. KVA PF: .93 LAGGING
LOSSES THRU FEEDER: 0. KW 0. KVAR 0. KVA

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Auxiliary Electrical System Study - Safety Injection Condition

WISCONSIN PUBLIC SERVICE CORPORATION - KEWAUNEE NUCLEAR PLANT

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS (BRANCH LOAD REPORT)
****
VOLTAGE EFFECT ON LOADS MODELED TRANSFORMER VOLTAGE DROP MODELED
VOLTAGE DROP CRITERIA: BRANCH = 3.75 % BUS = 10.00
PER UNIT DRIVING VOLTAGE = .9965

LOAD BUS: 524 MCC 1-52D DESIGN VOLTAGE: 480 LOAD VOLTAGE: 423 %VD: 11.8$
VOLTAGE ANGLE: -9.9 DEGREES
NET BRANCH DIVERSITY LOAD: 23. KW 18. KVAR
LOAD FROM: 5214 MCC 1-52AD FEEDER AMPS: 40 VOLTAGE DROP: 1. %VD: .20
PROJECTED POWER FLOW: 23. KW 18. KVAR 29. KVA PF: .80 LAGGING
LOSSES THRU FEEDER: 0. KW 0. KVAR 0. KVA

LOAD BUS: 525 MCC 1-52E DESIGN VOLTAGE: 480 LOAD VOLTAGE: 423 %VD: 11.9$
VOLTAGE ANGLE: -10.0 DEGREES
NET BRANCH DIVERSITY LOAD: 100. KW 73. KVAR
LOAD FROM: 520 BUS 1-52 FEEDER AMPS: 169 VOLTAGE DROP: 2. %VD: .50
PROJECTED POWER FLOW: 100. KW 73. KVAR 124. KVA PF: .81 LAGGING
LOSSES THRU FEEDER: 0. KW 1. KVAR 1. KVA

LOAD BUS: 526 MCC 1-52F DESIGN VOLTAGE: 480 LOAD VOLTAGE: 416 %VD: 13.2$
VOLTAGE ANGLE: -10.2 DEGREES ← worst case
NET BRANCH DIVERSITY LOAD: 164. KW 97. KVAR
LOAD FROM: 5268 MCC 1-52FF FEEDER AMPS: 264 VOLTAGE DROP: 0. %VD: .00
PROJECTED POWER FLOW: 164. KW 97. KVAR 190. KVA PF: .86 LAGGING
LOSSES THRU FEEDER: 0. KW 0. KVAR 0. KVA

LOAD BUS: 528 MCC 1-52FE DESIGN VOLTAGE: 480 LOAD VOLTAGE: 416 %VD: 13.3$
VOLTAGE ANGLE: -10.2 DEGREES
NET BRANCH DIVERSITY LOAD: 21. KW 0. KVAR
LOAD FROM: 5268 MCC 1-52FF FEEDER AMPS: 29 VOLTAGE DROP: 0. %VD: .02
PROJECTED POWER FLOW: 21. KW 0. KVAR 21. KVA PF: 1.00 UNITY
LOSSES THRU FEEDER: 0. KW 0. KVAR 0. KVA

LOAD BUS: 529 MCC 1-52BE *** NO LOAD SPECIFIED *** end ↓

LOAD BUS: 600 BUS 1-6 DESIGN VOLTAGE: 4160 LOAD VOLTAGE: 3862 %VD: 7.2
VOLTAGE ANGLE: -6.0 DEGREES
LOAD FROM: 26 RATA 3456 FEEDER AMPS: 489 VOLTAGE DROP: 1. %VD: .02
PROJECTED POWER FLOW: 2868. KW 1569. KVAR 3270. KVA PF: .88 LAGGING
LOSSES THRU FEEDER: 0. KW 1. KVAR 1. KVA

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WISCONSIN PUBLIC SERVICE CORPORATION - KEWAUNEE NUCLEAR PLANT

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS (BRANCH LOAD REPORT)
****
VOLTAGE EFFECT ON LOADS MODELED TRANSFORMER VOLTAGE DROP MODELED
VOLTAGE DROP CRITERIA: BRANCH = 3.75 % BUS = 10.00
PER UNIT DRIVING VOLTAGE = .9965


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LOAD BUS: 3460 SST 1-46    DESIGN VOLTAGE:  4160 LOAD VOLTAGE:  3859 %VD:  7.2
--------------------------                       VOLTAGE ANGLE:  -6.0 DEGREES
LOAD FROM:  400 BUS 1-4      FEEDER AMPS:    94 VOLTAGE DROP:    2. %VD:  .06
PROJECTED POWER FLOW:   581. KW   245. KVAR   631. KVA   PF:    .92  LAGGING
LOSSES THRU FEEDER:        0. KW        0. KVAR        0. KVA

