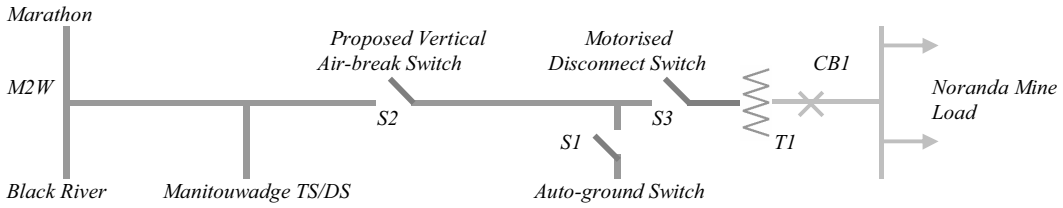
NORANDA AIR-BREAK SWITCH INSTALLATION - PHASE I
IESO EXPEDITED ASSESSMENT– REVISED (CAA ID 2005-EX224)

1.0 PROPOSED INSTALLATION

This assessment has been conducted to examine the impact on installation of a manually-operated, new vertical air-break disconnect switch S2 (as shown below) at Noranda Inc. GECO division site at Manitouwadge.



The new switch S2 will be kirk keyed to the circuit breaker CB1 located at the LT side of the 132/4.16 kV step-down transformer such that the switch S2 will not be opened unless the breaker CB1 is opened.

Presently, the faults at step-down transformer T1 are not effectively seen by the terminal breakers of the 115 kV circuit M2W. Thus, those faults activate a differential protection across the transformer which in turn activates a lockout relay. The lockout relay closes the auto-ground switch S1. Due to the resulting ground fault, M2W terminal breakers would now open. In future, above fault clearing mechanism will continue, but the new switch S2 can be manually opened provided the breaker CB1 is opened by the transformer fault, in case M2W to be re-energized while Noranda site is isolated.

The point of connection to the IESO-controlled grid will remain the same, hence will continue to be supplied via the 115 kV circuit M2W from Marathon.

The Noranda GECO peak load will remain approximately at 3 MW.

The new switch is expected to be in service by May 8, 2005.

2.0 SPECIFICATIONS FOR NEW SWITCH

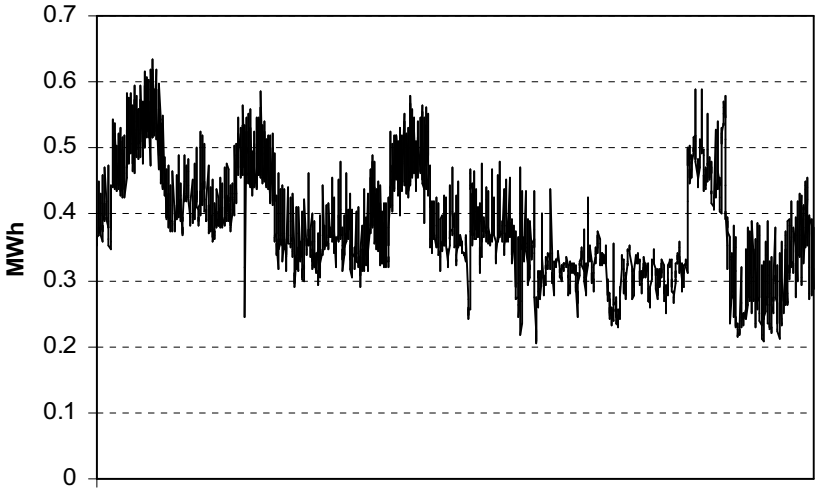
These are the data available for the new switch S2. If any of the following data is inaccurate, the applicant must provide the correct data to the IESO prior to completion of IESO's facility registration process.

Nominal voltage	132 kV
Interrupting media	Air
Rated continuous current	1200 A
Rated short term current	61 kA
BIL	650 kV

The registration of the new equipment to be installed will need to be completed through the IESO's facilities registration process before any equipment can be placed in-service. If the data supplied for the registration of the new equipment differ from those that were used for the assessment, then some of the assessment might need to be repeated.

