



European Standardization Organizations

## CEN-CENELEC Sector Forum PPE

Online workshop "Smart PPE – standardization for design and use"

2 June 2022

# Workshop moderator

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**Els SOMERS**

Project Manager

Policy & Partnerships

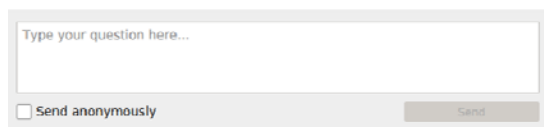
CEN-CENELEC

[esomers@cencenelec.eu](mailto:esomers@cencenelec.eu)

# Get the most out of the webinar today



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# Agenda

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- ▶ Opening and introduction
- ▶ EC information on upcoming initiatives relevant for smart PPE
- ▶ Published documents
- ▶ Standardization projects in progress
- ▶ Notified body: information on challenges with certification of smart PPE
- ▶ Examples from industry and R&D
- ▶ What is happening outside Europe in standardization?
- ▶ Conclusions

# Introduction

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**Henk VANHOUTTE**  
Secretary General  
European Safety Federation ivzw

# Setting the scene

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CEN-CENELEC Sector Forum on Personal Protective Equipment is a coordination platform for the concerned standardization committees in the PPE sector. PPE SF enhances networking and exchange on horizontal issues by including aspects of legislation, standardization and emerging risks.

Standardization activities on smart PPE started with the Standardization Request (M/553, advanced garments and ensembles of garments that provide protection against heat and flame, with integrated smart textiles and non-textile elements for enhanced health, safety and survival capabilities, in support of Regulations (EU) No 1007/2011 and (EU) 2016/425) issued by the EC. PPE SF promoted these activities with the following workshops:

- 2017 “Smart Textiles”
- 2019 “Smart garments and equipment”
- 2022 “Smart PPE and design for use” ([LINK](#))

# EC – information on upcoming initiatives relevant for smart PPE



**Salvatore SCALZO**

Communications Networks, Content and Technology (DG CNECT)

Artificial Intelligence (AI) Policy Development and Coordination



# SHAPING EUROPE'S DIGITAL FUTURE

## Proposal for a Regulation on Artificial Intelligence



# Why a Regulation on AI?

## AI is good ...

- For citizens
- For business
- For the public interest



## ... but creates some risks

- For the safety of consumers and users
- For fundamental rights

*“Whether it's precision farming in agriculture, more accurate medical diagnosis or safe autonomous driving - artificial intelligence will open up new worlds for us.  
**But this world also needs rules.**”*

President Ursula von der Leyen, State of the Union 2020



# Key regulatory concepts

## Internal market legislation (mainly based on Art. 114 TFEU)

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- ▶ “Classic” internal market rules for the **placing on the market and putting into service of** AI systems
- ▶ Aligned to vast EU acquis on product safety which shall be jointly applied (e.g. AI embedded in products)

Excluded: AI developed used exclusively for military purposes

## Layered risk-based approach



- 
- ▶ No regulation of the technology as such, but of concrete high-risk use cases
  - ▶ Covers risks to health, safety and/or fundamental rights

## Level playing field for EU and non-EU players

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- ▶ Independent of origin of producer or user

