



Photo: EcoQuest Adventure, Carolina, PR

Recommended Disinfection Methods for Personal Protective Equipment (PPE) for Adventure Courses

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Greetings, Owners, Operators, Guides, Facilitators, Monitors and Practitioners:

We will soon return to the field to do the most that we are passionate about, changing people's lives through the Adventure Courses. When we return to work and welcome our participants, the question will undoubtedly arise: How to disinfect Personal Protective Equipment (PPE)? In the Adventure Course industry, the PPE consists of the helmet, harness, connector, lanyards, and pulley system.

Aire Libre Internacional (ALI) was given the task of doing a brief investigation, based on a literature review, to answer two questions; Does EPP really need to be disinfected? And second, what is the best recommended method to disinfect PPE?

After research the literature, the conclusion is as follows; In effect, the PPE must be disinfected, because the COVID-19 could remain in it, up to 5 days. On the other hand, two methods for disinfecting PPE stand out among many other alternatives; (1) Water and Soap, each with its own conditions (water at 60°C and soap with a neutral pH) and (2) the 7-day Quarantine. ALI conducted the literature review based on publications from the following organizations:

1. Maxim Ropes
2. Teufelberger
3. Beal
4. 3M
5. Petzl
6. Association for Challenge Course Technology (ACCT)
7. Robertson
8. Singing Rock
9. Eldorado Walls
10. Edelrid
11. Misty Mountain
12. French Creek
13. Adrenalin Gear
14. Kong
15. United States Department of Agriculture
16. IAAPA
17. Buck
18. Rocks Edge
19. Milwaukee
20. Head Rush
21. Clic-it
22. ISC
23. Italian Adventure Park Association
24. Universidad de Carolina del Norte
25. WebMD
26. Stability of SARS-CoV-2 in different environmental conditions, Universidad de Hong Kong
27. Universidad Johns Hopkins
28. The New York Times.

It is important to highlight the fact that each manufacturer has its own tests, as well as its own recommendations. A review of the literature shows that there are recommendations that contradict each other. This phenomenon is easy to understand because the method that works for one organization does not necessarily work for another. Temperatures, types of alcohol, bleaches, detergents, times and other factors may vary between manufacturers' recommendations.

This document presents some findings found during the literature review on whether, in fact, PPE should be disinfected and how to disinfect it. The information is presented as published by the investigated organizations, for this reason, the recommendations may sometimes be inconsistent. Finally, each manufacturer recommends disinfecting products, these are not mentioned in this document because it is already a matter of brands, prices, effects and not all products are available in all countries. Therefore, only the necessary solutions are presented. Each Adventure Course is responsible for researching, testing, and accepting the commercial disinfectant that it will use.

General Data

- Nothing substitutes the manufacturer's instructions, consult the technical note provided in the equipment, for additional information, contact the supplier and consult your doubts and questions.
- The EPP disinfection area must have signs to alert staff to following best practices to avoid contagion.
- Chemical cleaners damage plastics and textiles, breaking down compounds and fibers.
- The only tested and recommended cleaning products are soap and water.
- Do not use bleach, cleaning chemicals, or disinfectants.
- There is some evidence that some bleach-containing solutions can damage webbing and seams.
- Hand scrubbing action will help break down dirt, grease and other materials on the treadmill.
- This method of washing with water at 60 ° C is different from the recommendations of 30 ° C. This temperature is used in a special case to “kill” the Virus.
- Some manufacturers recommend using dilution of potassium permanganate or ammonia. Although documented in some technical data sheets, a positive disinfecting effect cannot be guaranteed in relation to COVID-19.
- Hand wash products with soap and water at a maximum temperature of 65°C/149°F (Warning: these are exceptional measures during the COVID-19 crisis. Otherwise, in normal circumstances, wash your equipment at 30°C/89°F or as indicated in the technical note).
- Some manufacturers claim that, in the case of textiles, standard sterilization methods, such as steam, irradiation, ultraviolet light, or chemical washing, are not suitable for the synthetic fibers they use to manufacture their products.
- Do not use aggressive or abrasive cleaning tools.

- Make sure that the entire surface of the PPE has been applied with the solution (soap).
- A sponge or soft cloth can be used to rub the equipment.
- Polyamide harnesses, straps and slings will shrink between 1 and 5%.
- The equipment must be thoroughly rinsed. Run clean water over the equipment to remove any foreign substances and residual soap.
- Do not use a pressure sprayer of any kind.
- Equipment should be dried by hanging it in a cool, dry, shaded area with ventilation. Avoid direct sunlight.