LOAD BUS: 3499 SW 1-42TS   *** NO LOAD SPECIFIED ***
```

Start ↓

```
LOAD BUS: 3510 SST 1-51    DESIGN VOLTAGE:  4160 LOAD VOLTAGE:  3859 %VD:  7.2
--------------------------                       VOLTAGE ANGLE:  -6.0 DEGREES
LOAD FROM: 3512 BUS 1-5-12   FEEDER AMPS:   104 VOLTAGE DROP:    2. %VD:  .04
PROJECTED POWER FLOW:   588. KW   367. KVAR   693. KVA   PF:    .85  LAGGING
LOSSES THRU FEEDER:        0. KW        0. KVAR        0. KVA

LOAD BUS: 3512 BUS 1-5-12 DESIGN VOLTAGE:  4160 LOAD VOLTAGE:  3860 %VD:  7.2
--------------------------                       VOLTAGE ANGLE:  -6.0 DEGREES
LOAD FROM:  500 BUS 1-5      FEEDER AMPS:   224 VOLTAGE DROP:    0. %VD:  .00
PROJECTED POWER FLOW:  1245. KW   832. KVAR  1498. KVA   PF:    .83  LAGGING
LOSSES THRU FEEDER:        0. KW        0. KVAR        0. KVA

LOAD BUS: 3520 SST 1-52    DESIGN VOLTAGE:  4160 LOAD VOLTAGE:  3858 %VD:  7.3
--------------------------                       VOLTAGE ANGLE:  -6.0 DEGREES
LOAD FROM: 3512 BUS 1-5-12   FEEDER AMPS:   120 VOLTAGE DROP:    2. %VD:  .06
PROJECTED POWER FLOW:   657. KW   464. KVAR   805. KVA   PF:    .82  LAGGING
LOSSES THRU FEEDER:        1. KW        0. KVAR        1. KVA
```

end ↓

