

## Substation - Personal Protective Equipment SWP-151

### 1.0 Purpose

To establish rules and guidelines regarding personal protective equipment (PPE) for all workers required to enter Yukon Energy Corporation (YEC) substations.

This SWP applies to all YEC employees and contractors who work in YEC substations.

### 2.0 Minimum mandatory personal protective equipment (PPE)

2.1 The following PPE must be worn to enter any YEC substation:

1. Safety headwear; Type 2, Class E;
2. Arc rated flame retardant (ARFR) clothing; minimum HRC 2/ATPV8;
3. Safety footwear with dielectric rating; and,
4. Safety eyewear with side shields.



2.2 Other PPE could include:

1. Hi-visibility PPE (must be ARFR);
2. Hearing protection;
3. Gloves;
4. High voltage rubber gloves.

2.3 Safety headwear

2.3.1 Minimum requirement for safety headwear at Yukon Energy is CSA Type II, Class E (See Appendix B – CSA Hard Hat Classifications). ANSI equivalent is also acceptable.

2.3.2 Hard hats meeting the equivalent ANSI Z89.1 standard are acceptable.

2.3.3 Safety headwear must be worn by a worker:

1. In all areas of the substation; unless wearing safety headwear could create a hazard (e.g., work in control cabinets);
2. Any area where there is a danger of head injury from falling or flying objects; or, other harmful contacts;
3. When identified on the JSA/Tailboard; and,
4. In areas identified as a requirement by signage.

## 2.4 Arc-rated flame-retardant (ARFR) clothing

See Appendix A – CSA Z462-18; Table 6C – Personal protective equipment (PPE)

The minimum required ARFR clothing to enter an energized YEC substation is HRC 2/ATPV<sup>8</sup><sup>1</sup>.

- HRC – Hazard Risk Category; category system that prescribes a certain PPE category based on the features of the electrical equipment being considered.
- ATPV – Arc Thermal Performance Value; measured in calories per square centimeter squared (cal/cm<sup>2</sup>) and represents the maximum performance capability for arc-flash protection of a particular garment or fabric.

Arc-rated protective clothing can be a single garment with the required arc-rating, or a layered system of arc-rated garments that achieves/exceeds the required minimum HRC2/ATPV 8 rating. Layering arc-rated garments can provide extra protection.

A typical layering system could include cotton under garments (no ATPV rating), an arc-rated shirt and trouser, and an arc-rated coverall. See Appendix B – CSA Z462-18; Annex M (informative).

The ATPV rating of a garment can be obtained from the clothing manufacturer; typically on a tag attached to the garment.

Garments that are not arc-rated cannot be used to increase the arc-rating of a layered clothing system.

The outermost layer of the clothing system must be arc-rated material.

Workers must ensure that any fabric worn beneath arc-rated garments, and/or against the skin, is made of arc-rated or natural fabrics that will not melt when exposed to heat.

Melting fibers such as nylon, polyester, polypropylene, and spandex; or, cotton blended with these fibers, must not be worn beneath or as the outermost layer.

Cotton garments with painted/iron-on images also should not be worn beneath arc-rated garments, and/or against the skin.

The arc-rated garment(s) should cover all potentially exposed areas as completely as possible. Shirt sleeves should be fastened at the wrists, and shirts and jackets should be closed at the neck.

Avoid tight clothing. Loose fitting clothing provides some additional thermal insulation because of air spaces. In general, ARFR apparel should fit properly such that it does not interfere with the work.

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<sup>1</sup> Garments must be arc-rated. Regular FR garments (like those worn in the petroleum industry) are not adequate for exposure to electrical arc flash.

- 2.5 Safety footwear  
Safety footwear must be CSA approved with dielectric rating (orange Omega symbol  $\Omega$ ). ANSI equivalent is also acceptable.



- 2.6 Safety eyewear  
Safety eyewear must be CSA approved and adequate for accessing an energized substation and/or working on/near energized electrical equipment. ANSI equivalent is also acceptable.

Safety eyewear that provides infrared (IR) protection are recommended when there is the potential for exposure to an electrical arc when switching or other activities is undertaken.

### 3.0 Reference documents

- YEC SWP-010; (Hard Hats) Safety Headwear

## Appendix A – CSA Z462-18; Table 6C – Personal protective equipment (PPE)

Arc flash PPE category	PPE
1	<p data-bbox="431 365 1273 394">Arc rated clothing, minimum arc rating of 4 cal/cm<sup>2</sup> (16.75 J/cm<sup>2</sup>) (Note 1):</p> <p data-bbox="477 426 1122 455">Arc rated long-sleeve shirt and pants or arc rated coverall</p> <p data-bbox="477 485 1045 514">Arc rated faceshield or arc flash suit hood (Note 2)</p> <p data-bbox="477 543 1097 573">Arc rated jacket, parka, rainwear, or hard hat liner (AN)</p> <p data-bbox="431 602 683 632">Protective equipment:</p> <p data-bbox="477 661 578 690">Hard hat</p> <p data-bbox="477 720 878 749">Safety glasses or safety goggles (SR)</p> <p data-bbox="477 779 997 808">Hearing protection (ear canal inserts) (Note 4)</p> <p data-bbox="477 837 927 867">Heavy duty leather gloves (AN) (Note 3)</p> <p data-bbox="477 896 732 926">Leather footwear (AN)</p>
2	<p data-bbox="431 936 1260 966">Arc rated clothing, minimum arc rating of 8 cal/cm<sup>2</sup> (33.5 J/cm<sup>2</sup>) (Note 1):</p> <p data-bbox="477 995 1122 1024">Arc rated long-sleeve shirt and pants or arc rated coverall</p> <p data-bbox="477 1054 1317 1117">Arc-rated arc flash suit hood; or arc rated faceshield (Note 2) and arc rated balaclava</p> <p data-bbox="477 1146 1097 1176">Arc rated jacket, parka, rainwear, or hard hat liner (AN)</p> <p data-bbox="431 1205 683 1234">Protective equipment:</p> <p data-bbox="477 1264 578 1293">Hard hat</p> <p data-bbox="477 1323 878 1352">Safety glasses or safety goggles (SR)</p> <p data-bbox="477 1381 997 1411">Hearing protection (ear canal inserts) (Note 4)</p> <p data-bbox="477 1440 927 1470">Heavy duty leather gloves (AN) (Note 3)</p>