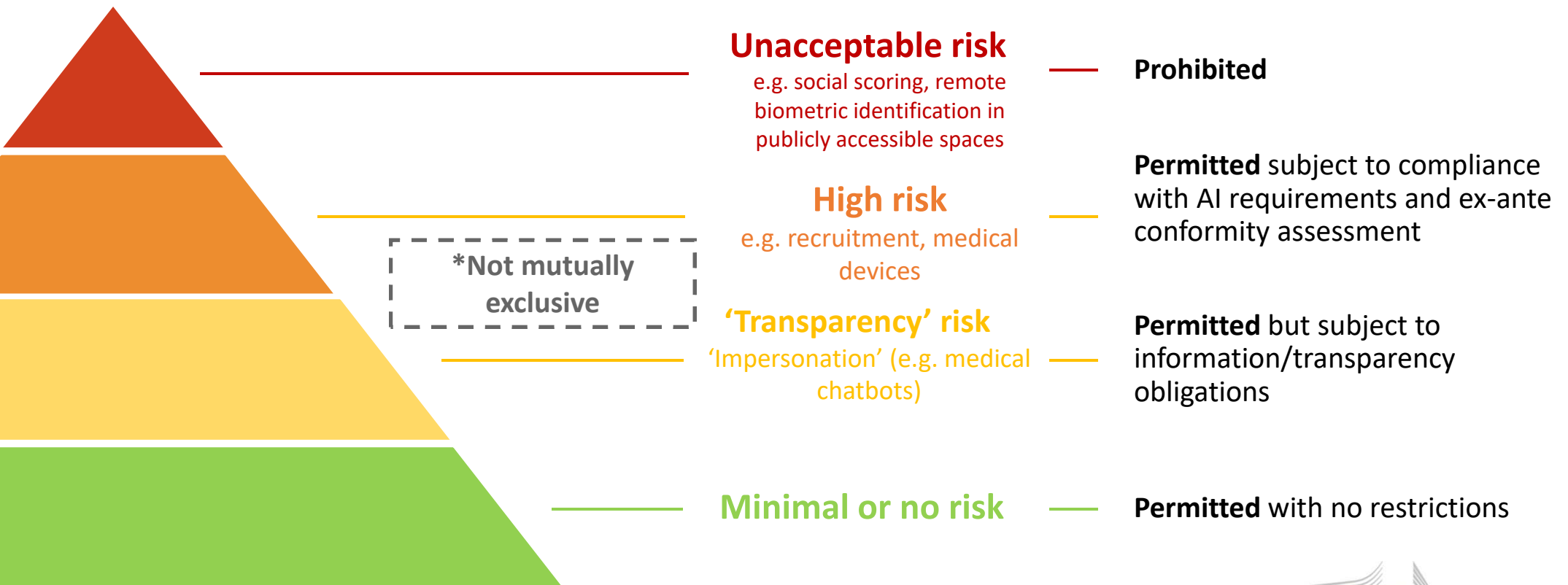
# Definition of Artificial Intelligence



“a software that is developed with one or more of the techniques and approaches listed in Annex I and can, for a given set of human-defined objectives, generate outputs such as content, predictions, recommendations, or decisions influencing the environments they interact with”

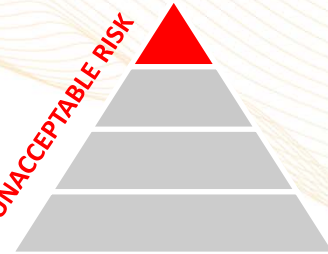
- ▶ Definition of AI should be **as neutral as possible** in order to cover techniques which are not yet known/developed
- ▶ **Overall aim is to cover all AI**, including traditional symbolic AI, Machine learning, as well as hybrid systems
- ▶ **Annex I:** list of AI techniques and approaches should provide for legal certainty (adaptations over time may be necessary)

# A risk-based approach



# AI that contradicts EU values is prohibited (Title II, Art. 5)

UNACCEPTABLE RISK



X

**Subliminal manipulation**  
resulting in physical/  
psychological harm

## EXAMPLE

An **inaudible sound** is played in truck drivers' cabins to push them to **drive longer than healthy and safe**. AI is used to find the frequency maximising this effect on drivers.

X

**Exploitation of vulnerabilities**  
resulting in physical/psychological  
harm

## EXAMPLE

A doll with an integrated **voice assistant** encourages a minor to **engage in progressively dangerous behavior** or challenges in the guise of a fun or cool game.

X

**'Social scoring'** by public  
authorities

## EXAMPLE

An AI system **identifies at-risk children** in need of social care **based on insignificant or irrelevant social 'misbehavior'** of parents, e.g. missing a doctor's appointment or divorce.

X

**'Real-time' remote biometric  
identification for law  
enforcement purposes in publicly  
accessible spaces**  
(with exceptions)

## EXAMPLE

All faces captured live by video cameras checked, in real time, against a database to identify a terrorist.

# Remote biometric identification (RBI)

## Use of real-time RBI systems for law enforcement (Art. 5)

UNACCEPTABLE RISK



### **Prohibition of use for law enforcement purposes in publicly accessible spaces with exceptions:**

- Search for victims of crime
- Threat to life or physical integrity or of terrorism
- Serious crime (EU Arrest Warrant)

### **Ex-ante authorisation by judicial authority or independent administrative body**

## Putting on the market of RBI systems (real-time and ex-post)

HIGH RISK



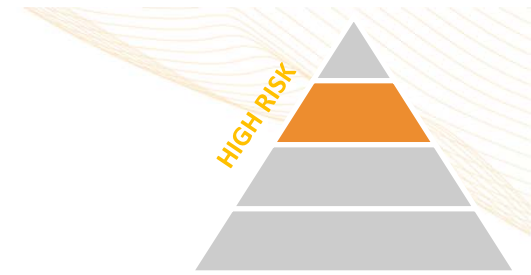
### ➤ **Ex ante third party conformity assessment**