Disinfection with alcohol

- Isopropyl alcohol is recommended to disinfect PPE and we found no evidence of negative effects in the literature review.
- Dip the textiles in isopropyl alcohol (or isopropanol) for a period of 30 to 60 seconds.
- Allow the products to dry by suspending them in a well-ventilated room (due to alcohol fumes), in fresh air at room temperature, away from direct sunlight.
- Let them dry for 24 hours.
- Polyamide, polyester and Dyneema do not weaken significantly with alcohol in these specific conditions.
- This method reduced the strength of the product by 2%.
- This method could lead to deterioration if used continuously.
- The use of this method should be limited to a maximum of 10 cycles.

Use of Washing Machine on Textile

- A bladeless load agitator style washer machine is acceptable for cleaning textile products.
- Textile products should be placed in a mesh laundry bag to avoid tangles.
- A full wash and rinse cycle should be performed with a mild detergent (without bleach) such as that used for washing personal clothing, or mild dishwashing soap.
- The water temperature, when washed, should not exceed 60°C - 65°C.
- Once clean, the product should be hung to air dry in a well ventilated area, out of direct sunlight. Never exceed 130°F (54.4°C) when drying.
- Always make sure the washing machine is free from other washing liquids and fabric softener residues to avoid contamination.

Steam Disinfection for Textiles

- Use a manufactured appliance as a Dry Steam Sanitizer that heats at 180°C
- Use it in the PPE from 15 - 10cm away.
- 5 - 8 second maximum time in each area.

- The steam dispersed by any other equipment must have a temperature of 120°C, and requires more time than with a super-hot manufactured appliance over 150°C.
- Steam is compatible with nylon, polyester and Kevlar.
- Do not use it with Dyneema
- Some manufacturers claim that, in the case of textiles, steam is not suitable for the synthetic fibers they use to make their products.
- Check with your provider before using this method.

Hot water and soap for Textiles

- Wash the PPE by hand with soap and water at a maximum temperature of 65°C (Warning: these are exceptional measures during the COVID-19 crisis. Otherwise, in normal circumstances, wash your equipment at 30°C or as indicated in the technical notes) and with soap (ph 5.5-8.5)
- Dry it outside in the sun for 24 hours.
- This method reduced the strength of the product by 2%.

Hot Water Disinfection for Textiles

- Immerse textile products in hot water 58°C -60°C (136°F -140° F) for 30 min.
- Dry them outside in the shade out of the sunlight for 24 hours.
- Do not use this method with Dyneema or Kevlar.
- The virus is not detectable after 30 minutes in 56°C of hot water.
- It is possible to increase the water temperature to 55°C without any effect on the strength of the Textile.
- This method is not applicable to equipment made of HMPE (Dyneema®, Spectra®, Dynex® or similar).
- This method reduced the strength of the textile product by 2%

Plastics

- For plastic composite components and aluminum casing, the use of hydro alcoholic solution is recommended.
- Protect your hands with disposable gloves and apply the product with a cloth.
- If there is no blood present in the product, it can be cleaned with a mild soap and a damp cloth to remove the liquids and then let it rest for 3 days.
- You can also disinfect with a mild soap and a damp cloth to remove dirt and grease, and then decontaminate with a dilute bleach solution, which is consistent with CDC advice.

Metals

- Use a few drops of antibacterial soap in a large tub of warm water.
- Dip the PPE in the tub, then immediately rinse it in another tub filled with clean warm water.
- Once thoroughly rinsed, allow to air dry away from heat or direct sunlight.

- It is recommended to use hot water at 55°C for a non-destructive disinfection of the metallic components.
- A 70% isopropyl alcohol can be sprayed or cleaned on metal products.
- It is recommended to apply 70% isopropyl alcohol with a cloth and clean it.
- Some organizations recommend bleach, alcohol or hydrogen peroxide based products as the best options to eliminate the risk of Covid-19 transmission in high contact metals.
- Because alcohol-based products are the easiest to control, it is suggested that a 70% IPA [isopropyl alcohol] solution be a good choice for disinfecting metals.

Leather gloves

- Soak them in soapy water, at a temperature of 86°F - 150°F.
- A sink, bucket, or container could be used.
- Baby shampoo works well, as it has few "additional" ingredients and has a pH of 5.5 or less, which is good for Leather in general.
- Don't put them in a washer machine or dryer.
- Shake the gloves vigorously for a minimum of 20 seconds to help break down the outer layer of the virus.
- Make sure that the entire glove has contact with soap and water.
- Longer time would be more effective, since the glove must be covered with soapy water in its entirety for a minimum of 20 seconds.
- Let them air dry outside in the sun.
- It is okay to use leather conditioners on the glove, according to the manufacturer's instructions.

Ropes Disinfection

- Use 70% Isopropanol solution and 30% distilled water for 3 min.
- It is recommended to use in nylon, polyester and Dyneema.
- The handy and flexibility of the rope may be lost a little after this process.
- It should not be disinfected every day, only when necessary.
- Low stretch rope made of Polyamide will shrink about 10%.
- Therefore, it will become more rigid and during use there will be more elongation.
- Almost no effect on dynamic ropes.