```
LOAD BUS: 3522 TRANS 1-53  *** NO LOAD SPECIFIED ***

LOAD BUS: 3524 BUS 1-35BD DESIGN VOLTAGE:   480 LOAD VOLTAGE:   423 %VD: 11.8$
--------------------------                       VOLTAGE ANGLE:  -9.8 DEGREES
LOAD FROM:  350 BUS 1-35     FEEDER AMPS:   177 VOLTAGE DROP:    0. %VD:  .00
PROJECTED POWER FLOW:   122. KW    44. KVAR   130. KVA   PF:    .94  LAGGING
LOSSES THRU FEEDER:        0. KW        0. KVAR        0. KVA
```

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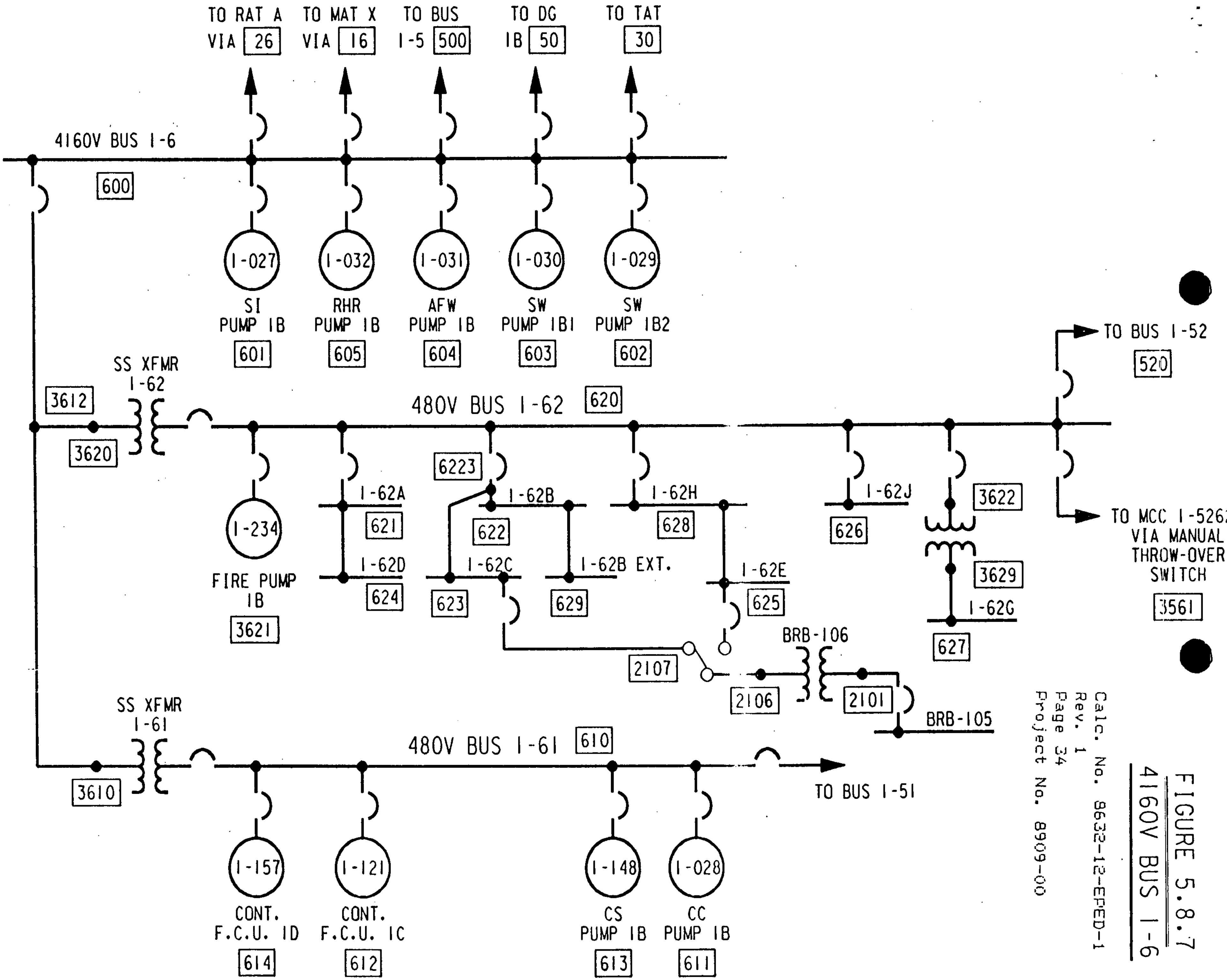

FIGURE 5.8.7
4160V BUS 1-6

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WISCONSIN PUBLIC SERVICE CORPORATION - KEWAUNEE NUCLEAR PLANT

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS (BRANCH LOAD REPORT)
****
VOLTAGE EFFECT ON LOADS MODELED TRANSFORMER VOLTAGE DROP MODELED
VOLTAGE DROP CRITERIA: BRANCH = 3.75 % BUS = 10.00
PER UNIT DRIVING VOLTAGE = .9960

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```
LOAD BUS:  524 MCC 1-52D  DESIGN VOLTAGE:   480 LOAD VOLTAGE:   423 %VD: 11.9
-------------------------                       VOLTAGE ANGLE:  -9.9 DEGREES
                  NET BRANCH DIVERSITY LOAD:      23. KW      18. KVAR
LOAD FROM: 5214 MCC 1-52AD   FEEDER AMPS:     40 VOLTAGE DROP:    1. %VD:  .20
PROJECTED POWER FLOW:     23. KW    18. KVAR    29. KVA    PF:   .80   LAGGING
LOSSES THRU FEEDER:        0. KW        0. KVAR       0. KVA

LOAD BUS:  525 MCC 1-52E  DESIGN VOLTAGE:   480 LOAD VOLTAGE:   423 %VD: 11.9$
-------------------------                       VOLTAGE ANGLE: -10.0 DEGREES
                  NET BRANCH DIVERSITY LOAD:     100. KW      73. KVAR
LOAD FROM:  520 BUS 1-52     FEEDER AMPS:    170 VOLTAGE DROP:    2. %VD:  .50
PROJECTED POWER FLOW:    100. KW    73. KVAR   124. KVA    PF:   .81   LAGGING
LOSSES THRU FEEDER:        0. KW        1. KVAR       1. KVA

LOAD BUS:  526 MCC 1-52F  DESIGN VOLTAGE:   480 LOAD VOLTAGE:   416 %VD: 13.3$
-------------------------                       VOLTAGE ANGLE: -10.2 DEGREES
                  NET BRANCH DIVERSITY LOAD:     164. KW      97. KVAR
LOAD FROM: 5268 MCC 1-52FF   FEEDER AMPS:    264 VOLTAGE DROP:    0. %VD:  .00
PROJECTED POWER FLOW:    164. KW    97. KVAR   190. KVA    PF:   .86   LAGGING
LOSSES THRU FEEDER:        0. KW        0. KVAR       0. KVA

LOAD BUS:  528 MCC 1-52FE DESIGN VOLTAGE:   480 LOAD VOLTAGE:   416 %VD: 13.3$
-------------------------                       VOLTAGE ANGLE: -10.3 DEGREES
                  NET BRANCH DIVERSITY LOAD:      21. KW       0. KVAR
LOAD FROM: 5268 MCC 1-52FF   FEEDER AMPS:     29 VOLTAGE DROP:    0. %VD:  .02
PROJECTED POWER FLOW:     21. KW     0. KVAR    21. KVA    PF:  1.00   UNITY
LOSSES THRU FEEDER:        0. KW        0. KVAR       0. KVA

LOAD BUS:  529 MCC 1-52BE   *** NO LOAD SPECIFIED ***

LOAD BUS:  600 BUS 1-6    DESIGN VOLTAGE:  4160 LOAD VOLTAGE:  3860 %VD:  7.2
-------------------------                       VOLTAGE ANGLE:  -6.0 DEGREES
LOAD FROM:   26 RATA 3456    FEEDER AMPS:    489 VOLTAGE DROP:    1. %VD:  .02
PROJECTED POWER FLOW:  2868. KW  1569. KVAR  3269. KVA    PF:   .88   LAGGING
LOSSES THRU FEEDER:        0. KW        1. KVAR       1. KVA
```