- Enhanced logging requirements
- “Four eyes” principle

No additional rules foreseen for use of real-time and post RBI systems: existing data protection rules apply

# High-risk AI Systems



## HIGH-RISK AI SYSTEMS IN AIA

1

CERTAIN SAFETY COMPONENTS OF REGULATED PRODUCTS (OR CERTAIN AI SYSTEMS WHICH ARE PRODUCTS BY THEMSELVES)

2

CERTAIN (STAND-ALONE) AI SYSTEMS – SPECIFIC USE-CASES - IN THE FOLLOWING AREAS (ANNEX III)

- ✓ Biometric identification and categorisation of natural persons
- ✓ Management and operation of critical infrastructure
- ✓ Education and vocational training
- ✓ Employment and workers management, access to self-employment
- ✓ Access to and enjoyment of essential private services and public services and benefits
- ✓ Law enforcement
- ✓ Migration, asylum and border control management
- ✓ Administration of justice and democratic processes

FOCUS OF ARTICLE 6

# CERTAIN SAFETY COMPONENTS OF REGULATED PRODUCTS (OR CERTAIN AI SYSTEMS WHICH ARE PRODUCTS BY THEMSELVES)

## 2 CUMULATIVE CONDITIONS (FOR BEING HIGH-RISK)

1. The AI system is intended to be used as a safety component of a product  
OR  
is itself a product  
covered by the Union harmonisation legislation listed in Annex II

2. The product whose safety component is the AI system OR the AI system itself as a product is required to undergo a third-party conformity assessment pursuant to the Union harmonisation legislation listed in Annex II.



# Requirements for high-risk AI systems (Title III, Chapter 2)



Establish and  
implement **risk  
management  
system**  
&  
in light of the  
**intended  
purpose** of the  
AI system

Use high-quality **training, validation and testing data** (relevant, representative etc.)

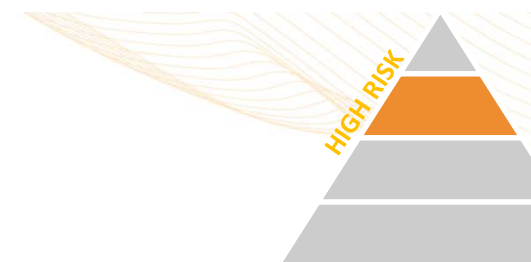
Draw up **technical documentation** & set up **logging capabilities** (traceability & auditability)

Ensure appropriate degree of **transparency** and provide users with **information** on capabilities and limitations of the system & how to use it

Ensure **human oversight** (measures built into the system and/or to be implemented by users)

Ensure **robustness, accuracy** and **cybersecurity**

# Overview: obligations of operators (Title III, Chapter 3)



## Provider obligations

- ▶ Establish and Implement **quality management** system in its organisation
- ▶ Draw-up and keep up to date **technical documentation**
- ▶ Undergo **conformity assessment** and potentially re-assessment of the system (in case of substantial modification)
- ▶ **Register AI system** in EU database
- ▶ Affix **CE marking** and sign declaration of conformity
- ▶ Conduct **post-market monitoring**
- ▶ **Collaborate** with market surveillance authorities

