



# **NYISO FAULT CURRENT ASSESSMENT**

**2009**

**Draft Report**

Prepared by  
Transmission Studies Staff  
New York Independent System Operator, Inc.

**July 14, 2009**

*Caution and Disclaimer*

**The contents of these materials are for informational purposes and are provided “as is” without representation or warranty of any kind, including without limitation, accuracy, completeness or fitness for any particular purposes. The New York Independent System Operator (NYISO) assumes no responsibility to the reader or any other party for the consequences of any errors or omissions. The NYISO may revise these materials at any time in its sole discretion without notice to the reader.**

**TABLE OF CONTENTS**

<b><u>SECTION</u></b>	<b><u>PAGE</u></b>
1. INTRODUCTION	4
2. SUMMARY OF RECOMMENDATIONS	4
3. SYSTEM REPRESENTATION AND BASE STUDY ASSUMPTIONS	5
4. DISCUSSION AND RESULTS	6
5. CONCLUSIONS AND RECOMMENDATIONS	9

**ATTACHMENTS**

1. BUS FAULT SUMMARY	10
----------------------	----

## 1. INTRODUCTION

The following report, prepared by the NYISO Transmission Studies Staff, highlights the significant results of the fault current screening analysis completed for the 2009 period. The purpose of this analysis is to document significant changes in fault current levels statewide, identify selected critical substations with potentially overdutied circuit breakers, refer these substations to the respective owners, and recommend remedial actions.

## 2. SUMMARY OF RECOMMENDATIONS

The following recommendations are presented based on the analysis and results documented in this report:

**Astoria East:** When two of the three Astoria dual yard steam units are operating on the East bus together with all other Astoria East units running, 138 kV circuit breakers, 1E, 2E, 3E, 6W, and 7W, at Astoria East are overdutied. When all three Astoria dual yard steam units are operating on the East bus with all other Astoria East units running, all 138 kV circuit breakers at Astoria East, except the BT tie-bus breaker, are overdutied.

**Corona:** In addition to the overdutied breakers at Astoria East, 138 kV circuit breakers, 1S, 2S, 4S, 8S, 9S, 10S, 1N, 3N, 4N, 5N, 6N, 8N, 9N, and 10N, at Corona are also overdutied when all three Astoria dual yard steam units are operating on the East bus together with all other Astoria East units running.

**Queensbridge:** 138 kV circuit breakers 6E and 11E at Queensbridge are overdutied when all three Astoria dual yard steam units are operating on the West bus together with all other Astoria West units running.

As indicated by the Interim Operating Protocol for Astoria East and West Stations Fault Current Mitigation approved by Operating Committee in May 22, 2008, Con Edison will normally configure the Astoria dual yard units in order to “to prevent overduty conditions at Astoria East, no more than one (1) Astoria dual yard unit can be connected to the East bus with all other Astoria East units running”. This configuration of the Astoria dual yard units would also prevent overduty conditions at Corona and Queensbridge stations.

### 3. SYSTEM REPRESENTATION AND BASE STUDY ASSUMPTIONS

#### I. System Representation

The NYISO 2009 Statewide Short Circuit representation, dated April 1, 2009, was used as the model for this study. This representation includes all system changes through the summer capability period ending October 31, 2009. The starting point for this representation was the NYISO 2008 Statewide Short Circuit representation, with updates from the NYCA transmission owners.

The adjacent control area data including Ontario, PJM, ISO-NE used in the April 1, 2009 representation is also updated at this time.

Significant changes in the 2009 NYISO Statewide Short Circuit Representation from 2008 include:

- Watercure 345/230 kV Transformer Back In-Service
- Caithness Long Island Power Project
- BP76 Line Out-of-Service
- Linden VFT Inter-Tie Project without Goethals Upgrade
- High Sheldon Wind Project
- Wethersfield Wind Project
- Canandaigua I &II Wind Project
- Noble Bliss I &II Wind Project
- Altona Wind Project
- Dewitt 345/115 Transformer#2 Out-of-Service

#### II. Base Study Assumptions

The short circuit levels for the initial screening analysis were calculated using the ASPEN OneLiner® program and the “NYISO Guideline for Fault Current Assessment”. The short circuit levels presented have been determined for all facilities scheduled in service during 2009.

## 4. DISCUSSION AND RESULTS

### I. Fault Current Calculation

As stated above, the baseline fault levels were calculated consistent with the methodology in the “NYISO Guideline for Fault Current Assessment”.

Consistent with generally accepted practices for short circuit studies, the Guideline requires that transmission lines and transformers be modeled in their normal operating condition, with all generating units modeled as in-service. This configuration, regardless of whether or not the system can actually be operated in such a manner, provides an adequate design margin of safety and reliability by yielding the worst case and most conservative fault levels.

