CANCER AWARENESS AND PREVENTION PROGRAM

MEMORANDUM

DATE:

TO:

FROM:

SUBJECT:

Issue:
Top-loading washing machines with agitators are not reflective of industry best practices for cleaning PPE nor are they recommended by Lion manufacturing.

Background:
For many years Fire Stations, have been outfitted with top-loading washing machines. While top-loading machines are NFPA 1851 compliant, they are not recommended by PPE manufacturers. According to Lion Manufacturing, top-loading machines with agitators are not recommended for PPE washing because they "…will not wash your garments as thoroughly, and the agitator may damage the garment and reduce its durability and protective value" (Lion Manufacturing [LM], 2011). Additionally, our top-loading machines cannot be programmed for multiple rinse cycles. Citrosqueeze, the manufacturer of our PPE cleaning solution recommends "… three separate rinse cycles (5min/each) in cold water" when washing PPE (Citrosqueeze [CS], n.d.).

Discussion:
NFPA 1851 covers the *Standard Care and Maintenance of Protective Ensembles for Structural Firefighting and Proximity Firefighting*. There are three types of turnout cleaning as defined by NFPA 1851, *basic, advanced,* and *specialized* (National Fire Protection Association [NFPA], 2014). *Basic* cleaning is employed for simple spot cleaning and is done in a utility sink with a soft brush and soap (NFPA, 2014). For PPE contaminated beyond a simple spot, the process of *advanced* cleaning is required (NFPA, 2014). Advanced cleaning is done in a washing machine, with liners and shells separated and washed separately (NFPA, 2014). Specialized cleaning is done by a professional contractor when PPE is exposed to unusual contaminants and is beyond the scope of this discussion.

In regards to cleaning PPE, NFPA 1851 directs organizations to "…examine the manufacturer's label and user information for instructions on cleaning and drying that the manufacturer provided with the

element. *In the absence of manufacturer's instructions* or manufacturer's approval of alternative procedures for the ensemble or ensemble element, the advanced cleaning and drying procedures provided in [NFPA 1851] shall be used" (NFPA, 2014). *Lion Manufacturing provides extensive care and maintenance instructions* with their PPE. When washing PPE, Lion recommends using a "…front-loading extractor or front-loading washing machine with a tumbling action for washing" (LM, 2011).

Historically, many Firefighters, thought (incorrectly) that extractors provided the best cleaning, because they "extracted" contaminants. However, the term extractor is misleading. Therefore, a brief overview of washing machine history and technology is warranted.

Spinning wet laundry to remove water using centrifugal force became possible with the advent of high speed electric motors (Ndola, n.d.). This process was originally done in a machine called an extractor, as the water was "extracted" while spinning (Ndola, n.d.). As technology evolved, the processes were combined and the modern washing machine as we know it today came to be (Ndola, n.d.). Because modern washing machines accomplish both washing and extraction (spinning) they were once referred to as washer/extractors (Ndola, n.d.). However, over time the term extractor was dropped and now washer/extractors are simply referred to as "washers" (Ndola, n.d.).

In the lodging, prison and hospital industries the term washer/extractor has remained, largely for marketing purposes. By extracting water at very high speeds nearly all the moisture is removed, greatly reducing drying times resulting in lower utility costs and faster turnaround times (Wash, 2011). The irony is that high-speed extraction (spinning) of PPE is prohibited by both NFPA 1851 and Lion Manufacturing (NFPA, 2014) (LM,2011). NFPA 1851 and Lion Manufacturing explicitly state that PPE should not be subjected to high extraction (spin) speeds due to the potential for damage to garments (max. allowable is 100G's) (NFPA, 2014) (LM, 2011). *It is the washing **and** rinsing with an appropriate cleaning solution that cleans PPE, not "extraction".*

In addition to extract/spin speed guidelines, Lion Manufacturing and NFPA 1851 recommend that washer water temperatures not exceed 105 degrees (NFPA, 2014)(LM, 2011) **and** Lion Manufacturing and Citrosqueeze PPE cleaning solution recommend that PPE be run through multiple rinse cycles during the washing process. Therefore, what is required is a front-loading washing machine that can be programmed for multiple rinse cycles, a spin speed of less than 100G's, and a water temp less than 105 degrees in order to adequately clean turnout gear in accordance with Lion Manufacturing, NFPA 1851 and Citrosqueeze PPE cleaning solution.

It is important to note that currently there is no published literature that quantifies the degree to which front-load washers vs front-load washer/extractors vs top-loaders clean PPE. However, front-load washers and/or front-load washer/extractors are considered by industry to be the standard in PPE care, as evidenced by manufacturer recommendations.

Lastly, many Firefighters have expressed concern over the potential for cross contamination as a result of washing Class B uniforms, linens etc. in the same machine that PPE is washed in. There is currently no evidence to support this concern and NFPA 1851 allows for this practice, so long as an empty load with detergent is run after cleaning PPE (NFPA, 2014). However, industry and others including the *Interagency Board*, a voluntary working group of more than 150 emergency preparedness and response professionals recommend that "Protective clothing should be washed in machines specifically

designated for this type of use in accordance with procedures meeting the manufacturer's specifications" (Interagency Board [IAB], 2016).

