Industrial Fabrics Association International

Introduction to PPE Production ft. Q&A with NC State's Wilson College of Textiles

May 12, 2020 12:00 CDT

NC STATE UNIVERSITY Wilson College of Textiles

IPC Association Connecting Electronics Industries

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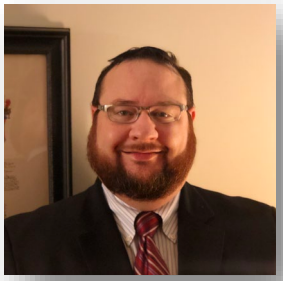
Emiel DenHartog
Director of Graduate Programs, TECS Associate Director, TPACC
Development of textiles for human health and safety

Stephen Sharp
Dir. of Engineering & Operations, Sanctuary Systems
Nonwoven technologies

Cassandra Kwon
Research Asst. Professor, TPACC
Functional design for performance and protective clothing

Karen Leonas
Professor, Textile & Apparel, Technology and Mgmt
Product development, medical textiles, environmental impact



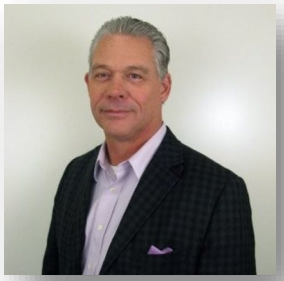
Marc Mathews
Research Associate, TPACC
Protective textile, apparel testing and design

Roger Barker
Director, TPACC
Thermal protection, mechanical evaluation of textiles

Don Thompson
Associate Director, TPACC
Fiber science, polymer science, protective textiles, textile comfort

Andre West
Director, Zeis Textiles Extension
Knit structure and design
Protective apparel design

Bryan Ormond
Assistant Professor, TECS and TPACC
Chemical and biological protection



Will Duncan
Executive Director, SEAMS

Martin King
Professor, TECS
Biomaterials, biotextiles

Michael McDonald
President, SPESA

Industrial Fabrics Association International

Questions? Submit them here:

https://forms.gle/kgDn8LCf1pTZdaeD8

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INTRODUCTION TO PERSONAL PROTECTIVE EQUIPMENT (PPE)

PPE Webinar Series

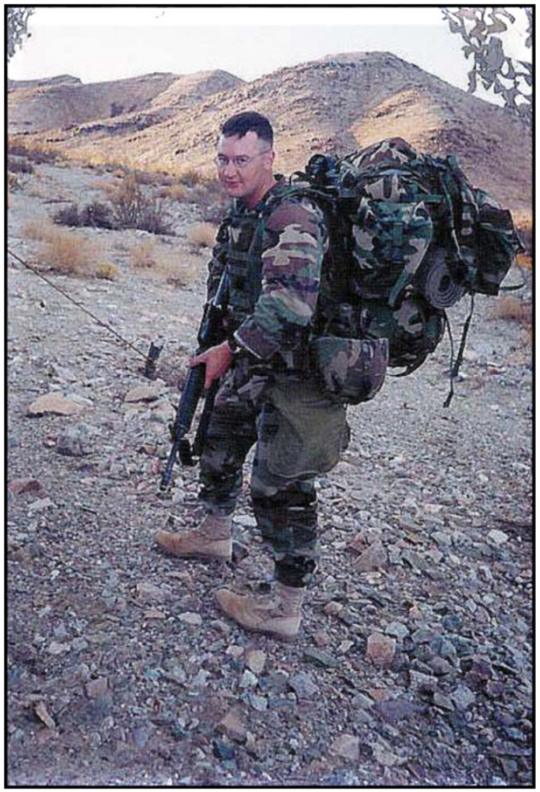
05/12/2020

Marc Mathews

Textile Protection and Comfort Center (TPACC)

MY BACKGROUND

- Military (USMC)
  - CBRN Defense Specialist, served in Iraq during OEF and OIF
- Education (NC State)
  - BS Chemical Engineering, MS Textile Engineering (ITT Fellow)
  - Currently working on PhD in Fiber and Polymer Science
- Professional Experience (Academia, Government and Industry)
  - 20 Years in protective clothing industry
  - Primarily doing research, development and engineering
  - Military, FR technology, CBRN systems, System Engineering, Comfort, Material selection, Human testing, T&E (fabric to system)



TEXTILE PROTECTION AND COMFORT CENTER (TPACC)

- The only academic center in the U.S. that incorporates in one location the capabilities to research, test, and evaluate the comfort and protective performance of textile materials, garments, and ensemble systems