Start ↓

1DATE: 5 16 91 TIME: 4 48 PM
Auxiliary Electrical System Study - Safety Injection Condition

WISCONSIN PUBLIC SERVICE CORPORATION - KEWAUNEE NUCLEAR PLANT

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS (BRANCH LOAD REPORT)

****

VOLTAGE EFFECT ON LOADS MODELED TRANSFORMER VOLTAGE DROP MODELED
VOLTAGE DROP CRITERIA: BRANCH = 3.75 % BUS = 10.00
PER UNIT DRIVING VOLTAGE = .9960

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```
LOAD BUS:  601 MT SIP 1B  DESIGN VOLTAGE:  4160 LOAD VOLTAGE:  3843 %VD:  7.6
                                              VOLTAGE ANGLE:  -5.9 DEGREES
--------------------------
                 NET BRANCH DIVERSITY LOAD:    656. KW     318. KVAR
LOAD FROM:  600 BUS 1-6       FEEDER AMPS:   110 VOLTAGE DROP:   17. %VD:  .40
PROJECTED POWER FLOW:    656. KW   318. KVAR   729. KVA    PF:   .90   LAGGING
LOSSES THRU FEEDER:         3. KW        1. KVAR        3. KVA

LOAD BUS:  602 MT SWP 1B2 DESIGN VOLTAGE:  4160 LOAD VOLTAGE:  3849 %VD:  7.5
                                              VOLTAGE ANGLE:  -6.0 DEGREES
--------------------------
                 NET BRANCH DIVERSITY LOAD:    309. KW     150. KVAR
LOAD FROM:  600 BUS 1-6       FEEDER AMPS:    51 VOLTAGE DROP:   11. %VD:  .26
PROJECTED POWER FLOW:    309. KW   150. KVAR   343. KVA    PF:   .90   LAGGING
LOSSES THRU FEEDER:         1. KW        0. KVAR        1. KVA

LOAD BUS:  603 MT SWP 1B1 DESIGN VOLTAGE:  4160 LOAD VOLTAGE:  3848 %VD:  7.5
                                              VOLTAGE ANGLE:  -5.9 DEGREES
--------------------------
                 NET BRANCH DIVERSITY LOAD:    308. KW     149. KVAR
LOAD FROM:  600 BUS 1-6       FEEDER AMPS:    51 VOLTAGE DROP:   12. %VD:  .28
PROJECTED POWER FLOW:    308. KW   149. KVAR   342. KVA    PF:   .90   LAGGING
LOSSES THRU FEEDER:         1. KW        0. KVAR        1. KVA

LOAD BUS:  604 MT AFWP 1B DESIGN VOLTAGE:  4160 LOAD VOLTAGE:  3851 %VD:  7.4
                                              VOLTAGE ANGLE:  -6.0 DEGREES
--------------------------
                 NET BRANCH DIVERSITY LOAD:    254. KW     123. KVAR
LOAD FROM:  600 BUS 1-6       FEEDER AMPS:    42 VOLTAGE DROP:    9. %VD:  .21
PROJECTED POWER FLOW:    254. KW   123. KVAR   282. KVA    PF:   .90   LAGGING
LOSSES THRU FEEDER:         1. KW        0. KVAR        1. KVA

