

The VELCO logo is displayed in a bold, white, sans-serif font. It is positioned on the left side of the top banner, which features a scenic background of rolling hills with autumn foliage and several transmission towers.

VERMONT'S TRANSMISSION RELIABILITY RESOURCE

Arc Hazard Update

September 18, 2014

MOVING **POWER**. MOVING **FORWARD**.



Requirement

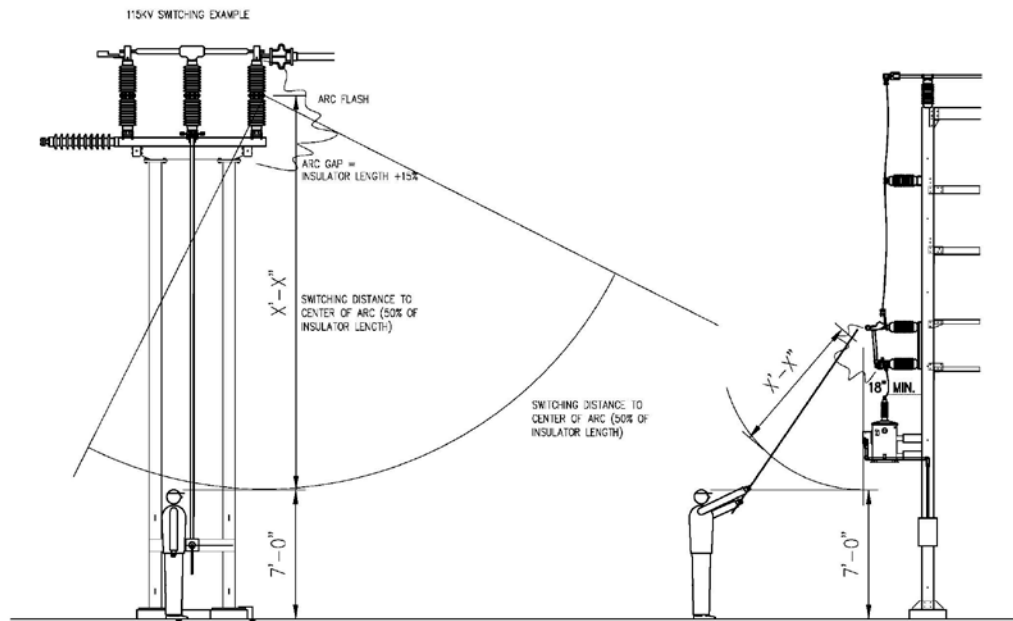
- On April 11, 2014, OSHA published changes to 29 CFR, Part 1910.269 regarding protection from flames and electric arcs.
- The changes require the employer to:
 - Assess the workplace for flame and electric arc hazards (paragraph (I)(8)(i)).
 - Make a reasonable estimate of the incident heat energy to which the employee would be exposed (paragraph (I)(8)(ii)).
 - Ensure that the each employee exposed to hazards from electric arcs wears protective clothing and other protective equipment with an arc rating greater than or equal to the heat energy estimated under paragraph (I)(8)(ii) of this section whenever that estimate exceeds 2.0 cal/cm².
- The obligation for the employer to make reasonable estimates of incident energy commences January 1, 2015.

Affected Areas

- Substations
 - Equipment greater than 15kV (affects DUs performing switching for VELCO)
 - Equipment between 1 and 15kV (affects DUs performing switching for VELCO)
 - 480 Volt Equipment
 - Equipment less than 300 Volts
 - DC Equipment
- Transmission Lines
 - 345kV
 - 230kV
 - 115kV

Approach

- Incident energy values were calculated for each switch at each substation based on a 7 foot switch operator standing on the ground directly below the switch.
- The highest incident energy level of all the switches at each substation was identified.
- The distance required to achieve 8 calories/cm² was determined.