3.0 NORANDA AVERAGE LOAD VARIATION

The IESO do not have the real-time monitoring of MW load at Noranda mine. Following graph provides the hourly variation in energy withdrawal in MWh by Noranda GECO mine for the period of Jan 10 – April 10, 2005. These data were obtained from revenue meters installed at site for financial settlement purposes. It is evident that the hourly average MW load for the monitored period is less than 1 MW.



4.0 REVIEW OF CONNECTION ARRANGEMENT

It is required that Noranda Inc. provides the IESO with confirmation on following (a), (b) and comply with (d) during facility registration process.

(a) Under-frequency Load Shedding Requirement

The Market Rules (Chapter 5, Section 10.4) and Market Manual 7.4 (Section 4.4) require that 35% of the total peak load of wholesale customers must be connected to UFLS relays. The discrete load shedding requirement is

- at 59.3 Hz, 12% of UFLS load must be disconnected.
- at 58.8 Hz, an additional 23% of UFLS load must be disconnected.

(b) Power Factor

The Market Rules (Chapter 4, Appendix 4.3) require that wholesale customers shall operate at a power factor within the range 0.9 lagging to 0.9 leading as measured at the connection point. For this facility, the connection point would be the 115 kV bus located at the Noranda facility.

Noranda has informed the IESO that the proponent intends to install a capacitor bank at this site in August 2005 in order to comply with above 0.9 lag power factor requirement. Before the capacitor bank is placed in-service, Noranda is expected to process the information of this cap bank via IESO's connection assessment process to assess its impact on the IESO-controlled grid.

(c) Voltage Reduction Facilities Requirements

Since the Noranda GECO peak load is less than 20 MVA, the installation of facilities to reduce the distribution voltage by 3% - 5% to preclude or mitigate emergency operating state is not required.

(d) On-line Monitoring

Noranda will have to meet the Market Rule requirement for installation of facilities to monitor real time variables for operating purpose.

5.0 NEED FOR SYSTEM IMPACT ASSESSMENT

Since the installation of the new air-break disconnect switch would not result in any material adverse effect on the reliability of the IESO-controlled grid, the analysis is performed as an expedited assessment. Since this expedited assessment has covered all system reliability issues related to the proposed installation, the System Impact Assessment is not required.

6.0 SUMMARY OF REQUIREMENTS

The following requirements have been identified during the assessment performed for the proposed installation. Prior to placing the new disconnect switch in-service, the applicant is required to demonstrate the compliance to following requirements.

1. The registration of the new equipment to be installed will need to be completed through IESO's facility registration process before the new equipment can be placed in-service.

2. The applicant is required to comply with (a), (b) and (d) of Section 4.0 in this report.

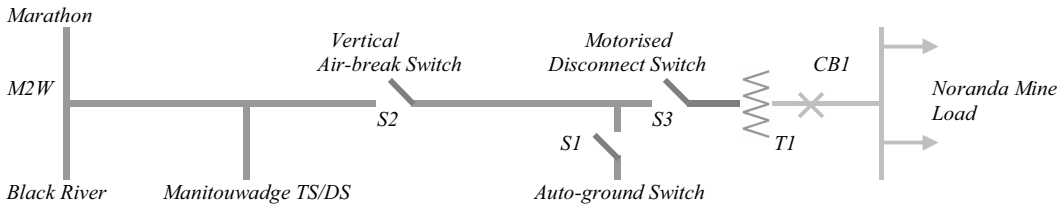
7.0 NOTIFICATION OF APPROVAL

It is recommended that a *Notification of Approval for Connection* be issued for this project subject to implementation of the requirements given in Section 6.0.

NORANDA SUB-STATION REPLACEMENT - PHASE II
IESO EXPEDITED ASSESSMENT – REVISED (CAA ID 2005-EX224)

1.0 PRESENT ARRANGEMENT

The present connection arrangement in Noranda Inc. GECO Division at Manitouwadge is shown below.



