

NYISO FAULT DUTY
ASSESSMENT
SUMMER 2005

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As Approved by the
NYISO Operating Committee

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1. INTRODUCTION

The following report, prepared by NYISO Operations Engineering Staff, highlights the significant results of the fault duty screening analysis completed for the Summer 2005 capability period (through October 31, 2005). The purpose of this analysis is to identify selected critical bulk power substations with potentially over-dutied circuit breakers, refer these substations to the respective owners, and recommend remedial actions.

2. SUMMARY RECOMMENDATIONS

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

1. **Nine Mile Point 1, Fitzpatrick and Packard:** Constellation, Entergy and National Grid, respectively, should replace or continue to replace the overdutied breakers at these stations on a priority basis.
2. **Corona:** The breaker which is overdutied at Corona is scheduled to be replaced in 2006. In the interim, the overduty condition can be eliminated by connecting no more than two (2) Astoria steam units to the Astoria East bus, which is an acceptable operating condition until commercial operation of the Poletti Expansion combined-cycle plant.

3. SYSTEM REPRESENTATION AND BASE STUDY ASSUMPTIONS

I. System Representation

The NYISO 2005 Statewide Short Circuit representation, dated April 15, 2005, was used for this study. This representation includes all system changes through the summer capability period ending October 31, 2005, known as of April 15. This representation was developed from the NYISO 2004 Statewide Short Circuit representation, with updates from the NYCA transmission owners and the adjacent Areas for 2005.

The adjacent Area representations used in the April 15, 2005 representation were obtained from the respective Area Reliability Coordinators and/or the interconnecting transmission owners.

Significant changes to the New York Control Area (NYCA) in the 2005 NYISO Statewide Short Circuit Representation from 2004 include:

- **New 345kV Series Reactors in ConEdison circuits M51, M52, 71 & 72**
- **Retirement of ConEdison Waterside units 6, 8 & 9**
- **Retirement of ConEdison Hudson Avenue 10**
- **New ConEdison East River Repowering Project**
- **Retirement of Albany Steam Generating Station**
- **New 750 MW PSEG Bethlehem Energy Center**
- **New 80 MW Calpine Bethpage Project**
- **New 80 MW Pinelawn Project**
- **New LIPA 138 kV Canal Substation**
- **Temporary LIPA Diesel generators at Shoreham and Holtsville**
- **New 500 MW NYPA Poletti Expansion (testing)**

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 initial short circuit levels presented have been determined for all facilities scheduled in service during the Summer 2005 period.

4. DISCUSSION AND RESULTS

I. Fault Current Calculation

The initial baseline fault levels were calculated using the “NYISO Guideline for Fault Current Assessment”, as previously stated.

The Guideline, in general terms, requires that all lines, feeders and generating units be placed in service, as is the accepted practice for short circuit studies. By assuming all lines, feeders and generating units are in service, regardless of whether or not the system can actually be operated that manner, provides an adequate design margin of safety and reliability by yielding the worst case, most conservative fault levels.

II. Circuit Breaker Rating

The lowest circuit breaker ratings shown for each of the selected bulk power substations were obtained from the NY 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.

III. Analysis

A. Bus Fault Summary

The first step in the procedure for identifying potentially overdutied circuit breakers was to generate a bus fault summary. The bus fault summary produced the three-line-to-ground (3LG), double-line-to-ground (2LG), and single-line-to-ground (SLG) fault values at each selected substation, and compared the results to the lowest rated breaker within the substations. 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.

It should be noted that simply because a bus fault level is greater than the lowest rated breaker does not necessarily mean any circuit breakers in the substation are actually over-dutied; it simply means the substation requires a more thorough analysis.

The complete results of the bus fault summary for the 115 stations that the NYISO studied are shown in Attachment 1. Of these 115 stations, 11 were identified as having a bus fault in excess of the lowest circuit breaker rating.

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.

The results of the IBA showed 4 of the 11 stations with overdutied circuit breakers, as summarized in Attachment 2 and detailed below:

Nine Mile Point 1 / Constellation

For a close-in single line to ground (1LG) fault on the line side of breaker R915 with the R925 and R80 breakers at Clay opening first, the breaker would have to interrupt 43.6 kA. Similarly, for a three phase (3LG) fault the breaker would have to interrupt 38.7 kA. Based on these results breaker R915 is over its 1LG rating of 41 kA.