LOAD BUS:  605 MT RHRP 1B DESIGN VOLTAGE:  4160 LOAD VOLTAGE:  3844 %VD:  7.6
                                              VOLTAGE ANGLE:  -5.9 DEGREES
--------------------------
                 NET BRANCH DIVERSITY LOAD:    144. KW      70. KVAR
LOAD FROM:  600 BUS 1-6       FEEDER AMPS:    24 VOLTAGE DROP:   16. %VD:  .38
PROJECTED POWER FLOW:    144. KW    70. KVAR   160. KVA    PF:   .90   LAGGING
LOSSES THRU FEEDER:         1. KW        0. KVAR        1. KVA
```

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Auxiliary Electrical System Study - Safety Injection Condition

WISCONSIN PUBLIC SERVICE CORPORATION - KEWAUNEE NUCLEAR PLANT

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS (BRANCH LOAD REPORT)
****
VOLTAGE EFFECT ON LOADS MODELED   TRANSFORMER VOLTAGE DROP MODELED
VOLTAGE DROP CRITERIA: BRANCH = 3.75 %   BUS = 10.00
PER UNIT DRIVING VOLTAGE = .9960

LOAD BUS: 610 BUS 1-61   DESIGN VOLTAGE: 480 LOAD VOLTAGE: 434 %VD: 9.6
VOLTAGE ANGLE: -9.5 DEGREES
LOAD FROM: 3610 SST 1-61   TRANSF AMPS: 867 VOLTAGE DROP: 11. %VD: 2.27
PROJECTED POWER FLOW: 584. KW 291. KVAR 652. KVA PF: .89 LAGGING
LOSSES THRU TRANSF: 9.9 KW 52.3 KVAR 53.2 KVA ***XFMR TAPS -2.5%***

LOAD BUS: 611 MT CCP 1B   DESIGN VOLTAGE: 480 LOAD VOLTAGE: 430 %VD: 10.4$
VOLTAGE ANGLE: -9.8 DEGREES
NET BRANCH DIVERSITY LOAD: 186. KW 90. KVAR
LOAD FROM: 610 BUS 1-61   FEEDER AMPS: 278 VOLTAGE DROP: 4. %VD: .85
PROJECTED POWER FLOW: 186. KW 90. KVAR 207. KVA PF: .90 LAGGING
LOSSES THRU FEEDER: 1. KW 2. KVAR 2. KVA

LOAD BUS: 612 MT CFCU 1C DESIGN VOLTAGE: 480 LOAD VOLTAGE: 425 %VD: 11.4$
VOLTAGE ANGLE: -9.4 DEGREES
NET BRANCH DIVERSITY LOAD: 109. KW 59. KVAR
LOAD FROM: 610 BUS 1-61   FEEDER AMPS: 168 VOLTAGE DROP: 9. %VD: 1.87
PROJECTED POWER FLOW: 109. KW 59. KVAR 124. KVA PF: .88 LAGGING
LOSSES THRU FEEDER: 2. KW 1. KVAR 3. KVA

LOAD BUS: 613 MT CSP 1B   DESIGN VOLTAGE: 480 LOAD VOLTAGE: 431 %VD: 10.1$
VOLTAGE ANGLE: -9.7 DEGREES
NET BRANCH DIVERSITY LOAD: 172. KW 78. KVAR
LOAD FROM: 610 BUS 1-61   FEEDER AMPS: 253 VOLTAGE DROP: 3. %VD: .57
PROJECTED POWER FLOW: 172. KW 78. KVAR 189. KVA PF: .91 LAGGING
LOSSES THRU FEEDER: 1. KW 1. KVAR 1. KVA

LOAD BUS: 614 MT CFCU 1D DESIGN VOLTAGE: 480 LOAD VOLTAGE: 425 %VD: 11.5$
VOLTAGE ANGLE: -9.4 DEGREES
NET BRANCH DIVERSITY LOAD: 109. KW 59. KVAR
LOAD FROM: 610 BUS 1-61   FEEDER AMPS: 168 VOLTAGE DROP: 9. %VD: 1.94
PROJECTED POWER FLOW: 109. KW 59. KVAR 124. KVA PF: .88 LAGGING
LOSSES THRU FEEDER: 3. KW 1. KVAR 3. KVA

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Auxiliary Electrical System Study - Safety Injection Condition

WISCONSIN PUBLIC SERVICE CORPORATION - KEWAUNEE NUCLEAR PLANT

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS (BRANCH LOAD REPORT)
****
VOLTAGE EFFECT ON LOADS MODELED TRANSFORMER VOLTAGE DROP MODELED
VOLTAGE DROP CRITERIA: BRANCH = 3.75 % BUS = 10.00
PER UNIT DRIVING VOLTAGE = .9960