Results – Substations (1 of 2)

Substation	Equipment >15KV		1KV<Equipment >15kV	480 Volt Equipment		Equipment <300 Volts		125 Volt DC Equipment
	Max I.E. (cal/cm ²) at 7'	Distance to achieve 8 cal/cm ²	Max I.E. (cal/cm ²) at 7'	Max I.E. (cal/cm ²) at working distance	Distance to achieve 8 cal/cm ²	Max I.E. (cal/cm ²) at working distance	Distance to achieve 8 cal/cm ²	Max I.E. (cal/cm ²) at working distance
Appletree	----	----	----	----	----	25	37"	1.33
Ascutney	10.19	12' 11"	----	----	----	23.2	36"	3.81
Barre	6.25	9' 2"	----	----	----	25	37"	1.65
Berlin	0.73	3' 4"	----	----	----	25	37"	1.57
Bennington	3.45	8' 4"	----	----	----	22.4	36"	3.81
Blissville	0.91	5' 10"	----	----	----	28	38"	3.78
Charlotte	0.13	2' 6"	3.17	----	----	25	37"	2.71
Chelsea	1.97	5' 10"	----	----	----	25	37"	1.91
Cold River	2.35	7' 6"	----	----	----	25	37"	1.56
Coolidge	0.74	6' 3"	----	----	----	25	37"	6.52
Duxbury	0.06	2' 6"	----	----	----	25	37"	----
East Avenue	0.69	3' 9"	0.61	----	----	29	39"	2.87
East Fairfax	0.34	2' 1"	----	----	----	25	37"	1.45
Essex	7.96	12' 1"	----	38	48"	76	70"	7.21
Florence	7.11	7'1"	----	----	----	25	37"	1.91
Georgia	0.93	2'11"	----	----	----	17	34"	5.52
Granite	5.24	12' 6"	----	38	48"	97	80"	6.24
Hartford	0.92	5' 5"	----	----	----	25	37"	2.87
Highgate	10.49	10' 10"	----	----	----	28	38"	4.49
Irasburg	0.46	2' 6"	----	----	----	25	37"	1.99
Jay	2.22	2'11"	----	----	----	29	39"	4.49
Lime Kiln	1.10	4' 2"	----	----	----	27	38"	2.87
Lyndonville	0.25	2' 6"	----	----	----	29	39"	5.32
Middlebury	4.93	8' 4"	----	----	----	25	37"	4.49

Results – Substations (2 of 2)

Substation	Equipment >15KV		1KV<Equipment >15kV	480 Volt Equipment		Equipment <300 Volts		125 Volt DC Equipment
	Max I.E. (cal/cm ²) at 7'	Distance to achieve 8 cal/cm ²	Max I.E. (cal/cm ²) at 7'	Max I.E. (cal/cm ²) at working distance	Distance to achieve 8 cal/cm ²	Max I.E. (cal/cm ²) at working distance	Distance to achieve 8 cal/cm ²	Max I.E. (cal/cm ²) at working distance
Middlesex	1.07	5' 5"	----	----	----	25	37"	1.91
Moshers Tap	0.03	1' 8"	----	----	----	25	37"	----
New Haven	0.62	5' 0"	----	----	----	25	37"	4.49
Newfane	0.81	6' 8"	----	----	----	43	50"	4.49
Newport	2.66	7' 1"	----	----	----	25	37"	3.78
North Ferrisburg	0.28	2' 11"	0.28	----	----	25	37"	1.91
North Rutland	2.57	8' 9"	----	----	----	25	37"	1.18
Queen City	0.68	3' 4"	0.44	----	----	29	39"	2.87
Sand Bar	1.21	3' 9"	----	----	----	25	37"	2.87
Sheffield	0.23	2' 6"	----	----	----	25	37"	1.99
Shelburne	0.08	2' 11"	3.14	----	----	25	37"	1.91
South Hero	0.48	4' 8"	----	----	----	25	37"	1.32
St. Albans	2.73	2'11"	----	----	----	25	37"	1.99
St. Albans Tap	0.70	3' 9"	----	----	----	25	37"	2.45
St. Johnsbury	0.38	3' 4"	----	----	----	25	37"	1.99
Stowe	12.61	7' 6"	----	----	----	25	37"	2.87
Taft's Corner	0.99	3' 4"	3.31	----	----	29	39"	2.87
Vergennes	0.50	3' 4"	----	----	----	29	39"	2.87
Vermont Yankee	3.52	10' 0"	----	38	48"	25	37"	3.78
Vernon	3.98	10' 10"	----	----	----	34	41"	6.52
West Rutland	1.35	6' 3"	----	----	----	17	34"	4.49
Williston	0.36	3' 4"	----	----	----	25	37"	2.87
Windsor	5.48	8' 4"	----	----	----	25	37"	1.99

Special Cases

	Equipment >15KV			
	Max I.E. (cal/cm ²)	Distance to		Max I.E. (cal/cm ²)
Substation	at 7'	achieve 8 cal/cm ²	Limiting Switch(s)	at 7' for all other switches
Ascutney	10.2	12'11"	15-8 ,1574-8, 150 ,15-2 1574-9, 174-8, 1740, 174-2 709, 7PF, 4SF	4.49
Stowe	12.6	7'6"	32PF, 33PF	7.02
Highgate	10.49	10'10"	202, 203	2.60