Fitzpatrick / Entergy

For a close-in single line to ground (1LG) fault on the line side of breaker 10052 at Fitzpatrick with breakers R10 and R935 at Edic opening first the breaker would have to interrupt 41.1 kA. Similarly, for a three phase (3LG) fault the breaker would have to interrupt 37.5 kA. Based on these results breaker 10052 is effectively at or just over its 1LG rating of 41 kA.

East Garden City, Newbridge Road, Northport and Pilgrim / LIPA

The IBA at each of these stations show none of the breakers are overdutied.

Packard / National Grid

At Packard, three of the five circuit breakers previously identified as over-dutied have been replaced by National Grid. Four additional breakers are scheduled to be replaced within the year, including the two which are currently overdutied.

Ramapo, Corona, Greenwood, and Jamaica / ConEdison

The IBA at Ramapo, Greenwood and Jamaica show none of the breakers are overdutied.

The IBA at Corona shows that the bus tie breaker would have to interrupt 45.2 kA, which is over its rating of 45 kA.

5. CONCLUSIONS AND DETAILED RECOMMENDATIONS

The 2005 Fault Duty Assessment shows that overall the available fault current on the bulk power system in Upstate New York has remained largely unchanged since last year. Conversely, there has been a large decrease in available fault current on the 345kV system in New York City, mainly due to installation of the 345kV series reactors in the M51, M52, 71 and 72 cables.

There was an increase in the available fault current on the New York City 138 kV system, mainly due to moving one of the Astoria steam units to the East bus with the Poletti Expansion interconnecting to the West bus. With the Poletti Expansion not due to be commercial until after December 1, 2005, it is recommended that two of the four Astoria steam units remain connected to the Astoria West bus, thereby mitigating fault levels in the Astoria East, Corona and Jamaica area.

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. The above Assessment makes the conservative assumption that all generation and transmission is in service, when in actual real time operation not all generation and transmission is in service given transmission constraints, economic generation dispatch and forced outage rates. The NYISO has conducted historical fault duty benchmarking analyses and confirmed that, the actual calculated fault levels across the State are lower than the results obtained using the worst-case assumption of all facilities in service. 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.

Based on the above, the NYISO recommends the following for the referenced overdutied stations:

1. **Nine Mile Point 1, Fitzpatrick, Packard:** Constellation, Entergy and National Grid should replace or continue to replace the overdutied breakers at these stations on a priority basis
2. **Corona:** It is recommended that ConEdison proceed with its plans to replace the bus tie breaker at Corona, which will eliminate the overduty condition. In the interim, the overduty condition can be eliminated by connecting no more than two (2) Astoria steam units to the Astoria East bus, which is an acceptable operating condition until commercial operation of the Poletti Expansion combined-cycle plant.

Attachment 1

Substation Bus Fault Summary Base Case Fault Levels

Substation Name	Voltage (kV)	Lowest Breaker Rating (kA)	Fault Current (kA)	Over Lowest Breaker (Y/N)
Adirondack	230	25	8.3	N
AES Somerset	345	40	17.9	N
Alps	345	40	15.4	N
Astoria East	138	63	51.9	N
Astoria West	138	45	38.8	N
Athens	345	50	33.0	N
Barrett	138	57.8	46.7	N
Bowline 1	345	40	27.7	N
Bowline 2	345	40	27.5	N
Brookhaven	138	35.4	23.7	N
Buchanan N.	345	40	29.1	N
Buchanan S.	345	40	38.8	N
Buchanan	138	40	15.7	N
Clay	345	40	34.2	N
Coopers Corners	345	37	15.6	N
Corona	138	45	50.4	Y
Dewitt	345	40	20.1	N
Dunkirk	230	37	15.3	N
Dunwoodie	345	63	49.7	N
Dunwoodie No.	138	40	32.1	N
Dunwoodie So.	138	40	30.5	N
East 13th	138	63	46.3	N
East 15th Street	345	none	47.3	NOTE 1
East 179th	138	63	42.4	N
East Fishkill	345	63	38.6	N
East Garden City	138	63	65.9	Y
East Garden City	345	58.6	25.1	N
Eastview	138	63	36.4	N
Eastview	345	none	34.1	NOTE 1
Edic	345	37	32.1	N
Elbridge	345	40	16.6	N
Farragut	345	63	51.4	N
Fitzpatrick	345	39	42.8	Y
Fox Hills	138	40	33.6	N
Fraser	345	37	17.3	N
Freeport	138	63	31.5	N