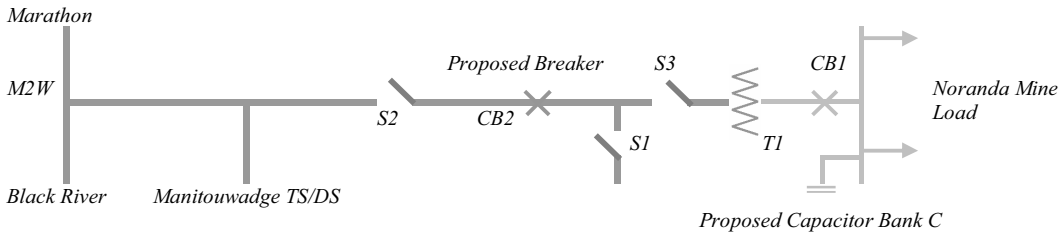
Noranda site at Manitouwadge is located about 67 km from Marathon TS and connected (via 132/4.16 kV, 10 MVA transformer T1) together with Manitouwadge DS/TS to the 115 kV circuit M2W which is supplied from Marathon.

Presently, the faults at step-down transformer T1 are not effectively seen by the terminal breakers of the circuit M2W. Thus, those faults activate a differential protection across the transformer which in turn activates a lockout relay. The lockout relay closes the auto-ground switch S1. Due to the resulting ground fault, M2W terminal breakers would open. The new switch S2 can be manually opened provided the breaker CB1 is opened by the transformer fault, in case M2W to be re-energized while Noranda site is isolated.

2.0 PROPOSED CHANGES

The proposed changes under Noranda Sub-Station Replacement Phase II Project include the

- installation of an outdoor circuit breaker CB2.
- replacement of existing lightning arresters in the transformer primary, neutral grounding resistor at the transformer secondary, cable bank from the transformer secondary to switchgear line-up and the revenue metering equipment with similar new equipment.
- installation of a motorized operator on the air-break switch S2.
- installation of a 4.16 kV, 150 kVAr capacitor bank C for power factor correction.



The new equipment is expected to be in service by Aug 27th, 2005.

The point of connection to the IESO-controlled grid will remain same, hence will continue to be supplied via the 115 kV circuit M2W from Marathon. In future, the faults on M2W will be cleared by CB2 at Noranda end and the faults on the step-down transformer will be cleared by CB1 and CB2.

3.0 SPECIFICATIONS FOR NEW EQUIPMENT

The data for the circuit breaker CB2 and capacitor bank provided to the IESO are following.

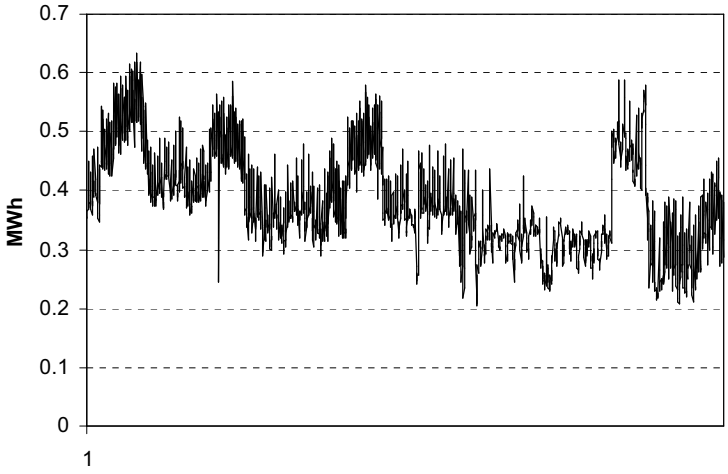
Circuit Breaker	
Nominal voltage	145 kV
Interrupting media	SF6
Rated continuous current	1200 A
Fault current rating	40 kA
BIL	650 kV
No of cycles	3

Capacitor Bank	
Step 1	50 kVAr
Step 2	50 kVAr
Step 3	25 kVAr
Step 4	25 kVAr
Rated voltage	4.16 kV

The Market Rules require that for northern Ontario, the equipment with 115 kV nominal rating must have the capability to continuously operate at 132 kV. The Transmission Code requires that 115 kV equipment to be rated at 50 kA symmetrical fault level and fault interrupting devices to have 5 cycles or less interrupting time.

4.0 NORANDA AVERAGE LOAD VARIATION

The IESO do not have the real time monitoring of the Noranda load. Following graph provides the hourly variation of the MWh of the Noranda load for the period of Jan 10 – April, 2005. This data are obtained from the IESO revenue metering data used for financial settlement purposes. It is evident that the hourly *average* MW for the monitored period is less than 1 MW.



