



***Affected System Impact  
Study on Load Flow, Short  
Circuit, and Stability for  
(Project #040708-01)***

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# I. INTRODUCTION

This Affected System Impact Study is part of the interconnection study process for an Affected System which is based on the Transmission Provider's analysis of the Interconnection Customer's request. This analysis has identified and requires the Interconnection Customer to request Cleco Power to perform an Affected System study for an interconnection on the transmission system at the Grand Gulf 500 kV substation located in Claiborn County, Mississippi for Project #040708-01. The requested interconnection will be evaluated as a Network Resource for the Transmission Provider. The proposed interconnection will be as follows:

- Installation of one new 1594 MW nuclear unit facility at Grand Gulf for a total incremental generating capacity of 1594 MW.
- Electrical connection to the existing Grand Gulf 500 kV switchyard.

The objective of this affected system study is to assess the reliability impact of the new facility on the Cleco Power's transmission system. Although this study is not intended to examine pre-existing problems unrelated to the proposed plant, it is intended to determine whether the transmission system meets Cleco Power's performance criteria when the plant is in-service. If not, transmission improvements will be identified and evaluated.

Interconnection Customer intends to install one new nuclear unit facility rated 1933 MVA with an expected power factor of 0.87, yielding a maximum gross output of 1687 MW. An auxiliary/host load of approximately 93 MW is expected at this site. Interconnection Customer anticipates injecting a total of approximately 1594 MW into the Transmission Provider's

transmission system. This project will increase the maximum total output at Grand Gulf Power Station to approximately 2932 MW. Interconnection Customer anticipates injecting approximately 1594 MW incremental into the Transmission Provider's transmission system.

The proposed in-service date for this facility is January 1, 2015.

The installation of this generation required a load flow analysis to determine if the existing Cleco Power transmission facilities are adequate to handle this amount of generation, a transient stability analysis to determine if this unit will have an adverse effect on the dynamic stability of the Cleco transmission system, and a short circuit analysis to determine if the generation would cause the available fault current to surpass the fault duty of previously installed equipment on the Cleco Power system.

This Affected System Impact Study was based on information provided by Interconnection Customer and assumptions made by Cleco's Transmission System Planning department. If the actual equipment installed is different from the supplied information or the assumptions made, the results outlined in this report are subject to change.

**It should be noted that carrying out the mandatory upgrades identified in this report does not guarantee transmission service for the customer. Transmission Service should be requested through OASIS and the request will be granted on a first-come, first served basis.**

Any assumptions or scenarios the Interconnection Customer deems appropriate for completeness of the Interconnection System Impact Study process must be submitted in writing with or before the receipt of the signed request for the Interconnection System Impact Study.

## **II. MODEL & CRITERIA**

### **A. Model Information**

The load flow analysis was performed based on the projected 2012 summer peak SERC load flow models. All firm power transactions between Transmission Provider and its neighboring control areas were modeled. Existing Transmission Provider designated network resource generation was modified to accommodate the proposed plant generation. In addition, as stated in the Large Generator Interconnection Proposal (LGIP) all proposed generation with a prior position in Transmission Provider's interconnection queue was modeled in an attempt to reflect worst case conditions. Mandatory transmission upgrades were also included to build a revised case for the load flow analysis. Therefore, for this request the dispatch scenario considered the transfer of 1594 MW of incremental generation at Grand Gulf Power Station to displace existing network resources and contracts.

The generator step-up transformers, generators, and interconnecting lines were modeled according to the information provided by Interconnection Customer.

### **Modifications to Model**

All interconnection requests that are in a prior (higher) position in the queue are required to be modeled when studying the current interconnection request.

There are no known upgrades required for preexisting projects in the Cleco Power LGIP queue.

The Transmission Provider required upgrades for this project are defined as follows:

- Upgrade the existing 40,000A breakers J3208 and J3210 at Lakeover 115 kV substation.
- Build 48 miles 500kV transmission line from Grand Gulf 500kV to Ray Braswell 500kV.
- Remove the existing Baxter Wilson to Ray Braswell 500kV line from Ray Braswell substation, and extend this line 22 miles to Lake Over 500kV.
- Build 56mile 500kV line from Webre 500kV to Richard 500kV

## **B. Software & Criteria**

### **i) AC Load Flow Analysis:**

The purpose of the load flow analysis is to stress the transmission system with the new generation addition by simulating outages on facilities in Cleco, Entergy, AEP, LEPA, and Lafayette Utility System while monitoring Cleco Power facilities to determine the impact of the incremental generation addition upon the Cleco Power transmission system. The objective is to identify potential criteria violations of current and voltage as identified in the Performance Criteria section of this report. This analysis was performed using PTI's Power System Simulator for Engineering (PSS/E) and MUST software to determine the reliability impact on the transmission system under single contingencies. Line loading levels were monitored for each contingency. If any additional facilities were found to be overloaded as a result of the upgrades, those facilities were upgraded as well and put back in the revised load flow case. The analysis was considered to be complete once no facilities were found to be overloaded.

## **ii) Short Circuit Analysis:**

The objective of the short circuit analysis is to determine the impact if any that the new generation will have on system fault current. The new fault current levels will be evaluated to determine if existing fault interrupting devices exceed their rating under simulated fault conditions as a result of the new generation addition. The software used in this fault analysis is ASPEN short circuit program.

## **iii) Transient Stability Analysis**

The objective of the transient stability analysis is to determine the ability of generators to remain in synchronism with one another by surviving the first swing of a disturbance such as a ground fault and subsequent breaker action on the Transmission System. Transient stability also simulates the ability of the system as a whole to return to a given steady-state equilibrium after being moved away from it by a small perturbation.

## **iv) Performance Criteria**

The criteria for overload and voltage violations are as follows:

### **A) With All Lines in Service**

- All bus voltages must remain within a 0.95 to 1.05 p.u. voltage range.
- The MVA flow in any branch should not exceed Rate A (normal rating).

### **B) Under Contingencies**

- All bus voltages must remain within a 0.92 to 1.05 p.u. range.

- Voltage deviation of no more than 0.03 p.u. between pre-contingency and post-contingency cases.
- The MVA flow through any facility should not exceed the emergency Rate B.
- If the flow on a facility in the exceeds 100% of its emergency rating with the plant in service for a particular contingency, the loading shall be compared with the corresponding loading on the line under a similar situation without the plant. If the plant causes a flow difference higher than 3.0%, the facility is expected to require improvement.
- If more than one scenario is used for dispatching power from the new plant, overloaded facilities that appear in all dispatch scenarios are expected to be improved regardless of their proximity to the new plant.

### **C) Short Circuit**

- Fault interrupting devices which exceed 90 % of rating will be designated as mandatory upgrade and replaced.

### **III. NETWORK RESOURCE INTERCONNECTION**

#### **A. Network Resource Interconnection Study Guidelines**

Transmission Provider must conduct the necessary studies and construct the Network Upgrades needed to integrate the Large Generating Facility (1) in a manner comparable to that in which Transmission Provider integrates its Generating Facilities to serve native load customers; or (2) in an ISO or RTO with market based congestion management, in the same manner as all other Network Resources. Network Resource Interconnection Service Allows Interconnection Customer's Large Generating Facility to be designated as a Network Resource, up to the Large Generating Facility's full output, on the same basis as all other existing Network Resources interconnected to Transmission Provider's Transmission System, and to be studied as a Network Resource on the assumption that such a designation will occur.

The Interconnection Study for Network Resource Interconnection Service shall assure that the Interconnection Customer's Large Generating Facility meets the requirements for Network Resource Interconnection Service and as a general matter, that such Large Generating Facility's interconnection is also studied with Transmission Provider's Transmission System at peak load, under a variety of severely stressed conditions, to determine whether, with the Large Generating Facility at full output, the aggregate of generation in the local area can be delivered to the aggregate of load on Transmission Provider's Transmission System, consistent with Transmission Provider's reliability criteria and procedures. This approach assumes that some portion of existing Network Resources are displaced by the output of Interconnection Customer's

Large Generating Facility. Network Resource Interconnection Service in and of itself does not convey any right to deliver electricity to any specific customer or Point of Delivery.

## **B. Power Flow Results**

After performing the AC Contingency analysis, it was determined that the elements shown in Table I.a. through I.b. are the limiting elements.

**TABLE I.a.**  
**GRAND GULF 1594 MW INCREMENTAL PLANT**  
**PLANT MODELED AT GRAND GULF 500 KV SWITCHYARD**  
**Preexisting Cleco LGIP Queue Position and Upgrades in-service**  
**(All Lines in service)**

2012 Total Grand Gulf Gen (MW)	Limiting Facility	Rating (MVA)	Base Loading (MW)
0	None		

**TABLE I.b.**  
**GRAND GULF 1594 MW INCREMENTAL PLANT**  
**PLANT MODELED AT GRAND GULF 500 KV SWITCHYARD**  
**Preexisting Cleco LGIP Queue Position and Upgrades in-service**

*UPGRADES:*  
*All Entergy SIS Upgrades*

*Planning Estimate*  
 Unknown

2012 Total Grand Gulf Gen (MW)	Overloaded Facility (Requires Upgrade)	First Contingency Responsible for Overload	Rating (MVA)
<i>Total:</i> >2000	Ray Braswell to Grand Gulf 500 kV line	Grand Gulf to Franklin 500 kV	1732

## **C. Transient Stability**

### **i) Model Information**

The 2005 dynamic database supplied by the Transmission Provider was used in this study and applied to the 2005 summer peak model. The Cleco System load and generation in this model are 2152 MW and 2834 MW respectively. One new 1594 MW Nuclear Facility is represented at the Interconnection Customer's 27 kV bus. The unit is dispatched at rated capacity. A total of 1594 MW of new generation was committed at the Interconnection Customer's plant. The new Interconnection Customer generators are represented using the standard PSS<sup>TM</sup>E dynamic stability 'GENROU' model, the exciter is represented as the 'ESST4B' model, the turbine governor is represented using the 'IEEEG1' model, and the Power System Stabilizer is represented using the 'PSS2A' model. The parameters for each of the models representing the Interconnection Customer units are shown in Appendix E. The loads in Cleco system have been represented using a constant current model for real power and a constant impedance model for reactive power.

### **ii) Transient Stability Analysis**

The stability analysis was performed using the PSS<sup>TM</sup>E dynamic stability program. Three phase faults were simulated in this study. These are considered to be the worst cases from a stability standpoint. Critical clearing time was determined for the worst three-phase fault conditions.

The list of cases simulated is shown below.

### Interconnection Customer stability analysis results

<b>Fault Location</b>	<b>Fault Type</b>	<b>Fault Duration</b>	<b>Facilities Tripped</b>	<b>Unstable Units</b>	<b>Status</b>
Richard 500 kV Bus	3Ph	25 Cycles	Richard to Webre 500 kV line		Stable
Richard 138 kV Bus	3Ph	25 Cycles	Richard to Colonial Acad 138 kV line		Stable

### iii) Study Results

#### Fault at Richard 500 kV Bus: - 25 Cycle Fault

A 3 phase fault was simulated at the Richard 500 kV end of the Richard to Webre 500 kV line. The breaker at the Richard 500 kV bus was tripped after 6 cycles. The fault continues to remain on the line for an additional nineteen (19) cycles, at which time the Richard to Webre 500 kV line segment is opened and the fault is removed from the transmission system. From the plots, it can be observed that the transmission system is stable. The plots for this simulation are shown in Appendix F.