### II. Circuit Breaker Rating

The lowest circuit breaker ratings shown for each of the selected substations were obtained from the New York transmission and generation owners. The ratings shown are the nameplate symmetrical rating, the de-rated symmetrical value as determined by the owner, or the approximate symmetrical value converted from a total current basis.

Circuit breakers rated on a total current basis were converted to an approximate symmetrical current rating by using the nominal voltage of the substation.

Advanced circuit breaker rating techniques – such as asymmetrical current analyses, de-rating for reclosing and de-rating for age - were not considered by the NYISO for this screening analysis, although each owner should consider these when performing their own analysis.

### III. Analysis

#### A. Bus Fault Summary

The first step in the procedure for identifying potentially overdutied circuit breakers is to generate a bus fault summary. The bus fault summary yielded the three-line-to-ground (3LG), double-line-to-ground (2LG), and single-line-to-ground (SLG) fault values at each selected substation. The results of the bus fault summary are compared to the lowest rated breaker within the substations, and if any of the bus faults exceeded the lowest rated breaker, an individual breaker analysis (IBA) was performed to determine if any circuit

breakers were actually overdutied.

The complete results of the bus fault summary for the 118 stations that the NYISO studied are shown in Attachment 1. Of these 118 stations, 3 were identified as having a bus fault in excess of the lowest circuit breaker rating, and required a more detailed analysis as outlined in the next section.

B. Detailed Analysis of Stations Identified in the Bus Fault Summary

The next step in the procedure for identifying potentially overdutied circuit breakers was to refer the results of the screening study to the facility owners for confirmation, and perform an individual breaker analysis (IBA) at each of the substations in question to determine if any of the circuit breakers were indeed overdutied.

Of the 3 stations with bus fault levels greater than their lowest breaker rating, the results of the IBA showed 3 stations without any overdutied circuit breakers. It's noted that three Astoria steam units have dual yard switching capability, the above results based on these units are configured with two of Astoria dual yard units ( unit#3 and #4) on the Astoria West bus, and one of Astoria dual yard units (unit #5) on the Astoria East bus and all other Astoria units running.

In the event these units are configured with two of three Astoria dual yard steam units (i.e., units #4 and #5) on the East bus and all other Astoria units running, 138 kV circuit breakers, 1E, 2E, 3E, 6W, and 7W, at Astoria East are overdutied.

In the event Astoria West station is configured with all three Astoria dual yard steam units (i.e., units #3, #4 and #5) on the West bus and all other Astoria units running, 138 kV circuit breakers 6E and 11E at Queensbridge are overdutied.

In the event Astoria East station is configured with all three Astoria dual yard steam units (i.e., units #3, #4 and #5) on the East bus and all other Astoria units running, 138 kV circuit breakers, 1S, 2S, 4S, 8S, 9S, 10S, 1N, 3N, 4N, 5N, 6N, 8N, 9N, and 10N, at Corona are overdutied and all 138 kV circuit breakers at Astoria East, except the BT tie-bus breaker, are also overdutied.

The Interim Operating Protocol for Astoria East and West Stations Fault Current Mitigation approved by Operating Committee in May 22, 2008 will be used to prevent the overduty conditions at Astoria East, Queensbridge, and Corona 138 kV stations.

## 5. CONCLUSIONS AND RECOMMENDATIONS

The 2009 Fault Current Assessment has identified the following significant changes in fault current statewide:

- Near Watercure and Hillside substations due to the Watercure 345/230 transformer being back in service
- Near Holbrook, Shoreham and Brookhaven substations due to new Caithness Long Island Power project being added
- Near Packard and Niagara substations due to BP76 line out-of-service.
- Near Stolle Road and Meyer substations due to High Sheldon Wind, Canandaigua Wind and Wethersfield Wind projects.
- Near Coethals, Farragut substations due to Linden VFT project.

It should be noted that fault duty studies are intended to be conservative in nature in order to provide an adequate margin of design safety and reliability. For example, the 2009 assessment has assumed that all generation and transmission are in service, while in real life, it is highly likely that some generation and transmission facilities are out of service due to transmission constraints, economic generation dispatch, or forced outages. Conversely, the NYISO has not taken into account other factors, such as reclosing, circuit breaker age or fault current asymmetry, which may lower breaker ratings or increase fault levels interrupted by the breakers. Facility owners have the responsibility for rating their equipment correctly, and as such shall routinely evaluate the interrupting capability of the circuit breakers using their own methods or industry standards.