5.0 REVIEW OF CONNECTION ARRANGEMENT

It is required that Noranda provides the IESO with confirmation on followings during facility registration process.

(a) Power Factor

The Market Rules (Chapter 4, Appendix 4.3) require that wholesale customers shall operate at a power factor within the range 0.9 lagging to 0.9 leading as measured at the *defined meter point*. The *defined meter point* is

established by the IESO and normally it would be the point of connection to the Transmitter's network. For this facility, the *defined meter point* would be the 115 kV busbar located at the Noranda site.

(b) Under-Frequency Load Shedding Requirement

The Market Rules (Chapter 5, Section 10.4) and Market Manual 7.4 (Section 4.4) require that 35% of the total peak load of wholesale customers must be connected to UFLS relays to reject loads as response to declining frequency. The load shedding is to be done in discreet manner:

- at 59.3 Hz, 12% of UFLS load must be disconnected.
- at 58.8 Hz, an additional 23% of UFLS load must be disconnected.

Based on the information provided to the IESO, it would appear that at 59.3 Hz estimated 15 % of the load will be tripped and at 58.8 Hz estimated 65% of the load will be tripped. The second step takes the water treatment plant off-line which is the majority of the load.

This UFLS tripping will be facilitated by the frequency monitoring facilities available in the new demand meter located in new switchgear which will send signals to trip appropriate 4.16 kV feeder breakers to meet the above discreet UFLS requirement.

However, Noranda will need to confirm above information during the IESO facility registration process.

(c) Telemetered Data

Noranda will have to meet the Market Rule requirement for installation of facilities to monitor real time variables for operating purpose.

(d) Reduction in Demand through Voltage Reduction or Interruption

Since the peak load less than 20 MVA, the installation of facilities to reduce voltage to preclude or mitigate emergency operating state is not required.

6.0 COMPUTER ANALYSIS

Based on the information provided to the IESO, the total expected peak is about 1600 kW, from which the power factor of 300 kW will be operated at about 0.85 lag, and the power factor of the remaining 1300 kW will be operated at about 0.9 lag. This would give total 1600 kW operating at about 0.89 lag power factor.

The IESO simulated the effect of a new capacitor bank that is to be connected to the 4.16 kV bus in order to determine the projected power factor at the 115 kV bus. The following table summarises the PSS/E results.

Noranda	*Capacitor bank*	*115 kV side of the transformer*			*4.16 kV side of the transformer*			*Transformer*
Load	*at 4.16 kV bus*	*Power flow*	*PF*	*voltage*	*Power flow*	*PF*	*voltage*	*losses*
1.6 + 0.8 j	-	1.6 + j 1.0	0.85	1.12 pu	1.6 + j 0.8	0.89	1.07 pu	0.2 MVAr
1.6 + 0.8 j	150 kVar	1.6 + j 0.8	0.89	1.12 pu	1.6 + j 0.6	0.93	1.07 pu	0.2 MVAr
1.6 + 0.8 j	200 kVar	1.6 + j 0.7	0.91	1.12 pu	1.6 + j 0.6	0.93	1.07 pu	0.1 MVAr

In order to control the power factor at 115 kV bus to at least 0.9 lag, it will be required to control the power factor at the 4.16 kV bus to about 0.93 taking reactive losses in the transformer in to account. In order to accomplish the above requirement, the analysis shows a planned 150 kVAr capacitor bank at 4.16 kV bus will not be sufficient, and at least 200 kVAr capacitor bank with suitable steps will be required at the 4.16 kV bus.

7.0 SUMMARY OF REQUIREMENTS

The following requirements have been identified during the assessment. Prior to placing the proposed changes in-service, the applicant is required to comply with following requirements.

1. The registration of the new equipment to be installed will need to be completed through the IESO's facility registration process.

2. In order to meet (a) of Section 5.0, it will be required that a capacitor bank of minimum 200 kVAr with suitable steps to be installed at 4.16 kV bus such that the power factor at 115 kV bus can be controlled to minimum 0.9 lag.

3. The applicant is required to comply with (b) and (c) of Section 5.0.

8.0 NOTIFICATION OF APPROVAL

It is recommended that a *Notification of Approval for Connection* be issued for this project subject to implementation of the requirements given in Section 7.0