3-24-2003

Arpin Operations Update for Summer 2003

This 2003 summer update of the Arpin area operating guide is based on the **"Arpin Area Study – Operations Report for summer 2002"**. For more background information on operation of this interface, please refer to this original report. This purpose of this update is to evaluate system conditions for summer 2003 and determine what the allowable transfer capability will be with all of the capacitor additions in service at T-Corners 115kV substation. The following table shows the capacitor banks that were available for summer of 2002 compared to those that are now available for summer of 2003.

Location	2002	2003
T-Corners 115kV bus	(2) 14.4 MVAR banks	(1) 20 MVAR bank (4) 30 MVAR banks
Totals	**28.8 MVAR**	**140 MVAR**

Eau Claire-Arpin 345kV Outage

In the event of an Eau Claire-Arpin 345kV contingency, the switched capacitors that are available at the T-Corners 115kV bus to support system voltages has increased from 28.8 MVAR to 140 MVAR (an increase of 111.2 MVAR). These capacitors are controlled by fast-acting switches and are switched on within 4 cycles of a disturbance. This essentially eliminates the voltage concerns that were associated with the 2002 summer OSL of 725 MW that was imposed on the Eau Claire-Arpin flowgate.

Powerflow cases were run for 2003 summer conditions at various transfer levels across the Eau Claire-Arpin interface. The summaries of these cases are located in attachment A. These results indicate that a new OSL of 790 MW can be set for the Eau Claire-Arpin flowgate for the summer of 2003.

The most limiting element for the Eau Claire-Arpin contingency is the Wissota-Wissota Beach 69kV line with a rating of 72 MVA. Operators at Xcel Energy, the owners of this facility, are willing to allow a maximum loading of 110% (79.2 MVA) for no more than 30 minutes. At a transfer level of 795 MW, this line loads to 110.1% (79.3 MVA). These results assume hydro generation on at Jim Falls (30 MW), Cornell (15 MW), and Holcomb (15 MW). Lesser outputs of these hydro units will result in higher loading on the Wissota-Wissota Beach 69kV line.

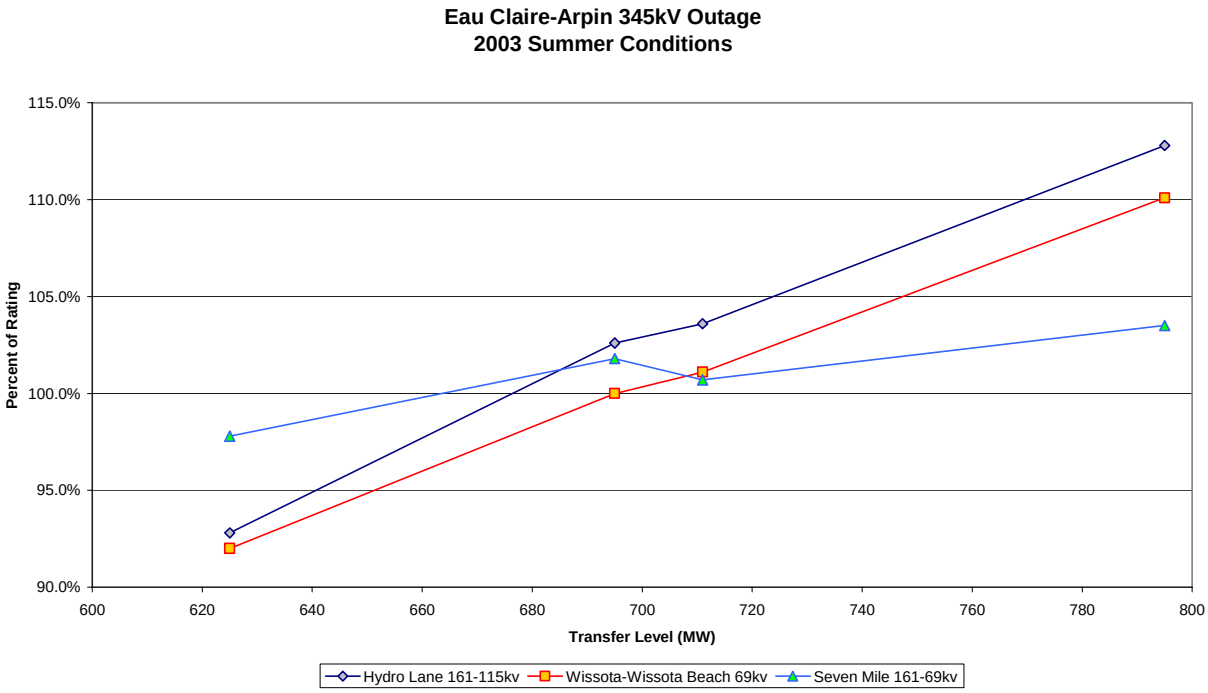
If the fault is of a permanent nature, system operators have the 30-minute window to take action or allow loadings to go down. Possible mitigating actions might include redispatch, or possibly opening the T-Corners 115kV line as a last resort.

The most heavily impacted elements for the Eau Claire-Arpin Contingency are:

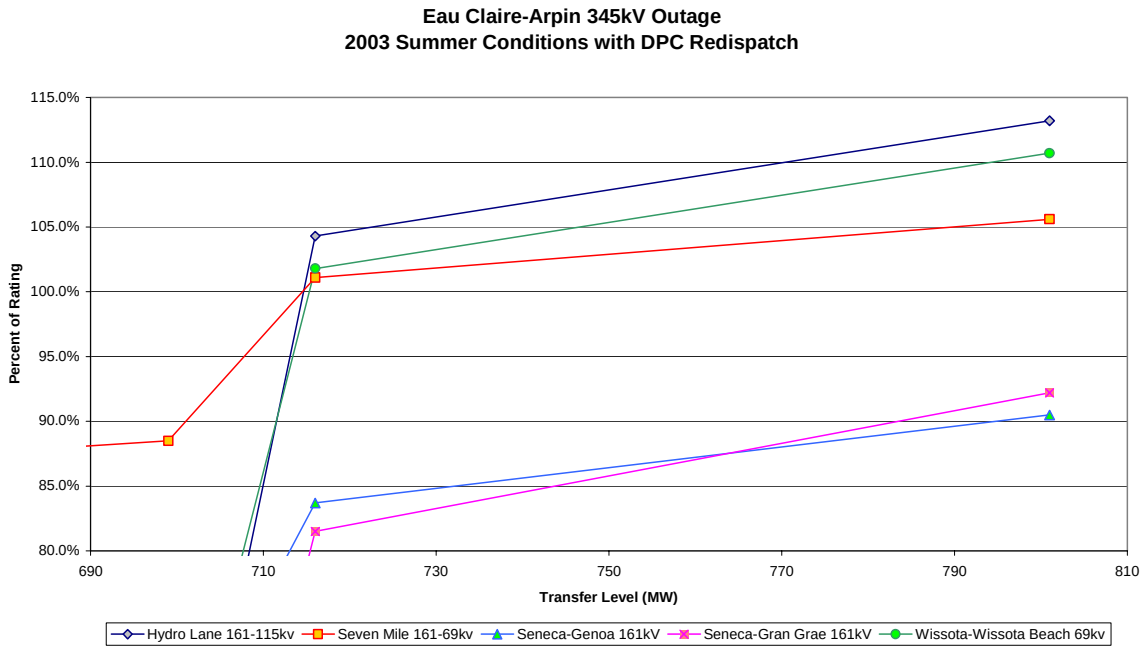
1. Wissota-Wissota Beach 69kV (rating = 72 MVA).
2 Hydro Lane 161-115kV transformer (rating = 187 MVA).
3. Seven Mile 161-69kV transformer (rating = 112 MVA).
4. Genoa-Seneca 161kV (rating = 304 MVA).
5. Seneca-Gran Grae 161kV (rating = 304 MVA).

Operators at Xcel Energy, the owners of the transformer facilities listed above, are willing to allow a maximum loading of 125% on system transformers for no more than 30 minutes.

The following chart shows how these key elements load up for this contingency while varying transfer levels across the interface.