Recommendations:
Large commercial washer/extractors like the kind used by professional PPE cleaning companies, CalFire, and major hotel chains are heavy-duty and last as long as 15-20 years with proper maintenance, however their cost is significant. A Unimac washer/extractor, considered to be the "gold standard", costs $12,972.00 per unit and requires 220v with a 3" drain line (Unimac, 02/16). Other brands including Continental are less expensive, with prices in $8,000-12,000 range plus required infrastructure improvements.

Without a doubt, large capacity washer/extractors like those used by turnout repair facilities, hotels and others do an excellent job of cleaning PPE. However, as previously stated there is currently no data quantifying the degree to which the various types of washers clean PPE. Therefore, in the absence of compelling data, a compromise is recommended, as equipping Fire Stations with $15,000 washers cannot be justified.

The proposed compromise would be to purchase heavy-duty, commercial, programmable front-loading washing machines. The proposed commercial front-load machine must be programmable and allow for multiple rinse cycles, temperature adjustments and spin speed control. *Programmable front-loading washers meet the 2014 NFPA 1851 Guidelines for advanced turnout cleaning, Lion manufacturing cleaning recommendations and Citrosqueeze PPE cleaning solution recommendations*

Speed Queen sells a stainless steel commercial front-loader for $1665.00 plus $134 sales tax per unit, requires no infrastructure improvement and has the same footprint as existing top-loaders (SpeedQueen, 2016). While Speed Queen readily admits the life of a commercial front-loader (3-5 years) is less than a heavy-duty washer extractor (15-20 years), the fact is we could buy 10 commercial front-loaders for the cost of one heavy-duty washer/extractor.

Speed Queen Commercial Washer

- Model SFNNCASP113TN01
- Deployment: 1 per station
- Cost per unit: $1665 + $134 tax x 50 = $89,950.00
- Warranty: 5 years parts/90 day labor
- Lifespan: 5-7 years per vendor
- Infrastructure improvement: none
- Capacity: 21.5 lb. capacity (one set of liners or one set of shells weighs approx. 7lbs)

Because the theoretical concern over cross-contamination is pervasive amongst Firefighters, it is recommended that when possible, top-load washers should remain in stations and be dedicated for non-PPE cleaning. Additionally, current SDFD PPE washing guidelines require an empty load with bleach be run after washing PPE. It is recommended that SDFD procedures be changed to reflect NFPA 1851 guidelines (empty load with detergent) and/or recommend both detergent *and* bleach be used when running an empty load after washing PPE.

Alternatives:

Purchase more robust front-loading commercial washing machines like those used by professional turnout cleaning contractors, CalFire, and major hotel chains.

- **Brand:** Unimac
- **Model:** M30 01UW-065K2L
- **Deployment:** TBD
- **Cost per unit:** 12,972.00
- **Infrastructure improvement:** requires 220V single phase and 3" drain
- **Capacity:** 65lb capacity
- **Warranty:** 5 years/parts
- **Lifespan:** 15 years per vendor

If resources were unlimited, purchasing the "gold standard" would be ideal. However, in the absence of compelling data to support such an expenditure, a compromise is prudent. The Speed Queen front-load programmable commercial washer is compliant with Lion Manufacturing PPE washing guidelines, NFPA 1851 (2014), Citrosqueeze PPE cleaning solution guidelines and requires no infrastructure improvements. Based on these factors, the Speed Queen option is recommended.

CAPP Representative

INITIALS/ad

Attachments: 1. NFPA 1851
2. Lion Manufacturing Care & Maintenance of PPE
3. Cirosqueeze Guidelines
4. Speed Queen Specifications

References

Lion (2011) NFPA Compliant Structural Firefighting Garment, User Instruction, Safety, and Training Guide. Retrieved from: http://www.lionprotects.com/sites/www.lionprotects.com/files/FI6157-054%20Structural%20Turnout%20User%20Guide.pdf

Citrosqueeze (n.d.) Laundering PPE with Citrosqueeze. Retrieved from: https://solutionssafety.com

Interagency Board (2016) Recommended Actions Related to Reducing the Known Risk of Cancer in Firefighters. Retrieved from: http://www.interagencyboard.org/sites/default/files/publications/Recommended%20Actions%20Related%20to%20Reducing%20the%20Known%20Risk%20of%20Cancer%20in%20FFs_0.pdf

NFPA (2014) NFPA 1851 Standard on Selection, Care, and Maintenance of Protective Ensembles for Structural Firefighting and Proximity Firefighting.

Ndola, F. (n.d.) Washing Machine. Retrieved from: http://www.frankshospitalworkshop.com/equipment/documents/various_equipment/wikipedia/Washing%20machine.pdf