#### Fault at Richard 138 kV Bus: - 25 Cycle Fault

A 3 phase fault was simulated at the Richard 138 kV end of the Richard to Colonial Academy 138 kV line. The breaker at the Richard 138 kV bus was tripped after 6 cycles. The fault continues to remain on the line for an additional nineteen (19) cycles, at which time the Richard to Colonial Academy 138 kV line segment is opened and the fault is removed from the transmission system. From the plots, it can be observed that the transmission system is stable.

The plots for this simulation are shown in Appendix F.

#### **iv) Transient Stability Results**

The Transient stability simulations indicate that for a 3 phase fault and breaker failure condition, the new Interconnection Customer's generators do not impact the stability of the transmission system. .

This study was performed using supplied data plus assumptions for the Interconnection Customer units and we recommend that this study be reviewed after more accurate data for the generators are obtained from the vendor.

## D. Short Circuit Results

The results of the short circuit analysis indicate that the addition of 1594 MW of generation addition at Grand Gulf Power Station causes an increase in short circuit fault levels such that the short circuit currents exceed the interrupting capability of the existing 138 kV Breakers at Richard and Acadia substations. The breakers at the Richard substation are the property of Cleco Power. The breakers at the Acadia substation are the property of Acadia Power Partners, which will need to be notified by the ICT that they are an Affected System to this request.

### FAULT STUDY RESULTS

THE INTERRUPT RATING OF THE FOLLOWING BREAKERS WILL BE EXCEEDED AS A RESULT OF THE ADDITION OF THE PROPOSED GENERATION:

ACADIA BREAKER	EXISTING RATING	STUDY FAULT DUTY	BREAKER RESULTS	PERCENTAGE
8901	63,000A	61,763A	64,480A	102.3%
8905	63,000A	61,763A	64,480A	102.3%
8909	63,000A	61,763A	64,480A	102.3%
8912	63,000A	61,763A	64,480A	102.3%
8916	63,000A	61,763A	64,480A	102.3%
8920	63,000A	61,763A	64,480A	102.3%
8923	63,000A	61,763A	64,480A	102.3%
8927	63,000A	61,763A	64,480A	102.3%
8931	63,000A	61,763A	64,480A	102.3%
8934	63,000A	61,763A	64,480A	102.3%
8938	63,000A	61,763A	64,480A	102.3%
8942	63,000A	61,763A	64,480A	102.3%
8945	63,000A	61,763A	64,480A	102.3%
8949	63,000A	61,763A	64,480A	102.3%
8953	63,000A	61,763A	64,480A	102.3%
8956	63,000A	61,763A	64,480A	102.3%
8960	63,000A	61,763A	64,480A	102.3%
8964	63,000A	61,763A	64,480A	102.3%

RICHARD BREAKER	EXISTING RATING	STUDY FAULT DUTY	BREAKER RESULTS	PERCENTAGE
17235	63,000A	61,735A	64,531A	102.4%
17240	63,000A	61,735A	64,531A	102.4%
17245	63,000A	61,735A	64,531A	102.4%

17250	63,000A	61,735A	64,531A	102.4%
17255	63,000A	61,735A	64,531A	102.4%
17260	63,000A	61,735A	64,531A	102.4%
17265	63,000A	61,735A	64,531A	102.4%
18440	63,000A	61,763A	64,531A	102.4%

## **E. Problem Resolution**

Table I.b. of Section III.B. identifies upgrades that relieve any overload conditions caused by the generation addition of 1594 MW at Grand Gulf 500 kV substation. There are no Cleco Power Transmission System Steady State overload conditions resulting from the addition of the new 1594 MW at Grand Gulf 500 kV substation.

The results of the transient stability analysis in Section III.C indicate that there is no stability issues associated with the addition of the new facility.

The results the short circuit analysis in Section III.D. indicate that the addition of 1594 MW of generation addition at Grand Gulf Power Station causes an increase in short circuit fault levels such that the short circuit currents exceed the interrupting capability of the existing 138 kV Breakers at Richard and Acadia substations. A total of 26 (twenty-six) 63kA circuit breakers exceed their fault interrupting capability at the Richard 138 kV and Acadia 138 kV substations. The estimated cost to replace a breaker is \$462,000 per breaker. The estimated total cost for the replacement of the eight 63kA circuit breakers for Cleco Power with eight 80kA breakers is \$3,696,000. Acadia Power Partners will need to be contacted by the SPP ICT to get an estimate on the replacement cost of the eighteen breakers within their ownership.

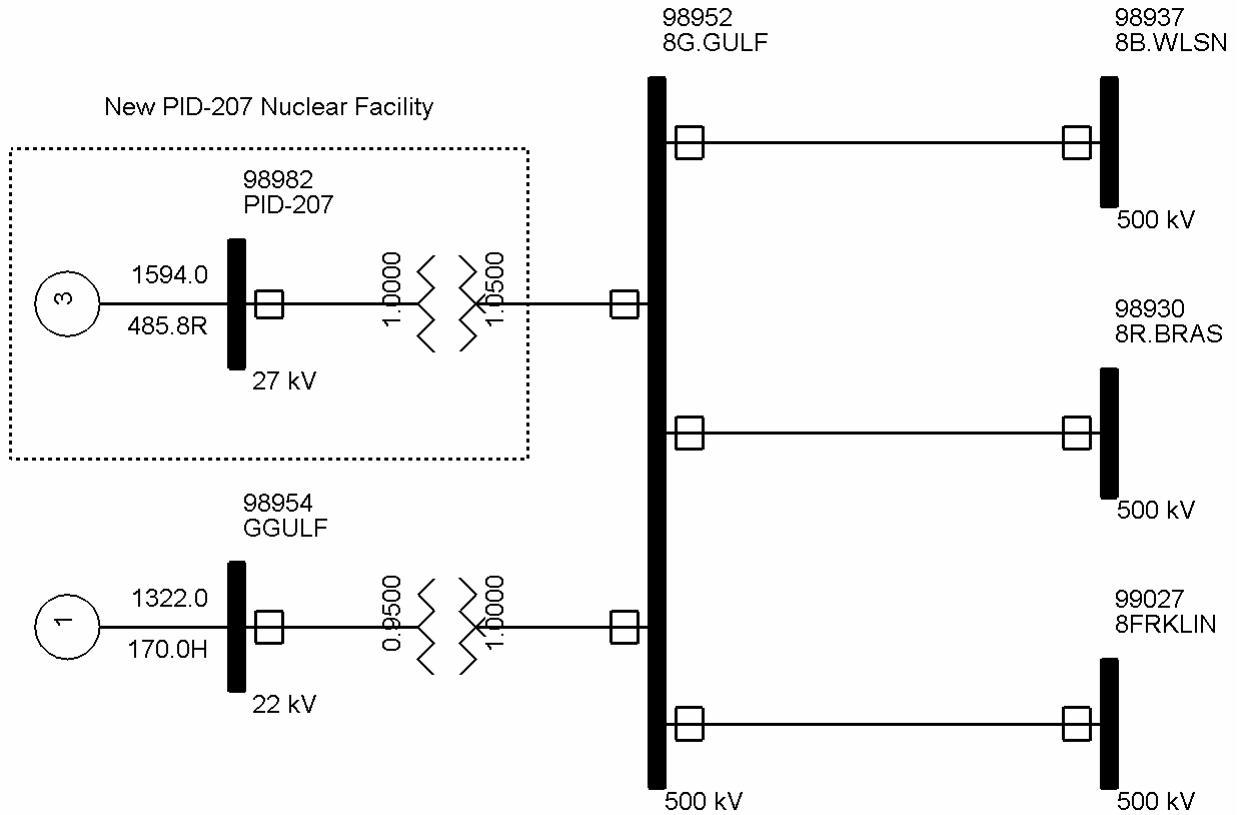
## **IV. CONCLUSION/RECOMMENDATION**

Based on the results presented in this Affected System Impact Study, which is to determine the impact on Cleco Power's transmission system the addition of new generation at Grand Gulf, will require mandatory upgrades in the Affected Cleco Transmission System. This generation addition at Grand Gulf Power Station will require the replacement of eight 63 kA 138 kV breakers at the Richard 138 kV substations with eight 80 kA circuit breakers with an estimated cost of approximately \$3,696,000.

## **V. ESTIMATED COST OF REQUIRED UPGRADES**

Replacement of eight 63kA circuit breakers at the Richard 138 kV substation with eight 80kA circuit breakers is estimated to cost \$3,696,000.

## Appendix A – One Line Diagram with Utility Interconnects



Interconnection Customer  
GENERATION

One new 1594 MW  
Nuclear Facility

Total 1594 MW

## Appendix B – Data Supplied by Interconnection Customer

### I. Unit Information

- The plant will consist of one 1933 MVA steam turbine generators.
- The net output capability of the plant is 1594 MW. This represents the maximum capability on a typical summer day (mid 90's dry bulb temperature)

Type of Generating Unit	1933 MVA Generator
Approximate MVA Rating	1933 MVA
Generator Model Used	GENROU
Generator Voltage	27 kV
T'do – Transient Direct Axis O.C. Field Time Constant	11.300
T''do – Subtransient Direct Axis O.C. Field Time Constant	0.038
T'qo – Transient Direct Axis O.C. Field Time Constant	0.530
T''qo – Subtransient Direct Axis O.C. Field Time Constant	0.068
H – Turbine & Generator Inertia	4.84 kW-sec/kVA
D – Damping	0.000
Xd – Direct Axis Reactance	2.060
Xq – Quadrature Axis Reactance	1.940
X'd – Transient Direct Axis Reactance	0.365
X'q – Transient Quadrature Axis Reactance	0.550
X''d – Subtransient Direct Axis Reactance	0.280
X <sub>L</sub> – Leakage Reactance	0.225
Saturation Factor @ 1.0 pu V	0.375
Saturation Factor @ 1.2 pu V	1.100

All the above values are on machine base.