Additional cases were run with generation increased at Alma to see how it affected the results. The following chart shows the loading of the key elements while varying the transfer level under this redispatch scenario.

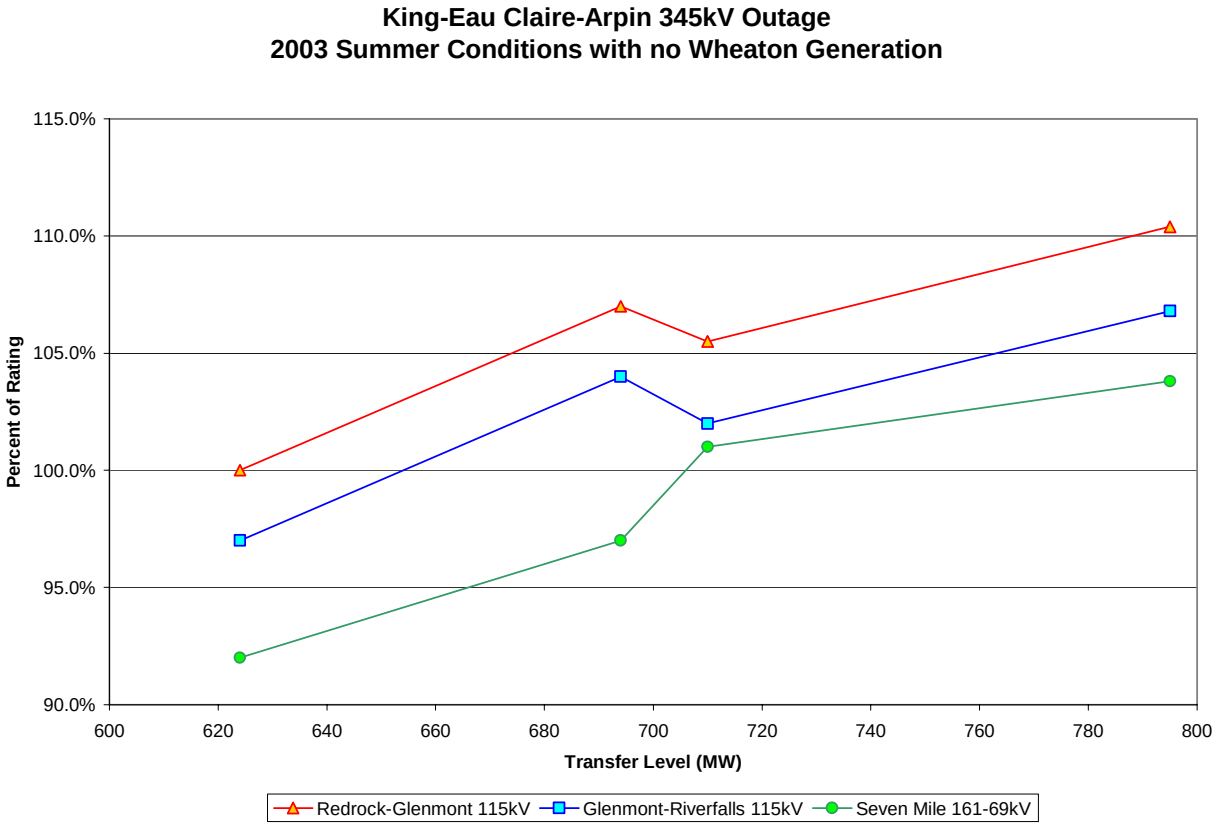


King-Eau Claire-Arpin 345kV Outage

The contingent loss of King-Eau Claire-Arpin 345kV has some nuances associated with it that differ from just the Eau Claire-Arpin section being out of service. The outage of both sections causes additional loading problems in the Eau Claire area. The lines in the Eau Claire area that are most affected by this contingency are:

1. Red Rock-Glenmont 115kV
2. Glenmont-Riverfalls 115kV
3. Eau Claire-Wheaton 161kV

The Red Rock-Glenmont 115kV line will load to 110% of rated at a 790 MW transfer level with no generation on at Wheaton. Operators at Xcel energy, owners of this facility, are willing to allow a maximum loading of 110% for no more than 30 minutes. This loading can be reduced by bringing on the peaking units at Wheaton. The following chart shows how the key elements load up for this contingency while varying transfer levels across the interface.



In the event of the contingent loss of the King-Eau Claire-Arpin 345kv line, the Xcel system operator should bring up peaking generation at Wheaton to reduce the Red Rock-Glenmont 115kV line loading to an acceptable level. The amount of generation required is dependent on the transfer level across the interface. One Wheaton unit will be required for a pre-contingent transfer range of 625 to 700 MW. A second Wheaton peaking unit would be required for pre-contingent transfer levels above 700 MW.

Recommended Actions:

1. Implement a new OSL of 790 MW on the Eau Claire-Arpin flowgate (immediately).
2. Establish a "must-run" guide for Wheaton and other generation in the Eau Claire area (to be determined by future studies).

Attachment A

Results Summaries for the 2003 Summer Update

PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS/E THU, MAR 06 2003 11:16
2003 SUMMER CASE WITH HIGH MAPP-AEP TRANSFER

EAU CLAIRE-ARPIN PRE-CONTINGENT FLOW = 625 MW

OUTAGED BRANCHES:
1. EAU CLAIRE-ARPIN 345KV
2. COUNCIL CREEK 69KV BUS TIE
3. MAUSTON-HILLTOP 69KV
4. LUBLIN-LAKEHEAD 69KV
5. WIEN-STRATFORD 115KV

OTHER SYSTEM CONDITIONS:
1. LONE ROCK PHASE-SHIFTING TRANSFORMER ADJUSTED TO 30 DEGREES (MAX)
2. BOTH T-CORNERS 115-69KV TRANSFORMERS SET ON 1.0144 FIXED TAP
3. GENERATION ADDED AT JIM FALLS(30), CORNELL(15), AND HOLCOMB(15)

BRANCH LOADINGS ABOVE 90.0 % OF RATING SET A:

X-------FROM BUS-------X				X--------TO BUS--------X					CURRENT(MVA)		
BUS	NAME	BSKV	AREA	BUS	NAME	BSKV	AREA	CKT	LOADING	RATING	PERCENT
38114*	WKA 69	69.0	364	38115	BOS 69	69.0	364	1	58.7	48.0	122.3
38115*	BOS 69	69.0	364	38116	BTA 69	69.0	364	1	48.5	47.0	103.1
38127	SPG 69	69.0	364	38128*	ARE 69	69.0	364	1	37.4	36.0	104.0
61873	HYDROLN7 115	623		61876*	HYDROLN5 161	623		1	173.6	187.0	92.8
61877*	SEVN ML5 161	623		69224	SEVN ML869.0	623		1	109.5	112.0	97.8
62122*	GENOA53G24.0	626		62123	GENOA 5 161	626		1	339.9	360.0	94.4
62140	ALMA5 5G14.4	626		62143*	ALMA 5 161	626		1	84.3	90.0	93.7
69168*	WISSOTAG69.0	623		69170	WISOTBC869.0	623		1	66.2	72.0	92.0

BUSES WITH VOLTAGE GREATER THAN 1.0500:

X------ BUS -----X	AREA	V(PU)	V(KV)	X------ BUS -----X	AREA	V(PU)	V(KV)
67667 HOLCOMBE69.0	626	1.0542	72.737	69224 SEVN ML869.0	623	1.0515	72.550

BUSES WITH VOLTAGE LESS THAN 0.9500:

X------ BUS -----X	AREA	V(PU)	V(KV)	X------ BUS -----X	AREA	V(PU)	V(KV)
38130 BLE 69 69.0	364	0.9471	65.353	38131 STG 69 69.0	364	0.9407	64.906
38133 TLT 69 69.0	364	0.9387	64.770	38134 MOH 69 69.0	364	0.9485	65.448
38686 CSP 69 69.0	367	0.9407	64.906	39114 SPG 138 138	364	0.9388	129.56

PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS/E THU, MAR 06 2003 11:23
2003 SUMMER CASE WITH HIGH MAPP-AEP TRANSFER

