GENERATOR INTERCONNECTION AFFECTED SYSTEM IMPACT STUDY REPORT

GIA-77 & GIA-78

Published July 2020

By SPP Generator Interconnections Dept.

REVISION HISTORY

Date	Author	Change Description
7/23/2019	SPP	Affected System Impact Study for AECI GIA-77 and GIA-78 Report Revision 0 Issued

EXECUTIVE SUMMARY

The AECI interconnection requests GIA-77 & GIA-78 were submitted to the AECI queue on 1/18/2019. In accordance with the Joint Operating Agreement between SPP and AECI, SPP was requested to study GIA-77 & GIA-78 to determine the impacts to the SPP transmission system on or around the proposed in-service dates of 9/28/2019 and 9/28/2020, respectively.

GIA-77 and GIA-78 represent a 50 MW and 52 capacity increase to the exiting Choteau units. These facilities are located in Mayes County, OK at the Chouteau 161 kV substation.

SPP has concluded that the increase of generation at the Choteau site does add to existing line loading limitations surrounding the area. The existing operating limits of these units have to be observed. The ASIS analysis did not identify any overloads or degradation to the SPP network due to GIA-77 and GIA-78 to interconnect the additional 102MW of generation with Energy Resource Interconnection Service (ERIS) and Network Resource Interconnection Service (NRIS).

It should be noted that although this ASIS analyzed many of the most probable contingencies, it is not an all-inclusive list that can account for every operational situation. Additionally, the generator may not be able to inject any power onto the Transmission System due to constraints that fall below the threshold of mitigation for a Generator Interconnection request. Because of this, it is likely that the Customer(s) may be required to reduce their generation output to 0 MW under certain system conditions to allow system operators to maintain the reliability of the transmission network.

Power flow analysis has yet to be performed. The following report details stability only.

Short circuit analysis was not performed since the generator parameters did not change.

Transient stability analysis for this ASIS was performed. For three phase faults with normal clearing and phase to ground faults with breaker failure, no transient stability issues were identified in this study due to the addition of the GIA-77 and GIA-78. For extreme faults, the operating limits for the existing generators need to be observed. For the severe fault, FLT_238 (Maid – Choteau 161kV line out of service, 3phase fault on Sportsman – GRDA1 7 345kV line clearing in 5 cycles), the stability operating limits of these units is a combined 935MW (units cannot operate at Pmax). Other extreme faults, three phase faults with breaker failure (FLT_001 -016), also showed instability and the critical clearing times were evaluated.

Nothing in this study should be construed as a guarantee of delivery or transmission service. If the customer(s) wishes to move power across the facilities of SPP, a separate request for transmission service must be made on Southwest Power Pool's OASIS by the Customer(s).

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PURPOSE

An Affected System Interconnection Customer has requested an Affected System Impact Study (ASIS) consistent with the Southwest Power Pool (SPP) Open Access Transmission Tariff (OATT) for interconnection requests on the Associated Electric Cooperative Inc. (AECI) transmission system.

The purpose of this study is to evaluate the impacts of interconnecting the AECI GIA-77 and GIA-78 requests. GIA-77 and GIA-78 are requesting the interconnection of a total increase of 102 MW combined cycle generators at the Point of Interconnection (POI) and associated facilities interconnecting to AECI at Choteau 1 and Choteau2 161kV substations in Mayes County, Oklahoma.

The ASIS considers the Base Case as well as all Generating Facilities (and with respect to (b) below, any identified Network Upgrades associated with such higher queued interconnection) that, on the date the ASIS is commenced:

a) are directly interconnected to the Transmission System;
b) are interconnected to Affected Systems and may have an impact on the Interconnection Request;
c) have a pending higher queued Interconnection Request to interconnect to the Transmission System listed in **Table 1** or
d) have no Queue Position but have executed an LGIA or requested that an unexecuted LGIA be filed with FERC.

Any changes to these assumptions, for example, one or more of the previously queued requests not included within this study execute an interconnection agreement and commencing commercial operation, may require a re-study of this ASIS at the expense of the Customer(s).

Nothing within this System Impact Study constitutes a request for transmission service or confers upon the Interconnection Customer(s) any right to receive transmission service rights. Should the Customer(s) require transmission service, those rights should be requested through SPP's Open Access Same-Time Information System (OASIS) or that of the applicable transmission provider.

This ASIS included prior queued generation interconnection requests. Requests listed within **Table 1** are assumed to have either full or partial interconnection service prior to the requested in-service date for this ASIS.

Table 1: SPP Higher Queued Interconnection Requests Included

GI Number	Capacity	Type	Service
GEN-2017-009	302	Wind	ER
GEN-2017-060	149	Wind	ER
GEN-2017-082	149	Wind	ER

Table 2: AECI Interconnection Requests Included

GI Number	Capacity	Type	Service
GIA-68	400[1]	Solar	ER/NR
GIA-77	50	CCT	ER/NR
GIA-78	52	CCT	ER/NR

[1] While this request has reduced to 200 MW, the results of this stability analysis were conducted under the assumption that the capacity of GIA-68 was 400 MW. A restudy of the stability analysis under the reduced amount was determined not to be necessary.

SPP's analysis for reviewing impacts for AECI's GIA-77 and GIA-78 was based on the higher-queued planned projects **Table 3** being in-service by 12/31/2019. Please note that as this network upgrade is no longer assigned to either DISIS-2016-001 or DISIS-2016-002, it will be necessary to refresh this analysis at a later date.

Table 3: Higher Queued Network Upgrades Included in the Study

Upgrades
16.DIS16014_ERIS_G08_BUILD_WOLFCREEK-EMPORIA-345kV-CKT1

At this time there are no stability network upgrades required for full interconnection service for any of the interconnection requests listed in **Table 2**. However, please note that as the powerflow analysis for these requests has yet to be completed and the higher queued network upgrades listed in **Table 3** have changed, a restudy will be required to confirm these study results.

Any upgrades assigned by SPP will require an Affected System Facilities Study agreement and deposit. These upgrades may require a Construction Agreement (CA) as a result of the Affected System Facilities Study.

Any changes to these assumptions may require a re-study of this ASIS at the expense of the Customer(s).

Nothing in this System Impact Study constitutes a request for transmission service or grants the Interconnection Customer(s) any rights to transmission service.

Posted SPP affected system reports can be located at the following Generation Interconnection Study URL: http://opsportal.spp.org/Studies/Gen

FACILITIES

GENERATING FACILITY

The Affected System Interconnection Customers' request the increase of 102MW combined cycle facilities at Choteau 1 (52MW) and Choteau 2 (50MW) 161kV substations. The Choteau generators were modeled using the assumptions provided by AECI for a net increase of 102 MW on the AECI transmission system in Mayes County, OK.

INTERCONNECTION FACILITIES

The GIA-77 and GIA-78 Interconnection Customer has requested a connection to the Affected System via the existing Choteau 1 and Choteau 2 161kV transmission system in Mayes County, OK. **Figure 1** illustrates the current study request, GIA-77 and 078.

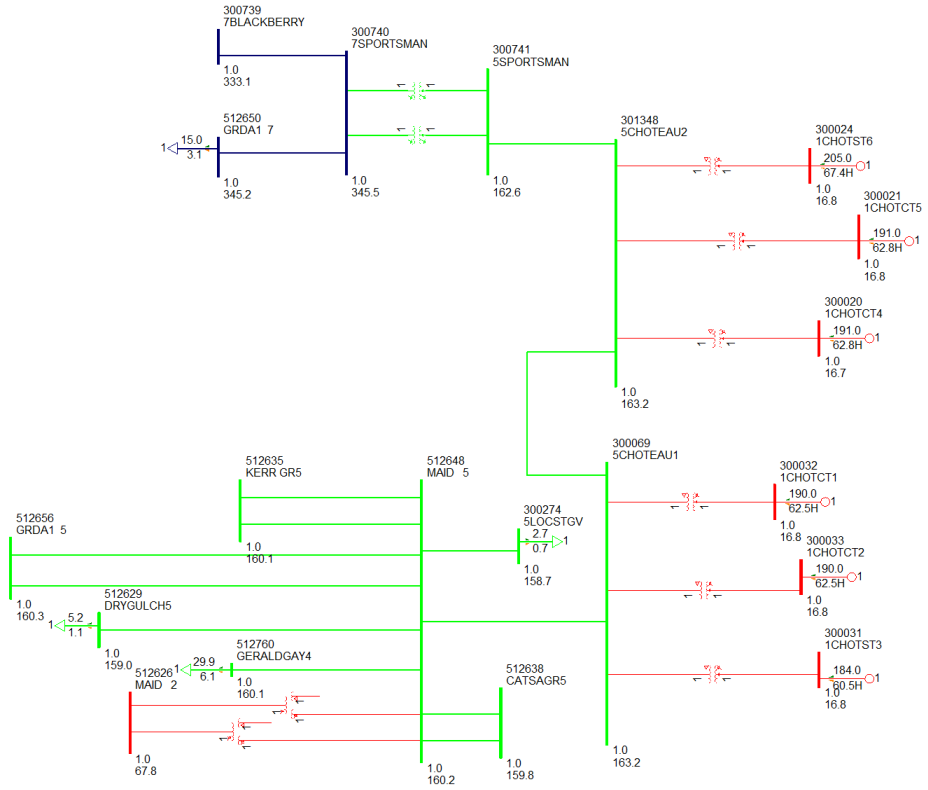

Figure 1: Proposed GIA-77 and GIA-78 Configuration and Request Dynamic Model

STABILITY ANAYLSIS

Stability analysis was performed to evaluate the effect of the addition of 102MW generating facility GIA-77 and GIA-78 on the system.

MODEL PREPARATION

Power flow analysis was performed using modified versions of the MDWG16 series study models including these seasonal models:

- 2017 Winter Peak (17WP)
- 2018 Summer Peak (18SP)
- 2026 Summer Peak (26SP)

To incorporate the Interconnection Customers' request, a re-dispatch of existing generation within AECI was performed with respect to the amount of the Customers' injection. The Group 8 dispatch scenario was considered. Higher Queue upgrades (Wolf Creek – Emporia 345kV transmission line) identified in Table 3 were included into the models.

GIA-68, GIA-77 and GIA-78 generators were dispatched into AECI.

To eliminate initialization suspect errors, the remote bus at the study generator was changed from the POI bus to its generator bus.

Machine angles, generator terminal voltage, generator power, generator VAR, generator speed and voltages were monitored.

Relay tripping was disabled for this analysis so that regional generator stability could be observed during these faults.

1) Assessment shall consist of 3-phase and phase-to-ground faults applied at the buses of the proposed interconnection plus all first-tier buses to the interconnection.

The 3-phase faults and phase-to-ground faults were simulated at the POI of GIA-77 and 078 plus all first tier buses to the interconnection (Choteau1, Choteau2, Sportsman, GRDA1 and Maid 161kV stations, Sportsman and GRDA1 345kV stations). Three phase faults were simulated at each 345kV station on each line clearing in 5 cycles and 161kV station clearing in 7 cycles. The three phase faults were also simulated with reclosing in 20cycles on the fault and clearing in 5 or 7 cycles to clear the fault. Phase-to-ground faults with breaker failure were simulated at every line at each of these stations (5 cycles (345kV) or 7 cycles (161kV) near end, then 9cycles opening remote end). GRDA provided relaying scenarios to test with breaker failures at the Maid, GRDA1 161kV and GRDA1 and GREC TAP 345kV stations (Faults FLT_001-016). The impedance of the single line to ground faults was estimated such that when the fault is applied, the voltage at the station drops to 60% of nominal voltage. The following tables show the faults that were analyzed.