### II. Generator Step-Up Transformer Information

Type of transformer	one each 1,200 MVA 3 ph.
Voltage	27/525 kV
Impedance	14.0% @ 1,200 MVA
MVA Rating	1,200/2,000 MVA @65 F

## Appendix C - Load Flow Model Data

### New Bus Data

<b>Bus Description</b>	<b>Bus Number</b>	<b>Bus Name</b>	<b>Bus Voltage</b>
Grand Gulf Nuclear Unit #3	98982	PID-207 27	27 kV

### New Branch/Transformer Data (Per Unit on 100MVA Base)

<b>From Bus</b>	<b>To Bus</b>	<b>Ckt#</b>	<b>R</b>	<b>X</b>	<b>B</b>	<b>Rating</b>
Grand Gulf 500	PID-207 27	1	0.00140	0.14000	0.0	1200MVA

### Generator Data

<b>Bus#</b>	<b>id</b>	<b>Pg</b>	<b>Qg</b>	<b>Qmax</b>	<b>Qmin</b>	<b>vs</b>	<b>ireg</b>	<b>Mbase</b>	<b>Pmax</b>	<b>Pmin</b>
98982	3	1594	513	842	-603	1.020	98952	1933	1612	0

## Appendix D - Load Flow Results

### 2012 Summer Peak Base Case AC Contingency

# Branch Violations

PSS(tm)MUST 8.3.1 -- Managing and Utilizing System Transmission -- WED, APR 23 2008 15:43  
 2012 SUMMER PEAK  
 2006 SERIES ENTERGY BASE CASE MODELS - 08/23/06  
 Case.File L:\TPP\interconnection\LGIP\_08\ASR 040708-01\SIS\EN12S06-newR15-lupg+nocst-bw1-bw2-  
 intch-noipp-scaleback-bcajl&2\_CLEQueue.sav  
 Subsys.File L:\TPP\interconnection\LGIP\_08\ASR 040708-01\SIS\AS-040708-01\_must.sub  
 Monit.File L:\TPP\interconnection\LGIP\_08\ASR 040708-01\SIS\AS-040708-01\_must.mon  
 Contin.File L:\TPP\interconnection\LGIP\_08\ASR 040708-01\SIS\AS-040708-01\_must.con  
 Exclud.File none

Branches with MVA flow more than 100.0 % of nominal rating

Limiting Element	ContMV A	Base Flow	Rating	Load- ing%	Ncon	Contingency
50085 HOPKINS4 138 98177 4MORIL 138 1	303.4	226.0	288.0	105.4	57	50092 IVANHOE4 138 50096 JULTAP 4 138 1
50085 HOPKINS4 138 98177 4MORIL 138 1	305.4	226.0	288.0	106.0	59	50096 JULTAP 4 138 50192 TECHE 4 138 1
50005 BRAPID 4 138 50197 TWINBR 4 138 1	331.3	132.0	325.0	101.9	74	50153 PINEV 6 230 50154 PINEV 4 138 1
50005 BRAPID 4 138 50197 TWINBR 4 138 1	331.3	132.0	325.0	101.9	75	50153 PINEV 6 230 50182 SHERWD 6 230 1
50085 HOPKINS4 138 98177 4MORIL 138 1	303.0	226.0	288.0	105.2	119	50092 IVANHOE4 138 98185 4BUWHSE 138 1
50031 COCODR 6 230 50039 COUGH 4 138 1	388.3	229.9	386.0	100.6	440	98107 8RICHARD 500 98109 8WELLS 500 1
50217 WELSRCT6 230 98109 8WELLS 500 1	889.4	296.6	560.0	158.8	440	98107 8RICHARD 500 98109 8WELLS 500 1
50085 HOPKINS4 138 98177 4MORIL 138 1	304.4	226.0	288.0	105.7	443	98109 8WELLS 500 98430 8WEBRE 500 1
50168 RAMOS 4 138 98572 4GIBSON 138 1	269.3	53.1	253.0	106.5	443	98109 8WELLS 500 98430 8WEBRE 500 1
50085 HOPKINS4 138 98177 4MORIL 138 1	298.0	226.0	288.0	103.5	454	98184 4DUBOIN 138 98185 4BUWHSE 138 1
50057 FISHER 4 138 99115 3FISHER 115 1	86.3	46.7	83.0	104.0	1128	99112 3WINFLD 115 99193 3WINPRS 115 1
50057 FISHER 4 138 99115 3FISHER 115 1	84.6	46.7	83.0	102.0	1130	99114 3CANVR 115 99193 3WINPRS 115 1

# AC Bus Voltage Violations

PSS(tm)MUST 8.3.1 -- Managing and Utilizing System Transmission -- WED, APR 23 2008 15:03  
 2012 SUMMER PEAK  
 2006 SERIES ENTERGY BASE CASE MODELS - 08/23/06  
 Case.File L:\TPP\interconnection\LGIP\_08\ASR 040708-01\SIS\EN12S06-newR15-lupg+nocst-bw1-  
 bw2-intch-noipp-scaleback-bcajl&2\_CLEQueue.sav  
 Subsys.File L:\TPP\interconnection\LGIP\_08\ASR 040708-01\SIS\AS-040708-01\_must.sub  
 Monit.File L:\TPP\interconnection\LGIP\_08\ASR 040708-01\SIS\AS-040708-01\_must.mon  
 Contin.File L:\TPP\interconnection\LGIP\_08\ASR 040708-01\SIS\AS-040708-01\_must.con  
 Exclud.File Terminal

Buses with voltage violations.

Bus #	Bus Name	KV	ContVolt	BaseVolt	Ncon	Contingency Description
50076	GUIDRY 4	138.0	0.9062	0.9348	27	50031 COCODR 6 230 50039 COUGH 4 138 1
50296	G6EVAN	13.8	0.8979	0.9364	27	50031 COCODR 6 230 50039 COUGH 4 138 1
50297	G7EVAN	22.0	0.8918	0.9300	27	50031 COCODR 6 230 50039 COUGH 4 138 1
50297	G7EVAN	22.0	0.9138	0.9300	29	50031 COCODR 6 230 50177 ROEMR 6 230 1
50298	G6-1EVAN	23.8	0.9198	0.9411	29	50031 COCODR 6 230 50177 ROEMR 6 230 1
50299	G7-1EVAN	23.8	0.9198	0.9411	29	50031 COCODR 6 230 50177 ROEMR 6 230 1
50300	G7-2EVAN	23.8	0.9198	0.9411	29	50031 COCODR 6 230 50177 ROEMR 6 230 1
50131	NATCH 4	138.0	0.8914	0.9359	31	50033 COLFAX 6 230 50177 ROEMR 6 230 1

N:\Oasis\_Data\Interconnection Procedures\2008 Interconnection Studies\040708-01\Affect System Impact  
 Study\Affected System Impact Study 040708-01\_Final.doc  
 Issued By: Cleco Power Transmission Planning Department  
 Issued on: July 7, 2008

50165	PRICE 4	138.0	0.9073	0.9509	31	50033 COLFAX 6	230	50177 RODEMR 6	230	1
50076	GUIDRY 4	138.0	0.8639	0.9348	38	50039 COUGH 4	138	50162 PLAISAN4	138	1
50162	PLAISAN4	138.0	0.8809	0.9504	38	50039 COUGH 4	138	50162 PLAISAN4	138	1
50120	MANY 4	138.0	0.9024	0.9899	47	50057 FISHER 4	138	50120 MANY 4	138	1
50297	G7EVAN	22.0	0.9198	0.9300	80	50174 RAPIDES6	230	50177 RODEMR 6	230	1
50028	CLARN 4	138.0	0.9139	0.9633	99	50027 CLARN 6	230	99116 6MONTGY	230	1
50131	NATCH 4	138.0	0.8845	0.9359	99	50027 CLARN 6	230	99116 6MONTGY	230	1
50165	PRICE 4	138.0	0.9006	0.9509	99	50027 CLARN 6	230	99116 6MONTGY	230	1
50028	CLARN 4	138.0	0.9195	0.9633	100	50033 COLFAX 6	230	99116 6MONTGY	230	1
50131	NATCH 4	138.0	0.8904	0.9359	100	50033 COLFAX 6	230	99116 6MONTGY	230	1
50165	PRICE 4	138.0	0.9063	0.9509	100	50033 COLFAX 6	230	99116 6MONTGY	230	1
50076	GUIDRY 4	138.0	0.9148	0.9348	440	98107 8RICHARD	500	98109 8WELLS	500	1
50282	G2RODEMR	22.0	1.0513	1.0472	440	98107 8RICHARD	500	98109 8WELLS	500	1
50290	G1-1ACAD	18.0	0.9146	0.9422	440	98107 8RICHARD	500	98109 8WELLS	500	1
50291	G1-2ACAD	18.0	0.9146	0.9422	440	98107 8RICHARD	500	98109 8WELLS	500	1
50292	G1 ACAD	18.0	0.9146	0.9422	440	98107 8RICHARD	500	98109 8WELLS	500	1
50293	G2-1ACAD	18.0	0.9146	0.9422	440	98107 8RICHARD	500	98109 8WELLS	500	1
50294	G2-2ACAD	18.0	0.9146	0.9422	440	98107 8RICHARD	500	98109 8WELLS	500	1
50295	G2 ACAD	18.0	0.9146	0.9422	440	98107 8RICHARD	500	98109 8WELLS	500	1
50297	G7EVAN	22.0	0.9164	0.9300	440	98107 8RICHARD	500	98109 8WELLS	500	1
50076	GUIDRY 4	138.0	0.8637	0.9348	443	98109 8WELLS	500	98430 8WEBRE	500	1
50162	PLAISAN4	138.0	0.8806	0.9504	443	98109 8WELLS	500	98430 8WEBRE	500	1
50281	G1RODEMR	22.0	1.0505	1.0426	443	98109 8WELLS	500	98430 8WEBRE	500	1
50282	G2RODEMR	22.0	1.0523	1.0472	443	98109 8WELLS	500	98430 8WEBRE	500	1
50290	G1-1ACAD	18.0	0.9032	0.9422	443	98109 8WELLS	500	98430 8WEBRE	500	1
50291	G1-2ACAD	18.0	0.9032	0.9422	443	98109 8WELLS	500	98430 8WEBRE	500	1
50292	G1 ACAD	18.0	0.9032	0.9422	443	98109 8WELLS	500	98430 8WEBRE	500	1
50293	G2-1ACAD	18.0	0.9032	0.9422	443	98109 8WELLS	500	98430 8WEBRE	500	1
50294	G2-2ACAD	18.0	0.9032	0.9422	443	98109 8WELLS	500	98430 8WEBRE	500	1
50295	G2 ACAD	18.0	0.9032	0.9422	443	98109 8WELLS	500	98430 8WEBRE	500	1
50296	G6EVAN	13.8	0.8975	0.9364	443	98109 8WELLS	500	98430 8WEBRE	500	1
50297	G7EVAN	22.0	0.8914	0.9300	443	98109 8WELLS	500	98430 8WEBRE	500	1
50298	G6-1EVAN	23.8	0.9081	0.9411	443	98109 8WELLS	500	98430 8WEBRE	500	1
50299	G7-1EVAN	23.8	0.9081	0.9411	443	98109 8WELLS	500	98430 8WEBRE	500	1
50300	G7-2EVAN	23.8	0.9081	0.9411	443	98109 8WELLS	500	98430 8WEBRE	500	1
50000	ABBEVL 4	138.0	0.9073	0.9630	451	98177 4MORIL	138	98178 4DELACAMB	138	1
50076	GUIDRY 4	138.0	0.9126	0.9348	557	98410 4LIVON	138	98411 4WILBT	138	1
50076	GUIDRY 4	138.0	0.9069	0.9348	1809	97319 4VATCAN	138	98130 4SCOTT	138	1
50000	ABBEVL 4	138.0	0.9172	0.9630	1824	97330 4LEBLAN	138	98178 4DELACAMB	138	1
50131	NATCH 4	138.0	0.9182	0.9359	1904	Unit: 50280 G1DOLHIL	24.0	Id:1		
50282	G2RODEMR	22.0	1.0523	1.0472	1905	Unit: 50281 G1RODEMR	22.0	Id:1		
50281	G1RODEMR	22.0	1.0505	1.0426	1906	Unit: 50282 G2RODEMR	22.0	Id:1		