EAU CLAIRE-ARPIN PRE-CONTINGENT FLOW = 695 MW

OUTAGED BRANCHES:
1. EAU CLAIRE-ARPIN 345KV
2. COUNCIL CREEK 69KV BUS TIE
3. MAUSTON-HILLTOP 69KV
4. LUBLIN-LAKEHEAD 69KV
5. WIEN-STRATFORD 115KV

OTHER SYSTEM CONDITIONS:
1. LONE ROCK PHASE-SHIFTING TRANSFORMER ADJUSTED TO 30 DEGREES (MAX)
2. BOTH T-CORNERS 115-69KV TRANSFORMERS SET ON 1.0144 FIXED TAP
3. GENERATION ADDED AT JIM FALLS(30), CORNELL(15), AND HOLCOMB(15)

BRANCH LOADINGS ABOVE 90.0 % OF RATING SET A:

X-------FROM BUS-------X				X--------TO BUS--------X					CURRENT(MVA)		
BUS	NAME	BSKV	AREA	BUS	NAME	BSKV	AREA	CKT	LOADING	RATING	PERCENT
38114*	WKA 69	69.0	364	38115	BOS 69	69.0	364	1	61.3	48.0	127.7
38115*	BOS 69	69.0	364	38116	BTA 69	69.0	364	1	51.0	47.0	108.4
38127*	SPG 69	69.0	364	38128	ARE 69	69.0	364	1	40.5	36.0	112.4
39706*	WIEN	115	366	61866	T-CRNRS7	115	623	1	190.1	202.0	94.1
61873	HYDROLN7	115	623	61876*	HYDROLN5	161	623	1	191.8	187.0	102.6
61877*	SEVN ML5	161	623	69224	SEVN ML8	69.0	623	1	114.1	112.0	101.8
62122*	GENOA53G	24.0	626	62123	GENOA 5	161	626	1	343.6	360.0	95.4
62140	ALMA5 5G	14.4	626	62143*	ALMA 5	161	626	1	84.9	90.0	94.4
69168*	WISSOTAG	69.0	623	69170	WISOTBC8	69.0	623	1	72.0	72.0	100.0

BUSES WITH VOLTAGE GREATER THAN 1.0500:

X------ BUS -----X	AREA	V(PU)	V(KV)	X------ BUS -----X	AREA	V(PU)	V(KV)
61866 T-CRNRS7 115	623	1.0523	121.02	67667 HOLCOMBE69.0	626	1.0579	72.997
69224 SEVN ML869.0	623	1.0505	72.488				

BUSES WITH VOLTAGE LESS THAN 0.9500:

X------ BUS -----X	AREA	V(PU)	V(KV)	X------ BUS -----X	AREA	V(PU)	V(KV)
38119 MUS 69 69.0	365	0.9483	65.432	38129 MAZ 69 69.0	364	0.9429	65.059
38130 BLE 69 69.0	364	0.9389	64.782	38131 STG 69 69.0	364	0.9350	64.518
38133 TLT 69 69.0	364	0.9339	64.438	38134 MOH 69 69.0	364	0.9438	65.121
38686 CSP 69 69.0	367	0.9350	64.518	39114 SPG 138 138	364	0.9255	127.72
39929 MZI 69 69.0	364	0.9448	65.189				

PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS/E THU, MAR 06 2003 10:59
2003 SUMMER CASE WITH HIGH MAPP-AEP TRANSFER

EAU CLAIRE-ARPIN PRE-CONTINGENT FLOW = 711 MW

OUTAGED BRANCHES:
1. EAU CLAIRE-ARPIN 345KV
2. COUNCIL CREEK 69KV BUS TIE
3. MAUSTON-HILLTOP 69KV
4. LUBLIN-LAKEHEAD 69KV
5. WIEN-STRATFORD 115KV

OTHER SYSTEM CONDITIONS:
1. LONE ROCK PHASE-SHIFTING TRANSFORMER ADJUSTED TO 30 DEGREES (MAX)
2. BOTH T-CORNERS 115-69KV TRANSFORMERS SET ON 1.0144 FIXED TAP
3. GENERATION ADDED AT JIM FALLS(30), CORNELL(15), AND HOLCOMB(15)

BRANCH LOADINGS ABOVE 90.0 % OF RATING SET A:

X-------FROM BUS-------X				X--------TO BUS--------X					CURRENT(MVA)		
BUS	NAME	BSKV	AREA	BUS	NAME	BSKV	AREA	CKT	LOADING	RATING	PERCENT
38114*	WKA 69	69.0	364	38115	BOS 69	69.0	364	1	61.6	48.0	128.4
38115*	BOS 69	69.0	364	38116	BTA 69	69.0	364	1	51.3	47.0	109.1
38127*	SPG 69	69.0	364	38128	ARE 69	69.0	364	1	40.5	36.0	112.5
39704	SHRMN ST 115		366	39705*	CASSEL	115	366	1	182.3	202.0	90.3
39706	WIEN	115	366	61866*	T-CRNRS7	115	623	1	202.9	202.0	100.4
61873	HYDROLN7	115	623	61876*	HYDROLN5	161	623	1	193.8	187.0	103.6
61877*	SEVN ML5	161	623	69224	SEVN ML8	69.0	623	1	112.8	112.0	100.7
62122*	GENOA53G	24.0	626	62123	GENOA 5	161	626	1	342.8	360.0	95.2
62140*	ALMA5 5G	14.4	626	62143	ALMA 5	161	626	1	84.9	90.0	94.4
69168*	WISSOTAG	69.0	623	69170	WISOTBC8	69.0	623	1	72.8	72.0	101.1

BUSES WITH VOLTAGE GREATER THAN 1.0500:

X------ BUS -----X	AREA	V(PU)	V(KV)	X------ BUS -----X	AREA	V(PU)	V(KV)
67667 HOLCOMBE69.0	626	1.0554	72.822	69224 SEVN ML869.0	623	1.0506	72.490

BUSES WITH VOLTAGE LESS THAN 0.9500:

X------ BUS -----X	AREA	V(PU)	V(KV)	X------ BUS -----X	AREA	V(PU)	V(KV)
38119 MUS 69 69.0	365	0.9457	65.250	38120 AVT 69 69.0	364	0.9491	65.487
38121 AVO 69 69.0	364	0.9482	65.424	38129 MAZ 69 69.0	364	0.9397	64.840
38130 BLE 69 69.0	364	0.9358	64.569	38131 STG 69 69.0	364	0.9321	64.318
38133 TLT 69 69.0	364	0.9310	64.238	38134 MOH 69 69.0	364	0.9413	64.948
38686 CSP 69 69.0	367	0.9321	64.318	39114 SPG 138 138	364	0.9221	127.25
39929 MZI 69 69.0	364	0.9416	64.968	61092 DELMAR 869.0	623	0.9474	65.373
67657 EIDSVOLD69.0	623	0.9466	65.315	69172 BOYD 869.0	623	0.9498	65.535
69173 STANLEY869.0	623	0.9466	65.313	69174 THORP 869.0	623	0.9486	65.456

PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS/E THU, MAR 06 2003 10:34
2003 SUMMER CASE WITH HIGH MAPP-AEP TRANSFER

EAU CLAIRE-ARPIN PRE-CONTINGENT FLOW = 795 MW

OUTAGED BRANCHES:
1. EAU CLAIRE-ARPIN 345KV
2. COUNCIL CREEK 69KV BUS TIE
3. MAUSTON-HILLTOP 69KV
4. LUBLIN-LAKEHEAD 69KV
5. WIEN-STRATFORD 115KV

OTHER SYSTEM CONDITIONS:
1. LONE ROCK PHASE-SHIFTING TRANSFORMER ADJUSTED TO 30 DEGREES (MAX)
2. BOTH T-CORNERS 115-69KV TRANSFORMERS SET ON 1.0144 FIXED TAP
3. GENERATION BROUGHT ON AT JIM FALLS(30), CORNELL(15), AND HOLCOMB(15)

BRANCH LOADINGS ABOVE 90.0 % OF RATING SET A:

FROM BUS				TO BUS					CURRENT(MVA)		
BUS	NAME	BSKV	AREA	BUS	NAME	BSKV	AREA	CKT	LOADING	RATING	PERCENT
38114*	WKA 69	69.0	364	38115	BOS 69	69.0	364	1	64.8	48.0	134.9
38114	WKA 69	69.0	364	39959*	GRANGRAE	69.0	364	1	65.6	71.0	92.4
38115*	BOS 69	69.0	364	38116	BTA 69	69.0	364	1	54.3	47.0	115.5
38127*	SPG 69	69.0	364	38128	ARE 69	69.0	364	1	44.0	36.0	122.1
39704	SHRMN ST 115		366	39705*	CASSEL 115		366	1	218.5	202.0	108.2
39705	CASSEL 115		366	39706*	WIEN 115		366	1	232.9	241.0	96.6
39706	WIEN 115		366	61866*	T-CRNRS7 115		623	1	236.5	202.0	117.1
61869	WHEATTP5 161		623	61876*	HYDROLN5 161		623	1	210.9	223.0	94.6
61873	HYDROLN7 115		623	61876*	HYDROLN5 161		623	1	210.9	187.0	112.8
61877*	SEVN ML5 161		623	69224	SEVN ML8	69.0	623	1	115.9	112.0	103.5
62122*	GENOA53G	24.0	626	62123	GENOA 5 161		626	1	347.3	360.0	96.5
62140	ALMA5 5G	14.4	626	62143*	ALMA 5 161		626	1	84.9	90.0	94.4
67632*	T LOYAL 69.0		626	67660	LOYAL 69.0		626	1	16.9	17.0	99.4
69168	WISSOTAG	69.0	623	69170*	WISOTBC8	69.0	623	1	79.3	72.0	110.1

BUSES WITH VOLTAGE GREATER THAN 1.0500:

BUS		AREA	V(PU)	V(KV)	BUS		AREA	V(PU)	V(KV)
67667	HOLCOMBE69.0	626	1.0565	72.901					

BUSES WITH VOLTAGE LESS THAN 0.9500:

BUS		AREA	V(PU)	V(KV)	BUS		AREA	V(PU)	V(KV)
38115	BOS 69 69.0	364	0.9385	64.759	38116	BTA 69 69.0	364	0.9331	64.387
38117	BOM 69 69.0	365	0.9385	64.756	38118	BRR 69 69.0	364	0.9333	64.395
38119	MUS 69 69.0	365	0.9274	63.989	38120	AVT 69 69.0	364	0.9307	64.221
38121	AVO 69 69.0	364	0.9298	64.157	38123	LOR 69 69.0	364	0.9420	64.996
38124	LOR 69P 69.0	364	0.9488	65.466	38128	ARE 69 69.0	364	0.9362	64.597
38129	MAZ 69 69.0	364	0.9250	63.822	38130	BLE 69 69.0	364	0.9227	63.667
38131	STG 69 69.0	364	0.9225	63.650	38133	TLT 69 69.0	364	0.9219	63.614
38134	MOH 69 69.0	364	0.9345	64.481	38686	CSP 69 69.0	367	0.9225	63.650
39114	SPG 138 138	364	0.9031	124.63	39929	MZI 69 69.0	364	0.9263	63.917
61092	DELMAR 869.0	623	0.9211	63.559	61876	HYDROLN5 161	623	0.9445	152.06
67506	DPC TAP869.0	626	0.9405	64.892	67657	EIDSVOLD69.0	623	0.9185	63.380
67658	T THORP869.0	626	0.9203	63.502	67848	LAKEHEAD69.0	626	0.9411	64.939
68823	CADOTT 869.0	623	0.9327	64.355	69172	BOYD 869.0	623	0.9259	63.886
69173	STANLEY869.0	623	0.9191	63.417	69174	THORP 869.0	623	0.9187	63.388
69175	OWEN 869.0	623	0.9288	64.089	69176	LAKEHEA869.0	623	0.9433	65.087

PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS/E WED, MAR 05 2003 14:14
2003 SUMMER CASE WITH HIGH MAPP-AEP TRANSFER

EAU CLAIRE-ARPIN PRE-CONTINGENT FLOW = 694 MW

(700 WITH WHEATON ON)

OUTAGED BRANCHES:
1. KING-EAU CLAIRE-ARPIN 345KV
2. COUNCIL CREEK 69KV BUS TIE
3. MAUSTON-HILLTOP 69KV
4. LUBLIN-LAKEHEAD 69KV
5. WIEN-STRATFORD 115KV

OTHER SYSTEM CONDITIONS:
1. LONE ROCK PHASE-SHIFTING TRANSFORMER ADJUSTED TO 30 DEGREES (MAX)
2. BOTH T-CORNERS 115-69KV TRANSFORMERS SET ON 1.0144 FIXED TAP
3. WHEATON GENERATOR OUTPUT = 55 MW (unit 1)

BRANCH LOADINGS ABOVE 95.0 % OF RATING SET B:

X-------FROM BUS-------X				X--------TO BUS--------X				CURRENT(MVA)		
BUS	NAME	BSKV	AREA	BUS	NAME	BSKV	AREA	CKT	LOADING	RATING	PERCENT
61744	REDROCK7	115	623	67677*	GLENMONT	115	623	1	195.0	191.0	102.1
61884	T RIVFL7	115	623	67677*	GLENMONT	115	623	1	191.1	194.0	98.5

BUSES WITH VOLTAGE GREATER THAN 1.0500:

X------ BUS -----X	AREA	V(PU)	V(KV)	X------ BUS -----X	AREA	V(PU)	V(KV)
61853 EAU CL 3 345	623	1.0622	366.47	61866 T-CRNRS7 115	623	1.0542	121.24

BUSES WITH VOLTAGE LESS THAN 0.9500:

X------ BUS -----X	AREA	V(PU)	V(KV)	X------ BUS -----X	AREA	V(PU)	V(KV)
38129 MAZ 69 69.0	364	0.9448	65.193	38130 BLE 69 69.0	364	0.9403	64.881
38131 STG 69 69.0	364	0.9355	64.549	38133 TLT 69 69.0	364	0.9340	64.449
38134 MOH 69 69.0	364	0.9439	65.128	38686 CSP 69 69.0	367	0.9355	64.549
39114 SPG 138 138	364	0.9281	128.08	39929 MZI 69 69.0	364	0.9468	65.332

PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS/E WED, MAR 05 2003 15:57
2003 SUMMER CASE WITH HIGH MAPP-AEP TRANSFER

EAU CLAIRE-ARPIN PRE-CONTINGENT FLOW = 694 MW

(700 MW WITH WHEATON ON)

OUTAGED BRANCHES:
1. KING-EAU CLAIRE-ARPIN 345KV
2. COUNCIL CREEK 69KV BUS TIE
3. MAUSTON-HILLTOP 69KV
4. LUBLIN-LAKEHEAD 69KV
5. WIEN-STRATFORD 115KV

OTHER SYSTEM CONDITIONS:
1. LONE ROCK PHASE-SHIFTING TRANSFORMER ADJUSTED TO 30 DEGREES (MAX)
2. BOTH T-CORNERS 115-69KV TRANSFORMERS SET ON 1.0144 FIXED TAP
3. WHEATON GENERATOR OUTPUT = 63 MW (unit 2)

BRANCH LOADINGS ABOVE 95.0 % OF RATING SET B:

X-------FROM BUS-------X				X--------TO BUS--------X				CURRENT(MVA)		
BUS	NAME	BSKV	AREA	BUS	NAME	BSKV	AREA	CKT	LOADING	RATING	PERCENT
61744	REDROCK7	115	623	67677*	GLENMONT	115	623	1	192.7	191.0	100.9
61854	EAU CLA5	161	623	61870*	WHEATON5	161	623	1	256.4	268.0	95.7
61884	T RIVFL7	115	623	67677*	GLENMONT	115	623	1	188.8	194.0	97.3

BUSES WITH VOLTAGE GREATER THAN 1.0500:

X------ BUS -----X	AREA	V(PU)	V(KV)	X------ BUS -----X	AREA	V(PU)	V(KV)
61853 EAU CL 3 345	623	1.0588	365.27				

BUSES WITH VOLTAGE LESS THAN 0.9500:

X------ BUS -----X	AREA	V(PU)	V(KV)	X------ BUS -----X	AREA	V(PU)	V(KV)
38129 MAZ 69 69.0	364	0.9443	65.158	38130 BLE 69 69.0	364	0.9398	64.849
38131 STG 69 69.0	364	0.9351	64.523	38133 TLT 69 69.0	364	0.9337	64.426
38134 MOH 69 69.0	364	0.9434	65.097	38686 CSP 69 69.0	367	0.9351	64.523
39114 SPG 138 138	364	0.9276	128.01	39929 MZI 69 69.0	364	0.9463	65.296

PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS/E TUE, MAR 04 2003 13:22
2003 SUMMER CASE WITH HIGH MAPP-AEP TRANSFER

EAU CLAIRE-ARPIN PRE-CONTINGENT FLOW = 710 MW

OUTAGED BRANCHES:
1. KING-EAU CLAIRE-ARPIN 345KV
2. COUNCIL CREEK 69KV BUS TIE
3. MAUSTON-HILLTOP 69KV
4. LUBLIN-LAKEHEAD 69KV
5. WIEN-STRATFORD 115KV

OTHER SYSTEM CONDITIONS:
1. LONE ROCK PHASE-SHIFTING TRANSFORMER ADJUSTED TO 30 DEGREES (MAX)
2. BOTH T-CORNERS 115-69KV TRANSFORMERS SET ON 1.0144 FIXED TAP

BRANCH LOADINGS ABOVE 95.0 % OF RATING SET B:

FROM BUS				TO BUS					CURRENT(MVA)		
BUS	NAME	BSKV	AREA	BUS	NAME	BSKV	AREA	CKT	LOADING	RATING	PERCENT
61744	REDROCK7	115	623	67677*	GLENMONT	115	623	1	201.6	191.0	105.5
61884	T RIVFL7	115	623	67677*	GLENMONT	115	623	1	197.8	194.0	102.0

BUSES WITH VOLTAGE GREATER THAN 1.0500:

BUS		AREA	V(PU)	V(KV)	BUS		AREA	V(PU)	V(KV)

* NONE *

BUSES WITH VOLTAGE LESS THAN 0.9500:

BUS		AREA	V(PU)	V(KV)	BUS		AREA	V(PU)	V(KV)
38119	MUS 69	365	0.9494	65.511	38129	MAZ 69	364	0.9417	64.981
38130	BLE 69	364	0.9374	64.682	38131	STG 69	364	0.9329	64.372
38133	TLT 69	364	0.9313	64.261	38134	MOH 69	364	0.9425	65.035
38686	CSP 69	367	0.9329	64.372	39114	SPG 138	364	0.9242	127.54
39929	MZI 69	364	0.9437	65.117					

PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS/E WED, MAR 05 2003 12:41
2003 SUMMER CASE WITH HIGH MAPP-AEP TRANSFER

EAU CLAIRE-ARPIN PRE-CONTINGENT FLOW = 710 MW

(717 MW WITH WHEATON ON)

OUTAGED BRANCHES:
1. KING-EAU CLAIRE-ARPIN 345KV
2. COUNCIL CREEK 69KV BUS TIE
3. MAUSTON-HILLTOP 69KV
4. LUBLIN-LAKEHEAD 69KV
5. WIEN-STRATFORD 115KV

OTHER SYSTEM CONDITIONS:
1. LONE ROCK PHASE-SHIFTING TRANSFORMER ADJUSTED TO 30 DEGREES (MAX)
2. BOTH T-CORNERS 115-69KV TRANSFORMERS SET ON 1.0144 FIXED TAP
3. WHEATON GENERATOR OUTPUT = 55 MW (unit 1)

BRANCH LOADINGS ABOVE 95.0 % OF RATING SET B:

X-------FROM BUS-------X				X--------TO BUS--------X				CURRENT(MVA)		
BUS	NAME	BSKV	AREA	BUS	NAME	BSKV	AREA	CKT	LOADING	RATING	PERCENT
61744	REDROCK7	115	623	67677*	GLENMONT	115	623	1	191.2	191.0	100.1
61877*	SEVN ML5	161	623	69224	SEVN ML869.0		623	1	107.3	112.0	95.8
61884	T RIVFL7	115	623	67677*	GLENMONT	115	623	1	187.4	194.0	96.6

BUSES WITH VOLTAGE GREATER THAN 1.0500:

X------ BUS -----X	AREA	V(PU)	V(KV)	X------ BUS -----X	AREA	V(PU)	V(KV)
61853 EAU CL 3 345	623	1.0618	366.33	69224 SEVN ML869.0	623	1.0516	72.563

BUSES WITH VOLTAGE LESS THAN 0.9500:

X------ BUS -----X	AREA	V(PU)	V(KV)	X------ BUS -----X	AREA	V(PU)	V(KV)
38119 MUS 69 69.0	365	0.9486	65.453	38129 MAZ 69 69.0	364	0.9417	64.978
38130 BLE 69 69.0	364	0.9374	64.682	38131 STG 69 69.0	364	0.9331	64.381
38133 TLT 69 69.0	364	0.9316	64.277	38134 MOH 69 69.0	364	0.9424	65.024
38686 CSP 69 69.0	367	0.9331	64.381	39114 SPG 138 138	364	0.9242	127.54
39929 MZI 69 69.0	364	0.9437	65.112				

PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS/E TUE, MAR 04 2003 13:22
2003 SUMMER CASE WITH HIGH MAPP-AEP TRANSFER

EAU CLAIRE-ARPIN PRE-CONTINGENT FLOW = 795 MW

OUTAGED BRANCHES:
1. KING-EAU CLAIRE-ARPIN 345KV
2. COUNCIL CREEK 69KV BUS TIE
3. MAUSTON-HILLTOP 69KV
4. LUBLIN-LAKEHEAD 69KV
5. WIEN-STRATFORD 115KV

OTHER SYSTEM CONDITIONS:
1. LONE ROCK PHASE-SHIFTING TRANSFORMER ADJUSTED TO 30 DEGREES (MAX)
2. BOTH T-CORNERS 115-69KV TRANSFORMERS SET ON 1.0144 FIXED TAP

BRANCH LOADINGS ABOVE 95.0 % OF RATING SET B:

X-------FROM BUS-------X				X--------TO BUS--------X				CURRENT(MVA)		
BUS	NAME	BSKV	AREA	BUS	NAME	BSKV	AREA	CKT	LOADING	RATING	PERCENT
61744	REDROCK7	115	623	67677*	GLENMONT	115	623	1	210.9	191.0	110.4
61877*	SEVN ML5	161	623	69224	SEVN ML869.0	623		1	116.3	112.0	103.8
61884	T RIVFL7	115	623	67677*	GLENMONT	115	623	1	207.2	194.0	106.8

BUSES WITH VOLTAGE GREATER THAN 1.0500:

X------ BUS -----X	AREA	V(PU)	V(KV)	X------ BUS -----X	AREA	V(PU)	V(KV)
69224 SEVN ML869.0	623	1.0510	72.517				

BUSES WITH VOLTAGE LESS THAN 0.9500:

X------ BUS -----X	AREA	V(PU)	V(KV)	X------ BUS -----X	AREA	V(PU)	V(KV)
38115 BOS 69 69.0	364	0.9440	65.139	38116 BTA 69 69.0	364	0.9388	64.779
38117 BOM 69 69.0	365	0.9440	65.136	38118 BRR 69 69.0	364	0.9389	64.787
38119 MUS 69 69.0	365	0.9331	64.382	38120 AVT 69 69.0	364	0.9363	64.605
38121 AVO 69 69.0	364	0.9354	64.542	38123 LOR 69 69.0	364	0.9471	65.349
38128 ARE 69 69.0	364	0.9403	64.880	38129 MAZ 69 69.0	364	0.9278	64.020
38130 BLE 69 69.0	364	0.9249	63.817	38131 STG 69 69.0	364	0.9232	63.704
38133 TLT 69 69.0	364	0.9222	63.632	38134 MOH 69 69.0	364	0.9352	64.527
38686 CSP 69 69.0	367	0.9232	63.704	39114 SPG 138 138	364	0.9066	125.12
39929 MZI 69 69.0	364	0.9294	64.129	61876 HYDROLN5 161	623	0.9455	152.22

PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS/E WED, MAR 05 2003 12:00
2003 SUMMER CASE WITH HIGH MAPP-AEP TRANSFER

EAU CLAIRE-ARPIN PRE-CONTINGENT FLOW = 795 MW

(803 MW WITH WHEATON ON)

OUTAGED BRANCHES:
1. KING-EAU CLAIRE-ARPIN 345KV
2. COUNCIL CREEK 69KV BUS TIE
3. MAUSTON-HILLTOP 69KV
4. LUBLIN-LAKEHEAD 69KV
5. WIEN-STRATFORD 115KV

OTHER SYSTEM CONDITIONS:
1. LONE ROCK PHASE-SHIFTING TRANSFORMER ADJUSTED TO 30 DEGREES (MAX)
2. BOTH T-CORNERS 115-69KV TRANSFORMERS SET ON 1.0144 FIXED TAP
3. WHEATON GENERATOR OUTPUT = 55 MW

BRANCH LOADINGS ABOVE 95.0 % OF RATING SET B:

X-------FROM BUS-------X				X--------TO BUS--------X				CURRENT(MVA)		
BUS	NAME	BSKV	AREA	BUS	NAME	BSKV	AREA	CKT	LOADING	RATING	PERCENT
61744	REDROCK7	115	623	67677*	GLENMONT	115	623	1	200.8	191.0	105.1
61877*	SEVN ML5	161	623	69224	SEVN ML869.0		623	1	108.3	112.0	96.7
61884	T RIVFL7	115	623	67677*	GLENMONT	115	623	1	197.1	194.0	101.6

BUSES WITH VOLTAGE GREATER THAN 1.0500:

X------ BUS -----X	AREA	V(PU)	V(KV)	X------ BUS -----X	AREA	V(PU)	V(KV)
61853 EAU CL 3 345	623	1.0607	365.96	69224 SEVN ML869.0	623	1.0507	72.500

BUSES WITH VOLTAGE LESS THAN 0.9500:

X------ BUS -----X	AREA	V(PU)	V(KV)	X------ BUS -----X	AREA	V(PU)	V(KV)
38115 BOS 69 69.0	364	0.9434	65.096	38116 BTA 69 69.0	364	0.9382	64.735
38117 BOM 69 69.0	365	0.9434	65.093	38118 BRR 69 69.0	364	0.9383	64.743
38119 MUS 69 69.0	365	0.9324	64.337	38120 AVT 69 69.0	364	0.9357	64.561
38121 AVO 69 69.0	364	0.9347	64.498	38123 LOR 69 69.0	364	0.9465	65.308
38128 ARE 69 69.0	364	0.9398	64.844	38129 MAZ 69 69.0	364	0.9274	63.992
38130 BLE 69 69.0	364	0.9245	63.794	38131 STG 69 69.0	364	0.9230	63.690
38133 TLT 69 69.0	364	0.9221	63.623	38134 MOH 69 69.0	364	0.9349	64.511
38686 CSP 69 69.0	367	0.9230	63.690	39114 SPG 138 138	364	0.9062	125.06
39929 MZI 69 69.0	364	0.9290	64.099				

PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS/E WED, MAR 05 2003 12:15
2003 SUMMER CASE WITH HIGH MAPP-AEP TRANSFER

EAU CLAIRE-ARPIN PRE-CONTINGENT FLOW = 795 MW

(803 MW WITH WHEATON ON)

OUTAGED BRANCHES:
1. KING-EAU CLAIRE-ARPIN 345KV
2. COUNCIL CREEK 69KV BUS TIE
3. MAUSTON-HILLTOP 69KV
4. LUBLIN-LAKEHEAD 69KV
5. WIEN-STRATFORD 115KV

OTHER SYSTEM CONDITIONS:
1. LONE ROCK PHASE-SHIFTING TRANSFORMER ADJUSTED TO 30 DEGREES (MAX)
2. BOTH T-CORNERS 115-69KV TRANSFORMERS SET ON 1.0144 FIXED TAP
3. WHEATON GENERATOR OUTPUT = 110 MW (units 1 and 3)

BRANCH LOADINGS ABOVE 95.0 % OF RATING SET B:

X-------FROM BUS-------X				X--------TO BUS--------X				CURRENT(MVA)		
BUS	NAME	BSKV	AREA	BUS	NAME	BSKV	AREA	CKT	LOADING	RATING	PERCENT
61744	REDROCK7	115	623	67677*	GLENMONT	115	623	1	190.7	191.0	99.8
61854	EAU CLA5	161	623	61870*	WHEATON5	161	623	1	287.1	268.0	107.1
61877*	SEVN ML5	161	623	69224	SEVN ML869.0		623	1	109.5	112.0	97.7
61884	T RIVFL7	115	623	67677*	GLENMONT	115	623	1	187.0	194.0	96.4
69168*	WISSOTAG69.0		623	69170	WISOTBC869.0		623	1	69.3	72.0	96.2

BUSES WITH VOLTAGE GREATER THAN 1.0500:

X------ BUS -----X	AREA	V(PU)	V(KV)	X------ BUS -----X	AREA	V(PU)	V(KV)
61853 EAU CL 3 345	623	1.0614	366.17	69224 SEVN ML869.0	623	1.0513	72.539

BUSES WITH VOLTAGE LESS THAN 0.9500:

X------ BUS -----X	AREA	V(PU)	V(KV)	X------ BUS -----X	AREA	V(PU)	V(KV)
38115 BOS 69 69.0	364	0.9425	65.034	38116 BTA 69 69.0	364	0.9373	64.672
38117 BOM 69 69.0	365	0.9425	65.031	38118 BRR 69 69.0	364	0.9374	64.680
38119 MUS 69 69.0	365	0.9315	64.274	38120 AVT 69 69.0	364	0.9348	64.499
38121 AVO 69 69.0	364	0.9338	64.435	38123 LOR 69 69.0	364	0.9456	65.249
38128 ARE 69 69.0	364	0.9391	64.796	38129 MAZ 69 69.0	364	0.9269	63.954
38130 BLE 69 69.0	364	0.9241	63.762	38131 STG 69 69.0	364	0.9227	63.669
38133 TLT 69 69.0	364	0.9219	63.608	38134 MOH 69 69.0	364	0.9346	64.486
38686 CSP 69 69.0	367	0.9227	63.669	39114 SPG 138 138	364	0.9057	124.99
39929 MZI 69 69.0	364	0.9284	64.060				

Eau Claire-Arpin Operating Guide (ATCLLC) (Xcel) 3-24-2003

1.0 Purpose

The Eau Claire-Arpin Operating Guide is a set of operating instructions intended to maintain system security during the contingent loss of any part of the King-Eau Claire-Arpin 345kV system. Due to the rebuild of a portion of the underlying 115kV system, it is now possible to operate the system without reliance on the Minnesota-Eastern Wisconsin Phase Angle Reduction Guide. The Phase Angle Reduction Guide will remain in effect and used as needed, but it is subordinate to this guide. A flow limit of 790 MW, as measured at Eau Claire, has been set for the Eau Claire-Arpin 345kV line for the summer of 2003. The intent of this limit and the associated operating guide is to maintain system security and stability following the loss of this critical tie. [1]

2.0 Background

A forced outage of the Eau Claire-Arpin 345kV transmission line may result in voltage violations and facility overloads at high west-to-east flows from MAPP to MAIN. This line segment, as part of the interface (known as the Minnesota-Wisconsin interface), is limited due to post contingent thermal, voltage, and system stability concerns on the underlying interface.