Table 4: Faults analyzed for Stability

3 Phase faults Normal Clearing and Reclosing on Fault/Clearing			
Fault Name	**Fault Location**	**Description**	**Clearing time**
FLT_201_5CHOTEAU1_5CHOTEAU1-5CHOTEAU2_161kV_3PH	CHOTEAU1 161kV	APPLY 3PH FAULT AT 5CHOTEAU1 161KV BUS, OPEN 5CHOTEAU1 -5CHOTEAU2 161KV CKT 1 LINE	7cy
FLT_201rec_5CHOTEAU1_5CHOTEAU1-5CHOTEAU2_161kV_3PH	CHOTEAU1 161kV	APPLY 3PH FAULT AT 5CHOTEAU1 161KV BUS, OPEN 5CHOTEAU1 -5CHOTEAU2 161KV CKT 1 LINE, WAIT 20cy RECLOSE LINE BREAKERS, TRIP IN 7cy	7CY, RECLOSE 20CY, TRIP 7CY
FLT_202_5CHOTEAU1_5CHOTEAU1-MAID5_161kV_3PH	CHOTEAU1 161kV	APPLY 3PH FAULT AT 5CHOTEAU1 161KV BUS, OPEN 5CHOTEAU1 - MAID 5 161KV CKT 1 LINE	7cy
FLT_202rec_5CHOTEAU1_5CHOTEAU1-MAID5_161kV_3PH	CHOTEAU1 161kV	APPLY 3PH FAULT AT 5CHOTEAU1 161KV BUS, OPEN 5CHOTEAU1 - MAID 5 161KV CKT 1 LINE, WAIT 20cy RECLOSE LINE BREAKERS, TRIP IN 7cy	7CY, RECLOSE 20CY, TRIP 7CY
FLT_203_5CHOTEAU2_5CHOTEAU2-5SPORTSMAN_161kV_3PH	CHOTEAU2 161kV	APPLY 3PH FAULT AT 5CHOTEAU2 161KV BUS, OPEN 5CHOTEAU2 - 5SPORTSMAN 161KV CKT 1 LINE	7cy
FLT_203rec_5CHOTEAU2_5CHOTEAU2-5SPORTSMAN_161kV_3PH	CHOTEAU2 161kV	APPLY 3PH FAULT AT 5CHOTEAU2 161KV BUS, OPEN 5CHOTEAU2 - 5SPORTSMAN 161KV CKT 1 LINE, WAIT 20cy RECLOSE LINE BREAKERS, TRIP IN 7cy	7CY, RECLOSE 20CY, TRIP 7CY
FLT_204_5SPORTSMAN_7SPORTSMAN_345-161kV_3PH	SPORTSMAN 161kV	APPLY 3PH FAULT AT 5SPORTSMAN 161KV BUS, OPEN 5SPORTSMAN - 7SPORTSMAN 161/345KV TRANSFORMER CKT 1	7cy
FLT_205_5SPORTSMAN_5SPORTSMAN-5CHOTEAU2_161kV_3PH	SPORTSMAN 161kV	APPLY 3PH FAULT AT 5SPORTSMAN 161KV BUS, OPEN 5SPORTSMAN - 5CHOTEAU2 161KV CKT 1 LINE	7cy
FLT_205rec_5SPORTSMAN_5SPORTSMAN-5CHOTEAU2_161kV_3PH	SPORTSMAN 161kV	APPLY 3PH FAULT AT 5SPORTSMAN 161KV BUS, OPEN 5SPORTSMAN - 5CHOTEAU2 161KV CKT 1 LINE, WAIT 20cy RECLOSE LINE BREAKERS, TRIP IN 7cy	7CY, RECLOSE 20CY, TRIP 7CY
FLT_206_7SPORTSMAN_7SPORTSMAN-7GRDA1_7_345kV_3PH	SPORTSMAN 345kV	APPLY 3PH FAULT AT 7SPORTSMAN 345KV BUS, OPEN 7SPORTSMAN - GRDA1 7 345KV CKT 1 LINE	5cy
FLT_206rec_7SPORTSMAN_7SPORTSMAN-7GRDA1_7_345kV_3PH	SPORTSMAN 345kV	APPLY 3PH FAULT AT 7SPORTSMAN 345KV BUS, OPEN 7SPORTSMAN - GRDA1 7 345KV CKT 1 LINE, WAIT 20cy RECLOSE LINE BREAKERS, TRIP IN 5cy	5CY, RECLOSE 20CY, TRIP 5CY
FLT_207_7SPORTSMAN_7SPORTSMAN-7BLACKBERRY_345kV_3PH	SPORTSMAN 345kV	APPLY 3PH FAULT AT 7SPORTSMAN 345KV BUS, OPEN 7SPORTSMAN - 7BLACKBERRY 345KV CKT 1 LINE	5cy
FLT_207rec_7SPORTSMAN_7SPORTSMAN-7BLACKBERRY_345kV_3PH	SPORTSMAN 345kV	APPLY 3PH FAULT AT 7SPORTSMAN 345KV BUS, OPEN 7SPORTSMAN - 7BLACKBERRY 345KV CKT 1 LINE, WAIT 20cy RECLOSE LINE BREAKERS, TRIP IN 5cy	5CY, RECLOSE 20CY, TRIP 5CY
FLT_208_7SPORTSMAN_7SPORTSMAN_345-161kV_3PH	SPORTSMAN 345kV	APPLY 3PH FAULT AT 7SPORTSMAN 345KV BUS, OPEN 7SPORTSMAN - 5SPORTSMAN 345/161KV TRANSFORMER CKT 1	5cy
FLT_209_GRDA1_7_GRDA1_7-GREC_TAP7_345kV_3PH	GRDA1 345kV	APPLY 3PH FAULT AT GRDA1 7 345KV BUS, OPEN GRDA1 7 - GREC TAP7 345KV CKT 1 LINE	5cy
FLT_209rec_GRDA1_7_GRDA1_7-GREC_TAP7_345kV_3PH	GRDA1 345kV	APPLY 3PH FAULT AT GRDA1 7 345KV BUS, OPEN GRDA1 7 - GREC TAP7 345KV CKT 1 LINE, WAIT 20cy RECLOSE LINE BREAKERS, TRIP IN 5cy	5CY, RECLOSE 20CY, TRIP 5CY
FLT_210_GRDA1_7_GRDA1_TONECE7_345kV_3PH	GRDA1 345kV	APPLY 3PH FAULT AT GRDA1 7 345KV BUS, OPEN GRDA1 7 - TONECE7 345KV CKT 1 LINE	5cy
FLT_210rec_GRDA1_7_GRDA1_TONECE7_345kV_3PH	GRDA1 345kV	APPLY 3PH FAULT AT GRDA1 7 345KV BUS, OPEN GRDA1 7 - TONECE7 345KV CKT 1 LINE, WAIT 20cy RECLOSE LINE BREAKERS, TRIP IN 5cy	5CY, RECLOSE 20CY, TRIP 5CY
FLT_211_GRDA1_7_7SPORTSMAN-7GRDA1_7_345kV_3PH	GRDA1 345kV	APPLY 3PH FAULT AT GRDA1 7 345KV BUS, OPEN 7SPORTSMAN - GRDA1 7 345KV CKT 1 LINE	5cy
FLT_211rec_GRDA1_7_7SPORTSMAN-7GRDA1_7_345kV_3PH	GRDA1 345kV	APPLY 3PH FAULT AT GRDA1 7 345KV BUS, OPEN 7SPORTSMAN - GRDA1 7 345KV CKT 1 LINE, WAIT 20cy RECLOSE LINE BREAKERS, TRIP IN 5cy	5CY, RECLOSE 20CY, TRIP 5CY
FLT_212_GRDA1_5_GRDA1_5_WAGNOR5_161kV_3PH	GRDA1 161kV	APPLY 3PH FAULT AT GRDA1 5 161KV BUS, OPEN GRDA1 5 - WAGNOR 5 161KV CKT 1 LINE	7cy
FLT_212rec_GRDA1_5_GRDA1_5_WAGNOR5_161kV_3PH	GRDA1 161kV	APPLY 3PH FAULT AT GRDA1 5 161KV BUS, OPEN GRDA1 5 - WAGNOR 5 161KV CKT 1 LINE, WAIT 20cy RECLOSE LINE BREAKERS, TRIP IN 7cy	7CY, RECLOSE 20CY, TRIP 7CY

3 Phase faults Normal Clearing and Reclosing on Fault/Clearing			
Fault Name	**Fault Location**	**Description**	**Clearing time**
FLT_213_GRDA1_7_GRDA1_7_GRDA1_5_345-161kV_3PH	GRDA1 345kV	APPLY 3PH FAULT AT GRDA1 7 345KV BUS, OPEN GRDA1 7 - GRDA1 5 - GRDA1 TRANSFORMER 1	5cy
FLT_214_GRDA1_5_GRDA1_5_CLARMR5_161kV_3PH	GRDA1 161kV	APPLY 3PH FAULT AT GRDA1 5 161KV BUS, OPEN GRDA1 5 - CLARMR 5 161KV CKT 1 LINE	7cy
FLT_214rec_GRDA1_5_GRDA1_5_CLARMR5_161kV_3PH	GRDA1 161kV	APPLY 3PH FAULT AT GRDA1 5 161KV BUS, OPEN GRDA1 5 - CLARMR 5 161KV CKT 1 LINE, WAIT 20cy RECLOSE LINE BREAKERS, TRIP IN 7cy	7CY, RECLOSE 20CY, TRIP 7CY
FLT_215_GRDA1_5_GRDA1_5_MAID5_161kV_3PH	GRDA1 161kV	APPLY 3PH FAULT AT GRDA1 5 161KV BUS, OPEN GRDA1 5 - MAID 5 161KV CKT 1 LINE	7cy
FLT_215rec_GRDA1_5_GRDA1_5_MAID5_161kV_3PH	GRDA1 161kV	APPLY 3PH FAULT AT GRDA1 5 161KV BUS, OPEN GRDA1 5 - MAID 5 161KV CKT 1 LINE, WAIT 20cy RECLOSE LINE BREAKERS, TRIP IN 7cy	7CY, RECLOSE 20CY, TRIP 7CY
FLT_216_GRDA1_5_GRDA1_5_WMAINST5_161kV_3PH	GRDA1 161kV	APPLY 3PH FAULT AT GRDA1 5 161KV BUS, OPEN GRDA1 5 - WMAIN ST5 161KV CKT 1 LINE	7cy
FLT_216rec_GRDA1_5_GRDA1_5_WMAINST5_161kV_3PH	GRDA1 161kV	APPLY 3PH FAULT AT GRDA1 5 161KV BUS, OPEN GRDA1 5 - WMAIN ST5 161KV CKT 1 LINE, WAIT 20cy RECLOSE LINE BREAKERS, TRIP IN 7cy	7CY, RECLOSE 20CY, TRIP 7CY
FLT_217_MAID_5_MAID_5_CATSAGR5_161kV_3PH	MAID 161kV	APPLY 3PH FAULT AT MAID 5 161KV BUS, OPEN MAID 5 - CATSAGR5 161KV CKT 1 LINE	7cy
FLT_217rec_MAID_5_MAID_5_CATSAGR5_161kV_3PH	MAID 161kV	APPLY 3PH FAULT AT MAID 5 161KV BUS, OPEN MAID 5 - CATSAGR5 161KV CKT 1 LINE, WAIT 20cy RECLOSE LINE BREAKERS, TRIP IN 7cy	7CY, RECLOSE 20CY, TRIP 7CY
FLT_218_MAID_5_MAID_5_GRDA1_5_161kV_3PH	MAID 161kV	APPLY 3PH FAULT AT MAID 5 161KV BUS, OPEN MAID 5 - GRDA1 5 161KV CKT 1 LINE	7cy
FLT_218rec_MAID_5_MAID_5_GRDA1_5_161kV_3PH	MAID 161kV	APPLY 3PH FAULT AT MAID 5 161KV BUS, OPEN MAID 5 - GRDA1 5 161KV CKT 1 LINE, WAIT 20cy RECLOSE LINE BREAKERS, TRIP IN 7cy	7CY, RECLOSE 20CY, TRIP 7CY
FLT_219_MAID_5_MAID_5_DRYGULCH5_161kV_3PH	MAID 161kV	APPLY 3PH FAULT AT MAID 5 161KV BUS, OPEN MAID 5 - DRYGULCH5 161KV CKT 1 LINE	7cy
FLT_219rec_MAID_5_MAID_5_DRYGULCH5_161kV_3PH	MAID 161kV	APPLY 3PH FAULT AT MAID 5 161KV BUS, OPEN MAID 5 - DRYGULCH5 161KV CKT 1 LINE, WAIT 20cy RECLOSE LINE BREAKERS, TRIP IN 7cy	7CY, RECLOSE 20CY, TRIP 7CY
FLT_220_MAID_5_MAID_5_5LOCSTGV_161kV_3PH	MAID 161kV	APPLY 3PH FAULT AT MAID 5 161KV BUS, OPEN MAID 5 - 5LOCSTGV 161KV CKT 1 LINE	7cy
FLT_220rec_MAID_5_MAID_5_5LOCSTGV_161kV_3PH	MAID 161kV	APPLY 3PH FAULT AT MAID 5 161KV BUS, OPEN MAID 5 - 5LOCSTGV 161KV CKT 1 LINE, WAIT 20cy RECLOSE LINE BREAKERS, TRIP IN 7cy	7CY, RECLOSE 20CY, TRIP 7CY
FLT_221_MAID_5_MAID_5_GERALDGAY4_161kV_3PH	MAID 161kV	APPLY 3PH FAULT AT MAID 5 161KV BUS, OPEN MAID 5 - GERALDGAY4 161KV CKT 1 LINE	7cy
FLT_221rec_MAID_5_MAID_5_GERALDGAY4_161kV_3PH	MAID 161kV	APPLY 3PH FAULT AT MAID 5 161KV BUS, OPEN MAID 5 - GERALDGAY4 161KV CKT 1 LINE, WAIT 20cy RECLOSE LINE BREAKERS, TRIP IN 7cy	7CY, RECLOSE 20CY, TRIP 7CY
FLT_222_MAID_5_MAID_5_5CHOTEAU1_161kV_3PH	MAID 161kV	APPLY 3PH FAULT AT MAID 5 161KV BUS, OPEN MAID 5 - 5CHOTEAU1 161KV CKT 1 LINE	7cy
FLT_222rec_MAID_5_MAID_5_5CHOTEAU1_161kV_3PH	MAID 161kV	APPLY 3PH FAULT AT MAID 5 161KV BUS, OPEN MAID 5 - 5CHOTEAU1 161KV CKT 1 LINE, WAIT 20cy RECLOSE LINE BREAKERS, TRIP IN 7cy	7CY, RECLOSE 20CY, TRIP 7CY
FLT_223_MAID_5_MAID_5_KERRGR5_161kV_3PH	MAID 161kV	APPLY 3PH FAULT AT MAID 5 161KV BUS, OPEN MAID 5 - KERR GR5 161KV CKT 1 LINE	7cy
FLT_223rec_MAID_5_MAID_5_KERRGR5_161kV_3PH	MAID 161kV	APPLY 3PH FAULT AT MAID 5 161KV BUS, OPEN MAID 5 - KERR GR5 161KV CKT 1 LINE, WAIT 20cy RECLOSE LINE BREAKERS, TRIP IN 7cy	7CY, RECLOSE 20CY, TRIP 7CY