## 2012 Summer Peak AC Contingency, 1594 MW with Upgrades

### Branch Violations

PSS(tm)MUST 8.3.1 -- Managing and Utilizing System Transmission -- TUE, APR 29 2008 13:29  
 2012 SUMMER PEAK+ GGUNIT2 ON  
 2006 SERIES ENTERGY BASE CASE MODELS - 08/23/06  
 Case.File L:\TPP\interconnection\LGIP\_08\ASR 040708-01\SIS\EN12S06-newR15-lupg+nocst-bw1-bw2-intch-noipp-scaleback-up3-bcaj1&2+GG2\_CELQueue\_CLEug.sav  
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 Monit.File L:\TPP\interconnection\LGIP\_08\ASR 040708-01\SIS\AS-040708-01\_must.mon  
 Contin.File L:\TPP\interconnection\LGIP\_08\ASR 040708-01\SIS\AS-040708-01\_must.con  
 Exclud.File Terminal

Branches with MVA flow more than 100.0 % of nominal rating

Limiting Element	ContMV A	Base Flow	Rating	Load- ing%	Ncon	Contingency
50005 BRAPID 4 138 50197 TWINBR 4 138 1	329.5	131.5	325.0	101.4	74	50153 PINEV 6 230 50154 PINEV 4 138 1
50005 BRAPID 4 138 50197 TWINBR 4 138 1	329.5	131.5	325.0	101.4	75	50153 PINEV 6 230 50182 SHERWD 6 230 1

### AC Bus Voltage Violations

PSS(tm)MUST 8.3.1 -- Managing and Utilizing System Transmission -- TUE, APR 29 2008 11:21  
 2012 SUMMER PEAK+ GGUNIT2 ON  
 2006 SERIES ENTERGY BASE CASE MODELS - 08/23/06  
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 Monit.File L:\TPP\interconnection\LGIP\_08\ASR 040708-01\SIS\AS-040708-01\_must.mon  
 Contin.File L:\TPP\interconnection\LGIP\_08\ASR 040708-01\SIS\AS-040708-01\_must.con  
 Exclud.File Terminal

Buses with voltage violations.

Bus #	Bus Name	KV	ContVolt	BaseVolt	Ncon	Contingency Description
50286	G3RODEMR	22.0	1.0833	1.0833	**	Base Case **
50287	TECHE_BS	13.8	1.0988	1.0988	**	Base Case **
50288	TECHE_06A	18.0	1.0793	1.0793	**	Base Case **
50289	TECHE_06B	18.0	1.0793	1.0793	**	Base Case **
50076	GUIDRY 4	138.0	0.9089	0.9378	27	50031 COCODR 6 230 50039 COUGH 4 138 1
50296	G6EVAN	13.8	0.9001	0.9389	27	50031 COCODR 6 230 50039 COUGH 4 138 1
50297	G7EVAN	22.0	0.8939	0.9326	27	50031 COCODR 6 230 50039 COUGH 4 138 1
50297	G7EVAN	22.0	0.9173	0.9326	29	50031 COCODR 6 230 50177 RODEMR 6 230 1
50076	GUIDRY 4	138.0	0.8641	0.9378	38	50039 COUGH 4 138 50162 PLAISAN4 138 1
50162	PLAISAN4	138.0	0.8810	0.9533	38	50039 COUGH 4 138 50162 PLAISAN4 138 1
50120	MANY 4	138.0	0.9041	0.9904	47	50057 FISHER 4 138 50120 MANY 4 138 1
50000	ABBEVL 4	138.0	0.9068	0.9645	453	98177 4MORIL 138 98178 4DELCCAMB 138 1
50076	GUIDRY 4	138.0	0.9149	0.9378	559	98410 4LIVON 138 98411 4WILBT 138 1
50076	GUIDRY 4	138.0	0.9090	0.9378	1812	97319 4VATCAN 138 98130 4SCOTT 138 1
50000	ABBEVL 4	138.0	0.9156	0.9645	1827	97330 4LEBLAN 138 98178 4DELCCAMB 138 1
50282	G2RODEMR	22.0	1.0523	1.0463	1908	Unit: 50281 G1RODEMR 22.0 Id:1
50281	G1RODEMR	22.0	1.0505	1.0411	1909	Unit: 50282 G2RODEMR 22.0 Id:1

50282	G2RODEM	22.0	1.0500	1.0463	1911	Unit: 50286 G3RODEM	22.0	Id:1
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**2012 Summer Peak Base Case Transfer**

**AC FCITC MULTIPLE TRANSFER REPORT**

PSS(tm)MUST 8.3.1 -- Managing and Utilizing System Transmission -- TUE, JUN 24 2008 8:05  
 2012 SUMMER PEAK  
 2006 SERIES ENTERGY BASE CASE MODELS - 08/23/06  
 Case.File L:\TPP\interconnection\LGIP\_08\ASR 040708-01\SIS\EN12S06-newR15-lupg+nocst-bw1-bw2-intch-noipp-scaleback-bcaj1&2\_CLEQueue.sav  
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 Contin.File L:\TPP\interconnection\LGIP\_08\ASR 040708-01\SIS\AS-040708-01\_must.con  
 Exclud.File none

AC FCITC	Limiting Constraint	Contingency	Pre Shift	Post Shift	AC TDF
Transfer from GG_Nuke_Exp to EES_Imp_50, Test Transfer level is 2000 MW					
-3197.7	50217 WELSRCT6 230 98109 8WELLS 500 1	98107 8RICHARD 500 98109 8WELLS 500 1	889.4	743.0	0.04578
Transfer from GG_Nuke_Exp to EES_ScaleLd, Test Transfer level is 2000 MW					
1259.7	50216 WELLS 230 50217 WELSRCT6230 1	98107 8RICHARD 500 98109 8WELLS 500 1	899.9	999.9	0.07936

**2012 Summer Peak Transfer Capabiltiy with upgrades**

**AC FCITC MULTIPLE TRANSFER REPORT**

PSS(tm)MUST 8.3.1 -- Managing and Utilizing System Transmission -- TUE, JUN 24 2008 8:05  
 2012 SUMMER PEAK  
 2006 SERIES ENTERGY BASE CASE MODELS - 08/23/06  
 Case.File L:\TPP\interconnection\LGIP\_08\ASR 040708-01\SIS\EN12S06-newR15-lupg+nocst-bw1-bw2-intch-noipp-scaleback-up3-bcaj1&2\_CLEQueue.sav  
 Subsys.File L:\TPP\interconnection\LGIP\_08\ASR 040708-01\SIS\AS-040708-01\_must.sub  
 Monit.File L:\TPP\interconnection\LGIP\_08\ASR 040708-01\SIS\AS-040708-01\_must.mon  
 Contin.File L:\TPP\interconnection\LGIP\_08\ASR 040708-01\SIS\AS-040708-01\_must.con  
 Exclud.File none

AC FCITC	Limiting Constraint	Contingency	Pre Shift	Post Shift	AC TDF
Transfer from GG_Nuke_Exp to EES_Imp_50, Test Transfer level is 2000 MW					
	None				
Transfer from GG_Nuke_Exp to EES_ScaleLd, Test Transfer level is 2000 MW					
	None				

## Appendix E – Transient Stability Model Data

### Generator Data

Bus	9898 2
Bus Name	PID- 207
Type	GENR OU
Bus KV	27.0
ID	3
MVA Base	1933
Z src	j0.2 80
X tran	0+j0
T'do	11.3 00
T''do	0.03 8
T'qo	0.53 0
T''qo	0.06 8
H	4.84 0 kW- sec/ kVA
D	0.00 0
Xd	2.06 0
Xq	1.94 0
X'd	0.36 5
X'q	0.55 0
X''d	0.28 0
x1	0.22 5
s(1.0)	0.37 5
s(1.2)	1.10 0

### Exciter Data

Bus	98982
Bus Name	PID- 207
Type	'ESST 4B'
Bus KV	27.0
ID	3
TR	0.0
KPR	2.66
KIR	2.66
VRMAX	1.0
VRMIN	-0.8
TA	0.01
KPM	1.0
KIM	0.0
VMMAX	1.0
VMMIN	-0.8
KG	0.0
KP	7.53
KI	0.0
VBMAX	9.41
KC	0.3
XL	0.0
THETA P	0.0

### Governor Data

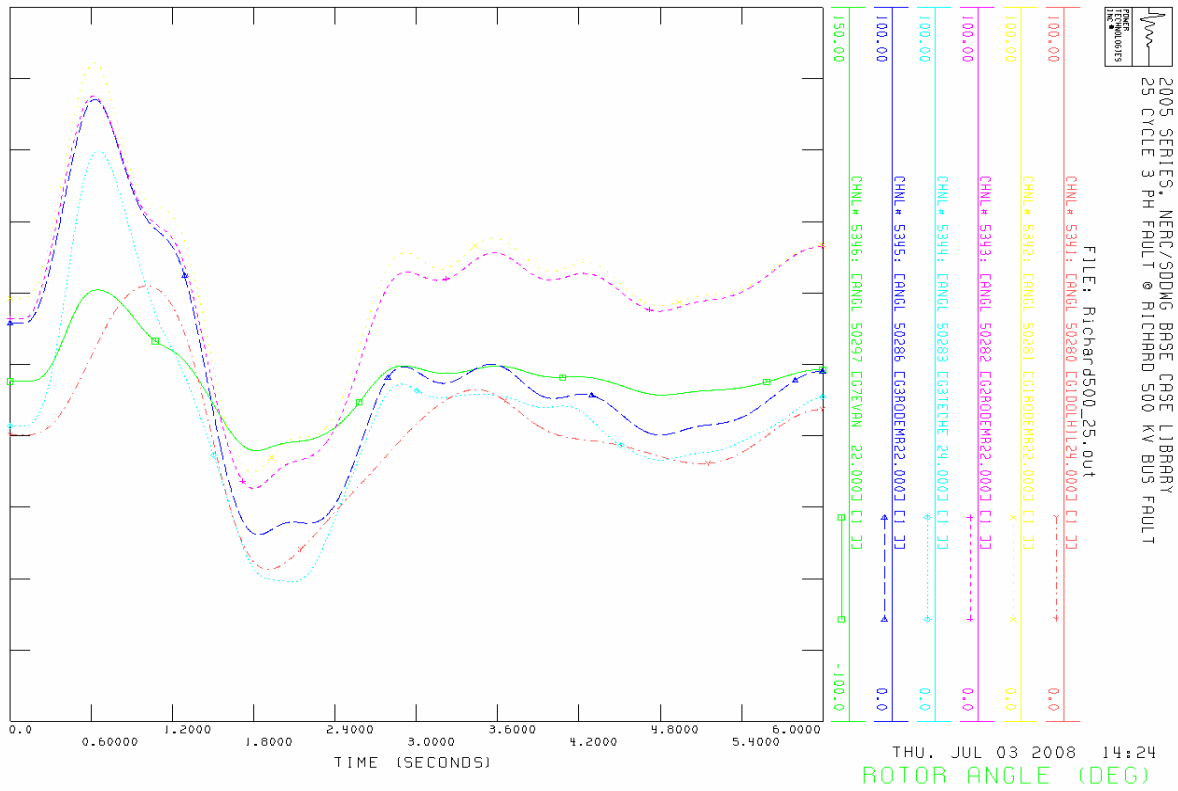
Bus	9898 2
Bus Name	PID- 207
Type	IEEE G1
Bus KV	27
ID	3
JBUS	0
M	0
K	20.0
T1	0.0
T2	0.0
T3	0.15
Uo	0.12
Uc	- 0.12
PMAX	1.0
PMIN	0.0
T4	0.5
K1	0.34
K2	0.0
T5	0.35
K3	0.66
K4	0.0
T6	0.0
K5	0.0
K6	0.0
T7	0.0
K7	0.0
K8	0.0

