

FDNY Chemical Protective Clothing Upgrade

by Lieutenant John Cassidy

Haz-Mat Operations is in the process of upgrading the Chemical Protective Clothing (CPC) issued to units in the Hazardous Materials Response Group.

Goals

The main goals of the upgrade project are threefold: increase Department response capabilities with mission-specific protection; improve responder safety; and decrease physical impact on responders.

History

The 1995 Sarin attack on the Tokyo subway system by the Aum Shinrikyo cult was a seminal event for the FDNY. The Department started to plan for a similar attack on the New York City subway system. As a result, there was a major expansion of the Hazardous Materials Response Group. All of the units were equipped with the Dupont TK Level A suit.

The decision to use Level A suits was based on the Code of Federal Regulations (CFR) Title 29 1910.120. Level A suits were selected to provide the highest level of skin, respiratory and eye protection. CFR 1910.120 specifies Level A suits must be gas/vapor-tight and fully encapsulated. The FDNY Chemical Protective Clothing Program uses Level A suits for two vastly different missions--mitigation and rescue.

Tiered response and mission-oriented response

The Hazardous Materials Response Group is comprised of 146 units, arranged in a tiered response system. The units have different levels of training and equipment and are tasked with different roles or missions at a hazardous materials incident. Life safety is one of the FDNY's core competencies under the City-wide Incident Management System (CIMS) and all Fire Department units contribute to that mission. The tiered response group includes:

- Car 11B, Chief in Charge of Haz-Mat Operations
- Three Group Supervisors (Haz-Mat, Rescue and Safety Battalions)
- One Specialist Unit (Hazardous Materials Company 1)
- 16 Haz-Mat Technician II units (four HM Technician Engines, seven Squads and five Rescues)
- 25 Haz-Mat Technician I SSL (SOC Support Ladder Companies)
- 25 Decon Engines
- One Decon Support unit
- 29 Chemical Protective Truck Companies (CPC Trucks)

- Five Decon Shower units
- 35 EMS Haz Tac Ambulances
- One Haz Tac Conditions Car
- Three Marine units

There are many different tasks that members of these units perform, but there is a major separation within the Hot Zone. All of the units are trained for life safety operations in the Hot Zone, but only the Haz-Mat Technician II units and Haz-Mat 1 are trained for mitigation of hazardous materials incidents. (Decon is performed in the *warm zone* and is not a focus of this article.)

Challenges

Fully encapsulated, gas-tight garments (Level A) pose a number of challenges for the responder. The design characteristics of the suits trap heat and put the responder at risk for heat injury. Vision is obscured when moisture (sweat and respiration) condenses on the inside of the visor. The bulk of the material in the old Level A suit required wearing oversized boots and the glove system compromised dexterity. Obscured vision, ill-fitting footwear and decreased dexterity increase the potential for injury. Packaging and removing exposed victims are physically demanding tasks that impact the limitations of using fully incapsulated CPC for rescue.

Improvements in technology and standards

The levels of protection (A, B, C, D) outlined in CFR 1910.120 are design, not performance standards. The National Fire Protection Association's (NFPA) standards are performance-based and influenced the decision to upgrade the FDNY's CPC program. NFPA PPE standards include NFPA 1971 Fire Fighting, NFPA 1991 Vapor-Protective Ensembles for Hazardous Materials Emergencies and NFPA 1992 Liquid Splash-Protective Ensembles for Hazardous Materials Emergencies. NFPA 1991 and 1992 were written for accidental releases of hazardous materials.

In 2007, the NFPA 1994 standard titled Protective Ensembles for First Responders to Chemical/Biological/Radiation/Nuclear (CBRN) Terrorism Incidents was released. The standard parallels the rescue mission of FDNY's tiered response system. Two garments were selected for inclusion in the Department's Chemical Protective Clothing Program.

Mission-specific protection--mitigation

The Trelleborg TrellecheM VPS Flash was selected to replace the existing Level A suit for mitigation missions performed by Haz-Mat 1 and Haz Mat Tech II units. Performance improvements include:

- VPS Flash meets optional flash fire standard in NFPA 1991 for increased safety.
- No over-garment yields 7.3 lb. weight savings, decreasing physical strain.
- Anti-fog, hard-impact visor increases safety by improving vision.
- One-Glove System has better dexterity than current glove system.



Wearing the Lion MT94 (photo left), mission-driven training includes CPC rescue in the subway simulator and wearing the TrellecheM VPS Flash (photo right), mitigating a leaking one-ton chlorine cylinder.

- Streamlined suit material does not require using oversized boots.
- The VPS Flash Suit improves safety and decreases the demands placed on FDNY's Haz-Mat Technicians. Mitigation missions often require fine motor skills to make repairs. Improvements in vision and dexterity increase the chances of being successful with one entry team.