Results – Transmission Lines

Line	Incident Energy (cal/cm ²) at 40"	Min. Distance for I.E. < 8 cal/cm ² (in.)	PPE Level
1429	7.20	40	8 cal/cm ²
K4	16.20	60	≥ 17 cal/cm ²
K6	14.60	60	≥ 15 cal/cm ²
K7	9.72	45	≥ 10 cal/cm ²
K15	20.30	70	≥ 21 cal/cm ²
K18	2.68	25	8 cal/cm ²
K19	2.74	25	8 cal/cm ²
K20	2.74	25	8 cal/cm ²
K21	3.38	25	8 cal/cm ²
K22	4.50	30	8 cal/cm ²
K23	3.38	25	8 cal/cm ²
K24	4.50	30	8 cal/cm ²
K25	3.38	25	8 cal/cm ²
K26	2.00	20	8 cal/cm ²
K27	2.74	25	8 cal/cm ²
K28	1.45	15	8 cal/cm ²
K30	6.32	35	8 cal/cm ²
K31	5.82	35	8 cal/cm ²
K32	5.82	35	8 cal/cm ²
K33	2.49	20	8 cal/cm ²
K34	6.32	35	8 cal/cm ²
K35	2.85	25	8 cal/cm ²
K37	6.32	35	8 cal/cm ²
K39	1.15	15	8 cal/cm ²
K40	8.59	45	≥ 9 cal/cm ²
K41	1.63	15	8 cal/cm ²
K42	1.98	20	8 cal/cm ²
K43	4.43	30	8 cal/cm ²
K46	1.02	10	8 cal/cm ²
K47	0.90	10	8 cal/cm ²
K50	1.53	15	8 cal/cm ²
K51	4.37	30	8 cal/cm ²
K54	5.83	35	8 cal/cm ²
K55	3.20	25	8 cal/cm ²
K56	2.64	25	8 cal/cm ²
K60	1.96	20	8 cal/cm ²
K63	4.43	30	8 cal/cm ²
K64	4.43	30	8 cal/cm ²
K65	2.03	20	8 cal/cm ²
K80	12.50	55	≥ 13 cal/cm ²
K149	4.24	30	8 cal/cm ²
K174	4.24	30	8 cal/cm ²
K186	11.50	50	≥ 12 cal/cm ²

Line	Incident Energy (cal/cm ²) at 75"	Min. Distance for I.E. < 8 cal/cm ² (in.)	PPE Level
206	2.01	30	8 cal/cm ²

345kV			
Line	Incident Energy (cal/cm ²) at 130"	Min. Distance for I.E. < 8 cal/cm ² (in.)	PPE Level
340	1.99	55	8 cal/cm ²
350	0.86	30	8 cal/cm ²
370	0.67	25	8 cal/cm ²
379	1.42	45	8 cal/cm ²
381	1.42	45	8 cal/cm ²
3320	1.99	55	8 cal/cm ²
3321	0.95	35	8 cal/cm ²
3340	1.42	45	8 cal/cm ²
3381	1.42	45	8 cal/cm ²

Summary

- People performing switching on VELCO's system will now be able to select the appropriate level of PPE and/or be able to alter their work practices to mitigate arc flash hazards.
- Incident energy impact will be considered in the design of all future substation addition and modification projects.
- Calculations assume highest available fault current (all lines in service, all generation running) and all protection systems in service. For alternate configurations or when protection systems are disabled alternate calculations can be performed.
- The Incident Energy levels calculated and published in the attached table represent the arc flash hazards on VELCO's system today. The incident energy levels on VELCO's system can and will change as the system is modified. Therefore, the attached table should be considered a living document and will be updated as necessary to reflect actual field conditions.

Next Steps

- Training on arc flash and incident energy levels will be included as part of the initial training and the two year training that all people must undergo to be certified to switch on VELCO's system.
- VELCO, with input from the distribution utilities will develop a mechanism for publicizing, disseminating and updating calculated incident energy values on VELCO's system.
- VELCO work procedures and practices will be revised as necessary to ensure that all work is performed in a manner that mitigates arc flash hazards.
- VELCO Engineering will provide any distribution utility with available fault current values and source-end clearing times for any interface location on the system, at the distribution utility's request.