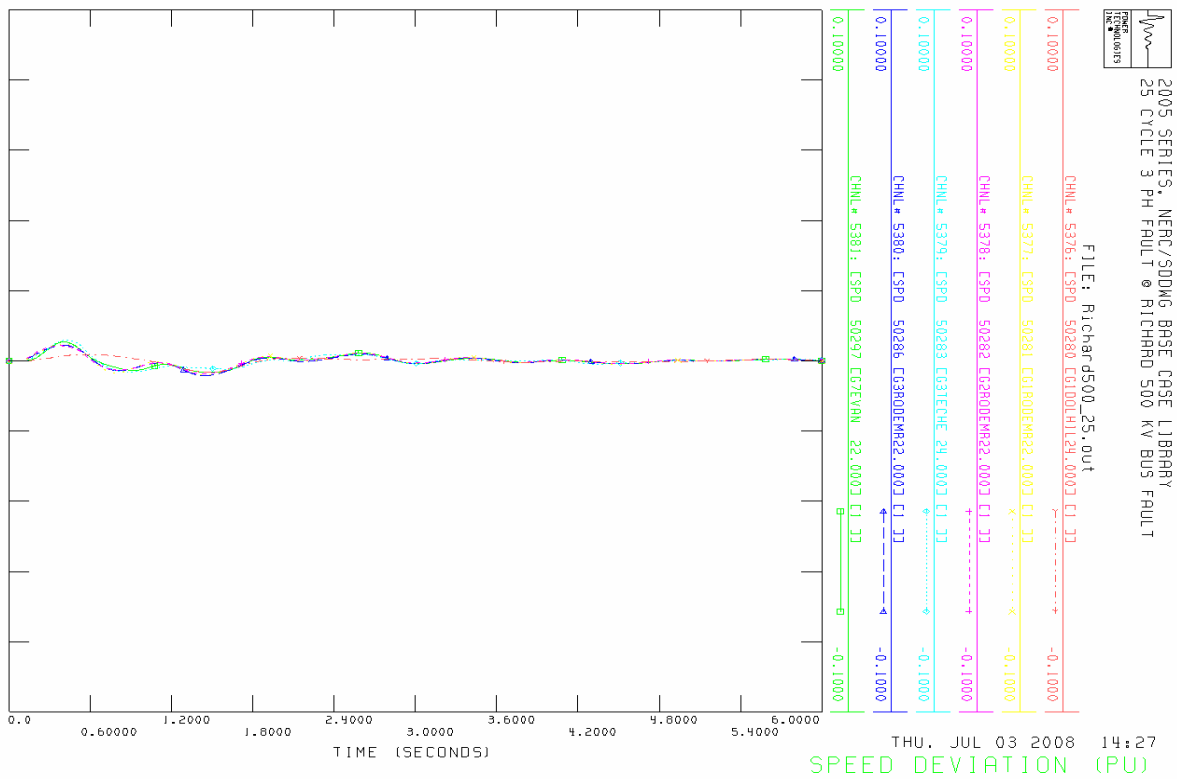
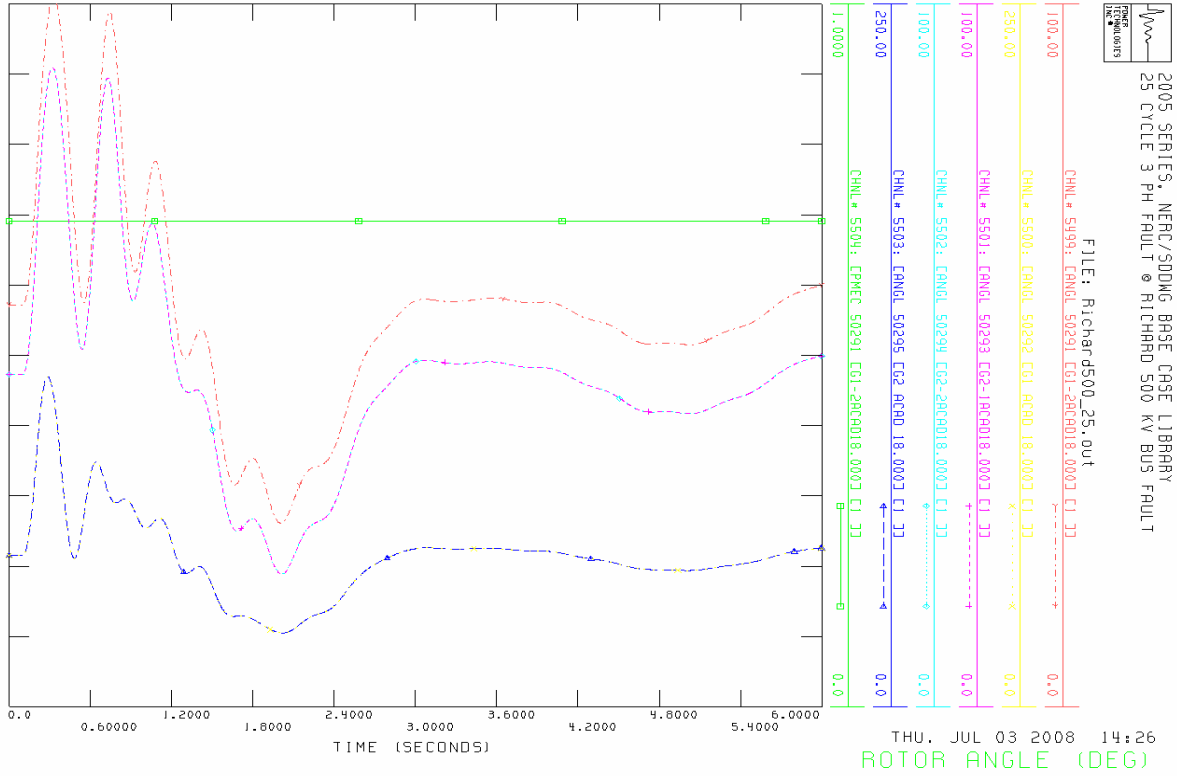
### PS Stabilizer Data

Bus	9898 2
Bus Name	PID- 207
Type	PSS2 A
Bus KV	27
ID	3
ICS1	1
REMBU S1	0
ICS2	3
REMBU S2	0
M	5
N	1
TW1	2.0
TW2	2.0
T6	0.0
TW3	2.0
TW4	0.0
T7	2.0
KS2	0.20 67
KS3	1.0
T8	0.5
T9	0.1
KS1	4.0
T1	0.15
T2	0.03
T3	0.15
T4	0.03
VSTMA X	0.1
VSTMI N	-0.1

