

Elaboration of a Sop (Standard Operating Procedure) for the Hygiene of Military Firefighters' Approach Clothes

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Abstract

In the daily missions that military firefighters face, there are many risks that require adequate and efficient protection. As for thermal risks, the approach clothing stands out, developed to protect the combatant from the extremely high temperatures present in fires. The correct cleaning procedure employs specific methods and products, therefore it is contraindicated that the approach clothes are washed under the same procedures adopted for common clothes. The development of a standard operating procedure ensures that the cleaning procedure is carried out properly.

Keywords: Firefighters, Cleaning, PPE, Health

Introduction

The context of PPE (personal protective equipment) is based on the user's health security, so that its adoption is increasingly

becoming a social issue, as well as a scientific one. In the definition of Alves (2013) an PPE is “[...] every product used as a work tool, for individual use, intended for the protection of the worker, minimizing risks that threaten safety and health at work [1]”.

The need for protection is also linked to the problems that can affect firefighters as a result of acute or chronic respiratory diseases. Examples are: pulmonary emphysema, bronchitis, bronchiolitis, COPD (chronic obstructive pulmonary disease), asthma, lung cancer, larynx or esophagus.

Military firefighters are a category of professionals within the Security Forces (FS) exposed to a high number of occupational risks due to the characteristics of the situations attended, which are capable of causing illnesses and occupational accidents. These adverse situations that are inherent to the type of work usually involve extreme situations, such as long hours of exposure to heat and smoke, without a break for rest [2].

Among the attributions of these professionals, there is protection against fire, rescue and rescue of people and animals, removal or neutralization of sources of danger, response to fire situations and acting in natural catastrophes and disasters. Frequently, the military firefighters (BMs) of the CBMAM (Amazon Military Fire Department) and other corporations also act in occurrences involving products classified as dangerous to the life and health of people, as well as occurrences with the presence of organic fluids [2].

The presence of dust, gases and vapors that come into contact with BM fighters in mission environments is also considered by Baumgart et al. and Contrera-Moreno a circumstance that deserves to be treated with great attention and importance [3,4].

This adverse reality imposed the need to develop PPE with wide body coverage that would be able to protect the BM combatant, especially against thermal risks. In this way, the firefighting suit was made and consecutively improved.

This suit, also known as approach clothing (AR) is an essential item in firefighting missions, as it is agreed that maintaining the worker's health depends, among other factors, on assessing the occupational risks to which these professionals are exposed. It also depends on the investment made by the company to minimize or eliminate risk factors, making work activities safer. Occupational risk is understood to be any possibility that any element or circumstance existing in a given process and work environment may cause harm to health.

The RA is an PPE that was specially configured to protect the fire fighter from the high temperatures emanating from fires. AR have been used since the 1930s, consisting of suits that had items such as asbestos or asbestos in their composition [5].

Currently, suits are available that are mainly made of impermeable materials, although liquids sometimes seep in and add weight to the garment. In any risk situation, the use of AR is considered a vital safeguard for the physical integrity of the military firefighter [6].

The material used in the manufacture of the AR consists of a combination of layers of fabric, air, as well as flame-resistant material and chemical retardants. The RA consists of a cape and pants, both made from a special fabric made of aramid fibers, which can withstand up to 800°C during missions. Therefore, it is inferred the need for careful care with the hygiene of this costume [7].

AR protects you from contact with chemical materials and prevents superficial wounds from contact with sharp surface objects. Maintaining the integrity and extending the useful life of AR is so important that in some countries there is an obligation to add to clothing even labels containing washing and handling instructions [6].

Given the above, this work is justified by the need to operationalize within the corporation CBMAM (Corpo de Fogo Militar do Amazonas) a standardization through the implementation of a SOP for the correct washing of AR in order to increase the useful life of the product and maintain the integrity of its reliability in protecting the BM fighter. In order to achieve this goal, research efforts were carried out regarding the characteristics of the specificities of the hygiene of the ARs.

Goals

This study aims to report the importance of a standard operating

procedure (SOP) and its creation process for the CBMAM corporation (Amazon Military Fire Department). This process has the merit of ensuring correct cleaning of firefighting clothing so that the fighter can increase the useful life and preserve the efficiency of his protective uniform.

Methodology

This research was carried out between the months of November and December 2022 in a partnership between the institution CBMAM and the teams of researchers from the laboratories of the Federal University of Santa Maria (UFSM) and GERONTEC from FUnATI. The search for the result aimed to provide answers to a question that was present among the CBMAM military regarding the cleaning procedures of the RAs. Initial steps in this search had been taken in the study by Muniz et al. [8].

Initially, AR parts used in a large fire that occurred in the city of Manaus in the same month of the research were collected. The AR pieces were packed in plastic bags and quickly sent to the GERONTEC laboratory for the sample collection stage.