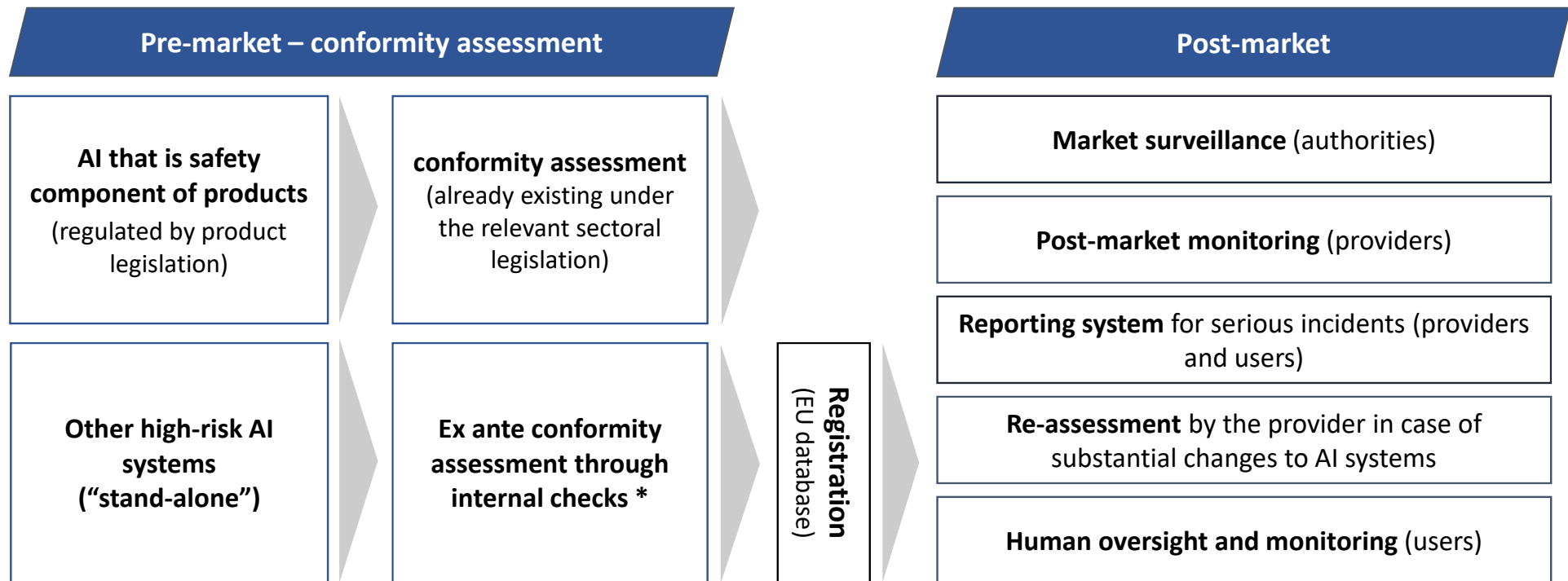
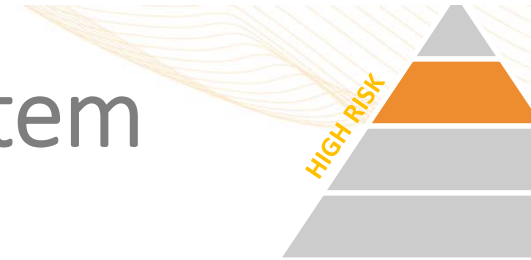


## User obligations

- ▶ Operate AI system in accordance with **instructions of use**
- ▶ Ensure **human oversight** when using of AI system
- ▶ **Monitor** operation for possible risks
- ▶ **Inform the provider or distributor about any serious incident or any malfunctioning**
- ▶ **Existing legal obligations** continue to apply (e.g. under GDPR)

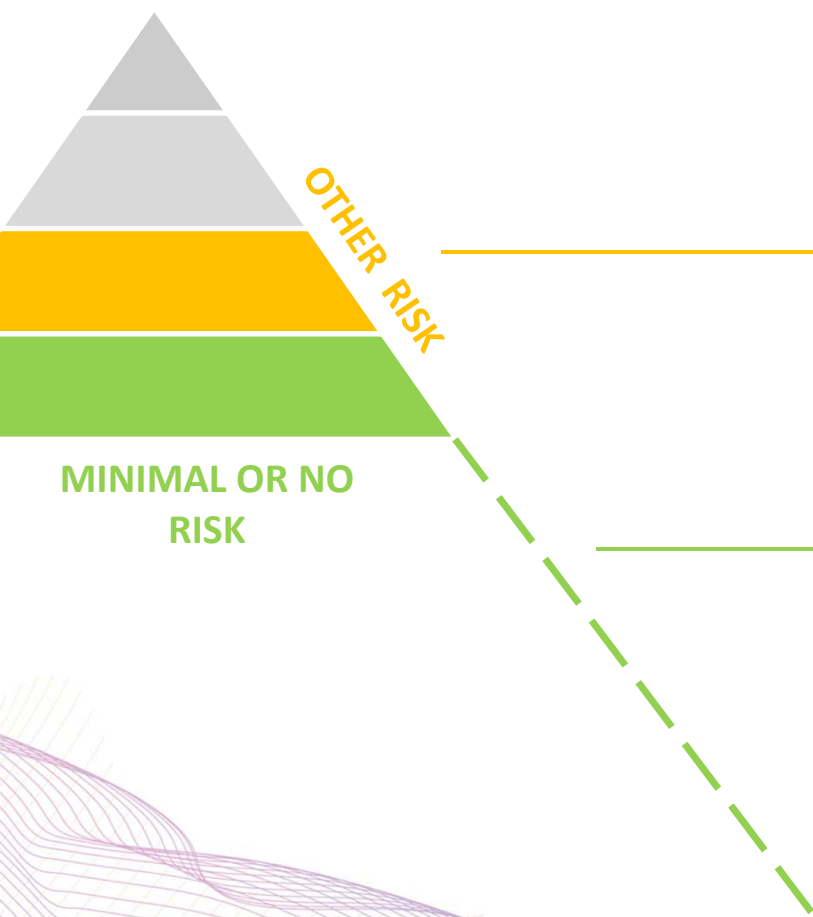


# The compliance and enforcement system



\* Exception remote biometric identification

# Most AI systems will not be high-risk (Titles IV, IX)



## Transparency obligations for certain AI systems (Art. 52)

- ▶ **Notify humans** that they are **interacting with an AI system** unless this is evident
- ▶ **Notify humans** that they are **exposed to emotional recognition or biometric categorisation systems**
- ▶ Apply **label to deep fakes**