3.0 Implementing Procedures

3.1 Pre-contingency Mitigation

To maintain adequate voltage in the event of an Eau Claire-Arpin 345kV contingency, there are a number of fast-switching capacitor banks available at T-Corners and Wien substations to support the system voltages. These capacitors are automatically controlled to respond very quickly to low system voltage. Outage of any of these capacitor banks may require some reduction in the OSL until such time as they are made available. These banks include:

T-Corners 69kV – (1) 5.4 MVAR
T-Corners 115kV – (1) 20.0 MVAR and (4) 30.0 MVAR
Wien 115kV – (3) 21.6 MVAR
Arpin 138kV – (1) 50.0 MVAR

As long as these banks are all available and operating, maintaining the flow from Eau Claire below 790 MW will prevent low voltages in the event of the contingent loss of any part of the King-Eau Claire-Arpin 345kV line.

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[1] refer to the "***Arpin Area Study – Operations Report for summer 2002***", and the "***Arpin Operations Update for summer 2003***" for more details.

3.1.1 Council Creek 69kV Bus Tie Status

This tie would be expected to be open during high transfer periods. This tie is very sensitive to flows across the interface and studies have shown that it will overload at high transfer levels with all facilities in service. The relays at Council Creek are set to trip the 69kV breaker # 335-S in 10 seconds if either the flow from Oakdale exceeds 32 MVA or the flow from Monroe County exceeds 50 MVA.

3.1.2 At a loading level of 765 MW, the ATCLLC System Operator will inform the MISO Security Coordinator to institute TLR Level 1. [2]

3.1.3 At a loading level of 790 MW, the ATCLLC system operator will inform the MISO Security Coordinator to implement TLR at sufficient levels to avoid increasing the flow above the 790 MW limit. [2]

3.1.4 The MISO Security Coordinator will maintain the real-time flow as measured at Eau Claire, on the Eau Claire-Arpin 345kV line to a maximum value of 790 MW. The MISO Security Coordinator may limit the pre-contingent flow to less than 790 MW if real-time studies, including, but not limited to, the daily voltage stability study indicate a need for reduction to a lesser value.

3.2 Post-Contingency Operation

Upon the loss of King-Eau Claire-Arpin 345kV or the Eau Claire-Arpin 345kV line:

2.2.1 The Hillsboro-Hilltop 69kV Line

This line is very sensitive to loss of the Eau Claire-Arpin 345kV line and will overload. The relays at Hilltop are set to trip 69kV breaker # 569 at Hilltop if the flow is greater than or equal to 72 MVA.

2.2.2 The Lublin-Lakehead 69kV Line

This line is also sensitive to the loss of the Eau Claire-Arpin 345kV line. The DPC system operators will open this line by supervisory control in response to sag limitations at 27 MVA and above, depending on ambient temperature. The relays at Lublin are set to operate breaker # 12NB56 automatically at 47 MVA.

2.2.3 The T-Corners Area 115kV System

The Hydro Lane-T Corners-Wien 115kV line and the Wien-McMillan-Wildwood-Hume-Arpin 115kV systems are susceptible to overloading for the outage of any portion of the King-Eau Claire-Arpin 345kV line. The relays at Wien are set to open the B-54 breaker on the Wien-Stratford 115kV line when the flow exceeds 90 MVA for 10 seconds. This operation will prevent the Marshfield 115kV system from overloading. If this line does not trip automatically, the ATCLLC system operator should open the B-54 breaker at Wien via supervisory control if system conditions are such that opening the line will improve conditions on the 115kV system.

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[2] Note: Operating horizon or real-time security analysis may establish a lower operating security limit based on, but not limited to, dynamic stability, voltage stability, or steady-state voltage. Any adjustment to the real-time operating security limit must be reflected in the loadings referenced in this section. For example, if a voltage stability limit is identified at 625 MW, a TLR level 1 is initiated at 600 MW.

3.2.4 System Operations at ATCLLC and Xcel verify that all mitigation schemes outlined in 3.1 have been performed properly.

3.2.5 Xcel and ATCLLC will test the line from Eau Claire to determine if the fault is temporary or permanent.

3.2.5.1 **Temporary Fault:** The line is available to the network. A minimum 5-minute time delay from the original trip is required to discharge capacitor banks before attempting to loop Eau Claire-Arpin 345kV. These capacitor banks are required to maintain adequate system voltage at high transfer levels and are required to be available when closing the loop. These include:

Eau Claire 161kV – (4) 88 MVAR switched.
Arpin 138kV - (1) 50 MVAR switched.

Prior to re-closing at Arpin, the ATCLLC system operator notifies the Weston generating station of the situation and requests that the station prepare for re-closure of the Eau Claire-Arpin facility.

3.2.5.2 The ATCLLC system operator verifies that the Weston generating units are prepared for networking the 345kV system.

3.2.5.3 The ATCLLC system operator verifies that the T Corners-Wien 115kV line is closed.

3.2.5.4 The ATCLLC system operator verifies with Xcel that the Eau Claire capacitors are available and that the King-Eau Claire 345kV line is closed.

3.2.5.5 The ATCLLC system operator verifies with Xcel that the Eau Claire end of the line is closed.

3.2.5.6 The ATCLLC system operator verifies that the Arpin capacitors are available.

3.2.5.7 The ATCLLC system operator closes the 345kV line breaker at Arpin.

3.2.5.8 **Permanent Fault:** If the Eau Claire-Arpin 345kV line cannot be successfully reclosed and it is determined that the outage is not of a temporary nature, additional measures need to be taken by the system operators to prepare for the next contingency. The next worst contingency with Eau Claire-Arpin 345kV out of service is expected to be Prairie Island-Byron 345kV. The next contingency would have very serious consequences and would require the curtailment of schedules across this interface and south of Twin Cities. To prepare for the next contingency and reduce its' severity, the steps in section 3.3 should be followed.

3.3 Post-Contingency Operation for a Permanent Fault

3.3.1 The ATCLLC system operator notifies the Weston generating plant of the permanent fault situation.

3.3.2 The ATCLLC system operators assess system conditions to determine if complete separation of the Minnesota-Eastern Wisconsin tie is necessary. Upon verification that complete interface separation is necessary to protect the NSP/DPC 69kV system, open breaker # W-23 at Wien on the Wien-T Corners line. Leaving this line in service during a permanent Eau Claire-Arpin outage would result in serious voltage violations in western and central Wisconsin for the next contingency.

3.3.3 Close breaker # B-54 on the Wien-Stratford 115kV line.

3.3.4 ATCLLC and Xcel will take necessary action to return the system to a secure state. ATCLLC and Xcel will review real-time security analysis to determine necessary actions. This may include, but is not limited to:

a. Initiating TLR (as needed) for the Prairie Island-Byron contingency (Xcel).
b. Initiating TLR (as needed) for the Wempletown-Paddock contingency (ATCLLC).

3.4 Return to Normal System Configuration

3.4.1 The ATCLLC system operators will verify that system conditions will allow closing of the W-23 breaker at Wien to re-establish the Minnesota-Eastern Wisconsin tie. The ATCLLC system operator will verify that system conditions will not require opening the Wien B-54 breaker before reclosing Wien-T Corners 115kV.

3.4.2 The ATCLLC system operator verifies with Xcel that the Eau Claire capacitors are available.

3.4.3 The ATCLLC system operator verifies that the Arpin capacitors are available.

3.4.4 The ATCLLC system operator notifies the Weston generating station of the situation and request that the station prepare for re-closure of the Wien-T Corners 115kV interconnection.

3.4.5 The ATCLLC system operator closes the W-23 breaker at Wien.

3.4.6 The Xcel system operator verifies that the King-Eau Claire 345kV line is closed before energizing the Eau Claire-Arpin 345kV line at Eau Claire.

3.4.7 The ATCLLC system operator closes the line at Arpin.

3.4.8 ATCLLC and Xcel operations will verify that all schemes are returned to their normal pre-contingent state.

3.4.9 ATCLLC and Xcel will release all TLR and restrictions on the flowgate to the normal pre-contingent state.

The system operators may use the **Minnesota-Eastern Wisconsin Open Phase Angle Reduction Guide** [3] in the event of a failure of any scheme in this guide to mitigate the OSL in a timely manner. The Minnesota-Eastern Wisconsin Open Phase Angle Reduction Guide shall only be used if necessary.