## **Appendix F - Transient Stability Plots**

25 Cycle 3 phase fault at Richard 500kV bus

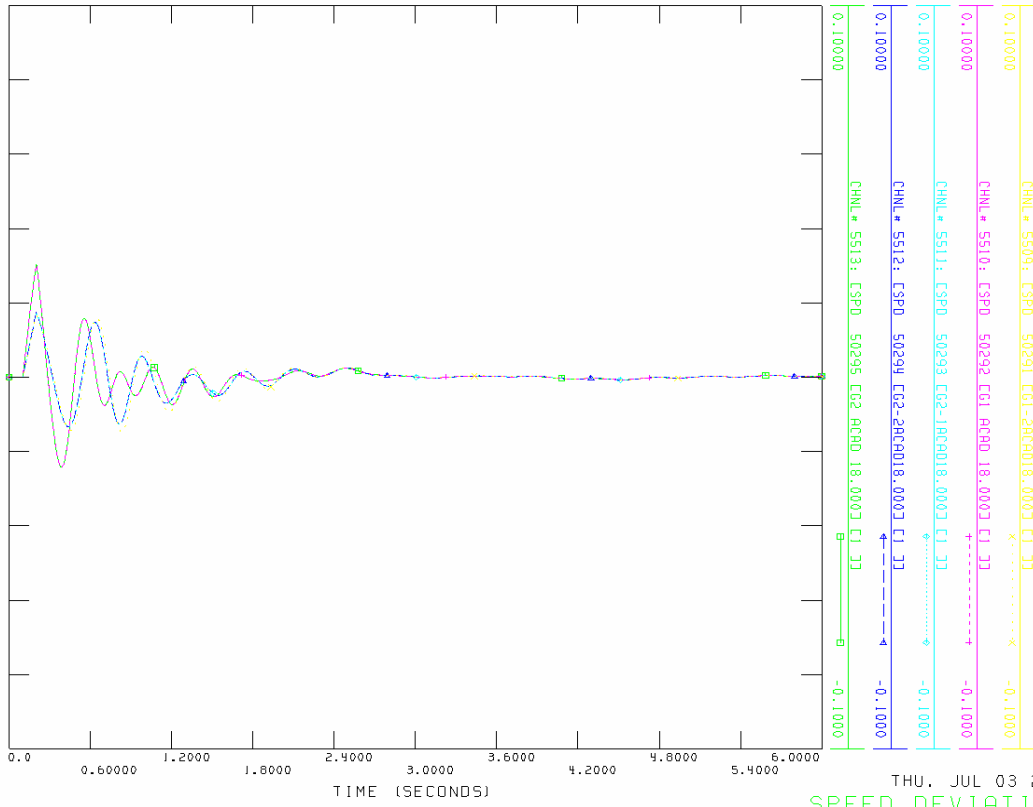


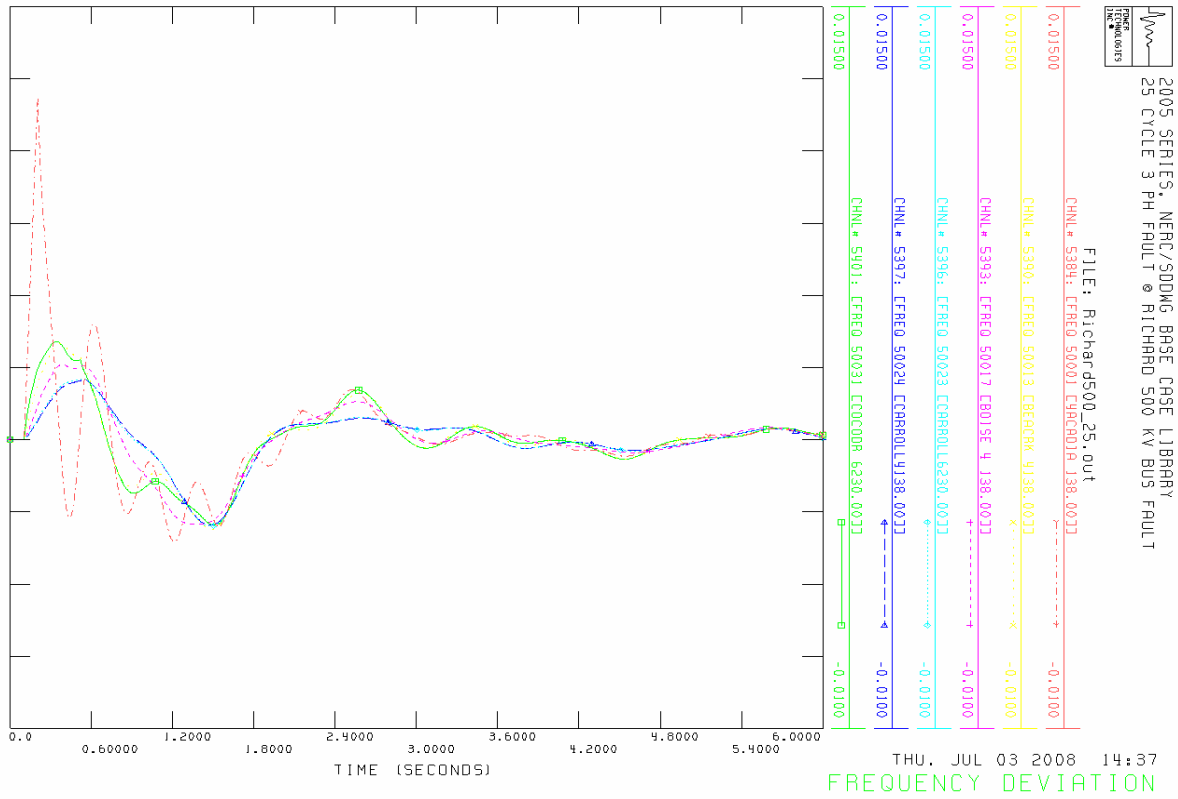


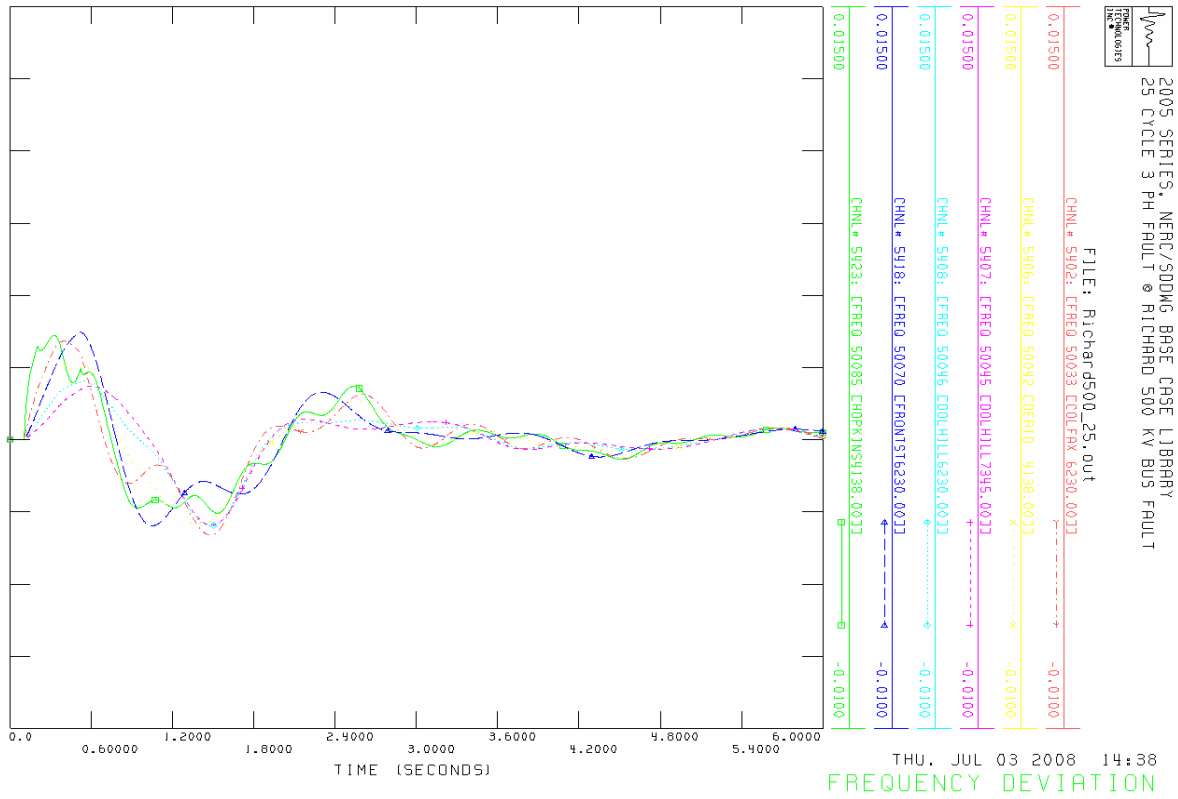


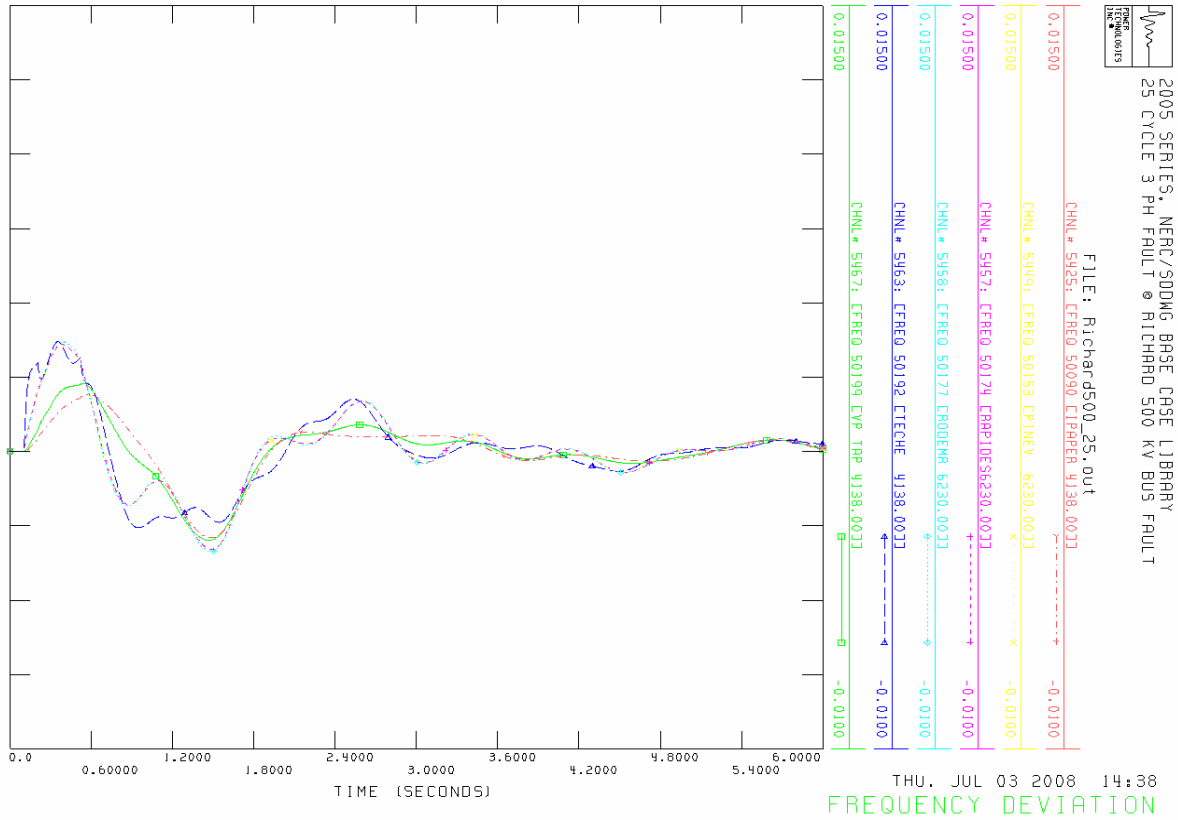
2005 SERIES, NERC/SDDMG BASE CASE LIBRARY  
25 CYCLE 3 PH FAULT @ RICHARD 500 KV BUS FAULT