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Fresh Kills	138	40	36.1	N
Fresh Kills	345	63	24.2	N
Gardenville	230	37	22.5	N
Gilboa	345	40	22.6	N
Goethals N.	345	40	23.7	N
Goethals S.	345	63	24.1	N
Gowanus N.	345	40	19.3	N
Gowanus S.	345	40	19.4	N
Greenwood	138	45	50.6	Y
Hillside	230	37	11.5	N
Holbrook	138	52.2	44.4	N
Huntley	230	37	27.1	N
Hurley Avenue	345	40	17.0	N
Independence	345	50	39.5	N
Jamaica	138	40	47.2	Y
Ladentown	345	63	40.0	N
Lafayette	345	40	18.6	N
Lake Success	138	57.8	39.1	N
Leeds	345	37	33.6	N
Marcy	345	63	31.3	N
Marcy	765	63	9.7	N
Massena	765	63	7.8	N
Meyer	230	37	6.1	N
Middletown Tap	345	63	17.2	N
Millwood	138	20	19.2	N
Millwood	345	63	44.4	N
New Scotland	345	37	30.1	N
Newbridge Road	138	63	63.7	Y
Niagara	230	63	56.3	N
Niagara	345	63	32.9	N
Nine Mile Point 1	345	39	45.1	Y
Northport	138	57.8	59.4	Y
Oakdale	230	none	6.4	NOTE 1
Oakdale	345	37	12.4	N
Oswego	345	37	32.9	N
Packard	230	37.6	43.5	Y
Pilgrim	138	57.8	57.9	Y
Pleasant Valley	345	63	39.5	N
Pleasantville	345	63	21.7	N
Poletti	345	63	40.7	N
Port Jefferson	138	63	31.6	N
Porter	230	25	18.8	N
Queensbridge	138	45	37.7	N
Rainey	345	63	49.3	N
Ramapo	345	40	43.4	Y
Ramapo	500	none	11.1	NOTE 1
Reynolds Road	345	none	11.9	NOTE 1
Riverhead	138	36.2	15.6	N

Robinson Road	230	43	14.5	N
Rock Tavern	345	38	27.0	N
Roseton	345	38	34.6	N
Rotterdam	230	25	12.4	N
Ruland	138	57.8	41.3	N
Scriba	345	50	48.6	N
Sherman Creek	138	63	38.8	N
Shore Road	138	57.8	48.6	N
Shore Road	345	63	27.6	N
Shoreham	138	52.2	25.7	N
South Mahwah	345	40	34.0	N
South Ripley	230	40	9.4	N
Sprain Brook	345	63	50.9	N
St. Lawrence	230	37	32.2	N
Station 122	345	40	17.0	N
Station 80	345	25	16.8	N
Stolle Road	230	37	13.1	N
Stolle Road	345	40	3.9	N
Tremont	138	63	37.8	N
Tremont	345	none	32.5	NOTE 1
Valley Stream	138	57.8	51.3	N
Vernon East	138	40	37.0	N
Vernon West	138	40	32.3	N
Volney	345	38.8	37.5	N
Watercure	230	33	11.4	N
Watercure	345	37	7.7	N
West 49th Street	345	63	45.0	N
West Haverstraw	345	none	29.1	NOTE 1
Willis	230	37	9.7	N
Wood Street A	345	none	21.6	NOTE 1
Wood Street B	345	none	24.8	NOTE 1

NOTES:

1. No circuit breaker is located at this substation.

Attachment 2

Substation Breaker Overduty Summary Individual Breaker Analyses

Substation Name	Voltage (kV)	Breaker Rating (kA)	Max. Fault Current (kA)	Percent Fault Duty (%)
Corona	138	45	45.2	100
Fitzpatrick	345	41	41.1	100
Nine Mile Point 1	345	41	43.6	106
Packard	230	37.6	38.9	103