## Possible voluntary codes of conduct (Art. 69)

- ▶ No mandatory obligations
- ▶ Commission and Board to encourage drawing up of codes of conduct (**voluntary application of requirements for high-risk AI systems or other requirements**)

# The governance structure (Titles VI and VII)

## European level

### Artificial Intelligence Board

- ▶ National Supervisory Authorities
- ▶ EDPS
  - ▶ European Commission Secretariat

- ▶ Collect and **share best practices & expertise**
- ▶ contribute to uniform administrative practices in the MS
- ▶ Provide advice, opinions, recommendations on AI issues:
  - ▶ Standards (including harmonized standards) & technical specifications
  - ▶ Preparation of guidance documents

## National level

### National Competent Authorities, incl. National Supervisory Authority

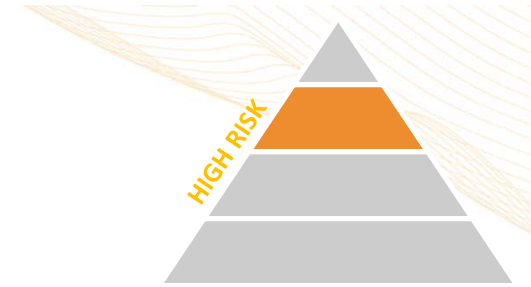
- ▶ Responsible for the application and implementation of the Regulation
  - ▶ Oversight of conformity assessment bodies
  - ▶ Market surveillance activities ex Regulation (EU) 2019/1020



**Thank you**

Back up slides legal text

# Lifecycle of AI systems and relevant obligations



## Design in line with requirements



Ensure AI systems **perform consistently for their intended purpose** and are in **compliance with the requirements** put forward in the Regulation

## Conformity assessment



**Ex ante** conformity assessment

## Post-market monitoring



Providers to **actively and systematically collect, document and analyse relevant data** on the reliability, performance and safety of AI systems throughout their lifetime, and to **evaluate continuous compliance of AI systems with the Regulation**

## Incident report system



**Report serious incidents as well as malfunctioning leading to breaches to fundamental rights** (as a basis for investigations conducted by competent authorities).

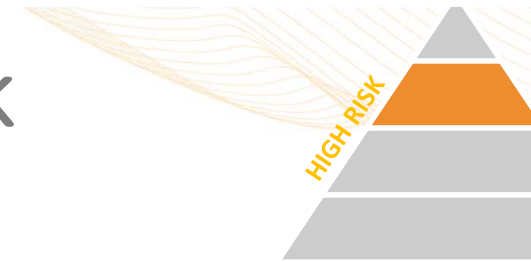
## New conformity assessment



**New conformity assessment** in case of **substantial modification** (modification to the intended purpose or change affecting compliance of the AI system with the Regulation) by providers or any third party, including when changes are **outside the “predefined range”** indicated by the provider for **continuously learning AI systems**.



# Classification of AI systems as high-risk (Title III, chapter 1 and Annex III)



Including available evidence

**Risk assessment to determine likelihood and severity of harm to safety/fundamental rights based on the following criteria:**

- ▶ Existing use of AI
- ▶ Previous harms or major concerns
- ▶ Potential impact & scale of a harm
- ▶ Dependency of affected person on outcome determined by AI system
- ▶ Reversibility of outcome produced by an AI system (e.g. physical harm)
- ▶ Availability/effectiveness of existing legal remedies

**Criteria for risk assessment**

Biometric identification in a shopping mall

AI as safety component of a grid management system

AI to dispatch emergency medical aid

AI to filter resumes of applicants

AI to grade students

AI to evaluate creditworthiness

AI to process asylum applications\*

...