Single Line to Ground Faults with Breaker Failure			
Fault Name	**Fault Location**	**Description**	**Clearing time**
FLT_001_GRDA17-1-GRDA17-GRDA15_345kV_1PH	GRDA17-1	Apply SLG fault at GRDA17-1 22.8 kV bus. Trip GRDA17-1 Unit 2 & GRDA 345/161 kV Xfmr #2	5cy + 9cy

Single Line to Ground Faults with Breaker Failure			
Fault Name	**Fault Location**	**Description**	**Clearing time**
FLT_002_GRDA1_7-GREC_TAP7_345kV_1PH	GRDA1 345kV	Apply SLG fault at GRDA1 7 345 kV bus. Trip the GRDA1 7 to GREC TAP7 345.00 kV line and GRDA 345/161 kV Xfmr #1	5cy + 9cy
FLT_003_GRDA1_7-7SPORTSMAN_345kV_GRDA-XFMR1_1PH	GRDA1 345kV	Apply SLG fault at GRDA1 7 345 kV bus. Trip the GRDA1 7 to 7SPORTSMAN 345.00 kV line and GRDA 345/161 kV Xfmr #1	5cy + 9cy
FLT_004_GRDA1_7-GREC_TAP7_345kV_GREC-GEN2_1PH	GRDA1 345kV	Apply SLG fault at GRDA1 7 345 kV bus. Trip the GRDA1 7 to GREC TAP7 345kV line and GREC Unit 2	5cy + 9cy
FLT_005_GRDA1_7-TONECE_345kV_GRDA_XFMR2_1PH	GRDA1 345kV	Apply SLG fault at GRDA1 7 345 kV bus. Trip the GRDA1 7 to Tonnece 345 kV line and GRDA 345/161 kV Xfmr #2	5cy + 9cy
FLT_006_GRECSTG_1-GREC1_7_GREC_TAP7_345kV_1PH	GRECSTG_1	Apply SLG fault at GRECCTG_1 20-kV bus. Trip GRECSTG_1 and the GREC1 7 to GREC TAP7 345.00 kV line	5cy + 9cy
FLT_007_GREC_TAP7_GRDA1_7_345kV_GRDA_XFMR1_1PH	GREC TAP 345kV	Apply SLG fault at GREC TAP7 345 kV bus. Trip the GREC TAP7 to GRDA1 7 345.00 kV line and GRDA 345/161 kV Xfmr #1	5cy + 9cy
FLT_008_GREC_TAP7_GRDA1_7_345kV_GREC_GEN2_1PH	GREC TAP 345kV	Apply SLG fault at GREC TAP7 345 kV bus. Trip the GREC TAP7 to GRDA1 7 345.00 kV line and GREC Unit 2	5cy + 9cy
FLT_009_GRDA1_5_CLARMR5_161kV_WAGNOR5_1PH	GRDA1 161kV	Apply SLG fault at GRDA1 5 161 kV bus. Trip the GRDA1 5 to CLARMR 5 161.00 kV line and Disconnect WAGNOR 5 bus	7cy + 9cy
FLT_010_GRDA1_5_WMAINST5_161kV_MAID5_1PH	GRDA1 161kV	Apply SLG fault at GRDA1 5 161 kV bus. Trip the GRDA1 5 to WMAIN ST5 161.00 kV line and GRDA1 5 to MAID 5 161.00 kV line	7cy + 9cy
FLT_011_GRDA1_5_MAID5_161kV_GRDA1_2_XFMR1_1PH	GRDA1 161kV	Apply SLG fault at GRDA1 5 161 kV bus. Trip the GRDA1 5 to MAID 5 161.00 kV line and GRDA 161/69 kV Xfmr #1	7cy + 9cy
FLT_012_MAID5_161kV_MAID5-CATSAGR5_1PH	MAID 161kV	Apply SLG fault at MAID 5 161 kV bus. Trip the MAID 5 to CATSAGR5 161.00 kV line and MAID 5 to CATSAGR5 161.00 kV line	7cy + 9cy
FLT_013_MAID5-GERALDGAY_161kV_MAID5-CHOTEAU_1PH	MAID 161kV	Apply SLG fault at MAID 5 161 kV bus. Trip the MAID 5 to GERALDGAY5 161.00 kV line and MAID 5 to 5CHOTEAU1 161.00 kV line	7cy + 9cy
FLT_014_MAID5-KERRGR5_161kV_MAID5-KERRGR5_1PH	MAID 161kV	Apply SLG fault at MAID 5 161 kV bus. Trip the MAID 5 to KERR GR5 161.00 kV line and MAID 5 to KERR GR5 161.00 kV line	7cy + 9cy
FLT_015_MAID5-GRDA1_5_161kV_MAID5-GRDA1_5_1PH	MAID 161kV	Apply SLG fault at MAID 5 161 kV bus. Trip the MAID 5 to GRDA1 5 161.00 kV line and MAID 5 to GRDA1 5 161.00 kV line	7cy + 9cy
FLT_016_MAID5-DRYGULCH5_161kV_5LOCSTGV_1PH	MAID 161kV	Apply SLG fault at MAID 5 161 kV bus. Trip the MAID 5 to DRYGULCH5 5 161.00 kV line and Disconnect 5LOCSTGV bus	7cy + 9cy

Extreme Faults			
Fault Name	**Fault Location**	**Description**	**Clearing time**
FLT_001_GRDA17-1-GRDA17-GRDA15_345kV_3PH	GRDA17-1	Apply 3-phase fault at GRDA17-1 22.8 kV bus. Trip GRDA17-1 Unit 2 & GRDA 345/161 kV Xfmr #2	5cy + 9cy
FLT_002_GRDA1_7-GREC_TAP7_345kV_3PH	GRDA1 345kV	Apply 3-phase fault at GRDA1 7 345 kV bus. Trip the GRDA1 7 to GREC TAP7 345.00 kV line and GRDA 345/161 kV Xfmr #1	5cy + 9cy
FLT_003_GRDA1_7-7SPORTSMAN_345kV_GRDA-XFMR1_3PH	GRDA1 345kV	Apply3-phase fault at GRDA1 7 345 kV bus. Trip the GRDA1 7 to 7SPORTSMAN 345.00 kV line and GRDA 345/161 kV Xfmr #1	5cy + 9cy
FLT_004_GRDA1_7-GREC_TAP7_345kV_GREC-GEN2_3PH	GRDA1 345kV	Apply 3-phase fault at GRDA1 7 345 kV bus. Trip the GRDA1 7 to GREC TAP7 345kV line and GREC Unit 2	5cy + 9cy
FLT_005_GRDA1_7-TONECE_345kV_GRDA_XFMR2_3PH	GRDA1 345kV	Apply 3-phase fault at GRDA1 7 345 kV bus. Trip the GRDA1 7 to Tonnece 345 kV line and GRDA 345/161 kV Xfmr #2	5cy + 9cy
FLT_006_GRECSTG_1-GREC1_7_GREC_TAP7_345kV_3PH	GRECSTG_1	Apply 3-phase fault at GRECCTG_1 20-kV bus. Trip GRECSTG_1 and the GREC1 7 to GREC TAP7 345.00 kV line	5cy + 9cy
FLT_007_GREC_TAP7_GRDA1_7_345kV_GRDA_XFMR1_3PH	GREC TAP 345kV	Apply 3-phase fault at GREC TAP7 345 kV bus. Trip the GREC TAP7 to GRDA1 7 345.00 kV line and GRDA 345/161 kV Xfmr #1	5cy + 9cy
FLT_008_GREC_TAP7_GRDA1_7_345kV_GREC_GEN2_3PH	GREC TAP 345kV	Apply 3-phase fault at GREC TAP7 345 kV bus. Trip the GREC TAP7 to GRDA1 7 345.00 kV line and GREC Unit 2	5cy + 9cy
FLT_009_GRDA1_5_CLARMR5_161kV_WAGNOR5_3PH	GRDA1 161kV	Apply 3-phase fault at GRDA1 5 161 kV bus. Trip the GRDA1 5 to CLARMR 5 161.00 kV line and Disconnect WAGNOR 5 bus	7cy + 9cy

Extreme Faults			
Fault Name	**Fault Location**	**Description**	**Clearing time**
FLT_010_GRDA1_5_WMAINST5_161kV_MAID5_3PH	GRDA1 161kV	Apply 3-phase fault at GRDA1 5 161 kV bus. Trip the GRDA1 5 to WMAIN ST5 161.00 kV line and GRDA1 5 to MAID 5 161.00 kV line	7cy + 9cy
FLT_011_GRDA1_5_MAID5_161kV_GRDA1_2_XFMR1_3PH	GRDA1 161kV	Apply 3-phase fault at GRDA1 5 161 kV bus. Trip the GRDA1 5 to MAID 5 161.00 kV line and GRDA 161/69 kV Xfmr #1	7cy + 9cy
FLT_012_MAID5_161kV_MAID5-CATSAGR5_3PH	MAID 161kV	Apply 3-phase fault at MAID 5 161 kV bus. Trip the MAID 5 to CATSAGR5 161.00 kV line and MAID 5 to CATSAGR5 161.00 kV line	7cy + 9cy
FLT_013_MAID5-GERALDGAY_161kV_MAID5-CHOTEAU_3PH	MAID 161kV	Apply 3-phase fault at MAID 5 161 kV bus. Trip the MAID 5 to GERALDGAY5 161.00 kV line and MAID 5 to 5CHOTEAU1 161.00 kV line	7cy + 9cy
FLT_014_MAID5-KERRGR5_161kV_MAID5-KERRGR5_3PH	MAID 161kV	Apply 3-phase fault at MAID 5 161 kV bus. Trip the MAID 5 to KERR GR5 161.00 kV line and MAID 5 to KERR GR5 161.00 kV line	7cy + 9cy
FLT_015_MAID5-GRDA1_5_161kV_MAID5-GRDA1_5_3PH	MAID 161kV	Apply 3-phase fault at MAID 5 161 kV bus. Trip the MAID 5 to GRDA1 5 161.00 kV line and MAID 5 to GRDA1 5 161.00 kV line	7cy + 9cy
FLT_016_MAID5-DRYGULCH5_161kV_5LOCSTGV_3PH	MAID 161kV	Apply 3-phase fault at MAID 5 161 kV bus. Trip the MAID 5 to DRYGULCH5 5 161.00 kV line and Disconnect 5LOCSTGV bus	7cy + 9cy
FLT_231_MAID_5_MAID_5_CATSAGR5_161kV_3PH	MAID 161kV	SPORTSMAN - CHOTEAU 161KV OOS, APPLY 3PH FAULT AT MAID 5 161KV BUS, OPEN MAID 5 - CATSAGR5 161KV CKT 1 LINE	7cy
FLT_232_MAID_5_MAID_5_GRDA1_5_161kV_3PH	MAID 161kV	SPORTSMAN - CHOTEAU 161KV OOS, APPLY 3PH FAULT AT MAID 5 161KV BUS, OPEN MAID 5 - GRDA1 5 161KV CKT 1 LINE	7cy
FLT_233_MAID_5_MAID_5_DRYGULCH5_161kV_3PH	MAID 161kV	SPORTSMAN - CHOTEAU 161KV OOS, APPLY 3PH FAULT AT MAID 5 161KV BUS, OPEN MAID 5 - DRYGULCH5 161KV CKT 1 LINE	7cy
FLT_234_MAID_5_MAID_5_5LOCSTGV_161kV_3PH	MAID 161kV	SPORTSMAN - CHOTEAU 161KV OOS, APPLY 3PH FAULT AT MAID 5 161KV BUS, OPEN MAID 5 - 5LOCSTGV 161KV CKT 1 LINE	7cy
FLT_235_MAID_5_MAID_5_GERALDGAY4_161kV_3PH	MAID 161kV	SPORTSMAN - CHOTEAU 161KV OOS, APPLY 3PH FAULT AT MAID 5 161KV BUS, OPEN MAID 5 - GERALDGAY4 161KV CKT 1 LINE	7cy
FLT_236_MAID_5_MAID_5_KERRGR5_161kV_3PH	MAID 161kV	SPORTSMAN - CHOTEAU 161KV OOS, APPLY 3PH FAULT AT MAID 5 161KV BUS, OPEN MAID 5 - KERR GR5 161KV CKT 1 LINE	7cy
FLT_237_5SPORTSMAN_7SPORTSMAN_345-161kV_3PH	SPORTSMAN 161kV	MAID - CHOTEAU 161KV OOS, APPLY 3PH FAULT AT 5SPORTSMAN 161KV BUS, OPEN 5SPORTSMAN - 7SPORTSMAN 161/345KV TRANSFORMER CKT 1	7cy
FLT_238_7SPORTSMAN_7SPORTSMAN-7GRDA1_7_345kV_3PH	SPORTSMAN 345kV	MAID - CHOTEAU 161KV OOS, APPLY 3PH FAULT AT 7SPORTSMAN 345KV BUS, OPEN 7SPORTSMAN - GRDA1 7 345KV CKT 1 LINE	5cy
FLT_239_7SPORTSMAN_7SPORTSMAN-7BLACKBERRY_345kV_3PH	SPORTSMAN 345kV	MAID - CHOTEAU 161KV OOS, APPLY 3PH FAULT AT 7SPORTSMAN 345KV BUS, OPEN 7SPORTSMAN - 7BLACKBERRY 345KV CKT 1 LINE	5cy
FLT_240_7SPORTSMAN_7SPORTSMAN_345-161kV_3PH	SPORTSMAN 345kV	MAID - CHOTEAU 161KV OOS, APPLY 3PH FAULT AT 7SPORTSMAN 345KV BUS, OPEN 7SPORTSMAN - 5SPORTSMAN 345/161KV TRANSFORMER CKT 1	5cy

The faults identified in the following table had shown numerical instability and tripped the detailed model for the Wind Catcher generators interconnecting to the R.S.S. -7 345kV bus 509782 in AEPW. For these faults, the detailed model of the Wind Catcher generators were replaced with an equivalent model. The results shown in for these faults are with the Wind Catcher generators equivalenced.