FILE: Rlchar-d500\_25.out

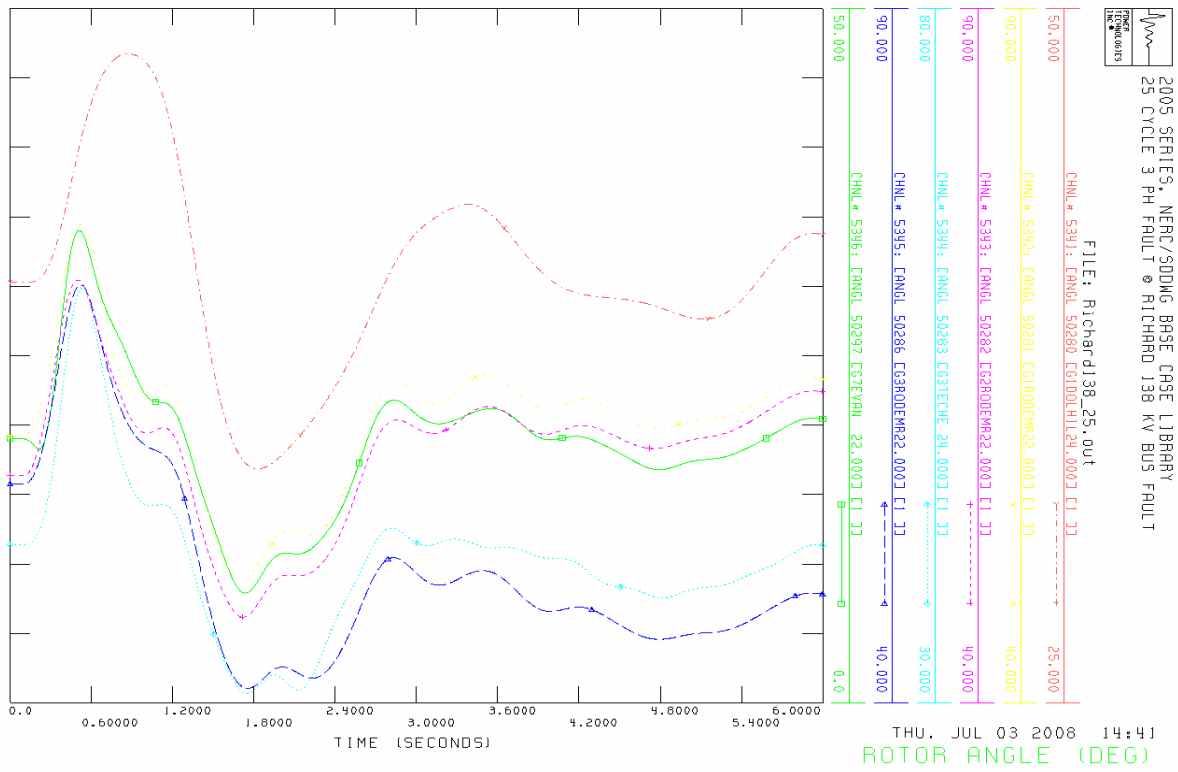


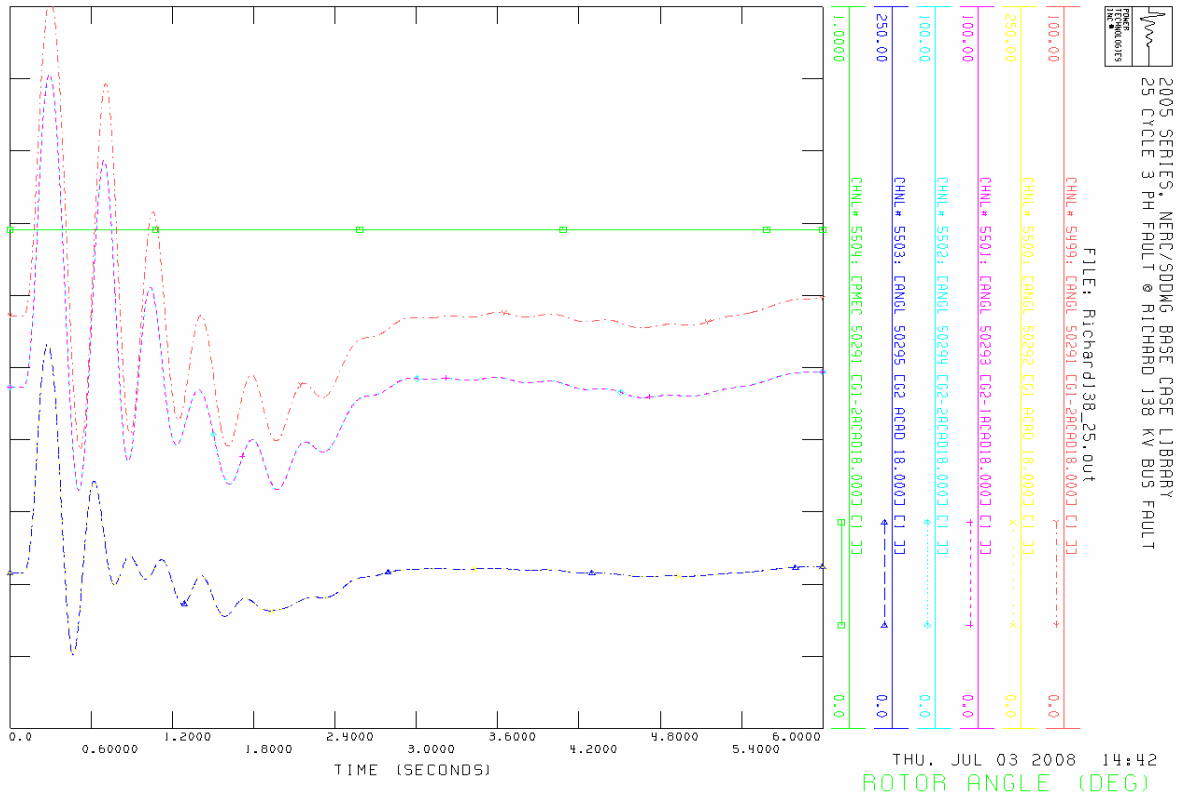


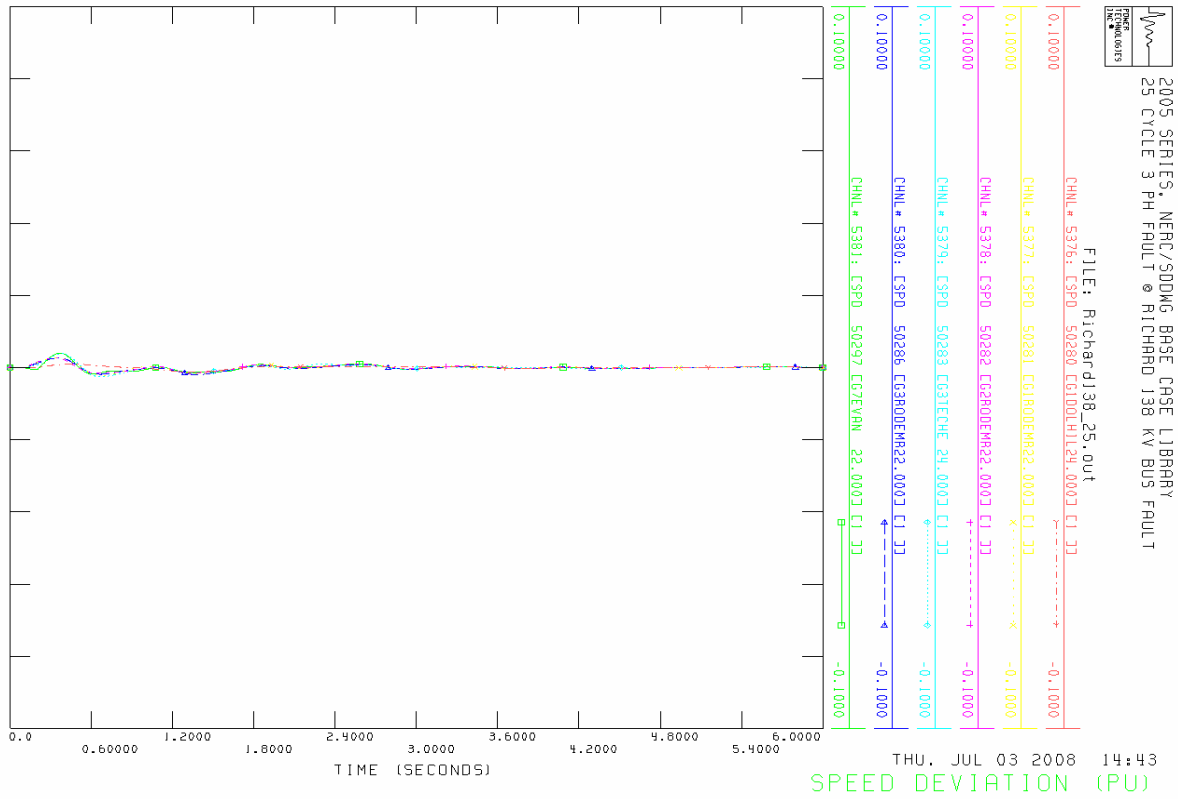




25 Cycle 3 phase fault at Richard 138 kV bus



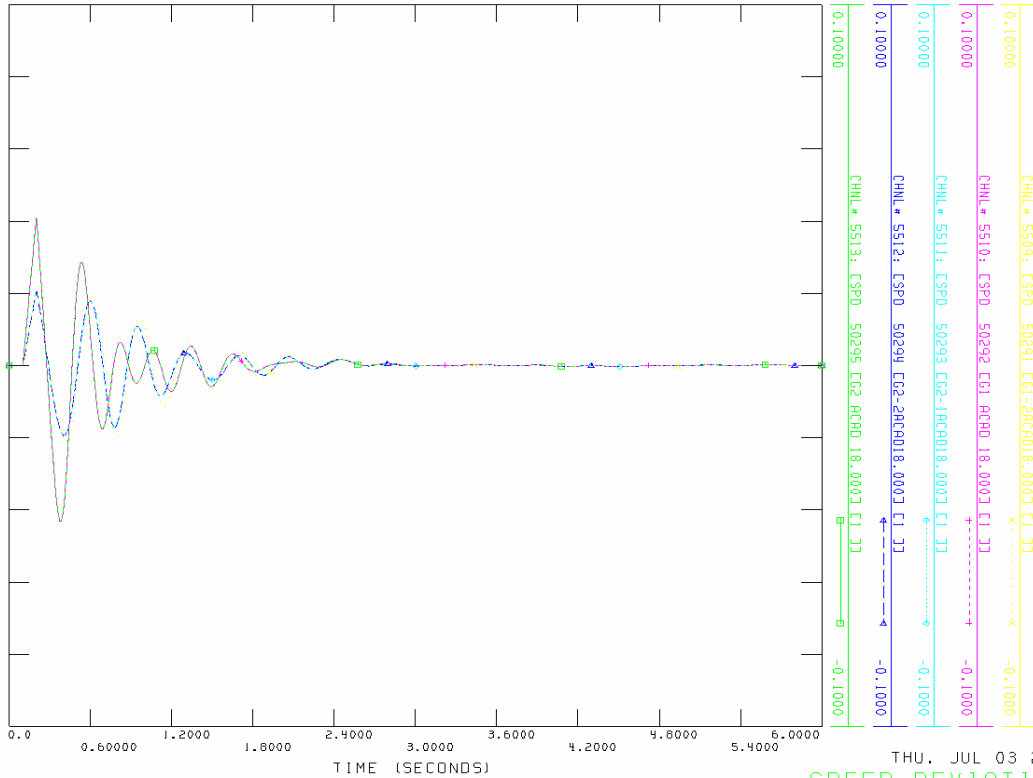


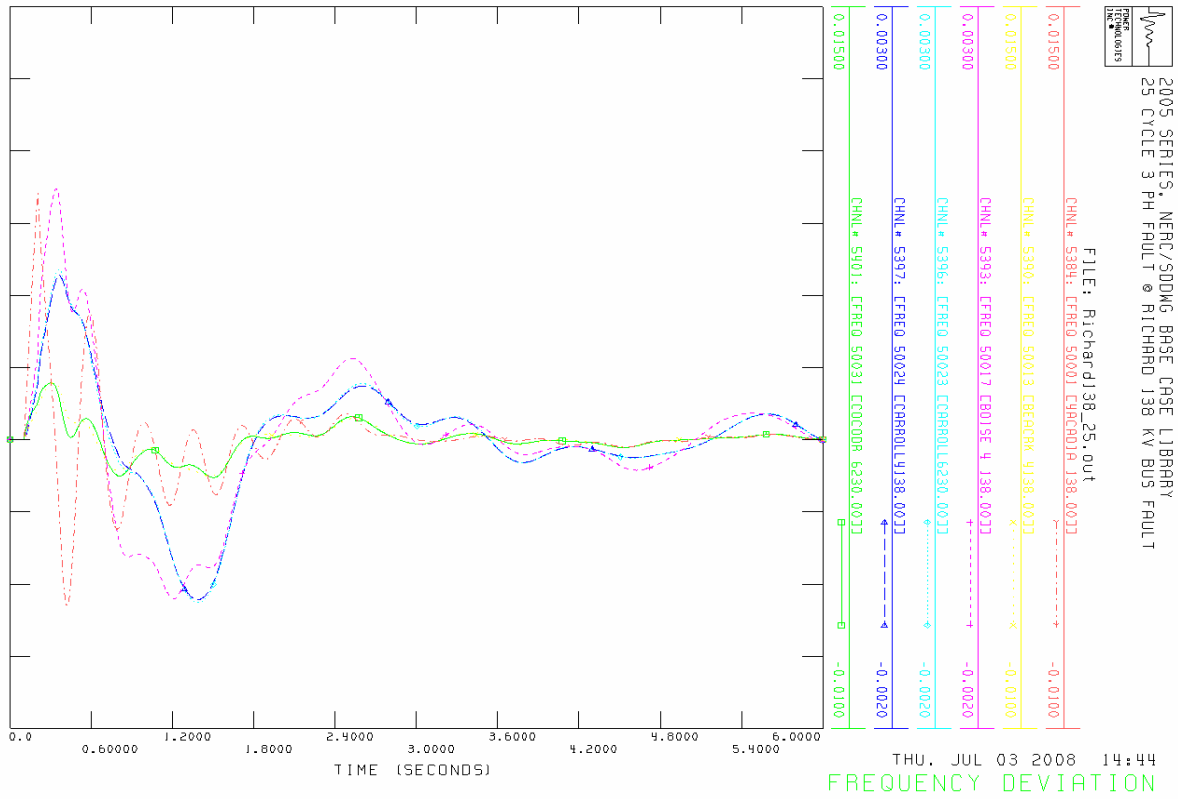


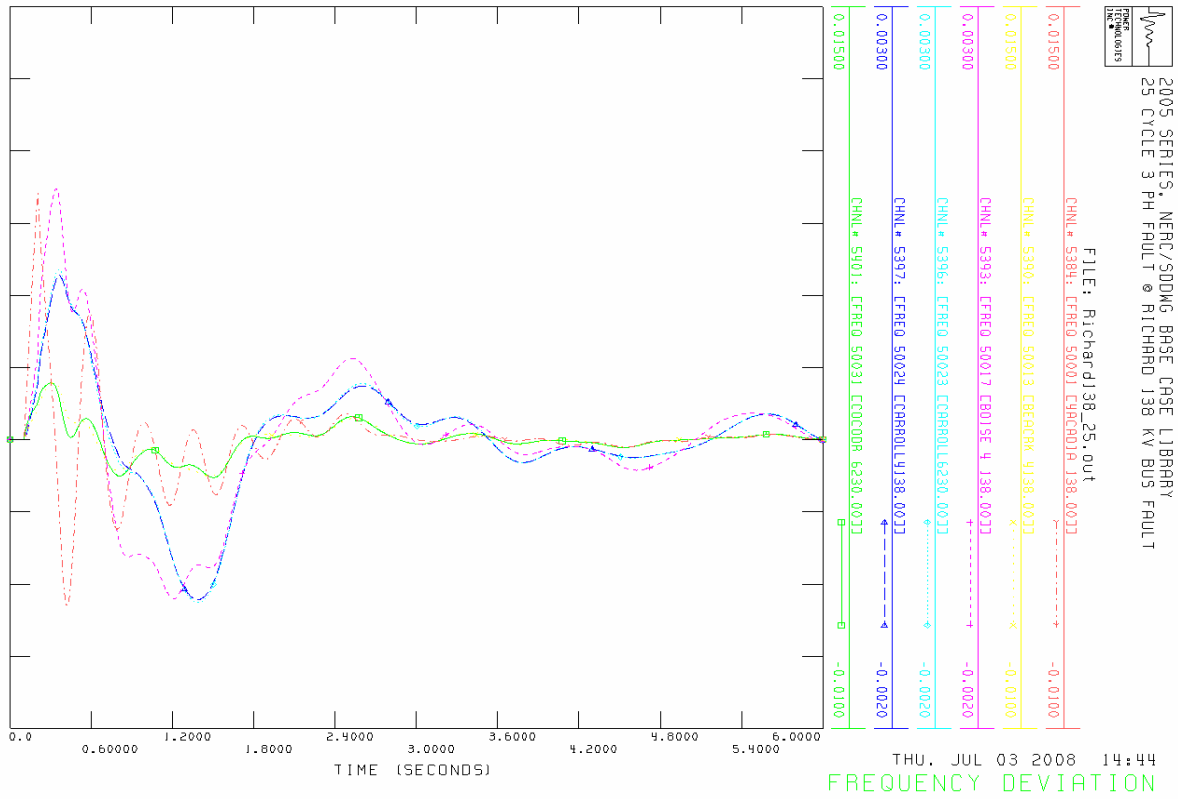


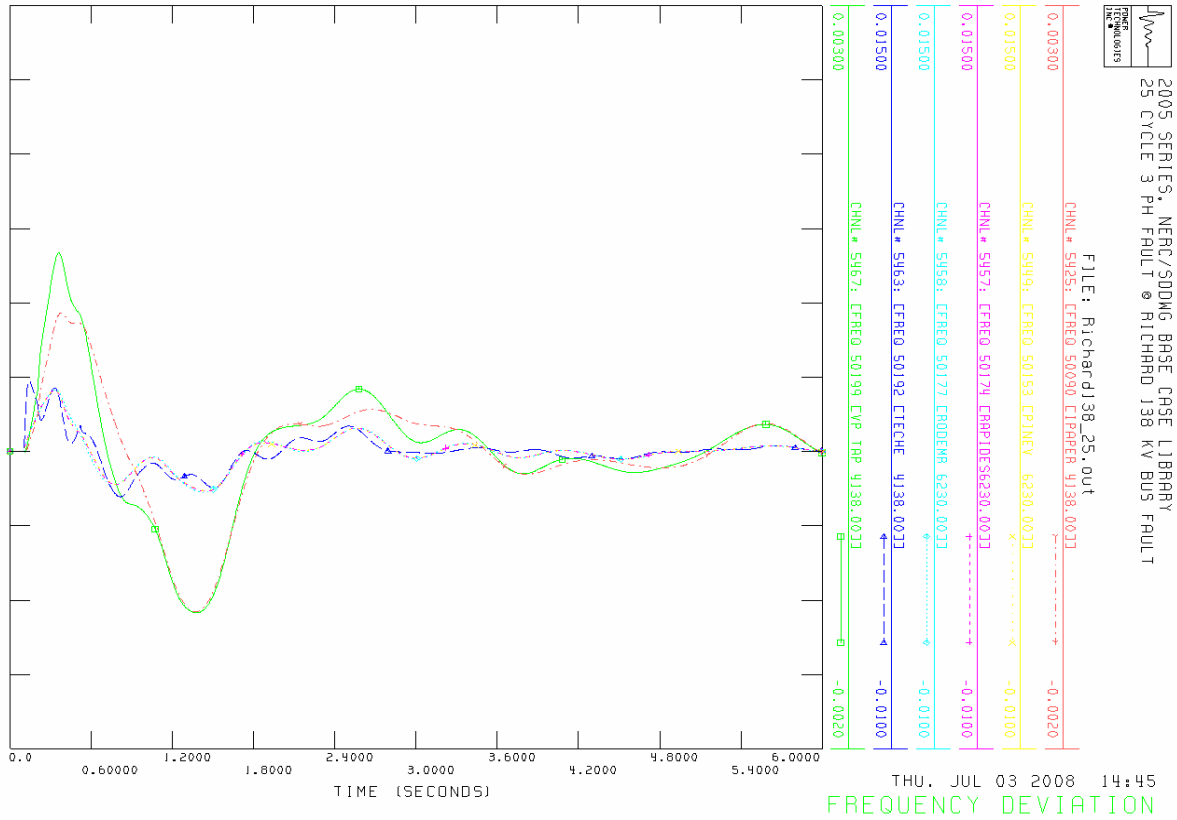
2005, SERIES, NERC/SODMG BASE CASE LIBRARY  
25 CYCLE 3 PH FAULT @ RICHARD 138 KV BUS FAULT

FILE: Richard138\_25.out









## ATTACHMENT I

(from Attachment K of the standard LGIP)

### **Definitions**

**Energy Resource Interconnection Service** shall mean an Interconnection Service that allows the Interconnection Customer to connect its Generating Facility to the Transmission Provider's Transmission System to be eligible to deliver the Generating Facility's electric output using the existing firm or nonfirm capacity of the Transmission Provider's Transmission System on an as available basis. Energy Resource Interconnection Service in and of itself does not convey transmission service.

**Network Resource** shall mean any designated generating resource owned, purchased, or leased by a Network Customer under the Network Integration Transmission Service Tariff. Network Resources do not include any resource, or any portion thereof, that is committed for sale to third parties or otherwise cannot be called upon to meet the Network Customer's Network Load on a non-interruptible basis.

**Network Resource Interconnection Service** shall mean an Interconnection Service that allows the Interconnection Customer to integrate its Large Generating Facility with the Transmission Provider's Transmission System (1) in a manner comparable to that in which the Transmission Provider integrates its generating facilities to serve native load customers; or (2) in an RTO or ISO with market based congestion management, in the same manner as all other Network Resources. Network Resource Interconnection Service in and of itself does not convey transmission.

### **Identification of Types of Interconnection Services.**

At the time the Interconnection Request is submitted, Interconnection Customer must request either Energy Resource Interconnection Service or Network Resource Interconnection Service, as described; provided, however, any Interconnection Customer requesting Network Resource Interconnection Service may also request that it be concurrently studied for Energy Resource Interconnection Service, up to the point when an Interconnection Facility Study Agreement is executed. Interconnection Customer may then elect to proceed with Network Resource Interconnection Service or to proceed under a lower level of interconnection service to the extent that only certain upgrades will be completed.