Based on the above discussion, the NYISO recommends the Interim Operating Protocol for Astoria East and West Stations Fault Current Mitigation approved by Operating Committee in May 22, 2008 continue to be implemented to prevent overduty conditions at Astoria East, Queensbridge, and Corona 138 kV stations by requiring that the normal configuration of the Astoria dual yard units allows no more than one (1) Astoria dual yard unit to be connected to the East bus with all other Astoria East units running.

ATTACHMENT 1 -2009 BUS FAULT SUMMARY

Substation Name	Nominal kV	Lowest Rated Circuit Breaker (kA)	08 Maximum Bus Fault (kA)	09 Maximum Bus Fault (kA)	Delta (09-08) Bus Fault (kA)	IBA Required (Y/N)
Marcy	765	63	9.7	9.7	0.0	N
Massena	765	63	7.8	7.8	0.0	N
Ramapo	500	none	11.0	11.2	0.2	n/a
AES Somerset	345	32	17.9	18.0	0.1	N
Alps	345	40	15.4	15.4	0.0	N
Athens	345	50	33.0	33.2	0.2	N
Bowline 1	345	40	26.3	26.6	0.3	N
Bowline 2	345	40	26.2	26.5	0.3	N
Buchanan N.	345	63	28.7	28.9	0.2	N
Buchanan S.	345	40	38.1	38.4	0.3	N
Clay	345	50	34.0	33.9	-0.1	N
Coopers Corners	345	32	15.5	15.6	0.1	N
Dewitt	345	40	19.9	19.3	-0.6	N
Dunwoodie	345	63	50.3	50.6	0.3	N
East 15th Street	345	none	54.5	55.1	0.6	n/a
East Fishkill	345	63	38.7	39.0	0.3	N
East Garden City	345	63	25.3	25.3	0.0	N
Eastview	345	none	34.1	34.3	0.2	n/a
Edic	345	40	32.3	32.3	0.0	N
Elbridge	345	40	16.4	16.4	0.0	N
Farragut	345	63	60.5	61.4	0.9	N
Fitzpatrick	345	37	42.7	42.4	-0.4	Y
Fraser	345	29.6	17.2	17.4	0.2	N
Fresh Kills	345	63	39.6	40.5	0.9	N
Gilboa	345	40	22.6	22.6	0.1	N
Goethals N.	345	63	39.7	40.1	0.4	N
Goethals S.	345	63	39.9	40.9	1.0	N
Gowanus N.	345	63	49.0	49.4	0.4	N
Gowanus S.	345	63	49.0	49.6	0.6	N
Hurley Avenue	345	40	17.0	17.1	0.0	N
Independence	345	50	39.4	39.3	-0.1	N
Ladentown	345	63	37.8	38.4	0.6	N
Lafayette	345	40	18.4	18.1	-0.3	N
Leeds	345	40	33.6	33.8	0.2	N
Marcy	345	63	31.5	31.5	0.0	N
Middletown Tap	345	63	16.9	17.0	0.0	N
Millwood	345	63	44.1	44.5	0.4	N
New Scotland	345	32	30.2	30.3	0.1	N
Niagara	345	63	32.7	34.1	1.4	N
Nine Mile Point 1	345	50	44.9	44.7	-0.2	N
Oakdale	345	29.6	11.8	12.6	0.8	N
Oswego	345	50	32.8	32.7	-0.1	N
Pleasant Valley	345	63	39.8	40.5	0.7	N