3 Phase faults Normal Clearing			
Fault Name	**Fault Location**	**Description**	**Clearing time**
FLT_201rec_5CHOTEAU1_5CHOTEAU1-5CHOTEAU2_161kV_3PH	CHOTEAU1 161kV	APPLY 3PH FAULT AT 5CHOTEAU1 161KV BUS, OPEN 5CHOTEAU1 - 5CHOTEAU2 161KV CKT 1 LINE, WAIT 20cy RECLOSE LINE BREAKERS, TRIP IN 7cy	7CY, RECLOSE 20CY, TRIP 7CY
FLT_202rec_5CHOTEAU1_5CHOTEAU1-MAID5_161kV_3PH	CHOTEAU1 161kV	APPLY 3PH FAULT AT 5CHOTEAU1 161KV BUS, OPEN 5CHOTEAU1 - MAID 5 161KV CKT 1 LINE, WAIT 20cy RECLOSE LINE BREAKERS, TRIP IN 7cy	7CY, RECLOSE 20CY, TRIP 7CY
FLT_203_5CHOTEAU2_5CHOTEAU2-5SPORTSMAN_161kV_3PH	CHOTEAU2 161kV	APPLY 3PH FAULT AT 5CHOTEAU2 161KV BUS, OPEN 5CHOTEAU2 - 5SPORTSMAN 161KV CKT 1 LINE	7cy
FLT_203rec_5CHOTEAU2_5CHOTEAU2-5SPORTSMAN_161kV_3PH	CHOTEAU2 161kV	APPLY 3PH FAULT AT 5CHOTEAU2 161KV BUS, OPEN 5CHOTEAU2 - 5SPORTSMAN 161KV CKT 1 LINE, WAIT 20cy RECLOSE LINE BREAKERS, TRIP IN 7cy	7CY, RECLOSE 20CY, TRIP 7CY
FLT_205rec_5SPORTSMAN_5SPORTSMAN-5CHOTEAU2_161kV_3PH	SPORTSMAN 161kV	APPLY 3PH FAULT AT 5SPORTSMAN 161KV BUS, OPEN 5SPORTSMAN - 5CHOTEAU2 161KV CKT 1 LINE, WAIT 20cy RECLOSE LINE BREAKERS, TRIP IN 7cy	7CY, RECLOSE 20CY, TRIP 7CY
FLT_209_GRDA1_7_GRDA1_7-GREC_TAP7_345kV_3PH	GRDA1 345kV	APPLY 3PH FAULT AT GRDA1 7 345KV BUS, OPEN GRDA1 7 - GREC TAP7 345KV CKT 1 LINE	5cy
FLT_210_GRDA1_7_GRDA1_TONECE7_345kV_3PH	GRDA1 345kV	APPLY 3PH FAULT AT GRDA1 7 345KV BUS, OPEN GRDA1 7 - TONECE7 345KV CKT 1 LINE	5cy
FLT_210rec_GRDA1_7_GRDA1_TONECE7_345kV_3PH	GRDA1 345kV	APPLY 3PH FAULT AT GRDA1 7 345KV BUS, OPEN GRDA1 7 - TONECE7 345KV CKT 1 LINE, WAIT 20cy RECLOSE LINE BREAKERS, TRIP IN 5cy	5CY, RECLOSE 20CY, TRIP 5CY

Single Line to Ground Faults			
Fault Name	**Fault Location**	**Description**	**Clearing time**
FLT_002_GRDA1_7-GREC_TAP7_345kV_1PH	GRDA1 345kV	Apply SLG fault at GRDA1 7 345 kV bus. Trip the GRDA1 7 to GREC TAP7 345.00 kV line and GRDA 345/161 kV Xfmr #1	5cy + 9cy
FLT_004_GRDA1_7-GREC_TAP7_345kV_GREC-GEN2_1PH	GRDA1 345kV	Apply SLG fault at GRDA1 7 345 kV bus. Trip the GRDA1 7 to GREC TAP7 345kV line and GREC Unit 2	5cy + 9cy
FLT_005_GRDA1_7-TONECE_345kV_GRDA_XFMR2_1PH	GRDA1 345kV	Apply SLG fault at GRDA1 7 345 kV bus. Trip the GRDA1 7 to Tonnece 345 kV line and GRDA 345/161 kV Xfmr #2	5cy + 9cy
FLT_007_GREC_TAP7_GRDA1_7_345kV_GRDA_XFMR1_1PH	GREC TAP 345kV	Apply SLG fault at GREC TAP7 345 kV bus. Trip the GREC TAP7 to GRDA1 7 345.00 kV line and GRDA 345/161 kV Xfmr #1	5cy + 9cy
FLT_008_GREC_TAP7_GRDA1_7_345kV_GREC_GEN2_1PH	GREC TAP 345kV	Apply SLG fault at GREC TAP7 345 kV bus. Trip the GREC TAP7 to GRDA1 7 345.00 kV line and GREC Unit 2	5cy + 9cy
FLT_013_MAID5-GERALDGAY_161kV_MAID5-CHOTEAU_1PH	MAID 161kV	Apply SLG fault at MAID 5 161 kV bus. Trip the MAID 5 to GERALDGAY5 161.00 kV line and MAID 5 to 5CHOTEAU1 161.00 kV line	7cy + 9cy

Extreme Faults			
Fault Name	**Fault Location**	**Description**	**Clearing time**
FLT_002_GRDA1_7-GREC_TAP7_345kV_3PH	GRDA1 345kV	Apply 3-phase fault at GRDA1 7 345 kV bus. Trip the GRDA1 7 to GREC TAP7 345.00 kV line and GRDA 345/161 kV Xfmr #1	5cy + 9cy
FLT_003_GRDA1_7-7SPORTSMAN_345kV_GRDA-XFMR1_3PH	GRDA1 345kV	Apply3-phase fault at GRDA1 7 345 kV bus. Trip the GRDA1 7 to 7SPORTSMAN 345.00 kV line and GRDA 345/161 kV Xfmr #1	5cy + 9cy
FLT_004_GRDA1_7-GREC_TAP7_345kV_GREC-GEN2_3PH	GRDA1 345kV	Apply 3-phase fault at GRDA1 7 345 kV bus. Trip the GRDA1 7 to GREC TAP7 345kV line and GREC Unit 2	5cy + 9cy
FLT_005_GRDA1_7-TONECE_345kV_GRDA_XFMR2_3PH	GRDA1 345kV	Apply 3-phase fault at GRDA1 7 345 kV bus. Trip the GRDA1 7 to Tonnece 345 kV line and GRDA 345/161 kV Xfmr #2	5cy + 9cy
FLT_007_GREC_TAP7_GRDA1_7_345kV_GRDA_XFMR1_3PH	GREC TAP 345kV	Apply 3-phase fault at GREC TAP7 345 kV bus. Trip the GREC TAP7 to GRDA1 7 345.00 kV line and GRDA 345/161 kV Xfmr #1	5cy + 9cy
FLT_008_GREC_TAP7_GRDA1_7_345kV_GREC_GEN2_3PH	GREC TAP 345kV	Apply 3-phase fault at GREC TAP7 345 kV bus. Trip the GREC TAP7 to GRDA1 7 345.00 kV line and GREC Unit 2	5cy + 9cy
FLT_009_GRDA1_5_CLARMR5_161kV_WAGNOR5_3PH	GRDA1 161kV	Apply 3-phase fault at GRDA1 5 161 kV bus. Trip the GRDA1 5 to CLARMR 5 161.00 kV line and Disconnect WAGNOR 5 bus	7cy + 9cy
FLT_010_GRDA1_5_WMAINST5_161kV_MAID5_3PH	GRDA1 161kV	Apply 3-phase fault at GRDA1 5 161 kV bus. Trip the GRDA1 5 to WMAIN ST5 161.00 kV line and GRDA1 5 to MAID 5 161.00 kV line	7cy + 9cy
FLT_011_GRDA1_5_MAID5_161kV_GRDA1_2_XFMR1_3PH	GRDA1 161kV	Apply 3-phase fault at GRDA1 5 161 kV bus. Trip the GRDA1 5 to MAID 5 161.00 kV line and GRDA 161/69 kV Xfmr #1	7cy + 9cy
FLT_012_MAID5_161kV_MAID5-CATSAGR5_3PH	MAID 161kV	Apply 3-phase fault at MAID 5 161 kV bus. Trip the MAID 5 to CATSAGR5 161.00 kV line and MAID 5 to CATSAGR5 161.00 kV line	7cy + 9cy
FLT_013_MAID5-GERALDGAY_161kV_MAID5-CHOTEAU_3PH	MAID 161kV	Apply 3-phase fault at MAID 5 161 kV bus. Trip the MAID 5 to GERALDGAY5 161.00 kV line and MAID 5 to 5CHOTEAU1 161.00 kV line	7cy + 9cy
FLT_014_MAID5-KERRGR5_161kV_MAID5-KERRGR5_3PH	MAID 161kV	Apply 3-phase fault at MAID 5 161 kV bus. Trip the MAID 5 to KERR GR5 161.00 kV line and MAID 5 to KERR GR5 161.00 kV line	7cy + 9cy
FLT_015_MAID5-GRDA1_5_161kV_MAID5-GRDA1_5_3PH	MAID 161kV	Apply 3-phase fault at MAID 5 161 kV bus. Trip the MAID 5 to GRDA1 5 161.00 kV line and MAID 5 to GRDA1 5 161.00 kV line	7cy + 9cy
FLT_016_MAID5-DRYGULCH5_161kV_5LOCSTGV_3PH	MAID 161kV	Apply 3-phase fault at MAID 5 161 kV bus. Trip the MAID 5 to DRYGULCH5 5 161.00 kV line and Disconnect 5LOCSTGV bus	7cy + 9cy
FLT_231_MAID_5_MAID_5_CATSAGR5_161kV_3PH	MAID 161kV	SPORTSMAN - CHOTEAU 161KV OOS, APPLY 3PH FAULT AT MAID 5 161KV BUS, OPEN MAID 5 - CATSAGR5 161KV CKT 1 LINE	7cy
FLT_232_MAID_5_MAID_5_GRDA1_5_161kV_3PH	MAID 161kV	SPORTSMAN - CHOTEAU 161KV OOS, APPLY 3PH FAULT AT MAID 5 161KV BUS, OPEN MAID 5 - GRDA1 5 161KV CKT 1 LINE	7cy
FLT_233_MAID_5_MAID_5_DRYGULCH5_161kV_3PH	MAID 161kV	SPORTSMAN - CHOTEAU 161KV OOS, APPLY 3PH FAULT AT MAID 5 161KV BUS, OPEN MAID 5 - DRYGULCH5 161KV CKT 1 LINE	7cy
FLT_234_MAID_5_MAID_5_5LOCSTGV_161kV_3PH	MAID 161kV	SPORTSMAN - CHOTEAU 161KV OOS, APPLY 3PH FAULT AT MAID 5 161KV BUS, OPEN MAID 5 - 5LOCSTGV 161KV CKT 1 LINE	7cy
FLT_235_MAID_5_MAID_5_GERALDGAY4_161kV_3PH	MAID 161kV	SPORTSMAN - CHOTEAU 161KV OOS, APPLY 3PH FAULT AT MAID 5 161KV BUS, OPEN MAID 5 - GERALDGAY4 161KV CKT 1 LINE	7cy
FLT_236_MAID_5_MAID_5_KERRGR5_161kV_3PH	MAID 161kV	SPORTSMAN - CHOTEAU 161KV OOS, APPLY 3PH FAULT AT MAID 5 161KV BUS, OPEN MAID 5 - KERR GR5 161KV CKT 1 LINE	7cy
FLT_238_7SPORTSMAN_7SPORTSMAN-7GRDA1_7_345kV_3PH	SPORTSMAN 345kV	MAID - CHOTEAU 161KV OOS, APPLY 3PH FAULT AT 7SPORTSMAN 345KV BUS, OPEN 7SPORTSMAN - GRDA1 7 345KV CKT 1 LINE	5cy

CONCLUSION

The AECI interconnection requests GIA-77 & GIA-78 were submitted to the AECI queue on 1/18/2019. In accordance with the Joint Operating Agreement between SPP and AECI, SPP was requested to study GIA-77 & GIA-78 to determine the impacts to the SPP transmission system on or around the proposed in-service dates of 9/28/2019 and 9/28/2020, respectively.