END

[3] This guide requires the use of significant generation redispatch from MAIN to MAPP to reduce the phase angle. Any generation reserve deficiency within MAIN may not provide enough generation to reduce the phase angle, possibly requiring the use of load curtailment.

Arpin-Rocky Run Operating Guide (ATCLLC) (Xcel) 3-24-2003

1.0 Purpose

The Arpin-Rocky Run Operating Guide is a set of operating instructions intended to maintain system loadings and voltages within allowable limits for the contingent loss of the Arpin-Rocky Run 345kV line. Due to the rebuild of a portion of the underlying 115kV system, it is now possible to operate the system without the use of the Minnesota-Wisconsin Phase Angle Agreement. This agreement will be used as needed, but it is subordinate to this guide. A limit of 790 MW, as measured at Eau Claire, has been set for the Eau Claire-Arpin 345kV line for the summer of 2003. The intent of this limit and the associated operating guide is to maintain system security and stability following the loss of this critical tie. [1]

2.0 Background

The Arpin-Rocky Run 345kV contingency may result in unacceptable voltage violations and overloads at high MAPP-MAIN transfer levels. This line segment, as part of the interface (known as the Minnesota-Wisconsin interface), is limited due to post contingent thermal, voltage, and system stability concerns on the underlying interface.

3.0 Implementing Procedures

3.1 Pre-contingency Mitigation

To maintain adequate voltage in the event of an Arpin-Rocky Run 345kV contingency, there are a number of fast-switching capacitor banks available at T-Corners and Wien substations to support the system voltages. These capacitors are automatically controlled to respond very quickly to low system voltage. Outage of any of these capacitor banks may require some reduction in the OSL until such time as they are available.

3.1.1 Council Creek 69kV Bus Tie Status

This tie would be expected to be open during high transfer periods. This tie is very sensitive to flows across the interface and studies have shown that it will overload at high transfer levels with all facilities in service. The relays at Council Creek are set to trip 69kV breaker # 335-S in 10 seconds if the flow from Oakdale exceeds 32 MVA or the flow from Monroe County exceeds 50 MVA.

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[1] refer to the ***"Arpin Area Study – Operations Report for summer 2002"*** and ***"Arpin Operations Update for summer 2003"*** for more details.

3.2 Post Contingency Operation

Upon loss of Arpin-Rocky Run 345kV:

3.2.1 The Port Edwards 138kV System
The Arpin 345-138kv transformer and the Arpin-Port Edwards 138kv system are both susceptible to overloading for the outage of the Arpin-Rocky Run 345kV line. To prevent this, the relays at Port Edwards will trip breaker #421 on the Wautoma 138kV line and breaker # 436 on the Saratoga 138kv line when the flow from Lakehead Vesper reaches 231 MVA.

3.2.2 The Hillsboro-Hilltop 69kV Line
This line is sensitive to loss of the Arpin-Rocky Run 345kV line and will overload. The relays at Hilltop are set to trip 69kV breaker # 569 at Hilltop if the flow is greater than or equal to 72 MVA.

3.2.3 The Lublin-Lakehead 69kV Line
This line is also sensitive to the loss of the Arpin-Rocky Run 345kV line. The DPC system operators will open this line by supervisory control in response to sag limitations at 27 MVA and above, depending on ambient temperature. The relays at Lublin are set to operate breaker # 12NB56 automatically at 47 MVA.

3.2.4 The West Wisconsin Rapids 46kv System
The West Wisconsin Rapids 69-46kV transformers and the West Wisconsin Rapids-Water Quality 46kv line are both susceptible to overloading for the outage of Arpin-Rocky Run 345kV with the Port Edwards 138kv lines open. To prevent this, the relays at West Wisconsin Rapids will trip breaker # 1659 on the W. Wisconsin Rapids-Water Quality 46kv line when the flow on the W. Wisconsin Rapids 69-46kV transformers reaches 60 MVA.

3.2.5 The T-Corners Area 115kV System
Open Wien-Stratford 115kV. The Arpin 138-115kV transformer and the Arpin-Hume-Wildwood-McMillan-Stratford-Wien 115kV system is susceptible to overloading for the outage of the Arpin-Rocky Run 345kV line with the Port Edwards 138kV lines open at high transfer levels. The relay setting at Wien will trip the B-54 breaker on the Wien-Stratford 115kv line at 90 MVA in 10 seconds. This protects the Marshfield 115kV system from overload and will also limit the Arpin 138-115kV transformer to approximately 160 MVA with normal Marshfield system peak loads.

3.2.6 System operators at ATCLLC verify that all mitigation schemes outlined in 3.2 have been performed properly.

3.2.7 ATCLLC will test the line from Arpin to determine if the fault is temporary or permanent.

3.2.7.1 **Temporary Fault:** The line is available to the network. A minimum 5-minute time delay from the original trip is required to discharge capacitor banks before attempting to loop Arpin-Rocky Run 345kV. These capacitor banks are

required to maintain adequate system voltage at high transfer levels and are required to be available when closing the loop. These include:

Eau Claire 161kV – (4) 88 MVAR switched.
Arpin 138kV - (1) 50 MVAR switched.

Prior to re-closing at Arpin, the ATCLLC system operator notifies the Weston generating station of the situation and requests that the station prepare for re-closure of the Arpin-Rocky Run facility.

3.2.7.2 The ATCLLC system operator verifies that the Weston generating units are prepared for networking the 345kV system.

3.2.7.3 The ATCLLC system operator verifies with Xcel that the Eau Claire capacitors are available.

3.2.7.4 The ATCLLC system operator verifies that the Arpin capacitors are available.

3.2.7.5 The ATCLLC system operator verifies that the T Corners-Wien 115kV line is closed.

3.2.7.6 The ATCLLC system operator closes the 345kV line breaker at Arpin.

3.2.7.7 **Permanent Fault:** If the Arpin-Rocky Run 345kV line cannot be successfully re-closed and it is determined that the outage is not of a temporary nature, additional measures need to be taken by the system operators to prepare for the next contingency. The next worst contingency with Arpin-Rocky Run 345kV out of service is expected to be Rocky Run-North Appleton 345kV. The next contingency would have very serious consequences and would require the curtailment of schedules across the Minnesota-Eastern Wisconsin interface. To prepare for the next contingency and reduce its' severity, the steps in section 3.3 should be followed.

3.3 Post-Contingency Operation for a Permanent Fault

3.3.1 The ATCLLC system operator contacts the Weston generating plant of the permanent fault situation.

3.3.2 ATCLLC will take necessary action to return the system to a secure state. ATCLLC will review real-time security analysis to determine necessary actions. This may include, but is not limited to:

a. Initiating TLR (as needed) for the Rocky Run-North Appleton contingency (ATCLLC).
b. Initiating TLR (as needed) for the Prairie Island-Byron contingency (Xcel).

3.4 Return to Normal System Configuration

3.4.1 The ATCLLC system operator verifies with Xcel that the Eau Claire capacitors are available.

3.4.2 The ATCLLC system operator verifies that the Arpin capacitors are available.

3.4.3 The ATCLLC system operator notifies the Weston generating station of the situation and request that the station prepare for re-closure of the Arpin-Rocky Run 345kV facility.

3.4.4 The ATCLLC system operator closes the line at Arpin.

3.4.5 ATCLLC operations will verify that all schemes are returned to their normal pre-contingent state.

3.4.6 ATCLLC will release all TLR and restrictions on the flowgate to the normal pre-contingent state.

The system operators may use the **Minnesota-Eastern Wisconsin Open Phase Angle Reduction Guide** [2] in the event of a failure of any scheme in this guide to mitigate the OSL in a timely manner. The Minnesota-Eastern Wisconsin Open Phase Angle Reduction Guide shall only be used if necessary.

END

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[2] This guide requires the use of significant generation redispatch from MAIN to MAPP to reduce the phase angle. Any generation reserve deficiency within MAIN may not provide enough generation to reduce the phase angle, possibly requiring the use of load curtailment.