Substation Name	Nominal kV	Lowest Rated Circuit Breaker (kA)	08 Maximum Bus Fault (kA)	09 Maximum Bus Fault (kA)	Delta (09-08) Bus Fault (kA)	IBA Required (Y/N)
Pleasantville	345	63	21.8	21.9	0.1	N
Poletti	345	63	45.6	45.8	0.2	N
Rainey	345	63	56.6	57.3	0.7	N
Ramapo	345	63	41.0	42.0	1.0	N
Reynolds Road	345	none	11.9	11.9	0.0	n/a
Rock Tavern	345	38	26.3	26.4	0.1	N
Roseton	345	38	34.4	34.6	0.2	N
Scriba	345	50	48.5	48.2	-0.3	N
Shore Road	345	63	27.8	27.8	0.0	N
South Mahwah	345	40	32.4	33.3	0.9	N
Sprain Brook	345	63	51.4	51.8	0.4	N
Station 122	345	32	17.0	17.1	0.1	N
Station 80	345	32	17.0	17.1	0.1	N
Stolle Road	345	32	3.9	4.0	0.1	N
Tremont	345	none	32.7	32.8	0.1	n/a
Volney	345	40	37.4	37.2	-0.1	N
Watercure	345	29.6	5.3	7.9	2.6	N
West 49th Street	345	63	51.1	51.5	0.4	N
West Haverstraw	345	none	27.5	27.8	0.3	n/a
Wood Street A	345	none	21.6	21.7	0.0	n/a
Wood Street B	345	none	24.8	24.9	0.1	n/a
Mott Haven	345	63	n/a	50.5	n/a	N
Adirondack	230	25	9.6	9.7	0.0	N
Dunkirk	230	26	15.3	15.2	-0.1	N
Gardenville	230	30	21.7	22.4	0.7	N
Hillside	230	28.6	8.0	11.9	3.9	N
Huntley	230	27	26.6	26.3	-0.3	N
Meyer	230	28.6	5.8	6.6	0.8	N
Niagara	230	63	55.3	55.7	0.4	N
Oakdale	230	none	6.2	6.5	0.3	n/a
Packard	230	50	42.4	39.5	-2.9	N
Porter	230	25	19.5	19.5	0.0	N
Robinson Road	230	34.4	14.2	14.4	0.2	N
Rotterdam	230	20	12.5	12.4	-0.2	N
South Ripley	230	40	9.2	9.1	-0.1	N
St. Lawrence	230	37	33.0	33.2	0.2	N
Stolle Road	230	28.6	12.8	13.9	1.1	N
Watercure	230	26.4	7.7	11.9	4.2	N
Willis	230	37	10.6	11.2	0.6	N
Astoria East (1) (2)	138	63	56.6	56.5	-0.1	N
Astoria West	138	63	46.1	46.0	-0.1	N
Barrett	138	59.2	49.2	49.2	0.0	N

Substation Name	Nominal kV	Lowest Rated Circuit Breaker (kA)	08 Maximum Bus Fault (kA)	09 Maximum Bus Fault (kA)	Delta (09-08) Bus Fault (kA)	IBA Required (Y/N)
Brookhaven	138	35.4	23.3	26.6	3.2	N
Buchanan	138	40	15.8	15.8	0.0	N
Corona (2)	138	63	54.8	54.7	0.0	N
Dunwoodie No.	138	40	32.6	32.6	0.0	N
Dunwoodie So.	138	40	30.4	30.4	0.0	N
East 13th	138	63	47.6	47.1	-0.5	N
East 179th	138	63	43.2	43.7	0.5	N
East Garden City	138	80	72.3	72.4	0.1	N
Eastview	138	63	36.5	36.5	0.0	N
Fox Hills	138	40	34.6	34.3	-0.3	N
Freeport	138	63	36.1	36.1	0.0	N
Fresh Kills	138	40	37.8	37.4	-0.4	N
Greenwood	138	63	51.1	50.7	-0.4	N
Holbrook	138	52.2	43.7	47.7	4.0	N
Jamaica	138	45	48.2	48.0	-0.2	Y
Lake Success	138	57.8	39.5	39.5	0.0	N
Millwood	138	20	19.2	19.3	0.1	N
Newbridge Road	138	80	73.2	73.3	0.1	N
Northport	138	56.2	60.3	60.0	-0.3	Y
Pilgrim	138	63	59.3	59.5	0.2	N
Port Jefferson	138	63	31.5	32.2	0.7	N
Queensbridge (3)	138	45	44.3	44.1	-0.2	N
Riverhead	138	36.5	16.8	17.2	0.5	N
Ruland	138	63	45.5	45.7	0.2	N
Sherman Creek	138	63	39.5	39.9	0.4	N
Shore Road	138	57.8	49.3	49.2	-0.1	N
Shoreham	138	52.2	23.5	25.0	1.5	N
Tremont	138	63	38.4	38.9	0.5	N
Valley Stream	138	57.8	53.4	53.4	0.0	N
Vernon East	138	40	37.5	37.3	-0.2	N
Vernon West	138	40	34.0	33.7	-0.3	N
Clay	115	60	n/a	38.1	n/a	N
Porter	115	43	n/a	41.4	n/a	N

Notes:

1. In the event of two Astoria dual yard steam units in the East and all other Astoria East units running, 138 kV circuit breakers, 1E, 2E, 3E, 6W, and 7W, at Astoria East are overdutied.
2. In the event of all three Astoria dual yard steam units in the East and all other Astoria East units running, all 138 kV circuit breakers, except BT tie-bus breaker, at Astoria East, and 138 kV circuit breakers, 1S, 2S, 4S, 8S, 9S, 10S, 1N, 3N, 4N, 5N, 6N, 8N, 9N, and 10N, at Corona are overdutied.
3. In the event of all three Astoria dual yard steam units in the West and all other Astoria West units running, 138 kV circuit breakers 6E and 11E at Queensbridge are overdutied.