GIA-77 and GIA-78 represent a 50 MW and 52 capacity increase to the exiting Choteau units. These facilities are located in Mayes County, OK at the Chouteau 161 kV substation.

SPP has concluded that the increase of generation at the Choteau site does add to existing line loading limitations surrounding the area. The existing operating limits of these units have to be observed. The ASIS analysis did not identify any overloads or degradation to the SPP network due to GIA-77 and GIA-78 to interconnect the additional 102MW of generation with Energy Resource Interconnection Service (ERIS) and Network Resource Interconnection Service (NRIS).

Please note that as the higher queued network upgrades assumed to be in-service for this study have changed, it will be necessary to restudy the stability analysis at a later date to confirm no network upgrades are required for full interconnection service. Also, please note that this analysis did not consider steady state conditions, which may contribute to the required network upgrade set. Powerflow analysis is expected to be conducted at a later date.

It should be noted that although this ASIS analyzed many of the most probable contingencies, it is not an all-inclusive list that can account for every operational situation. Additionally, the generator may not be able to inject any power onto the Transmission System due to constraints that fall below the threshold of mitigation for a Generator Interconnection request. Because of this, it is likely that the Customer(s) may be required to reduce their generation output to 0 MW under certain system conditions to allow system operators to maintain the reliability of the transmission network.

Transient stability analysis for this ASIS was performed. For the three phase faults with normal clearing and phase to ground faults with breaker failure, there were no transient stability issues identified in this study. For the Extreme Faults tested, instability was monitored and the existing operating limits of the Choteau plants still need to be maintained. In particular, FLT_238 (Maid – Choteau 161kV line out of service, 3phase fault on Sportsman – GRDA1 7 345kV line clearing in 5 cycles) the stability operating limits of these units is a combined 935MW (units cannot operate at Pmax). For the Extreme Faults, FLT_001 – 016, that showed instability, critical clearing times were calculated.

Any changes to these assumptions, for example, one or more of the previously queued requests not included within this study execute an interconnection agreement and commencing commercial operation, may require a re-study of this ASIS at the expense of the Customer.

Nothing in this System Impact Study constitutes a request for transmission service or confers upon the Interconnection Customer any right to receive transmission service.

DYNAMIC MODEL PARAMETERS

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PLANT MODELS

 REPORT FOR ALL MODELS                    BUS 300020 [1CHOTCT4    16.000] MODELS


 Model GENROE Bus 300020 [1CHOTCT4    16.000] Machine "1 " :

             MBASE     Z S O R C E         X T R A N       GENTAP
             202.0  0.00232+J 0.13600  0.00000+J 0.00000  1.00000

  T'D0 T''D0  T'Q0 T''Q0     H   DAMP   XD     XQ     X'D    X'Q   X''D    XL
  9.09 0.042  2.50 0.150   6.63  0.00 1.6360 1.5540 0.1880 0.3660 0.1360 0.1180

                               S(1.0)  S(1.2)
                               0.1200  0.4500


 Model PSS2A Bus 300020 [1CHOTCT4    16.000] Machine "1 " :

                    IC1 REMBUS1     IC2 REMBUS2       M       N
                      1       0       3       0       5       1

       TW1      TW2      T6       TW3      TW4      T7       KS2      KS3
     5.000    5.000    0.009    5.000    0.000    5.000    0.377    1.000

       T8       T9      KS1       T1       T2       T3       T4      VSTMAX   VSTMIN
     1.000    0.200   15.000    0.110    0.030    0.110    0.030    0.050   -0.050


 Model ESST4B Bus 300020 [1CHOTCT4    16.000] Machine "1 " :


     TR    KPR     KIR     VRMAX    VRMIN    TA     KPM     KIM    VMMAX   VMMIN
   0.010  23.000   2.300   0.966  -0.819   0.000   1.000   0.000   0.966  -0.819

            KG      KP      KI   VBMAX     KC      XL    THETAP
          0.000   5.060   0.000   6.324   0.083  0.0000   0.000


 Model GAST Bus 300020 [1CHOTCT4    16.000] Machine "1 " :


       R      T1     T2      T3   LOAD LIM   KT     VMAX    VMIN     DT
     0.040  0.100  0.500   4.500   1.000   2.000   1.000   0.000   0.000

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1    PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS(R)E     MON, JAN 06 2020  13:50
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 2016 MDWG FINAL WITH 2015 SERIES MMWG FINAL
 MDWG 2018S WITH MMWG 2017S

 PLANT MODELS

 REPORT FOR ALL MODELS                    BUS 300021 [1CHOTCT5    16.000] MODELS


 Model GENROE Bus 300021 [1CHOTCT5    16.000] Machine "1 " :


             MBASE     Z S O R C E         X T R A N       GENTAP
             202.0  0.00232+J 0.13600  0.00000+J 0.00000  1.00000

  T'D0 T''D0  T'Q0 T''Q0     H   DAMP   XD     XQ     X'D    X'Q   X''D    XL
  9.09 0.042  2.50 0.150   6.63  0.00 1.6360 1.5540 0.1880 0.3660 0.1360 0.1180

                               S(1.0)  S(1.2)
                               0.1200  0.4500
 Model PSS2A Bus 300021 [1CHOTCT5    16.000] Machine "1 " :


                    IC1 REMBUS1     IC2 REMBUS2       M       N
                      1       0       3       0       5       1

       TW1      TW2      T6       TW3      TW4      T7       KS2      KS3
      5.000    5.000    0.009    5.000    0.000    5.000    0.377    1.000

       T8       T9      KS1       T1       T2       T3       T4      VSTMAX   VSTMIN
      1.000    0.200   15.000    0.110    0.030    0.110    0.030    0.050   -0.050


 Model ESST4B Bus 300021 [1CHOTCT5    16.000] Machine "1 " :

     TR    KPR     KIR     VRMAX    VRMIN    TA     KPM     KIM    VMMAX   VMMIN
   0.010  23.000   2.300   0.966  -0.819   0.000   1.000   0.000   0.966  -0.819

            KG      KP      KI   VBMAX     KC      XL    THETAP
          0.000   5.060   0.000   6.324   0.083  0.0000   0.000


 Model GAST Bus 300021 [1CHOTCT5    16.000] Machine "1 " :


       R      T1     T2      T3   LOAD LIM   KT     VMAX    VMIN     DT
     0.040  0.100  0.500   4.500   1.000   2.000   1.000   0.000   0.000

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1    PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS(R)E     MON, JAN 06 2020  13:50
 2016 MDWG FINAL WITH 2015 SERIES MMWG FINAL
 MDWG 2018S WITH MMWG 2017S

 PLANT MODELS
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REPORT FOR ALL MODELS BUS 300024 [1CHOTST6 16.000] MODELS

Model GENROE Bus 300024 [1CHOTST6 16.000] Machine "1 " :

MBASE	Z S O R C E	X T R A N	GENTAP
216.0	0.00000+J 0.14500	0.00000+J 0.00000	1.00000

T'D0	T''D0	T'Q0	T''Q0	H	DAMP	XD	XQ	X'D	X'Q	X''D	XL
9.09	0.042	2.50	0.150	7.58	0.00	1.7380	1.6520	0.1990	0.3880	0.1440	0.1320

S(1.0)	S(1.2)
0.1200	0.4500

Model PSS2A Bus 300024 [1CHOTST6 16.000] Machine "1 " :

IC1	REMBUS1	IC2	REMBUS2	M	N
1	0	3	0	5	1

TW1	TW2	T6	TW3	TW4	T7	KS2	KS3
5.000	5.000	0.009	5.000	0.000	5.000	0.330	1.000

T8	T9	KS1	T1	T2	T3	T4	VSTMAX	VSTMIN
1.000	0.200	15.000	0.110	0.030	0.110	0.030	0.050	-0.050

Model ESST4B Bus 300024 [1CHOTST6 16.000] Machine "1 " :

TR	KPR	KIR	VRMAX	VRMIN	TA	KPM	KIM	VMMAX	VMMIN
0.010	22.000	2.200	0.966	-0.819	0.000	1.000	0.000	0.966	-0.819

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            KG      KP      KI   VBMAX     KC      XL    THETAP
          0.000   5.298   0.000   6.622   0.088  0.0000   0.000

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1    PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS(R)E     MON, JAN 06 2020  13:50
 2016 MDWG FINAL WITH 2015 SERIES MMWG FINAL
 MDWG 2018S WITH MMWG 2017S

 PLANT MODELS

 REPORT FOR ALL MODELS                    BUS 300031 [1CHOTST3    16.000] MODELS


 Model GENROE Bus 300031 [1CHOTST3    16.000] Machine "1 " :


             MBASE     Z S O R C E         X T R A N       GENTAP
             194.0  0.00000+J 0.14400  0.00000+J 0.00000  1.00000

  T'D0 T''D0  T'Q0 T''Q0     H   DAMP   XD     XQ     X'D    X'Q   X''D    XL
  9.09 0.042  2.50 0.150   7.48  0.00 1.8320 1.7410 0.2100 0.4110 0.1520 0.1320

                               S(1.0)  S(1.2)
                               0.1200  0.4500


 Model PSS2A Bus 300031 [1CHOTST3    16.000] Machine "1 " :


                    IC1 REMBUS1     IC2 REMBUS2       M       N
                      1       0       3       0       5       1

       TW1      TW2      T6       TW3      TW4      T7       KS2      KS3
      5.000    5.000    0.009    5.000    0.000    5.000    0.334    1.000

       T8       T9      KS1       T1       T2       T3       T4      VSTMAX   VSTMIN
      1.000    0.200   15.000    0.100    0.020    0.100    0.020    0.050   -0.050


 Model ESST4B Bus 300031 [1CHOTST3    16.000] Machine "1 " :


      TR    KPR     KIR     VRMAX    VRMIN    TA     KPM     KIM    VMMAX   VMMIN
   0.010  20.000   2.000   0.970  -0.819   0.000   1.000   0.000   0.970  -0.819

            KG      KP      KI   VBMAX     KC      XL    THETAP
          0.000   5.749   0.000   7.186   0.091  0.0000   0.000

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1    PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS(R)E     MON, JAN 06 2020  13:50
 2016 MDWG FINAL WITH 2015 SERIES MMWG FINAL
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 MDWG 2018S WITH MMWG 2017S

 PLANT MODELS

 REPORT FOR ALL MODELS                    BUS 300032 [1CHOTCT1    16.000] MODELS


 Model GENROE Bus 300032 [1CHOTCT1    16.000] Machine "1 " :


            MBASE     Z S O R C E         X T R A N       GENTAP
            201.0  0.00000+J 0.15400  0.00000+J 0.00000  1.00000

  T'D0 T''D0  T'Q0 T''Q0     H   DAMP   XD     XQ     X'D    X'Q   X''D    XL
  9.09 0.042  2.50 0.150   7.04  0.00 1.7640 1.6760 0.2020 0.3900 0.1470 0.1270

                               S(1.0)  S(1.2)
                               0.1200  0.4500
 Model PSS2A Bus 300032 [1CHOTCT1    16.000] Machine "1 " :


                    IC1 REMBUS1     IC2 REMBUS2       M       N
                      1       0       3       0       5       1

       TW1      TW2      T6       TW3      TW4      T7       KS2      KS3
      5.000    5.000    0.009    5.000    0.000    5.000    0.355    1.000

       T8       T9      KS1       T1       T2       T3       T4      VSTMAX   VSTMIN
      1.000    0.200   15.000    0.110    0.030    0.110    0.030    0.050   -0.050


 Model ESST4B Bus 300032 [1CHOTCT1    16.000] Machine "1 " :


     TR    KPR     KIR     VRMAX    VRMIN    TA     KPM     KIM    VMMAX   VMMIN
   0.010  20.000   2.000   0.970  -0.819   0.000   1.000   0.000   0.970  -0.819

            KG      KP      KI   VBMAX     KC      XL    THETAP
          0.000   5.828   0.000   7.284   0.091  0.0000   0.000


 Model GAST Bus 300032 [1CHOTCT1    16.000] Machine "1 " :


       R      T1     T2      T3   LOAD LIM   KT     VMAX    VMIN     DT
     0.050  0.100  0.500   4.500   1.000   2.000   1.000   0.000   0.000

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1    PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS(R)E     MON, JAN 06 2020  13:50
 2016 MDWG FINAL WITH 2015 SERIES MMWG FINAL
 MDWG 2018S WITH MMWG 2017S

 PLANT MODELS
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REPORT FOR ALL MODELS                    BUS 300033 [1CHOTCT2    16.000] MODELS


Model GENROE Bus 300033 [1CHOTCT2    16.000] Machine "1 " :