**Examples of concrete high-risk use cases**

**Risks to health, safety and/or fund. rights in the following areas:**

- ▶ Biometric identification and categorisation
- ▶ Management & operation of critical infrastructure & services
- ▶ Education & vocational training
- ▶ Employment & workers management
- ▶ Access to & enjoyment of private services & public services & benefits
- ▶ Law enforcement
- ▶ Migration, asylum & border control management
- ▶ Administration of justice & democratic processes, institutions & discourse

**Sensitive areas**

# Market surveillance in AI regulation

## General principles and specific considerations for certain AI systems

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- ▶ Market Surveillance Regulation 1020/2019 applies in its entirety
- ▶ Interplay with other NLF legislations: Market surveillance authority of relevant NLF legislation shall be in charge for the purpose of the AI regulation
- ▶ Specific considerations for AI related to financial sector and law enforcement
- ▶ EDPS to be market surveillance authority in relation to Union institutions, agencies and bodies

## Certain prerogatives of other authorities

- ▶ Facilitate enforcement of fundamental rights – special prerogatives for national public authorities or bodies which supervise or enforce the respect of obligations under Union law protecting fundamental rights
  - ▶ Access to documentation of providers – they shall inform market surveillance authorities
  - ▶ They can request the organization of testing – through market surveillance authority

# Question time

Should AI be allowed to determine protective action of smart PPE (e.g. amount of cooling necessary to keep the user healthy in a hot environment)?



- ▶ CEN/TR 17512:2020, Smart garments - Terms and definitions
- ▶ CEN/TR 17260:2021, Guidelines for selection, use, care and maintenance of smart garments protecting against heat and flame
- ▶ EN 17673:2022, Protection against heat and flame - Requirements and test methods for garments with integrated smart textiles and non-textile elements



## Laurent Houillon

BNITH Manager, sectorial bureau of standardisation, acting by AFNOR delegation

Project Leader for CEN/TR 17512 and ISO 11610

Convenor of CEN TC162 WG1 and ISO/TC 94/SC 13/WG1

# CEN/TR 17512 (2020)

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## [CEN/TR 17512 \(2020\)](#)

Personal protective equipment - Smart garments - Terms and definitions

This technical report lists terms and definitions related to core terms in the field of smart garments providing protection against heat and flame (i.e. advanced garments and ensembles of garments).

It is intended to facilitate communications, for example, between organizations and individuals in industry and those who interact with them.

# Beyond publication of CEN/TR 17512

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Some terms and definitions will be introduced in the project EN ISO 11610 Protective clothing - Vocabulary (ISO/TC 94 SC 13/WG1) – currently under FDIS preparation

# Published documents

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**Kalev Kuklane**

Netherlands Institute for Public  
Safety (NIPV)



# CEN/TR 17620:2021 Guidelines for selection, use, care and maintenance of smart garments protecting against heat and flame

(CEN/TR 17620 was published on April 7, 2021)



Kalev Kuklane

# Why SUCAM for smart heat and flame protective garments?



- ▶ **The exposure at the incident sites has changed rapidly**
- ▶ New/smart textile and clothing solutions
- ▶ Increase in smart systems, including smart garments and PPE to support the rescue operations.
- ▶ Increase of the use of smart functions to give feedback on personal conditions, e.g. measuring heart rate, core temperature etc.
- ▶ Increase of the use of smart functions to give feedback on environmental conditions, e.g. air temperature, substances in air etc.
- ▶ At the same time, the use of smart solutions may also involve
  - ▶ more complex procedures and logistics when smart elements are included in the PPE



- ▶ *Commission implementing decision of 6.1.2017 on a standardisation request to the European standardisation organisations as regards advanced garments and ensembles of garments that provide protection against heat and flame, with integrated smart textiles and non-textile elements for enhanced health, safety and survival capabilities, in support of Regulations (EU) No 1007/2011 and (EU) 2016/425 of the European Parliament and of the Council.*

# What do firefighters want?

- ▶ A location monitoring system
- ▶ An automatic body cooling system
- ▶ A wireless communication system
- ▶ A vision support system



Source: Santos G.

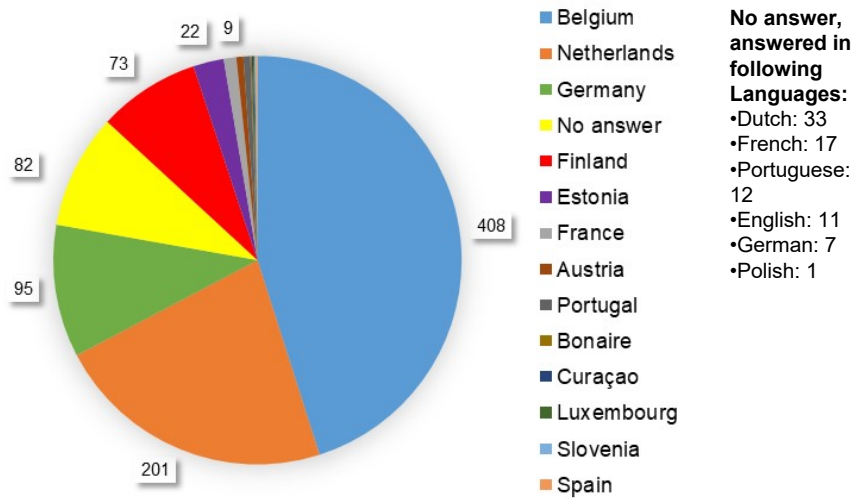
- ▶ *Lee et al. 2015. What do firefighters desire from the next generation of personal protective equipment? Outcomes from an international survey. Industrial Health, 53, p. 434-444.*

