



NIOSH Protective Clothing Challenge

**Striving for Safety and Health
Equity for All Workers**

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**Centers for Disease Control
and Prevention**
National Institute for Occupational
Safety and Health



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More than 20 million U.S. workers routinely
rely on personal protective equipment (PPE)

They all deserve to come home to
their families safe and healthy





PPE solutions need to provide equitable protections for the full spectrum of the U.S. workforce



What does equitable PPE protection look like?

Use

Protects from intended hazards and does not create other risks

Acceptability

Designs that are sensitive to social, cultural, comfort, and physiological considerations

Access

Located at the point of use – “when and where it is needed”

Availability

Procurable without undue burden/challenge

Knowledge

Correctly selected, used, and maintained



FEDERAL REGISTER

The Daily Journal of the United States Government



Ⓝ Notice

Needs and Challenges in Personal Protective Equipment (PPE) Use for Underserved User Populations

[Federal Register Notice](#) (June – October 2021)

Additional input from various organizations with an interest in PPE such as

- International Safety Equipment Association (ISEA)
- Select National Occupational Research Agenda (NORA) Councils

Examples of fit-related challenges and needs

Identified issues	Examples of challenges and needs when using PPE
Use	<ul style="list-style-type: none">• Different somatotypes (e.g., female, different ethnicities, health-related body changes)• Rapid somatotype changes during pregnancy
Acceptability	<ul style="list-style-type: none">• Interference with religious practices (e.g., turban, beard, hijab, long skirts)• Exacerbation of sensory decrements• Interference or reduced protections when paired with other equipment/technologies• Difficult to put on, take off, wear, dispose of, or maintain
Access	<ul style="list-style-type: none">• Remote locations• Infrequent need in a space-limited environment
Availability	<ul style="list-style-type: none">• Range of sizes to accommodate all workers• Higher per-unit cost for lower-volume units• Logistics challenges with managing multiple SKUs
Knowledge	<ul style="list-style-type: none">• Materials targeted to educated, English-speaking workers• Lack of selection guidance or standards related to different somatotypes or to address person-specific acceptability challenges• Fear of repercussions for migrant workers (e.g., visa status)

What are some reasons why these issues exist?

Identified issues

Examples of challenges and needs when using PPE

Use

- Different somatotypes (e.g., female, different ethnicities, health-related body changes)
- Rapid somatotype changes during pregnancy
- Lack of anthropometric data; lack of analysis on existing data for this purpose
- Lack of R&D funding for worker populations that represent a smaller percentage of the overall workforce

Acceptability

- Interference with religious practices (e.g., turban, beard, hijab, long skirts)
 - Exacerbation of sensory decrements
 - Interference or reduced protections when paired with other equipment/technologies
 - Difficult to put on, take off, wear, dispose of, or maintain
 - Lack of R&D funding for worker populations that represent a smaller percentage of the overall workforce
 - Lack of performance requirements and test methods related to ease of use, comfort, tolerability, interoperability with other products, etc.
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What are some reasons why these issues exist?

Identified issues	Examples of challenges and needs when using PPE
Access	<ul style="list-style-type: none">• Remote locations• Infrequent need in a space-limited environment• Logistics challenges related to mobile storage in difficult environmental conditions (e.g., terrain, heat, and humidity)• Limited application of industrial engineering principles
Availability	<ul style="list-style-type: none">• Range of sizes to accommodate all workers• Per-unit cost higher for lower-volume units• Market dynamics that reward high-volume purchases
Knowledge	<ul style="list-style-type: none">• Materials targeted to educated, English-speaking workers• Lack of selection guidance or standards related to different somatotypes or to address person-specific acceptability challenges• Fear of repercussions for migrant workers (e.g., visa status)• Worker populations that represent a smaller percentage of the overall workforce using these PPE• Lack of availability and access to materials that clarify worker rights

The NIOSH Protective Clothing Challenge— Leaving No Body Unprotected



Solvers are being asked to help the nation achieve equitable PPE protections by proposing ideas about how fit-related challenges can be addressed for

- Medical gowns
- Firefighter turnout coats and pants
- Protective coveralls

<https://www.herox.com/NIOSHProtectiveClothing>



Medical Gowns

(disposable or reusable)

Protects User From:

- Microorganisms, body fluids, and particulate matter

Relevant Standards:

- **ANSI/AAMI PB70** Liquid barrier performance and classification of protective apparel and drapes intended for use in healthcare facilities
- **ASTM F3352** Standard specification for isolation gowns intended for use in healthcare facilities
- **ASTM F2407** Standard specification for surgical gowns intended for use in healthcare facilities
- **EN 13795** Surgical drapes, gowns and clean air suits, used as medical devices for patients, clinical staff and equipment



Photo Credit: Max Air



Photo Credit: Kimberly Clark



Firefighter Turnout Coats and Pants

PROTECTS USER FROM

Burns, sharps, abrasives, chemicals, particulates, heat exhaustion

Firefighter Turnout Coats and Pants

(reusable)

NFPA 1851-Selection, Care, and Maintenance

NFPA 1971- Protective Ensembles for Structural/Proximity Fire Fighting

ASTM F3031-17 – Standard Practice for Range of Motion Evaluation of First Responder's Protective Ensembles

NFPA
1851

Standard on
Selection, Care, and
Maintenance of Protective
Ensembles for Structural
Fire Fighting and Proximity
Fire Fighting

2020



NFPA
1971

Standard on
Protective Ensembles for
Structural Fire Fighting and
Proximity Fire Fighting