            MBASE     Z S O R C E         X T R A N       GENTAP
            201.0  0.00000+J 0.15400  0.00000+J 0.00000  1.00000

 T'D0 T''D0  T'Q0 T''Q0     H   DAMP   XD     XQ     X'D    X'Q   X''D    XL
 9.09 0.042  2.50 0.150   7.04  0.00 1.7640 1.6760 0.2020 0.3900 0.1470 0.1270

                              S(1.0)  S(1.2)
                              0.1200  0.4500


Model PSS2A Bus 300033 [1CHOTCT2    16.000] Machine "1 " :


                   IC1 REMBUS1     IC2 REMBUS2       M       N
                     1       0       3       0       5       1

      TW1      TW2      T6       TW3      TW4      T7       KS2      KS3
     5.000    5.000    0.009    5.000    0.000    5.000    0.355    1.000

      T8       T9      KS1       T1       T2       T3       T4      VSTMAX   VSTMIN
     1.000    0.200   15.000    0.110    0.030    0.110    0.030    0.050   -0.050


Model ESST4B Bus 300033 [1CHOTCT2    16.000] Machine "1 " :


    TR    KPR     KIR     VRMAX    VRMIN    TA     KPM     KIM    VMMAX   VMMIN
  0.010  20.000   2.000   0.970  -0.819   0.000   1.000   0.000   0.970  -0.819

           KG      KP      KI   VBMAX     KC      XL    THETAP
         0.000   5.828   0.000   7.284   0.091  0.0000   0.000


Model GAST Bus 300033 [1CHOTCT2    16.000] Machine "1 " :


      R      T1     T2      T3   LOAD LIM   KT     VMAX    VMIN     DT
    0.050  0.100  0.500   4.500   1.000   2.000   1.000   0.000   0.000
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DYNAMIC STABILITY RESULTS

3 Phase Faults Normal Clearing						
Fault Name	**Fault Location**	**Description**	**Clearing time**	**2017w_ G08**	**2018s_ G08**	**2026s_ G08**
FLT_201_5CHOTEAU1_5CHOTEAU1-5CHOTEAU2_161kV_3PH	CHOTEAU1 161kV	APPLY 3PH FAULT AT 5CHOTEAU1 161KV BUS, OPEN 5CHOTEAU1 -5CHOTEAU2 161KV CKT 1 LINE	7cy	STABLE	STABLE	STABLE
FLT_201rec_5CHOTEAU1_5CHOTEAU1-5CHOTEAU2_161kV_3PH	CHOTEAU1 161kV	APPLY 3PH FAULT AT 5CHOTEAU1 161KV BUS, OPEN 5CHOTEAU1 -5CHOTEAU2 161KV CKT 1 LINE, WAIT 20cy RECLOSE LINE BREAKERS, TRIP IN 7cy	7CY, RECLOSE 20CY, TRIP 7CY	STABLE	STABLE	STABLE
FLT_202_5CHOTEAU1_5CHOTEAU1-MAID5_161kV_3PH	CHOTEAU1 161kV	APPLY 3PH FAULT AT 5CHOTEAU1 161KV BUS, OPEN 5CHOTEAU1 - MAID 5 161KV CKT 1 LINE	7cy	STABLE	STABLE	STABLE
FLT_202rec_5CHOTEAU1_5CHOTEAU1-MAID5_161kV_3PH	CHOTEAU1 161kV	APPLY 3PH FAULT AT 5CHOTEAU1 161KV BUS, OPEN 5CHOTEAU1 - MAID 5 161KV CKT 1 LINE, WAIT 20cy RECLOSE LINE BREAKERS, TRIP IN 7cy	7CY, RECLOSE 20CY, TRIP 7CY	STABLE	STABLE	STABLE
FLT_203_5CHOTEAU2_5CHOTEAU2-5SPORTSMAN_161kV_3PH	CHOTEAU2 161kV	APPLY 3PH FAULT AT 5CHOTEAU2 161KV BUS, OPEN 5CHOTEAU2 - 5SPORTSMAN 161KV CKT 1 LINE	7cy	STABLE	STABLE	STABLE
FLT_203rec_5CHOTEAU2_5CHOTEAU2-5SPORTSMAN_161kV_3PH	CHOTEAU2 161kV	APPLY 3PH FAULT AT 5CHOTEAU2 161KV BUS, OPEN 5CHOTEAU2 - 5SPORTSMAN 161KV CKT 1 LINE, WAIT 20cy RECLOSE LINE BREAKERS, TRIP IN 7cy	7CY, RECLOSE 20CY, TRIP 7CY	STABLE	STABLE	STABLE
FLT_204_5SPORTSMAN_7SPORTSMAN_345-161kV_3PH	SPORTSMAN 161kV	APPLY 3PH FAULT AT 5SPORTSMAN 161KV BUS, OPEN 5SPORTSMAN - 7SPORTSMAN 161/345KV TRANSFORMER CKT 1	7cy	STABLE	STABLE	STABLE
FLT_205_5SPORTSMAN_5SPORTSMAN-5CHOTEAU2_161kV_3PH	SPORTSMAN 161kV	APPLY 3PH FAULT AT 5SPORTSMAN 161KV BUS, OPEN 5SPORTSMAN - 5CHOTEAU2 161KV CKT 1 LINE	7cy	STABLE	STABLE	STABLE
FLT_205rec_5SPORTSMAN_5SPORTSMAN-5CHOTEAU2_161kV_3PH	SPORTSMAN 161kV	APPLY 3PH FAULT AT 5SPORTSMAN 161KV BUS, OPEN 5SPORTSMAN - 5CHOTEAU2 161KV CKT 1 LINE, WAIT 20cy RECLOSE LINE BREAKERS, TRIP IN 7cy	7CY, RECLOSE 20CY, TRIP 7CY	STABLE	STABLE	STABLE
FLT_206_7SPORTSMAN_7SPORTSMAN-7GRDA1_7_345kV_3PH	SPORTSMAN 345kV	APPLY 3PH FAULT AT 7SPORTSMAN 345KV BUS, OPEN 7SPORTSMAN - GRDA1 7 345KV CKT 1 LINE	5cy	STABLE	STABLE	STABLE
FLT_206rec_7SPORTSMAN_7SPORTSMAN-7GRDA1_7_345kV_3PH	SPORTSMAN 345kV	APPLY 3PH FAULT AT 7SPORTSMAN 345KV BUS, OPEN 7SPORTSMAN - GRDA1 7 345KV CKT 1 LINE, WAIT 20cy RECLOSE LINE BREAKERS, TRIP IN 5cy	5CY, RECLOSE 20CY, TRIP 5CY	STABLE	STABLE	STABLE
FLT_207_7SPORTSMAN_7SPORTSMAN-7BLACKBERRY_345kV_3PH	SPORTSMAN 345kV	APPLY 3PH FAULT AT 7SPORTSMAN 345KV BUS, OPEN 7SPORTSMAN - 7BLACKBERRY 345KV CKT 1 LINE	5cy	STABLE	STABLE	STABLE
FLT_207rec_7SPORTSMAN_7SPORTSMAN-7BLACKBERRY_345kV_3PH	SPORTSMAN 345kV	APPLY 3PH FAULT AT 7SPORTSMAN 345KV BUS, OPEN 7SPORTSMAN - 7BLACKBERRY 345KV CKT 1 LINE, WAIT 20cy RECLOSE LINE BREAKERS, TRIP IN 5cy	5CY, RECLOSE 20CY, TRIP 5CY	STABLE	STABLE	STABLE
FLT_208_7SPORTSMAN_7SPORTSMAN_345-161kV_3PH	SPORTSMAN 345kV	APPLY 3PH FAULT AT 7SPORTSMAN 345KV BUS, OPEN 7SPORTSMAN - 5SPORTSMAN 345/161KV TRANSFORMER CKT 1	5cy	STABLE	STABLE	STABLE
FLT_209_GRDA1_7_GRDA1_7-GREC_TAP7_345kV_3PH	GRDA1 345kV	APPLY 3PH FAULT AT GRDA1 7 345KV BUS, OPEN GRDA1 7 - GREC TAP7 345KV CKT 1 LINE	5cy	STABLE	STABLE	STABLE

3 Phase Faults Normal Clearing						
Fault Name	**Fault Location**	**Description**	**Clearing time**	**2017w_ G08**	**2018s_ G08**	**2026s_ G08**
FLT_209rec_GRDA1_7_GRDA1_7-GREC_TAP7_345kV_3PH	GRDA1 345kV	APPLY 3PH FAULT AT GRDA1 7 345KV BUS, OPEN GRDA1 7 - GREC TAP7 345KV CKT 1 LINE, WAIT 20cy RECLOSE LINE BREAKERS, TRIP IN 5cy	5CY, RECLOSE 20CY, TRIP 5CY	STABLE	STABLE	STABLE
FLT_210_GRDA1_7_GRDA1_TONECE7_345kV_3PH	GRDA1 345kV	APPLY 3PH FAULT AT GRDA1 7 345KV BUS, OPEN GRDA1 7 - TONECE7 345KV CKT 1 LINE	5cy	STABLE	STABLE	STABLE
FLT_210rec_GRDA1_7_GRDA1_TONECE7_345kV_3PH	GRDA1 345kV	APPLY 3PH FAULT AT GRDA1 7 345KV BUS, OPEN GRDA1 7 - TONECE7 345KV CKT 1 LINE, WAIT 20cy RECLOSE LINE BREAKERS, TRIP IN 5cy	5CY, RECLOSE 20CY, TRIP 5CY	STABLE	STABLE	STABLE
FLT_211_GRDA1_7_7SPORTSMAN-7GRDA1_7_345kV_3PH	GRDA1 345kV	APPLY 3PH FAULT AT GRDA1 7 345KV BUS, OPEN 7SPORTSMAN - GRDA1 7 345KV CKT 1 LINE	5cy	STABLE	STABLE	STABLE
FLT_211rec_GRDA1_7_7SPORTSMAN-7GRDA1_7_345kV_3PH	GRDA1 345kV	APPLY 3PH FAULT AT GRDA1 7 345KV BUS, OPEN 7SPORTSMAN - GRDA1 7 345KV CKT 1 LINE, WAIT 20cy RECLOSE LINE BREAKERS, TRIP IN 5cy	5CY, RECLOSE 20CY, TRIP 5CY	STABLE	STABLE	STABLE
FLT_212_GRDA1_5_GRDA1_5_WAGNOR5_161kV_3PH	GRDA1 161kV	APPLY 3PH FAULT AT GRDA1 5 161KV BUS, OPEN GRDA1 5 - WAGNOR 5 161KV CKT 1 LINE	7cy	STABLE	STABLE	STABLE
FLT_212rec_GRDA1_5_GRDA1_5_WAGNOR5_161kV_3PH	GRDA1 161kV	APPLY 3PH FAULT AT GRDA1 5 161KV BUS, OPEN GRDA1 5 - WAGNOR 5 161KV CKT 1 LINE, WAIT 20cy RECLOSE LINE BREAKERS, TRIP IN 7cy	7CY, RECLOSE 20CY, TRIP 7CY	STABLE	STABLE	STABLE
FLT_213_GRDA1_7_GRDA1_7_GRDA1_5_345-161kV_3PH	GRDA1 345kV	APPLY 3PH FAULT AT GRDA1 7 345KV BUS, OPEN GRDA1 7 - GRDA1 5 - GRDA1 TRANSFORMER 1	5cy	STABLE	STABLE	STABLE
FLT_214_GRDA1_5_GRDA1_5_CLARMR5_161kV_3PH	GRDA1 161kV	APPLY 3PH FAULT AT GRDA1 5 161KV BUS, OPEN GRDA1 5 - CLARMR 5 161KV CKT 1 LINE	7cy	STABLE	STABLE	STABLE
FLT_214rec_GRDA1_5_GRDA1_5_CLARMR5_161kV_3PH	GRDA1 161kV	APPLY 3PH FAULT AT GRDA1 5 161KV BUS, OPEN GRDA1 5 - CLARMR 5 161KV CKT 1 LINE, WAIT 20cy RECLOSE LINE BREAKERS, TRIP IN 7cy	7CY, RECLOSE 20CY, TRIP 7CY	STABLE	STABLE	STABLE
FLT_215_GRDA1_5_GRDA1_5_MAID5_161kV_3PH	GRDA1 161kV	APPLY 3PH FAULT AT GRDA1 5 161KV BUS, OPEN GRDA1 5 - MAID 5 161KV CKT 1 LINE	7cy	STABLE	STABLE	STABLE
FLT_215rec_GRDA1_5_GRDA1_5_MAID5_161kV_3PH	GRDA1 161kV	APPLY 3PH FAULT AT GRDA1 5 161KV BUS, OPEN GRDA1 5 - MAID 5 161KV CKT 1 LINE, WAIT 20cy RECLOSE LINE BREAKERS, TRIP IN 7cy	7CY, RECLOSE 20CY, TRIP 7CY	STABLE	STABLE	STABLE
FLT_216_GRDA1_5_GRDA1_5_WMAINST5_161kV_3PH	GRDA1 161kV	APPLY 3PH FAULT AT GRDA1 5 161KV BUS, OPEN GRDA1 5 - WMAIN ST5 161KV CKT 1 LINE	7cy	STABLE	STABLE	STABLE
FLT_216rec_GRDA1_5_GRDA1_5_WMAINST5_161kV_3PH	GRDA1 161kV	APPLY 3PH FAULT AT GRDA1 5 161KV BUS, OPEN GRDA1 5 - WMAIN ST5 161KV CKT 1 LINE, WAIT 20cy RECLOSE LINE BREAKERS, TRIP IN 7cy	7CY, RECLOSE 20CY, TRIP 7CY	STABLE	STABLE	STABLE
FLT_217_MAID_5_MAID_5_CATSAGR5_161kV_3PH	MAID 161kV	APPLY 3PH FAULT AT MAID 5 161KV BUS, OPEN MAID 5 - CATSAGR5 161KV CKT 1 LINE	7cy	STABLE	STABLE	STABLE
FLT_217rec_MAID_5_MAID_5_CATSAGR5_161kV_3PH	MAID 161kV	APPLY 3PH FAULT AT MAID 5 161KV BUS, OPEN MAID 5 - CATSAGR5 161KV CKT 1 LINE, WAIT 20cy RECLOSE LINE BREAKERS, TRIP IN 7cy	7CY, RECLOSE 20CY, TRIP 7CY	STABLE	STABLE	STABLE
FLT_218_MAID_5_MAID_5_GRDA1_5_161kV_3PH	MAID 161kV	APPLY 3PH FAULT AT MAID 5 161KV BUS, OPEN MAID 5 - GRDA1 5 161KV CKT 1 LINE	7cy	STABLE	STABLE	STABLE
FLT_218rec_MAID_5_MAID_5_GRDA1_5_161kV_3PH	MAID 161kV	APPLY 3PH FAULT AT MAID 5 161KV BUS, OPEN MAID 5 - GRDA1 5 161KV CKT 1 LINE, WAIT 20cy RECLOSE LINE BREAKERS, TRIP IN 7cy	7CY, RECLOSE 20CY, TRIP 7CY	STABLE	STABLE	STABLE

