ISO Rule Section 502.11 (Substation) Workgroup Meeting – Proposed Agenda

Meeting Date: October 29, 2015 from 10:00 am to 3:00 pm
Meeting Place: ENMAX Office, 141 – 50 Avenue SE, Calgary

Agenda Item	Time	Presenter
1. Welcome and finalization of Sept 17 meeting minutes	10:00	[AESO]
2. Discussions on the following items: • Should we define a "major substation" (or "system substation")? • If so, what should be the criteria?	10:00 – 10:15	[AESO] / All
3. Discussions on AltaLink's findings on "transmission element". This definition is required in defining reliability and availability requirements	10:15 – 10:30	[AltaLink] / All
4. Discussions on what will be included in the substation rule 502.11 • General requirement ▪ Grounding ▪ Insulation ▪ Service conditions ▪ Station service ▪ Control building	10:30 – 12:00	All
5. Lunch break	12:00 – 1:00	All
6. Continue discussions on substation rule 502.11	1:00 – 2:45	All
7. Summarize and next meeting	2:45 – 3:00	[AESO]

<u>Grounding</u>

The AIES is an effectively grounded system for the 240 kV and 500 kV systems. The 138 kV system is also an effectively grounded system for new installations.

Should the following be part of 502.11 minimum requirements (Note: WG members may have more items to be included in 502.11)

(a) For all substations
- All autotransformers must be solidly grounded at the neutral
- The ratio of X0/X1 must be three (3) or less (how do we specify this?)
- The grounding resistance must be 1 ohm or less
- The design of the grounding grid must incorporate 10 year short circuit current values
- Cannot use aluminum as grounding conductor
- Grounding rods must be installed around the substation grounding grid perimeter and around transformers
- Substation fence must be grounded
- Grounding grid must be extended to beyond the fence line

- Any fence leaving a substation must be insulated from the substation fence
- For surge arresters, separate ground leads for arresters mounted on metal structures must be used
- Ground rods must be installed near or at surge arresters

(b) For substations having generation connections
- Any GSUs must have an effectively grounded wye winding on the HV side connecting to the AIES

(c) For Major Substations
- Require that grounding mat be installed above the grounding grid

(d) For GIS substations
- Require that continuous enclose must be used
- Shall avoid establishment of current loop via other station equipment (such as CT or switchgear)

Insulation Coordination

ISO rule 502.2 has mentioned IEEE, IEC and CSA standards in various places. Table 4 in 502.2 specifies insulation levels (CIFO) for transmission lines at 25, 138 and 240 kV voltages. For 500 kV systems, the insulation levels are up to each project.

Should the following be part of 502.11 minimum requirements (Note: WG members may have more items to be included in 502.11)

(a) For all substations
- Lightning mast or shielding wire shall be installed
- CSA C22.3 be used for the calculation of switching surge values
- AEUC code (and CSA C22.3 No.1) be used for the calculation and determination of conductor clearances
- Every line entrance must be equipped with surge arresters
- Every transformer, including station service transformer, must be equipped with surge arresters on both sides
- Altitude factor should be considered if altitude is above 1000m

(b) The following voltage table be specified

Nominal (kV)	Extreme Continuous Minimum (kV)	Normal Continuous Minimum (kV)	Normal Continuous Maximum (kV)	Extreme Continuous Maximum (kV)
138	124	135	145	150
144	130	137	151	155
240	216	234	252	264
260[1]	234	247	266	275
500	475	500	525	550

[1] For all 240 kV buses from Whitefish north and Sagitawah north

(c) The following BIL and SIL values be specified

Nominal Voltage Classification (kV rms)	**138/144**		**240/260**		**500**	
	BIL	**SIL**	**BIL**	**SIL**	**BIL**	**SIL**
Station Post Insulators and	550	450	900	750	1550	1175

Airbreaks						
Circuit Breakers	650	540	1050	850	1800	1425
Current and Potential Transformers	650	540	1050	850	1800	1425
Transformer Windings (protected by surge arresters)	550	450	850	750	1550	1175

(d) Should we require a higher BIL/BSL for GIS substations?

Nominal Voltage Classification (kV rms)	**138/144**		**240/260**		**500**	
	BIL	**SIL**	**BIL**	**SIL**	**BIL**	**SIL**
Disconnect switches	860		1050	850	1800	1425
Switchgears	860		1050	850	1800	1425
Current and Potential Transformers	860		1050	850	1800	1425

Service Conditions

The minimum requirement would deal with normal or usual service conditions. Alberta differs from many other jurisdictions in terms of ambient temperature.

Should the following be part of 502.11 minimum requirements (Note: WG members may have more items to be included in 502.11)

(a) For all substations
- Ambient temperature rating of –50°C to +40°C for all outdoor equipment
- All equipment shall be capable of being energized at –50°C
- All equipment shall be designed to withstand wind velocity of 160 km/h
- Snow and icing conditions will be the same as 502.2 requirements

(b) Should we define temperature zones for Alberta (see attached paper)?
(c) Any other conditions?

Station power supply & control building

Currently, most substations in Alberta have a control building in the form of either pre-engineered trailer or building.

Should the following be part of 502.11 minimum requirements (Note: WG members may have more items to be included in 502.11)

(e) For all substations
- Must have one battery bank
- Maximum charge time from zero to full for battery charger is 24 (or 12?) hours
- Minimum discharge time of 8 hours for the batteries

- Station service power PT should be allowed for 240 kV or below
- All secondary AC and DC boards must have automatic transfer switch
- AC boards 1 and 2 must be on opposite sides of the building
- DC boards 1 and 2 must be located in separate rooms and opposite sides of the building
- a control building to be constructed in each and every transmission substation
- all protective replaying panels and cabinets for alternative line equipment must be installed on alternative sides of the aisle/walkway
- Control building must be with either a floating floor or trenches, or with a basement, and no other forms

(f) For Major Substations

- Must have dual station service power supplies, one of which being battery
- Minimum discharge time of 12 hours for the batteries or emergency generation
- The sizing of each station service should be 100% of the station load
- sufficient space must be planned and designed for major substations for future expansion, in the first place