# European User Survey on smart PPE for Firefighters

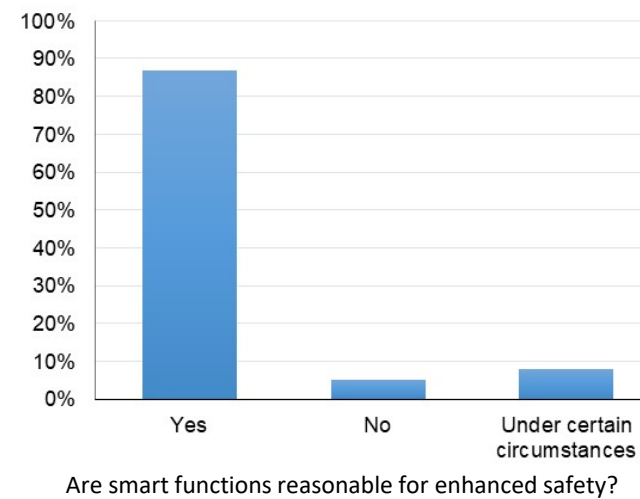
(Krause et al., ECPC2021, European User Survey on smart PPE for Firefighters)



- ▶ 907 European firefighters from 13 different countries took part
  - ▶ 196 firefighters were active in two and 6 in three types of fire brigades



**No answer, answered in following Languages:**  
 •Dutch: 33  
 •French: 17  
 •Portuguese: 12  
 •English: 11  
 •German: 7  
 •Polish: 1

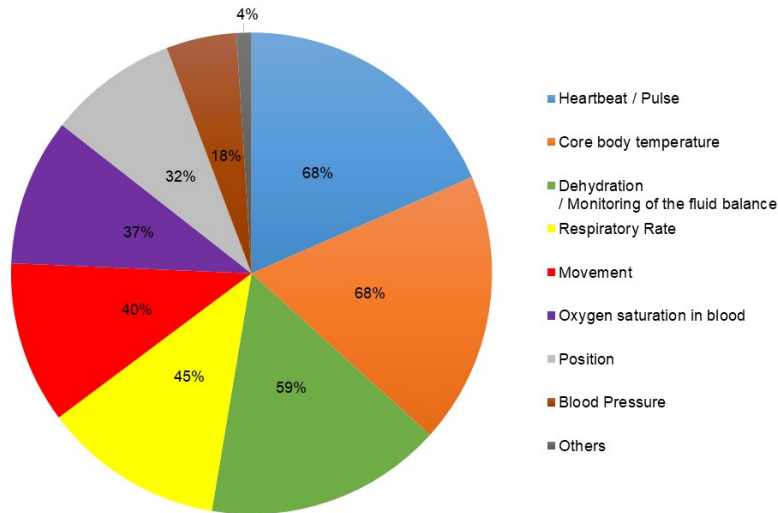


# European firefighters' opinions on smart solutions

(Krause et al., ECPC2021, European User Survey on smart PPE for Firefighters)

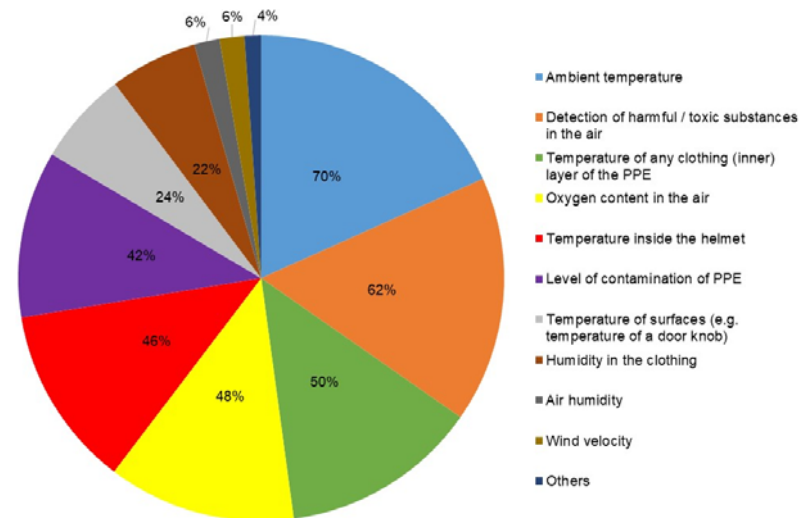


Which personal (vital) parameters should be monitored in your opinion?