3 Phase Faults Normal Clearing						
Fault Name	**Fault Location**	**Description**	**Clearing time**	**2017w_ G08**	**2018s_ G08**	**2026s_ G08**
FLT_219_MAID_5_MAID_5_DRYGULCH5_161kV_3PH	MAID 161kV	APPLY 3PH FAULT AT MAID 5 161KV BUS, OPEN MAID 5 - DRYGULCH5 161KV CKT 1 LINE	7cy	STABLE	STABLE	STABLE
FLT_219rec_MAID_5_MAID_5_DRYGULCH5_161kV_3PH	MAID 161kV	APPLY 3PH FAULT AT MAID 5 161KV BUS, OPEN MAID 5 - DRYGULCH5 161KV CKT 1 LINE, WAIT 20cy RECLOSE LINE BREAKERS, TRIP IN 7cy	7CY, RECLOSE 20CY, TRIP 7CY	STABLE	STABLE	STABLE
FLT_220_MAID_5_MAID_5_5LOCSTGV_161kV_3PH	MAID 161kV	APPLY 3PH FAULT AT MAID 5 161KV BUS, OPEN MAID 5 - 5LOCSTGV 161KV CKT 1 LINE	7cy	STABLE	STABLE	STABLE
FLT_220rec_MAID_5_MAID_5_5LOCSTGV_161kV_3PH	MAID 161kV	APPLY 3PH FAULT AT MAID 5 161KV BUS, OPEN MAID 5 - 5LOCSTGV 161KV CKT 1 LINE, WAIT 20cy RECLOSE LINE BREAKERS, TRIP IN 7cy	7CY, RECLOSE 20CY, TRIP 7CY	STABLE	STABLE	STABLE
FLT_221_MAID_5_MAID_5_GERALDGAY4_161kV_3PH	MAID 161kV	APPLY 3PH FAULT AT MAID 5 161KV BUS, OPEN MAID 5 - GERALDGAY4 161KV CKT 1 LINE	7cy	STABLE	STABLE	STABLE
FLT_221rec_MAID_5_MAID_5_GERALDGAY4_161kV_3PH	MAID 161kV	APPLY 3PH FAULT AT MAID 5 161KV BUS, OPEN MAID 5 - GERALDGAY4 161KV CKT 1 LINE, WAIT 20cy RECLOSE LINE BREAKERS, TRIP IN 7cy	7CY, RECLOSE 20CY, TRIP 7CY	STABLE	STABLE	STABLE
FLT_222_MAID_5_MAID_5_5CHOTEAU1_161kV_3PH	MAID 161kV	APPLY 3PH FAULT AT MAID 5 161KV BUS, OPEN MAID 5 - 5CHOTEAU1 161KV CKT 1 LINE	7cy	STABLE	STABLE	STABLE
FLT_222rec_MAID_5_MAID_5_5CHOTEAU1_161kV_3PH	MAID 161kV	APPLY 3PH FAULT AT MAID 5 161KV BUS, OPEN MAID 5 - 5CHOTEAU1 161KV CKT 1 LINE, WAIT 20cy RECLOSE LINE BREAKERS, TRIP IN 7cy	7CY, RECLOSE 20CY, TRIP 7CY	STABLE	STABLE	STABLE
FLT_223_MAID_5_MAID_5_KERRGR5_161kV_3PH	MAID 161kV	APPLY 3PH FAULT AT MAID 5 161KV BUS, OPEN MAID 5 - KERR GR5 161KV CKT 1 LINE	7cy	STABLE	STABLE	STABLE
FLT_223rec_MAID_5_MAID_5_KERRGR5_161kV_3PH	MAID 161kV	APPLY 3PH FAULT AT MAID 5 161KV BUS, OPEN MAID 5 - KERR GR5 161KV CKT 1 LINE, WAIT 20cy RECLOSE LINE BREAKERS, TRIP IN 7cy	7CY, RECLOSE 20CY, TRIP 7CY	STABLE	STABLE	STABLE

Single Line to Ground Fault with Breaker Failure						
Fault Name	**Fault Location**	**Description**	**Clearing time**	**2017w_ G08**	**2018s_ G08**	**2026s_ G08**
FLT_001_GRDA17-1-GRDA17-GRDA15_345kV_1PH	GRDA17-1	Apply SLG fault at GRDA17-1 22.8 kV bus. Trip GRDA17-1 Unit 2 & GRDA 345/161 kV Xfmr #2	5cy + 9cy	STABLE	STABLE	STABLE
FLT_002_GRDA1_7-GREC_TAP7_345kV_1PH	GRDA1 345kV	Apply SLG fault at GRDA1 7 345 kV bus. Trip the GRDA1 7 to GREC TAP7 345.00 kV line and GRDA 345/161 kV Xfmr #1	5cy + 9cy	STABLE	STABLE	STABLE
FLT_003_GRDA1_7-7SPORTSMAN_345kV_GRDA-XFMR1_1PH	GRDA1 345kV	Apply SLG fault at GRDA1 7 345 kV bus. Trip the GRDA1 7 to 7SPORTSMAN 345.00 kV line and GRDA 345/161 kV Xfmr #1	5cy + 9cy	STABLE	STABLE	STABLE
FLT_004_GRDA1_7-GREC_TAP7_345kV_GREC-GEN2_1PH	GRDA1 345kV	Apply SLG fault at GRDA1 7 345 kV bus. Trip the GRDA1 7 to GREC TAP7 345kV line and GREC Unit 2	5cy + 9cy	STABLE	STABLE	STABLE
FLT_005_GRDA1_7-TONECE_345kV_GRDA_XFMR2_1PH	GRDA1 345kV	Apply SLG fault at GRDA1 7 345 kV bus. Trip the GRDA1 7 to Tonnece 345 kV line and GRDA 345/161 kV Xfmr #2	5cy + 9cy	STABLE	STABLE	STABLE
FLT_006_GRECSTG_1-GREC1_7_GREC_TAP7_345kV_1PH	GRECSTG_1	Apply SLG fault at GRECCTG_1 20-kV bus. Trip GRECSTG_1 and the GREC1 7 to GREC TAP7 345.00 kV line	5cy + 9cy	STABLE	STABLE	STABLE
FLT_007_GREC_TAP7_GRDA1_7_345kV_GRDA_XFMR1_1PH	GREC TAP 345kV	Apply SLG fault at GREC TAP7 345 kV bus. Trip the GREC TAP7 to GRDA1 7 345.00 kV line and GRDA 345/161 kV Xfmr #1	5cy + 9cy	STABLE	STABLE	STABLE
FLT_008_GREC_TAP7_GRDA1_7_345kV_GREC_GEN2_1PH	GREC TAP 345kV	Apply SLG fault at GREC TAP7 345 kV bus. Trip the GREC TAP7 to GRDA1 7 345.00 kV line and GREC Unit 2	5cy + 9cy	STABLE	STABLE	STABLE
FLT_009_GRDA1_5_CLARMR5_161kV_WAGNOR5_1PH	GRDA1 161kV	Apply SLG fault at GRDA1 5 161 kV bus. Trip the GRDA1 5 to CLARMR 5 161.00 kV line and Disconnect WAGNOR 5 bus	7cy + 9cy	STABLE	STABLE	STABLE
FLT_010_GRDA1_5_WMAINST5_161kV_MAID5_1PH	GRDA1 161kV	Apply SLG fault at GRDA1 5 161 kV bus. Trip the GRDA1 5 to WMAIN ST5 161.00 kV line and GRDA1 5 to MAID 5 161.00 kV line	7cy + 9cy	STABLE	STABLE	STABLE
FLT_011_GRDA1_5_MAID5_161kV_GRDA1_2_XFMR1_1PH	GRDA1 161kV	Apply SLG fault at GRDA1 5 161 kV bus. Trip the GRDA1 5 to MAID 5 161.00 kV line and GRDA 161/69 kV Xfmr #1	7cy + 9cy	STABLE	STABLE	STABLE
FLT_012_MAID5_161kV_MAID5-CATSAGR5_1PH	MAID 161kV	Apply SLG fault at MAID 5 161 kV bus. Trip the MAID 5 to CATSAGR5 161.00 kV line and MAID 5 to CATSAGR5 161.00 kV line	7cy + 9cy	STABLE	STABLE	STABLE
FLT_013_MAID5-GERALDGAY_161kV_MAID5-CHOTEAU_1PH	MAID 161kV	Apply SLG fault at MAID 5 161 kV bus. Trip the MAID 5 to GERALDGAY5 161.00 kV line and MAID 5 to 5CHOTEAU1 161.00 kV line	7cy + 9cy	STABLE	STABLE	STABLE
FLT_014_MAID5-KERRGR5_161kV_MAID5-KERRGR5_1PH	MAID 161kV	Apply SLG fault at MAID 5 161 kV bus. Trip the MAID 5 to KERR GR5 161.00 kV line and MAID 5 to KERR GR5 161.00 kV line	7cy + 9cy	STABLE	STABLE	STABLE
FLT_015_MAID5-GRDA1_5_161kV_MAID5-GRDA1_5_1PH	MAID 161kV	Apply SLG fault at MAID 5 161 kV bus. Trip the MAID 5 to GRDA1 5 161.00 kV line and MAID 5 to GRDA1 5 161.00 kV line	7cy + 9cy	STABLE	STABLE	STABLE
FLT_016_MAID5-DRYGULCH5_161kV_5LOCSTGV_1PH	MAID 161kV	Apply SLG fault at MAID 5 161 kV bus. Trip the MAID 5 to DRYGULCH5 5 161.00 kV line and Disconnect 5LOCSTGV bus	7cy + 9cy	STABLE	STABLE	STABLE