```
LOAD BUS:  620 BUS 1-62    DESIGN VOLTAGE:   480 LOAD VOLTAGE:   429 %VD: 10.6$
-------------------------                        VOLTAGE ANGLE:  -9.4 DEGREES
LOAD FROM: 3620 SST 1-62      TRANSF AMPS:   920 VOLTAGE DROP:    16. %VD: 3.34
PROJECTED POWER FLOW:    583. KW    356. KVAR    683. KVA    PF:    .85   LAGGING
LOSSES THRU TRANSF:     13.4 KW    59.3 KVAR    60.8 KVA ***XFMR TAPS  -2.5%***

LOAD FROM: 3622 TRANS 1-63    FEEDER AMPS:          VOLTAGE DROP:     0. %VD:  .00
PROJECTED POWER FLOW:      0. KW      0. KVAR      0. KVA    PF:    .00   LAGGING
LOSSES THRU FEEDER:        0. KW       0. KVAR        0. KVA

LOAD BUS:  621 MCC 1-62A  DESIGN VOLTAGE:   480 LOAD VOLTAGE:   425 %VD: 11.4$
-------------------------                        VOLTAGE ANGLE:  -9.5 DEGREES
                  NET BRANCH DIVERSITY LOAD:    127. KW     88. KVAR
LOAD FROM: 6214 MCC 1-62AD   FEEDER AMPS:   210 VOLTAGE DROP:     0. %VD:  .00
PROJECTED POWER FLOW:    127. KW     88. KVAR    155. KVA    PF:    .82   LAGGING
LOSSES THRU FEEDER:        0. KW       0. KVAR        0. KVA

LOAD BUS:  622 MCC 1-62B  DESIGN VOLTAGE:   480 LOAD VOLTAGE:   428 %VD: 10.9$
-------------------------                        VOLTAGE ANGLE:  -9.4 DEGREES
                  NET BRANCH DIVERSITY LOAD:     17. KW     13. KVAR
LOAD FROM: 6229 MCC 1-62BB   FEEDER AMPS:    29 VOLTAGE DROP:     0. %VD:  .00
PROJECTED POWER FLOW:     17. KW     13. KVAR     22. KVA    PF:    .80   LAGGING
LOSSES THRU FEEDER:        0. KW       0. KVAR        0. KVA

LOAD BUS:  623 MCC 1-62C  DESIGN VOLTAGE:   480 LOAD VOLTAGE:   428 %VD: 10.8$
-------------------------                        VOLTAGE ANGLE:  -9.4 DEGREES
                  NET BRANCH DIVERSITY LOAD:     28. KW     11. KVAR
LOAD FROM: 6223 BUS 1-62BC   FEEDER AMPS:    54 VOLTAGE DROP:     1. %VD:  .14
PROJECTED POWER FLOW:     38. KW     14. KVAR     40. KVA    PF:    .93   LAGGING
LOSSES THRU FEEDER:        0. KW       0. KVAR        0. KVA