Mission-specific protection--rescue

The Lion MT94™ was selected for rescue missions within the Hot Zone and meets the NFPA 1994 Class 2 standard. Performance improvements include:

- The suit has a three- to four-minute donning time, improving time to victim contact.
- Due to the non-encapsulating design, visibility is not an issue.
- The glove system provides superior dexterity and protection.
- There is a substantial reduction in heat stress and physical demand on the first responder.
- Garment durability promotes expanded areas of operations.

The MT94 is a non-encapsulating gas/vapor-tight garment that is 13 lbs. lighter than the previous Level A suit. There are substantial improvements in decreasing heat stress and improving performance with the Lion MT94. These improvements are due to the unique material used in the garment. W.L. Gore® developed the CHEMPAK® fabric in response to military and first responder teams' requests for a lightweight, highly mobile and durable garment for use in chemical/biological response. The suit is constructed with a Gore CHEMPAK ultra barrier fabric between two layers of Nomex®.

Heat generation is lowered by decreasing the garment's weight and increasing flexibility. Heat stress can be further reduced by wetting the garment with water. A combination of conductive and evaporative cooling is seen when the garment is wet, which decreases the thermal load on the responders. By reducing heat stress and physical exertion, air consumption decreases. The responder can remain safely in the Hot Zone for longer periods. In training, there is a marked increase in the number of extractions a CPC team can complete before depleting their air supply. Tactical operations have expanded to include areas that were considered too damaging to the previously used encapsulated Level A garment; i.e., collapse debris zones. The Lion MT94 also can be used by members of the FAST team to respond to injured members of the entry team.

Equipment and distribution

To achieve a gas-tight seal in a non-encapsulation design, the Scott AV3000 Sure Seal Face Piece was purchased for distribution with the Lion MT94. The facepieces are company-issued and for use only with the Lion MT94. Bump helmets are issued to units with MT94s. The helmets will use the same identification system as the

 <p>Suit Manufacturer and model:</p> <p>Certifications:</p> <p>Distribution:</p> <p>Notes:</p>	<h2 style="text-align: center;">Haz-Mat Operations CPC Upgrade Program</h2> <div style="display: flex; justify-content: space-around;">    </div> <p>Tactix MT94</p> <p>NFPA 1994 (class 2): Ensembles for Responders to CBRN Terrorism Incidents</p> <p>NFPA 1992: Standard on Liquid Splash-Protective Ensembles and Clothing for Hazardous Materials Emergencies</p> <p>All CPC Equipped Units (including EMS Haz Tac)</p> <p>This suit <u>replaces</u> the DuPont Tychem TK Level A for CPC Trucks Decon Engines and SOC Support Ladders (4th qtr 2010)</p> <p>This Suit is an <u>additional</u> suit for Rescue, Squad, Tech Engines and Haz Mat 1 (July 2010)</p> <p>Mission Specific for: Rescue</p>	 <p>NFPA 1991: Standard on Vapor Protective Ensembles Optional Flash Fire Certification Optional Liquefied Gas Certification</p> <p>Rescues, Squads, Tech Engines and Haz Mat Company 1</p> <p>This suit <u>replaces</u> the DuPont Tychem TK Level A for all S.O.C Units (July 2010)</p> <p>Mission Specific for: Mitigation</p>
--	---	--

front piece on FDNY firefighting helmets.

The Lion MT94 and Trellechem VPS Flash were issued to SOC. The MT94 replaces the Level A suit for the balance of CPC-equipped companies. EMS Haz Tac units carry Lion MT94 suits. Haz Tac EMTs and Paramedics can be identified in the Hot Zone by their EMS helmets and the Haz Tac patch on the right shoulder. FDNY EMS Haz Tac members are trained to triage, treat and oversee the care of chemical casualties in the Hot Zone, alongside Firefighters and Officers. All Lion MT94s have the Department patch on the left shoulder.

Mission-driven training

Training on the two new garments began in December 2009 so that members would be trained in their use before the equipment was distributed. The training programs included both original and refresher training at the Haz-Mat Technician School. Evolutions were selected to replicate the skills required for a given mission.

Conclusion

The CPC upgrade program has increased capability for the FDNY, while simultaneously improving safety for the responder. It is of particular importance that Incident Commanders understand the capabilities of the units within the FDNY's tiered response system and ensure PPE selected be mission-focused.

About the Author...

Lieutenant John Cassidy is a 14-year veteran of the FDNY. He is assigned to Hazardous Materials Company 1. He holds an AAS degree in Biomedical Engineering from SUNY-Farmingdale and a BSN degree in Nursing from SUNY-Stony Brook. This is his second article for WNYF.