Extreme Faults						
Fault Name	**Fault Location**	**Description**	**Clearing time**	**2017w_ G08**	**2018s_ G08**	**2026s_ G08**
FLT_001_GRDA17-1-GRDA17-GRDA15_345kV_3PH	GRDA17-1	Apply 3-phase fault at GRDA17-1 22.8 kV bus. Trip GRDA17-1 Unit 2 & GRDA 345/161 kV Xfmr #2	5cy + 9cy	STABLE	STABLE	STABLE
FLT_002_GRDA1_7-GREC_TAP7_345kV_3PH	GRDA1 345kV	Apply 3-phase fault at GRDA1 7 345 kV bus. Trip the GRDA1 7 to GREC TAP7 345.00 kV line and GRDA 345/161 kV Xfmr #1	5cy + 9cy	UNSTABLE #	UNSTABLE #	UNSTABLE #
FLT_003_GRDA1_7-7SPORTSMAN_345kV_GRDA-XFMR1_3PH	GRDA1 345kV	Apply3-phase fault at GRDA1 7 345 kV bus. Trip the GRDA1 7 to 7SPORTSMAN 345.00 kV line and GRDA 345/161 kV Xfmr #1	5cy + 9cy	UNSTABLE #	UNSTABLE #	UNSTABLE #
FLT_004_GRDA1_7-GREC_TAP7_345kV_GREC-GEN2_3PH	GRDA1 345kV	Apply 3-phase fault at GRDA1 7 345 kV bus. Trip the GRDA1 7 to GREC TAP7 345kV line and GREC Unit 2	5cy + 9cy	STABLE	STABLE	STABLE
FLT_005_GRDA1_7-TONECE_345kV_GRDA_XFMR2_3PH	GRDA1 345kV	Apply 3-phase fault at GRDA1 7 345 kV bus. Trip the GRDA1 7 to Tonnece 345 kV line and GRDA 345/161 kV Xfmr #2	5cy + 9cy	UNSTABLE #	UNSTABLE #	UNSTABLE #
FLT_006_GRECSTG_1-GREC1_7_GREC_TAP7_345kV_3PH	GRECSTG_1	Apply 3-phase fault at GRECCTG_1 20-kV bus. Trip GRECSTG_1 and the GREC1 7 to GREC TAP7 345.00 kV line	5cy + 9cy	STABLE	STABLE	STABLE
FLT_007_GREC_TAP7_GRDA1_7_345kV_GRDA_XFMR1_3PH	GREC TAP 345kV	Apply 3-phase fault at GREC TAP7 345 kV bus. Trip the GREC TAP7 to GRDA1 7 345.00 kV line and GRDA 345/161 kV Xfmr #1	5cy + 9cy	UNSTABLE #	UNSTABLE #	UNSTABLE #
FLT_008_GREC_TAP7_GRDA1_7_345kV_GREC_GEN2_3PH	GREC TAP 345kV	Apply 3-phase fault at GREC TAP7 345 kV bus. Trip the GREC TAP7 to GRDA1 7 345.00 kV line and GREC Unit 2	5cy + 9cy	UNSTABLE #	UNSTABLE #	UNSTABLE #
FLT_009_GRDA1_5_CLARMR5_161kV_WAGNOR5_3PH	GRDA1 161kV	Apply 3-phase fault at GRDA1 5 161 kV bus. Trip the GRDA1 5 to CLARMR 5 161.00 kV line and Disconnect WAGNOR 5 bus	7cy + 9cy	UNSTABLE #	UNSTABLE #	UNSTABLE #
FLT_010_GRDA1_5_WMAINST5_161kV_MAID5_3PH	GRDA1 161kV	Apply 3-phase fault at GRDA1 5 161 kV bus. Trip the GRDA1 5 to WMAIN ST5 161.00 kV line and GRDA1 5 to MAID 5 161.00 kV line	7cy + 9cy	UNSTABLE #	UNSTABLE #	UNSTABLE #
FLT_011_GRDA1_5_MAID5_161kV_GRDA1_2_XFMR1_3PH	GRDA1 161kV	Apply 3-phase fault at GRDA1 5 161 kV bus. Trip the GRDA1 5 to MAID 5 161.00 kV line and GRDA 161/69 kV Xfmr #1	7cy + 9cy	UNSTABLE #	UNSTABLE #	UNSTABLE #
FLT_012_MAID5_161kV_MAID5-CATSAGR5_3PH	MAID 161kV	Apply 3-phase fault at MAID 5 161 kV bus. Trip the MAID 5 to CATSAGR5 161.00 kV line and MAID 5 to CATSAGR5 161.00 kV line	7cy + 9cy	UNSTABLE #	UNSTABLE #	UNSTABLE #
FLT_013_MAID5-GERALDGAY_161kV_MAID5-CHOTEAU_3PH	MAID 161kV	Apply 3-phase fault at MAID 5 161 kV bus. Trip the MAID 5 to GERALDGAY5 161.00 kV line and MAID 5 to 5CHOTEAU1 161.00 kV line	7cy + 9cy	UNSTABLE #	UNSTABLE #	UNSTABLE #
FLT_014_MAID5-KERRGR5_161kV_MAID5-KERRGR5_3PH	MAID 161kV	Apply 3-phase fault at MAID 5 161 kV bus. Trip the MAID 5 to KERR GR5 161.00 kV line and MAID 5 to KERR GR5 161.00 kV line	7cy + 9cy	UNSTABLE #	UNSTABLE #	UNSTABLE #
FLT_015_MAID5-GRDA1_5_161kV_MAID5-GRDA1_5_3PH	MAID 161kV	Apply 3-phase fault at MAID 5 161 kV bus. Trip the MAID 5 to GRDA1 5 161.00 kV line and MAID 5 to GRDA1 5 161.00 kV line	7cy + 9cy	UNSTABLE #	UNSTABLE #	UNSTABLE #
FLT_016_MAID5-DRYGULCH5_161kV_5LOCSTGV_3PH	MAID 161kV	Apply 3-phase fault at MAID 5 161 kV bus. Trip the MAID 5 to DRYGULCH5 5 161.00 kV line and Disconnect 5LOCSTGV bus	7cy + 9cy	UNSTABLE #	UNSTABLE #	UNSTABLE #
FLT_231_MAID_5_MAID_5_CATSAGR5_161kV_3PH	MAID 161kV	SPORTSMAN - CHOTEAU 161KV OOS, APPLY 3PH FAULT AT MAID 5 161KV BUS, OPEN MAID 5 - CATSAGR5 161KV CKT 1 LINE	7cy	STABLE	STABLE	STABLE
FLT_232_MAID_5_MAID_5_GRDA1_5_161kV_3PH	MAID 161kV	SPORTSMAN - CHOTEAU 161KV OOS, APPLY 3PH FAULT AT MAID 5 161KV BUS, OPEN MAID 5 - GRDA1 5 161KV CKT 1 LINE	7cy	STABLE	STABLE	STABLE
FLT_233_MAID_5_MAID_5_DRYGULCH5_161kV_3PH	MAID 161kV	SPORTSMAN - CHOTEAU 161KV OOS, APPLY 3PH FAULT AT MAID 5 161KV BUS, OPEN MAID 5 - DRYGULCH5 161KV CKT 1 LINE	7cy	STABLE	STABLE	STABLE
FLT_234_MAID_5_MAID_5_5LOCSTGV_161kV_3PH	MAID 161kV	SPORTSMAN - CHOTEAU 161KV OOS, APPLY 3PH FAULT AT MAID 5 161KV BUS, OPEN MAID 5 - 5LOCSTGV 161KV CKT 1 LINE	7cy	STABLE	STABLE	STABLE

Extreme Faults						
Fault Name	**Fault Location**	**Description**	**Clearing time**	**2017w_ G08**	**2018s_ G08**	**2026s_ G08**
FLT_235_MAID_5_MAID_5_GERALDGAY4_161kV_3PH	MAID 161kV	SPORTSMAN - CHOTEAU 161KV OOS, APPLY 3PH FAULT AT MAID 5 161KV BUS, OPEN MAID 5 - GERALDGAY4 161KV CKT 1 LINE	7cy	STABLE	STABLE	STABLE
FLT_236_MAID_5_MAID_5_KERRGR5_161kV_3PH	MAID 161kV	SPORTSMAN - CHOTEAU 161KV OOS, APPLY 3PH FAULT AT MAID 5 161KV BUS, OPEN MAID 5 - KERR GR5 161KV CKT 1 LINE	7cy	STABLE	STABLE	STABLE
FLT_237_5SPORTSMAN_7SPORTSMAN_345-161kV_3PH	SPORTSMAN 161kV	MAID - CHOTEAU 161KV OOS, APPLY 3PH FAULT AT 5SPORTSMAN 161KV BUS, OPEN 5SPORTSMAN - 7SPORTSMAN 161/345KV TRANSFORMER CKT 1	7cy	STABLE	STABLE	STABLE
FLT_238_7SPORTSMAN_7SPORTSMAN-7GRDA1_7_345kV_3PH	SPORTSMAN 345kV	MAID - CHOTEAU 161KV OOS, APPLY 3PH FAULT AT 7SPORTSMAN 345KV BUS, OPEN 7SPORTSMAN - GRDA1 7 345KV CKT 1 LINE	5cy	UNSTABLE **	UNSTABLE **	UNSTABLE **
FLT_239_7SPORTSMAN_7SPORTSMAN-7BLACKBERRY_345kV_3PH	SPORTSMAN 345kV	MAID - CHOTEAU 161KV OOS, APPLY 3PH FAULT AT 7SPORTSMAN 345KV BUS, OPEN 7SPORTSMAN - 7BLACKBERRY 345KV CKT 1 LINE	5cy	STABLE	STABLE	STABLE
FLT_240_7SPORTSMAN_7SPORTSMAN_345-161kV_3PH	SPORTSMAN 345kV	MAID - CHOTEAU 161KV OOS, APPLY 3PH FAULT AT 7SPORTSMAN 345KV BUS, OPEN 7SPORTSMAN - 5SPORTSMAN 345/161KV TRANSFORMER CKT 1	5cy	STABLE	STABLE	STABLE

** Instability is due to the operating limit of local generators. If the operating limit is observed, no stability issues were identified.

Generators that showed instability are in close proximity to the faults simulated

For faults FLT_001 – 016 that were unstable, critical clearing times for fault clearing was investigated and the times are as follows:

Critical Clearing Times				
Fault Name	**Fault Location**	**Description**	**Clearing time**	**Critical Clearing Time**
FLT_002_GRDA1_7-GREC_TAP7_345kV_3PH	GRDA1 345kV	Apply 3-phase fault at GRDA1 7 345 kV bus. Trip the GRDA1 7 to GREC TAP7 345.00 kV line and GRDA 345/161 kV Xfmr #1	5cy + 9cy	5cy + 6cy
FLT_003_GRDA1_7-7SPORTSMAN_345kV_GRDA-XFMR1_3PH	GRDA1 345kV	Apply3-phase fault at GRDA1 7 345 kV bus. Trip the GRDA1 7 to 7SPORTSMAN 345.00 kV line and GRDA 345/161 kV Xfmr #1	5cy + 9cy	5cy + 6cy
FLT_005_GRDA1_7-TONECE_345kV_GRDA_XFMR2_3PH	GRDA1 345kV	Apply 3-phase fault at GRDA1 7 345 kV bus. Trip the GRDA1 7 to Tonnece 345 kV line and GRDA 345/161 kV Xfmr #2	5cy + 9cy	5cy + 6cy
FLT_007_GREC_TAP7_GRDA1_7_345kV_GRDA_XFMR1_3PH	GREC TAP 345kV	Apply 3-phase fault at GREC TAP7 345 kV bus. Trip the GREC TAP7 to GRDA1 7 345.00 kV line and GRDA 345/161 kV Xfmr #1	5cy + 9cy	5cy + 7cy
FLT_008_GREC_TAP7_GRDA1_7_345kV_GREC_GEN2_3PH	GREC TAP 345kV	Apply 3-phase fault at GREC TAP7 345 kV bus. Trip the GREC TAP7 to GRDA1 7 345.00 kV line and GREC Unit 2	5cy + 9cy	5cy + 7cy
FLT_009_GRDA1_5_CLARMR5_161kV_WAGNOR5_3PH	GRDA1 161kV	Apply 3-phase fault at GRDA1 5 161 kV bus. Trip the GRDA1 5 to CLARMR 5 161.00 kV line and Disconnect WAGNOR 5 bus	7cy + 9cy	7cy + 3cy
FLT_010_GRDA1_5_WMAINST5_161kV_MAID5_3PH	GRDA1 161kV	Apply 3-phase fault at GRDA1 5 161 kV bus. Trip the GRDA1 5 to WMAIN ST5 161.00 kV line and GRDA1 5 to MAID 5 161.00 kV line	7cy + 9cy	7cy + 3cy
FLT_011_GRDA1_5_MAID5_161kV_GRDA1_2_XFMR1_3PH	GRDA1 161kV	Apply 3-phase fault at GRDA1 5 161 kV bus. Trip the GRDA1 5 to MAID 5 161.00 kV line and GRDA 161/69 kV Xfmr #1	7cy + 9cy	7cy + 3cy
FLT_012_MAID5_161kV_MAID5-CATSAGR5_3PH	MAID 161kV	Apply 3-phase fault at MAID 5 161 kV bus. Trip the MAID 5 to CATSAGR5 161.00 kV line and MAID 5 to CATSAGR5 161.00 kV line	7cy + 9cy	7cy + 3cy
FLT_013_MAID5-GERALDGAY_161kV_MAID5-CHOTEAU_3PH	MAID 161kV	Apply 3-phase fault at MAID 5 161 kV bus. Trip the MAID 5 to GERALDGAY5 161.00 kV line and MAID 5 to 5CHOTEAU1 161.00 kV line	7cy + 9cy	7cy + 3cy
FLT_014_MAID5-KERRGR5_161kV_MAID5-KERRGR5_3PH	MAID 161kV	Apply 3-phase fault at MAID 5 161 kV bus. Trip the MAID 5 to KERR GR5 161.00 kV line and MAID 5 to KERR GR5 161.00 kV line	7cy + 9cy	7cy + 1cy
FLT_015_MAID5-GRDA1_5_161kV_MAID5-GRDA1_5_3PH	MAID 161kV	Apply 3-phase fault at MAID 5 161 kV bus. Trip the MAID 5 to GRDA1 5 161.00 kV line and MAID 5 to GRDA1 5 161.00 kV line	7cy + 9cy	7cy + 3cy
FLT_016_MAID5-DRYGULCH5_161kV_5LOCSTGV_3PH	MAID 161kV	Apply 3-phase fault at MAID 5 161 kV bus. Trip the MAID 5 to DRYGULCH5 5 161.00 kV line and Disconnect 5LOCSTGV bus	7cy + 9cy	7cy + 3cy