Two extraction techniques were employed: collection using adhesive tape and collection using a swab. Slides were prepared for observation under the microscope as a way of observing the previous proportion of the level of dirt present in the RAs after a mission. Afterwards, the ARs were washed with the product determined according to their own research. Such surveys relied on information taken directly from fabric manufacturers in ARs about the cleaning products they recommended for washing their aramid fiber fabrics.

The product consisted of a liquid soap, sold in 1.5 L bottles and highly concentrated. Due to the extremely dirty state of the tested RAs, the dilution in its maximum proportion indicated on the label for clothes in the same condition was used (1 part of the cleaner to 10 parts of water).

The solution resulting from mixing the cleaner with water was placed in a spray bottle and sprayed onto the RA tissue under analysis. Then mechanical friction was performed with a stiff bristle brush suitable for manual washing of clothes made of firm and dense fabrics.

After cleaning the fabric, the processes for collecting any remaining dirt on the fabric sample were repeated.

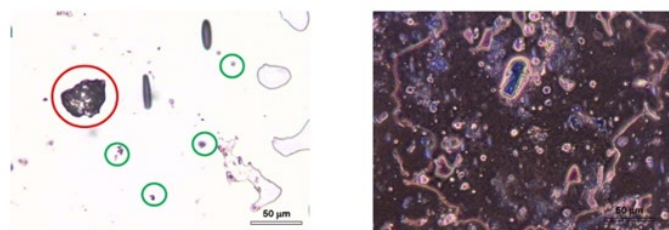
Results

The first stage of the cleaning process was the search for a product whose chemical characteristics were appropriate so as not to cause damage to the material that makes up the fabric of the ARs or to its coating of flame retardant chemicals. The survey was conducted by pharmacy and chemistry professionals from the CBMAM staff and had the participation of cleaner manufacturers who provided data on their products.

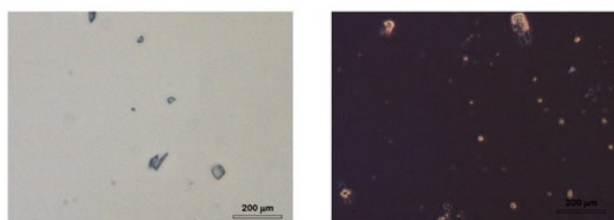
The objective was to find a product with low alkalinity, containing surfactants and that did not need to be heated during the washing procedure. After the search process, a liquid saponaceous was found that suited the requirements of the manufacturers of ARs, thus being the item used in the other phases of this research.

With the appropriate product in hand, a preliminary analysis was carried out of the type of residue that was present on the surface of an AR used in a fire that occurred on the premises of a factory in the municipality of Manaus in November. Two sets of ARs were provided for study by the CBMAM corporation.

The garments were duly packed in plastic bags to avoid external contamination and brought to the FUnATI biogenomics



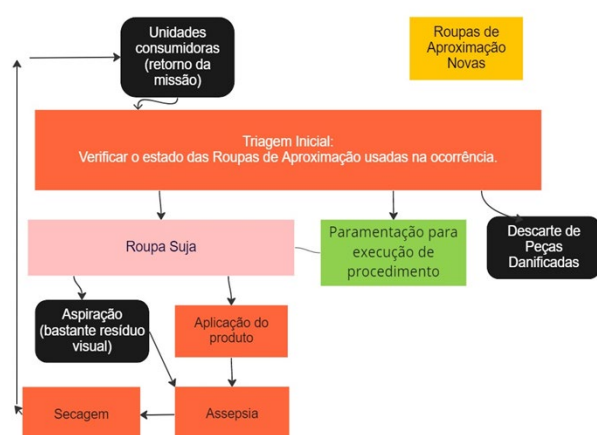
However, after the cleaning procedures with the product, the same procedures were repeated and brought surprising and satisfactory results in terms of cleaning. Below are photos of the microscopic slides showing the good result of the product's effects on the fabric:



Conclusions

The results obtained with the use of the aspiration technique and the use of the product were quite satisfactory for washing that does not require a washing machine. Considering that the CBMAM corporation has a very intense routine for dealing with incidents, it is necessary to establish a SOP that allows adequate hygiene of the RAs in a practical and satisfactory way, saving time for the combatants, since each one is responsible for cleaning their respective AR.

The judicious washing of ARs with the aid of a standardized flowchart can help prevent dermatological diseases and even cancer by avoiding aspiration of soot particles from fires that adhere to the tissue and detach from it in the hours following the return of the mission through the physical movements of the combatant [9].



The construction of the flowchart shown above contemplating steps of the standard operating procedure will help to eliminate informality, disparity in procedures and possible ineffectiveness or damage to the material of the ARs during cleaning. The definition of a product approved by specialists consulted in this research will guarantee a cleaning with a true reduction of the bacterial load and solid particles

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