LOAD BUS:  624 MCC 1-62D  DESIGN VOLTAGE:   480 LOAD VOLTAGE:   425 %VD: 11.5$
-------------------------                        VOLTAGE ANGLE:  -9.5 DEGREES
                  NET BRANCH DIVERSITY LOAD:     21. KW     16. KVAR
LOAD FROM: 6214 MCC 1-62AD   FEEDER AMPS:    36 VOLTAGE DROP:     1. %VD:  .11
PROJECTED POWER FLOW:     21. KW     16. KVAR     26. KVA    PF:    .80   LAGGING
LOSSES THRU FEEDER:        0. KW       0. KVAR        0. KVA
```

Auxiliary Electrical System Study - Safety Injection Condition

WISCONSIN PUBLIC SERVICE CORPORATION - KEWAUNEE NUCLEAR PLANT

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BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS (BRANCH LOAD REPORT)

****

VOLTAGE EFFECT ON LOADS MODELED TRANSFORMER VOLTAGE DROP MODELED
VOLTAGE DROP CRITERIA: BRANCH = 3.75 % BUS = 10.00
PER UNIT DRIVING VOLTAGE = .9960

LOAD BUS: 625 MCC 1-62E DESIGN VOLTAGE: 480 LOAD VOLTAGE: 426 %VD: 11.2$
VOLTAGE ANGLE: -9.6 DEGREES
NET BRANCH DIVERSITY LOAD: 189. KW 123. KVAR
LOAD FROM: 6285 MCC 1-62HE FEEDER AMPS: 305 VOLTAGE DROP: 1. %VD: .22
PROJECTED POWER FLOW: 188. KW 123. KVAR 225. KVA PF: .84 LAGGING
LOSSES THRU FEEDER: 0. KW 0. KVAR 1. KVA

LOAD BUS: 626 MCC 1-62J DESIGN VOLTAGE: 480 LOAD VOLTAGE: 423 %VD: 11.9$ worst case Bus 6
VOLTAGE ANGLE: -9.8 DEGREES
NET BRANCH DIVERSITY LOAD: 185. KW 96. KVAR
LOAD FROM: 620 BUS 1-62 FEEDER AMPS: 284 VOLTAGE DROP: 6. %VD: 1.22
PROJECTED POWER FLOW: 185. KW 96. KVAR 208. KVA PF: .89 LAGGING
LOSSES THRU FEEDER: 2. KW 3. KVAR 3. KVA

LOAD BUS: 627 MCC 1-62G *** NO LOAD SPECIFIED ***

LOAD BUS: 628 MCC 1-62H DESIGN VOLTAGE: 480 LOAD VOLTAGE: 427 %VD: 11.0$
VOLTAGE ANGLE: -9.5 DEGREES
NET BRANCH DIVERSITY LOAD: 3. KW 2. KVAR
LOAD FROM: 6285 MCC 1-62HE FEEDER AMPS: 5 VOLTAGE DROP: 0. %VD: .00
PROJECTED POWER FLOW: 3. KW 2. KVAR 3. KVA PF: .86 LAGGING
LOSSES THRU FEEDER: 0. KW 0. KVAR 0. KVA

LOAD BUS: 629 MCC 1-62BE *** NO LOAD SPECIFIED *** end ↓

LOAD BUS: 1101 BRA106 SEC DESIGN VOLTAGE: 208 LOAD VOLTAGE: 182 %VD: 12.5$
VOLTAGE ANGLE: -10.4 DEGREES
LOAD FROM: 1106 BRA106 PRI TRANSF AMPS: 71 VOLTAGE DROP: 2. %VD: .82
PROJECTED POWER FLOW: 21. KW 7. KVAR 22. KVA PF: .95 LAGGING
LOSSES THRU TRANSF: .1 KW .2 KVAR .3 KVA

Auxiliary Electrical System Study - Safety Injection Condition

WISCONSIN PUBLIC SERVICE CORPORATION - KEWAUNEE NUCLEAR PLANT

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS (BRANCH LOAD REPORT)

****

VOLTAGE EFFECT ON LOADS MODELED TRANSFORMER VOLTAGE DROP MODELED
VOLTAGE DROP CRITERIA: BRANCH = 3.75 % BUS = 10.00
PER UNIT DRIVING VOLTAGE = .9960

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```
LOAD BUS: 3529 TRANS 1-53   *** NO LOAD SPECIFIED ***


LOAD BUS: 3536 BUS 1-35CF DESIGN VOLTAGE:   480 LOAD VOLTAGE:   423 %VD: 11.9%
-------------------------                     VOLTAGE ANGLE:   -9.8 DEGREES
LOAD FROM:  350 BUS 1-35      FEEDER AMPS:   216 VOLTAGE DROP:    0. %VD:  .00
PROJECTED POWER FLOW:   129. KW     91. KVAR   158. KVA    PF:   .82   LAGGING
LOSSES THRU FEEDER:       0. KW      0. KVAR      0. KVA


LOAD BUS: 3561 TRANSF SW  DESIGN VOLTAGE:   480 LOAD VOLTAGE:   425 %VD: 11.5$
-------------------------                     VOLTAGE ANGLE:   -9.9 DEGREES
LOAD FROM:  520 BUS 1-52      FEEDER AMPS:    27 VOLTAGE DROP:    0. %VD:  .05
PROJECTED POWER FLOW:    16. KW     12. KVAR    20. KVA    PF:   .80   LAGGING
LOSSES THRU FEEDER:       0. KW      0. KVAR      0. KVA


LOAD BUS: 3562 MCC 1-5262 DESIGN VOLTAGE:   480 LOAD VOLTAGE:   425 %VD: 11.5$
-------------------------                     VOLTAGE ANGLE:   -9.9 DEGREES
             NET BRANCH DIVERSITY LOAD:      16. KW     12. KVAR
LOAD FROM: 3561 TRANSF SW     FEEDER AMPS:    27 VOLTAGE DROP:    0. %VD:  .01
PROJECTED POWER FLOW:    16. KW     12. KVAR    20. KVA    PF:   .80   LAGGING
LOSSES THRU FEEDER:       0. KW      0. KVAR      0. KVA


LOAD BUS: 3610 SST 1-61   DESIGN VOLTAGE:  4160 LOAD VOLTAGE:  3857 %VD:  7.3
-------------------------                     VOLTAGE ANGLE:   -6.0 DEGREES
LOAD FROM: 3612 BUS 1-6-12    FEEDER AMPS:   103 VOLTAGE DROP:    3. %VD:  .08
PROJECTED POWER FLOW:   593. KW    344. KVAR   686. KVA    PF:   .87   LAGGING
LOSSES THRU FEEDER:       1. KW      0. KVAR      1. KVA


LOAD BUS: 3612 BUS 1-6-12 DESIGN VOLTAGE:  4160 LOAD VOLTAGE:  3860 %VD:  7.2
-------------------------                     VOLTAGE ANGLE:   -6.0 DEGREES
LOAD FROM:  600 BUS 1-6       FEEDER AMPS:   211 VOLTAGE DROP:    0. %VD:  .00
PROJECTED POWER FLOW:  1191. KW    759. KVAR  1413. KVA    PF:   .84   LAGGING
LOSSES THRU FEEDER:       0. KW      0. KVAR      0. KVA
```