2018

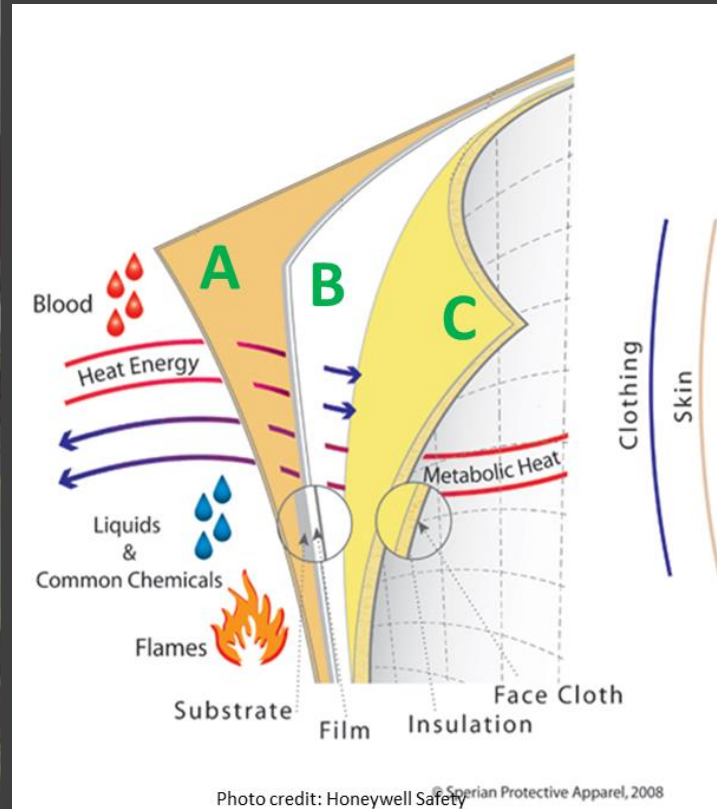


Photo credit: Honeywell Safety



A: Outer Shell **B: Moisture Barrier** **C: Thermal Liner**



Photo Credit: DuPont



Photo Credit: DuPont



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Protective Coveralls

(disposable and reusable)

Protects User From:

Chemicals, gas, liquids, heat and flame, arc, infective agents, spray, molten metal, particulates, sharps, abrasives, or heat exhaustion

Select U.S. and European Standards

[NFPA 2112 - Standard on Flame-Resistant Clothing for Protection of Industrial Personnel Against Short-Duration Thermal Exposures from Fire](#)

[NFPA 1999 - Standard on Protective Clothing and Ensembles for Emergency Medical Operations](#)

[NFPA 1990 - Standard for Protective Ensembles for Hazardous Materials and CBRN Operations](#)

[NFPA 70E - Standard for Electrical Safety in the Workplace](#)

[OSHA 1910.120 App B – General Description and Discussions of the Levels of Protection and Protective Gear](#)

[OSHA 1910.1030 - Bloodborne Pathogens](#)

[EN ISO 13688 – Minimum Requirements for Protective Clothing](#)

[EN 14126 – Performance Requirements and Test Methods for Protective Clothing Against Infective Agents](#)

[EN 943-1 Protective clothing against dangerous solid, liquid and gaseous chemicals, including liquid and solid aerosols](#)

[EN ISO 13982 Protective clothing for use against solid particulates](#)

[EN 14605 Protective clothing against liquid chemicals](#)

The background of the slide features a row of five incandescent light bulbs. The first two bulbs on the left are in sharp focus, while the remaining three bulbs to the right are progressively more blurred, creating a sense of depth. The bulbs are set against a dark, textured blue background.

Streams of Innovation Needed

Technology and Design Opportunities

Mannequin proportions don't reflect the size and shape of this nation's workers

Current designs do not accommodate all tasks, cultural differences, or religious practices

Knowledge Management Materials

Building knowledge is not easy – training, guidance, job aids, development, evaluation, distribution, assessment, and more

Pathways to Success

Market dynamics affect smaller employers differently

Employers are drowning in logistics challenges



The post-challenge world and your winning ideas...



NIOSH is developing a national strategy to provide equitable PPE protections for all U.S. workers

As the nation's PPE laboratory, NIOSH's NPPTL will provide national leadership, coordinating across the PPE community to:

1

Document the existence and characteristics of gaps and challenges related to equitable PPE protections

2

Identify and organize collaborators across the PPE community

3

Identify viable solutions and approaches to address gaps and challenges

4

Establish a prioritization framework for meeting gaps and challenges

5

Identify and describe roles for members of the PPE community and establish participant buy-in as needed

6

Establish a roadmap with (1) timelines for each gap and challenge, (2) linkages to PPE community member roles, and (3) metrics for success

This will be an iterative process

1

Document the existence and characteristics of gaps and challenges related to equitable PPE protections

2

Identify and organize collaborators across the PPE community

3

Identify viable solutions and approaches to address gaps and challenges

Ongoing/Completed Activities

Federal Register Notice

NORA Councils

ISEA

Literature Review

Federal Register Notice

NORA Councils

ISEA

Crowdsourcing Ideas

[The NIOSH Protective Clothing Challenge—Leaving No Body Unprotected](#)



Next Steps



Fall 2022 Workshop (virtual, open to all, winning Challenge ideas introduced)

Establish NIOSH Partnership for Equitable PPE Protection

Draft Strategy w/ Partnership Members and Mobilize PPE Community



Help us put an end to inequities in PPE protections

Quality Partnerships to Enhance Worker Safety and Health

Visit NIOSH NPPTL

<https://www.cdc.gov/niosh/npptl/default.html>



**Centers for Disease Control
and Prevention**
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