TotalCare®
VERIFIED PPE MAINTENANCE

# NEW $CO_2$ CLEANING TECHNOLOGY SAFELY REMOVES HARMFUL CHEMICALS

## Saves Department From Complete Gear Replacement Cost

### CHALLENGE

**Typical water wash cannot effectively lower the contamination levels in firefighting PPE** (turnout gear) enough to return the PPE back into service after exposure to by-products from a lithium-ion battery fire.

### SOLUTION

**LION RedZone™ $CO_2$ cleaning removed and reduced the poly-aromatic hydrocarbons** (PAHs) and volatile organic compounds (VOCs) to a level deemed safe from the OSHA Permissible Exposure Limits (PEL) and allowed the department to return the exposed turnout gear to service.

REDZONE™ $CO_2$ CLEAN powered by TERSUS SOLUTIONS

**In research conducted by the National Fire Protection Research Foundation in 2016, there has been an increase in the use of lithium-ion batteries not only in urban areas, but in high-rise structures and single and multi-family residences (Blum, A. & Long, T. 2016)**

These batteries store an immense amount of energy in a small amount of space. They can deliver voltage up to three times higher than other battery types. Issues can arise when they get overcharged, damaged, or start to build up heat to the point of ignition.

Lithium–ion battery fires generate intense heat and considerable amounts of gas, smoke, and toxic substances. Some lithium-ion batteries combustion can separate fluorine from lithium-ion cells in the battery. If mixed with water vapors, fluorine may produce hydrofluoric acid, which is particularly hazardous because workers may not feel its effects until hours after exposure. These damaging chemicals are referred to as polycyclic aromatic hydrocarbons (PAHs) and can adhere to first responders gear during firefighting. PAHs are highly absorptive through the skin. The long-term health effects from absorption could include cancer, reproductive damage, thyroid gland function, heart or kidney failure (NJ Health, 2008).

### THE ASSESSMENT

In 2022, a major metropolitan California fire and rescue agency had contamination on eight sets of turnout gear worn in response to a vehicle fire that contained a lithium-ion battery. Initial testing by an independent test laboratory showed detectable concentrations of aluminum, calcium, cobalt, iron, lead, lithium-ion, manganese, nickel and phosphorus,all by-products of a lithium-ion battery fire.

After testing, the contaminated gear was sent to a LION TotalCare® facility for RedZone $CO_2$ cleaning and decontamination.

## FINDINGS AND RESULTS

**After several rounds of follow-up assessments to determine the by-product concentration levels, the findings were conclusive that the RedZone $CO_2$ Clean powered by Tersus Solutions was effective at removing by-product concentrations to a safe level.** The lithium-ion concentrations levels were reduced below the recommended levels for cleanliness, which has not been achieved by any other cleaning methods. Concentrations of aluminum, calcium, cobalt, iron, lead, manganese, nickel and phosphorus were lower in comparison to the previous concentrations and were well below the PEL for airborne concentrations of the metals. The decontamination was also effective in removing concentrations of fluoride and phosphoric acid.

In summary, the concentration levels were either removed completely or determined to have been adequately decontaminated for reuse per the CAL/OSHA Permissible Exposure Limits. In addition to adequate decontamination, the smell of the gear was returned to normal. In most advanced and specialized cleaning cases, the smell of fire from the gear is never completely removed regardless of the cleaning agents and the number of times gear is washed. In this case, the smell was non-existent after RedZone $CO_2$ cleaning.

> **"ONE SIGNIFICANT THING THAT I NOTICED WAS THE COMPLETE ABSENCE OF FIRE SMELL ON THE GEAR."**
>
> – Russ Snider, Orange County Fire Authority

## CONCLUSION

Due to the advanced technology in the RedZone $CO_2$ cleaning and decontamination process, proprietary to Tersus Solutions and LION TotalCare, the structural firefighting gear was able to be returned to service, instead of requiring retirement. Replacement gear costs on average $3,000 per set, which demonstrates that the cleaning afforded the department, and in turn the municipality, substantial monetary savings.

LION RedZone $CO_2$ cleaning effectively penetrates all layers of turnout gear without the use of water and physical agitation to the gear. All contaminants in LION RedZone $CO_2$ cleaning are captured and disposed of properly, protecting the environment and keeping our first responders safe after the fire.

### LION REDZONE $CO_2$ CLEANING:

**EXTENDS THE LIFE OF GEAR, REDUCING REPLACEMENT COSTS**

**REMOVES UP TO 95% OF PAHS AND VOCS**

TotalCare®
VERIFIED PPE MAINTENANCE

## KEEPING YOU SAFER, LONGER

**To learn more about LION TotalCare and LION RedZone $CO_2$ Clean, visit lionprotects.com/redzoneco2 or contact us at totalcare@lionprotects.com**