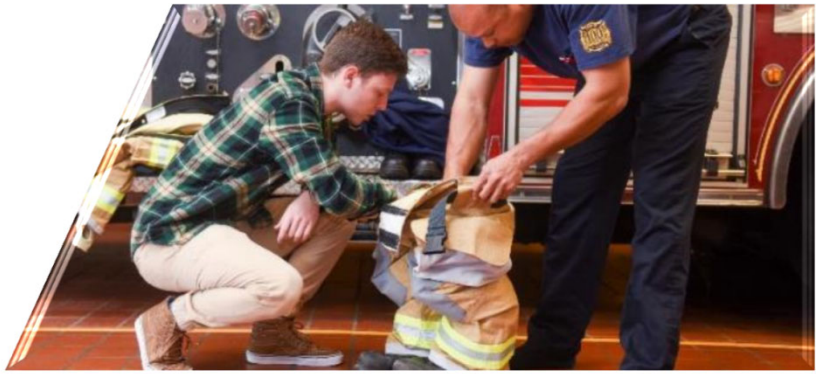
PURPOSE

- Introduce Personal Protective Equipment (PPE)
- Discuss some aspects of PPE that make them unique in the world of textiles based products

WHAT IS PPE?

- Equipment/Clothing worn to minimize exposure to a range of hazards that can cause serious injuries and illnesses.

- Examples include: gloves, safety glasses, shoes, earplugs, hard hats, respirators, coveralls, uniforms, vests and full body suits, helmets.



MARKET BACKGROUND

- Global Market
  - 8.8 Billion (USD) in 2019[1]
  - Projected to reach (USD) 11.9 Billion by 2024 at 6.3% CAGR[1]
  - The smart PPE market is expected to see a 16% CAGR from 2019 – 2023[2]
- North America is the largest market
  - Increase focus on worker safety
  - Influx of demand
- Thermal and Chemical protective clothing are two of the largest and fastest growing hazard segments

[1]-Markets and Markets, Protective Clothing Global Projection to 2024
[2]-Technavio, Global Smart Personal Protective Equipment (PPE) Market 2019-2023

HAZARDS

- Thermal
  - Flame, Heat flux
- Chemical
  - Liquids, vapor, aerosol
- Radiological
  - Alpha/beta particles
  - X-ray, gamma
- Biological
  - Virus
  - Bacteria
  - Microorganisms
  - Blood
  - Sewage/Waste
  - Insects
- Environmental
  - Exposure
  - Terrain
  - Weather
- Physical/Mechanical
  - Cut, puncture, crush
  - Impact
  - Vibrational
- Electrical
  - Arc Flash
  - Electric Shock
- Explosive
  - Blast, overpressure
  - Shrapnel
  - Projectiles
- Long Term/Unknown
  - Smoke skin exposure→ Cancer

END USERS/APPLICATIONS

- Military
- Healthcare/Medical
- Firefighting & Law enforcement
- Oil & gas
- Construction
- Manufacturing
- Mining
- Warehouse & logistics
- Others
  - Food processing, DIY, Other specialty
  - New users- (general public)

PPE CATEGORIES

- By durability/wear conditions
  - Disposable/single use
  - Reusable
  - Daily wear
- By hazard
  - Chemical
  - Thermal
  - Multi-hazard
  - Mechanical
  - Electrical
  - Medical
- By end use
  - Military
  - First Responder
  - Medical
  - Industrial
- By design
  - Single-piece
  - Multi-piece
  - Overgarment
  - Undergarment
  - Encapsulated
  - Apron
- By standard/ specification/ purchase order:
  - NFPA
  - MIL Spec
  - EN
  - ISO

PROTECTIVE EQUIPMENT/CLOTHING

- How is PPE different than other textile based products?

PROTECTIVE EQUIPMENT/CLOTHING

- Human safety is involved
  - Severe consequences if it fails
- User/Consumer is not always the purchaser
  - Purchaser priorities don't always match the user needs
- Extreme environments
  - Used in extreme environments
  - Continued effectiveness over time

PROTECTIVE EQUIPMENT/CLOTHING

- Often complex architectures
  - Many parts/pieces/layers
  - Interfaces are often critical to effectiveness
  - Generally worn with other clothing
  - Needs to be compatible with external equipment
- Competing variables
  - Technical requirements vs user needs
  - Protection vs Comfort
- Materials
  - Often require specific and technical expertise to produce
  - Can be expensive

MARKET BACKGROUND

How will the PPE market change due to the COVID-19 pandemic?

QUESTIONS

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Textile Protection and Comfort Center (TPACC)
NC State University, Wilson College of Textiles