Start

Auxiliary Electrical System Study - Safety Injection Condition

WISCONSIN PUBLIC SERVICE CORPORATION - KEWAUNEE NUCLEAR PLANT

BALANCED VOLTAGE DROP AND LOAD FLOW ANALYSIS (BRANCH LOAD REPORT)

****

VOLTAGE EFFECT ON LOADS MODELED TRANSFORMER VOLTAGE DROP MODELED
VOLTAGE DROP CRITERIA: BRANCH = 3.75 % BUS = 10.00
PER UNIT DRIVING VOLTAGE = .9960

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```
LOAD BUS: 3620 SST 1-62   DESIGN VOLTAGE:  4160 LOAD VOLTAGE:  3856 %VD:  7.3
-------------------------                       VOLTAGE ANGLE:  -6.0 DEGREES
LOAD FROM: 3612 BUS 1-6-12   FEEDER AMPS:   109 VOLTAGE DROP:     4. %VD:  .09
PROJECTED POWER FLOW:   596. KW   415. KVAR   727. KVA    PF:    .82  LAGGING
LOSSES THRU FEEDER:        1. KW        0. KVAR        1. KVA

LOAD BUS: 3622 TRANS 1-63  *** NO LOAD SPECIFIED ***

LOAD BUS: 3629 TRANS 1-63  *** NO LOAD SPECIFIED ***
```

end ↓

```
LOAD BUS: 4224 BUS 1-42BD DESIGN VOLTAGE:   480 LOAD VOLTAGE:   432 %VD:  9.9
-------------------------                       VOLTAGE ANGLE:  -8.5 DEGREES
LOAD FROM:  420 BUS 1-42     FEEDER AMPS:   366 VOLTAGE DROP:     0. %VD:  .00
PROJECTED POWER FLOW:   243. KW   126. KVAR   274. KVA    PF:    .89  LAGGING
LOSSES THRU FEEDER:        0. KW        0. KVAR        0. KVA

LOAD BUS: 4236 BUS 1-42CF DESIGN VOLTAGE:   480 LOAD VOLTAGE:   432 %VD:  9.9
-------------------------                       VOLTAGE ANGLE:  -8.5 DEGREES
LOAD FROM:  420 BUS 1-42     FEEDER AMPS:   219 VOLTAGE DROP:     0. %VD:  .00
PROJECTED POWER FLOW:   160. KW    38. KVAR   164. KVA    PF:    .97  LAGGING
LOSSES THRU FEEDER:        0. KW        0. KVAR        0. KVA

LOAD BUS: 4271 MCC 1-42GA DESIGN VOLTAGE:   480 LOAD VOLTAGE:   430 %VD: 10.4$
-------------------------                       VOLTAGE ANGLE:  -8.4 DEGREES
LOAD FROM:  420 BUS 1-42     FEEDER AMPS:    97 VOLTAGE DROP:     2. %VD:  .46
PROJECTED POWER FLOW:    61. KW    40. KVAR    73. KVA    PF:    .84  LAGGING
LOSSES THRU FEEDER:        0. KW        0. KVAR        0. KVA

LOAD BUS: 4524 BUS 1-45BD DESIGN VOLTAGE:   480 LOAD VOLTAGE:   427 %VD: 11.0$
-------------------------                       VOLTAGE ANGLE:  -9.8 DEGREES
LOAD FROM:  450 BUS 1-45     FEEDER AMPS:    80 VOLTAGE DROP:     0. %VD:  .00
PROJECTED POWER FLOW:    56. KW    19. KVAR    59. KVA    PF:    .95  LAGGING
LOSSES THRU FEEDER:        0. KW        0. KVAR        0. KVA
```