### **Energy Resource Interconnection Service.**

**The Product.** Energy Resource Interconnection Service allows Interconnection Customer to connect the Large Generating Facility to the Transmission System and be eligible to deliver the Large Generating Facility's output using the existing firm or non-firm capacity of the Transmission System on an "as available" basis. Energy Resource Interconnection Service does

not in and of itself convey any right to deliver electricity to any specific customer or Point of Delivery.

**The Study.** The study consists of short circuit/fault duty, steady state (thermal and voltage) and stability analyses. The short circuit/fault duty analysis would identify direct Interconnection Facilities required and the Network Upgrades necessary to address short circuit issues associated with the Interconnection Facilities. The stability and steady state studies would identify necessary upgrades to allow full output of the proposed Large Generating Facility and would also identify the maximum allowed output, at the time the study is performed, of the interconnecting Large Generating Facility without requiring additional Network Upgrades.

#### **Network Resource Interconnection Service.**

**The Product.** Transmission Provider must conduct the necessary studies and construct the Network Upgrades needed to integrate the Large Generating Facility (1) in a manner comparable to that in which Transmission Provider integrates its Generating Facilities to serve native load customers; or (2) in an ISO or RTO with market based congestion management, in the same manner as all other Network Resources. Network Resource Interconnection Service Allows Interconnection Customer 's Large Generating Facility to be designated as a Network Resource, up to the Large Generating Facility's full output, on the same basis as all other existing Network Resources interconnected to Transmission Provider's Transmission System, and to be studied as a Network Resource on the assumption that such a designation will occur.

**The Study.** The Interconnection Study for Network Resource Interconnection Service shall assure that the Interconnection Customer's Large Generating Facility meets the requirements for Network Resource Interconnection Service and as a general matter, that such Large Generating Facility's interconnection is also studied with Transmission Provider's Transmission System at peak load, under a variety of severely stressed conditions, to determine whether, with the Large Generating Facility at full output, the aggregate of generation in the local area can be delivered to the aggregate of load on Transmission Provider's Transmission System, consistent with Transmission Provider's reliability criteria and procedures. This approach assumes that some portion of existing Network Resources are displaced by the output of Interconnection Customer's Large Generating Facility. Network Resource Interconnection Service in and of itself does not convey any right to deliver electricity to any specific customer or Point of Delivery.