



Technical Support Working Group

Technical Brief

Improved Chemical Protective Ensemble (ICE)

20 November 2007

Requirement: A certified, non-encapsulating, protective ensemble providing improved ergonomic use by First Responders at CBRN incidents, and having vapor, aerosol, and splash protection from chemical and biological terrorism agents according to the following:

- Certification to 2007 Edition NFPA 1994 Class 2 - Standard on Protective Ensembles for First Responders to CBRN Terrorism Incidents
- Compatible (and certified) with Drager Panorama Nova SCBA Face Mask and CBRN SCBA System.
- Vertical Flame resistance in accordance with ASTM D 6413.
- MIST Testing with an average systemic physiological protective dosage factor (PPDF_{sys}) value in the range of 800 – 1900
- SF₆ Vapor Ingress Test results of < 2%, per NFPA 1994 - Class 2, 2001 Edition

[Note: NFPA 1991, 2005 edition - Standard on Vapor-Protective Ensembles for Hazardous Materials Emergencies requires SF₆ Vapor Ingress Test results of < 0.2%.]



Technical Description: The Improved Chemical Protective Ensemble (ICE) provides protection against chemical and biological agents along with dramatically enhanced operational ergonomics, flexibility, weight, durability, heat stress reduction, service life, and costs associated with currently available protective gear. The main differences between this ensemble and those currently available (i.e. Level A) are that 1) this ensemble is not of a fully encapsulated design, 2) its primary certification is against NFPA 1994, not NFPA 1991, and 3) the material itself provides secondary fire protection.

TSWG, via an initial contract with InterSpiro, and ultimately, through a second contract with W.L. Gore & Associates, Inc, has developed the ICE as an improved chemical protective ensemble that provides at least the same level of vapor, aerosol, and splash protection from CBR agents as required for a National Fire Protection Association (NFPA) 1994 Class 2 ensemble. The ICE is a more ergonomic garment design incorporating GORE® CHEMPAK® Ultra Barrier Fabric, providing the first responder with increased mobility and visual capabilities. The GORE® CHEMPAK® Ultra Barrier Fabric incorporates a Nomex® woven textile as its outer layer to provide a durability and ruggedness unlike any of the typical Level A suit materials. The woven textile outer layer also has the advantage of enabling water wicking (via a wetting-down procedure during operations) which enables an evaporative cooling process and heat stress reduction. This process has an immediate cooling impact upon responder skin temperature, and ultimately, helps to keep the responders core temperature rise to a minimum. The ensemble is currently certified for use with only the Drager Panorama Nova SCBA Face Mask

and CBRN SCBA System; however, compatibility with other face mask systems is currently being explored.

The ICE is ideal when there is a need to complete a physically demanding mission in a chemical or CBRN hazardous environment. The ICE is best suited for performing tactically demanding operations such as:

- Search and Rescue
- Technical Rescue
- SWAT and High Risk Entry
- Hazardous Material Emergency
- WMD or Terrorist Incident
- Containment and Decontamination

Characteristics and Limitations:

- Chemical protection and fire protection in a non-encapsulating suit that provides vapor, aerosol, and splash protection from chemical and biological agents, and has improved heat stress reduction capabilities.
- Performance for the Gore material has been verified by field trial over 5 wearing/wash cycles and is documented in a white paper. Life-expectancy beyond this use-age has not been field verified.
- Training requirements are minimal and can be done via video. Essentially the responder climbs into the one-piece suit and puts on the protective gloves and attaches the respirator. As required by the NFPA certification, a Users Guide and a Technical Data Package are provided with the ensemble.
- This ensemble has no thermal insulation or fire helmet, and cannot be used for structural firefighting operations.

Status of Development: Development and testing were completed in November 2007. The ICE ensemble is now transitioning to production. Lion Apparel, Inc. will market and sell ICE as the Lion Apparel ICG NFPA 1994 Class 2 and NFPA 1992 Ensemble.

Applicable Standards and Test and Evaluation Results: The ICE garment (with Drager CBRN SCBA system) has met all the requirements of the 2007 Edition of NFPA 1994 Class 2 Standard on Protective Ensembles for First Responders to CBRN Terrorism Incidents.

In addition, the garment ensemble has also been certified to the 2005 Edition of NFPA 1992 Standard on Liquid Splash-Protective Ensembles and Clothing for Hazardous Materials Emergencies.

Acquisition and Support Costs: Approximately \$2100 per ensemble (excluding SCBA).

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