Helmet Disinfection

- Wash helmets with warm soapy water (neutral pH, maximum 30°C).
- Then, rinse thoroughly with fresh water and dry outside, out of the sun's rays.
- Use only household soap for face and body.
- All other cleaning products, such as solvents, stain removers, degreasers, are too powerful, are incompatible with polycarbonate, polystyrene or nylon, and can weaken the helmet shell.

- The helmet shell can be cleaned with a cloth slightly moistened with alcohol.
- Do not immerse the helmet directly in alcohol.

Quarantined Equipment

- Another way to disinfect.
- Depends on the cycle of participants and amount of equipment.
- Possibly losses in tourism and visitors in general, may allow PPE to be quarantined without affecting the operation.
- There are basically two types of recommendations regarding time.
- Place the equipment in quarantine in a ventilated place not exposed to the sun for a period of 7 days.
- Place the equipment in quarantine in a ventilated place not exposed to the sun for a period of 72 hours.
- The quarantine time should be based on the best information from the relevant authorities.
- It is recommended to quarantine the PPE for the recommended time and add an extra day, as a safety factor.
- Thus, the recommendation leans towards 7 days quarantine, given that the virus could be in metals for up to 5 days, plus an additional one (1) day as a safety factor. The result leans more towards the 7-day recommendation.

Table of the life period of COVID-19 on different surfaces

Materials	Corona Virus duration
Out Doors	3 hours
Paper y higienic paper	30 minutes
Madera	1 days
textiles	1 – 2 days
Cristal	2 - 5 days
Money	4 days
Plastic	3-4 days
Secretions	3 days
Cartoon	24 horas
Cooper	4 horas
Stainless Steel	3 days
Metals	5 days
Aluminum	8 hours

Conclusion

After reviewing the bibliographic sources of expert and validated organizations in the Adventure Course Industry, it is notable that several studies on the subject were carried out 3 to 4 years ago. Those demonstrate that the disinfection of the PPE is not a new subject. Of course, these investigations and recommendations are in addition to those recently carried out due to the COVID-19 Pandemic.

After conducting the study, it is shown that, in effect, it is necessary to disinfect the PPE. The Corona Virus could be "alive" on flat metal, aluminum and stainless steel surfaces from 8 hours to 5 days. Which means the virus could survive on the connectors and metal buckles and other metal parts that are used in the operation of the Circuit, even if they are not classified as EPP. For example, descent devices, belay devices, metal equipment to perform rescues, among others. All metal parts can become a point of contagion. The duration of the Virus in the EPP could be postponed for days. According to the publications consulted, the PPE could be contaminated for up to 5 days. Without disinfection, the PPE could be used by another participant inclusive, the same day, and the virus could be spread. The virus lasts:

- A. Two (2) days on textiles: such as harness, safety lanyards, and chest harness.
- B. Four (4) days in plastic: as in helmets and other PPE components.
- C. Three (3) days on stainless steel: like some EPP components.
- D. Five (5) days in metals: as some PPE components.
- E. Eight (8) hours in aluminum: like the carabineer or figure 8.
- F. Three (3) days in body substance: secretions that can fall on the PPE, from the staff or from the participants

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On the other hand, the answer to the question with which to disinfect the PPE, the literature review shows that the best and most recommended method is the use of soap and water. The main recommendation for disinfecting is water at 60°C, a temperature that is not normally recommended in the technical notes. The temperature rise is to increase the chances of "killing" the virus. In fact, even so, some organizations specify the temperature to disinfect their particular equipment. It was evident that water temperatures of 40°C and 55°C, are specified by some manufacturers for their products. As for the soap, everyone agrees that it must be mild, with a neutral pH (5.5), to be used with the EPP.

PPE is the equipment used to protect personnel and participants when they are performing activities in places where there is a risk of falling. The Corona Virus has the ability to stay "alive" for certain periods of time, depending on the material and the characteristics of the surface. This means that, in effect, the Virus could lodge

in the materials that make up PPE, plastic, metals and textiles, and remain for up to 5 days. Fortunately, a well-known and easily available remedy can be used to eliminate the Virus effectively. Despite the fact that there are a wide variety of products that do not all work due to their concentrations, soap continues to be identified as the first and most effective alternative for this purpose. The managers of each Adventure Course are invited to reflect on the subject.

General Recommendations

1. Disinfects all PPE (plastics, metals, textiles) with hot water (manufacturer's recommended temperature) and soap (manufacturer's recommended type and pH).
2. Let them air dry, in a ventilated place, out of the sunlight.
3. The quarantine technique is also recommended.
4. Place the EPP in quarantine for at least 7 days, to ensure that the virus does indeed "die" regardless of the type of surface.