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Arc flash PPE category	PPE
	Leather footwear
3	<p>Arc rated clothing, selected so that the system arc rating meets the required minimum arc rating of 25 cal/cm<sup>2</sup> (104.7 J/cm<sup>2</sup>) (Note 1):</p> <ul style="list-style-type: none"> <li>Arc rated long-sleeve shirt (AR)</li> <li>Arc rated pants (AR)</li> <li>Arc rated coverall (AR)</li> <li>Arc rated arc flash suit jacket (AR)</li> <li>Arc rated arc flash suit pants (AR)</li> <li>Arc rated arc flash suit hood</li> <li>Arc rated gloves (Note 1)</li> <li>Arc-rated jacket, parka, rainwear, or hard hat liner (AN)</li> </ul> <p>Protective equipment:</p> <ul style="list-style-type: none"> <li>Hard hat</li> <li>Safety glasses or safety goggles (SR)</li> <li>Hearing protection (ear canal inserts) (Note 4)</li> <li>Leather footwear</li> </ul>

*(Continued)*

Arc flash PPE category	PPE
4	<p data-bbox="461 285 1273 338">Arc rated clothing, selected so that the system arc rating meets the required minimum arc rating of 40 cal/cm<sup>2</sup> (167.5 J/cm<sup>2</sup>) (Note 1):</p> <ul style="list-style-type: none"> <li data-bbox="505 365 837 390">Arc rated long-sleeve shirt (AR)</li> <li data-bbox="505 420 721 445">Arc rated pants (AR)</li> <li data-bbox="505 474 745 499">Arc rated coverall (AR)</li> <li data-bbox="505 529 867 554">Arc rated arc flash suit jacket (AR)</li> <li data-bbox="505 583 862 609">Arc rated arc flash suit pants (AR)</li> <li data-bbox="505 638 808 663">Arc rated arc flash suit hood</li> <li data-bbox="505 693 773 718">Arc rated gloves (Note 1)</li> <li data-bbox="505 747 1094 772">Arc-rated jacket, parka, rainwear, or hard hat liner (AN)</li> </ul> <p data-bbox="461 802 699 827">Protective equipment:</p> <ul style="list-style-type: none"> <li data-bbox="505 856 602 882">Hard hat</li> <li data-bbox="505 911 886 936">Safety glasses or safety goggles (SR)</li> <li data-bbox="505 966 997 991">Hearing protection (ear canal inserts) (Note 4)</li> <li data-bbox="505 1020 691 1045">Leather footwear</li> </ul>

**Legend:**

AN = as needed (optional)

AR = as required

SR = selection required

**Notes:**

1) Arc rating is defined in Clause 3.

2) Faceshields shall meet the requirements of Clause 4.3.7.3.10 c). An arc flash suit hood may be worn in lieu of a faceshield.

3) If rubber insulating gloves with leather protectors are used, additional leather or arc-rated gloves shall not be required. The combination of rubber insulating gloves with leather protectors satisfies the arc flash protection requirement.

Δ 4) Other types of hearing protection may be used in lieu of or in addition to ear canal inserts provided they are worn under an arc-rated arc flash hood.

**Appendix B – CSA Z462-18; Annex M (informative)***Annex M (informative)****Layering of protective clothing and total system arc rating***

*Note: This Annex is not a mandatory part of this Standard.*

**M.1 Layering of arc-rated protective clothing**

Layering of arc-rated clothing is an effective approach to achieving a required arc rating. It can be used to achieve the required arc rating with the lowest number of layers and lowest clothing system weight. Garments that are not arc-rated should not be used to increase the arc rating of a garment or of a clothing system.

**M.2 Total system arc rating****M.2.1**

The total system arc rating is the arc rating obtained when all clothing layers worn by a worker are tested as a multi-layer sample. An example of a clothing system is an arc-rated coverall worn over an arc-rated shirt and arc-rated pants. For this two-layer arc-rated clothing system, the arc rating is typically greater than the sum of the two arc thermal performance value ratings. Other examples of multi-layering include an arc-rated coverall worn over another pair of arc-rated coveralls, an arc flash suit worn over arc-rated coveralls, or an arc flash suit worn over an arc-rated shirt and arc-rated pants. Layering can provide the required arc rating at a lower overall weight of clothing and with fewer total layers of fabric and consequently can provide the required protection with a higher level of worker comfort.

**M.2.2**

It is important to understand that the total system arc rating cannot be determined by adding the arc ratings of the individual layers. In a few cases, it has been observed that the total system arc rating actually decreased when another arc-rated layer of a specific type was added to the system as the outermost layer. The only way to determine the total system arc rating is to conduct a multi-layer arc test in accordance with ASTM F1959/F1959M on the combination of all of the layers assembled as they would be worn.

**M.2.3**

It is important to note that face and head protection that has the appropriate arc rating for the task should be selected if layering is used.

**M.3 Layering using arc-rated clothing over natural-fibre clothing underlayers****M.3.1**

Under some exposure conditions, natural-fibre underlayers can ignite even when natural-fibre clothing is worn under arc-rated clothing.