- ▶ **Others:**
- ▶ Position of team members
  - ▶ Recording polycyclic aromatic hydrocarbons (PAH) and volatile organic compounds (VOCs)
  - ▶ Tiredness
  - ▶ Tracking of BA (breathing apparatus) crew search technique (where they have been to recognize where a search is still required by the next crew)

Which environmental parameters should be monitored in your opinion?



- ▶ **Others:**
- ▶ Radiation
  - ▶ Location (distance, elevation and direction or even 3D location inside building)
  - ▶ Air tank information
  - ▶ Wind direction

# The risks related to smart solutions

- ▶ Risk of selecting smart systems that are not needed (cost aspects, overload with unnecessary information);
- ▶ Risks with falling sense of danger (Is smart smart enough?);
- ▶ Risks related to possible system failures and reduced safety;
- ▶ Risks related to data security.

# The technical report is to assist:



- ▶ Employers, employees and suppliers in taking the necessary decisions regarding the selection, use, care and maintenance of advanced garments for enhanced health, safety and survival capabilities.
- ▶ Developers and manufacturers in designing and producing garments with smart textiles and smart non-textile elements that will meet the user needs and comply with the requirements set for protective clothing on use, care and maintenance up to and including the disposal of the protective gear.



# Contents of CEN TR 17620

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European foreword

Introduction

1 Scope

2 Normative references

3 Terms and definitions

4 Total process

5 Selection

6 Use

7 Care

8 Maintenance

## [Annex A Performance levels relating to clothing designed to provide protection from heat and flame](#)

[A.1 General](#)

[A.2 Standards describing performance requirements for protective clothing or materials](#)

## **Annex B Risk assessment**

**Annex C Examples: Relationship between type of activity, the heat/flame hazard linked to the activity and clothing to be chosen for protection based on the existing product standards**

## [Annex D Practical performance tests related to firefighter clothing](#)

[D.1 Ergonomics](#)

[D.2 Cold protection](#)

[D.3 Rain protection](#)

[D.4 Parameters to be measured](#)

[D.5 Additional testing](#)

[D.6 Heat protection](#)

[D.7 Physiological heat load](#)

## [Annex E Description of burn injury risks](#)

## [Annex F Label, marking and instruction for use/manufacturer's instructions/user instructions \(for procurement\)](#)

## [Annex G Examples of scenarios of heat and flame exposure](#)

[G.1 General](#)

[G.2 Structural firefighting and industrial firefighting](#)

[G.3 Outside firefighting](#)

[G.4 Wildland firefighting](#)

[G.5 Fires in transport sector](#)

[G.6 Technical rescue operations](#)

[G.7 Welding](#)

## [Annex H Examples of SUCAM procedures for smart solutions in garments](#)

[H.1 The garments with PCM packages: PCM vest](#)

[H.2 Electrical circuits and power supplies for use in wet conditions](#)

[H.3 Suggested SUCAM procedures for an arbitrary smart firefighter ensemble \(based on the systems developed in connection with Smart@Fire\)](#)

[H.4 Suggested user instructions for operator clothing with heat and flame protective properties in a process industry](#)

## [Bibliography](#)

# Future of CEN/TR 17620



- ▶ Revise CEN/TR 14560 and thereafter withdraw CEN/TR 17620
- ▶ Revise CEN/TR 17620 and thereafter withdraw CEN/TR 14560
- ▶ Update CEN/TR 14560 according to improvements in CEN/TR 17620 and revise CEN/TR 17620 to cover all smart garments for protection
  - ▶ e.g. chemical protection, breathing system, diving etc. that have their own basic requirements to consider
- ▶ Bring under VA all relevant elements into ISO/TR 21808:2021 and withdraw both CEN/TR 14560 and CEN/TR 17620

# Thank You for the attention!



- ▶ The 10<sup>th</sup> European Conference on Protective Clothing (ECPC2023) will be organized on May 9-12, 2023 by NIPV in Arnhem, the Netherlands (<https://nipv.nl/evenement/the-10th-european-conference-on-protective-clothing-ecpc2023/>) including
  - ▶ a special **Firefighters Theme Day**
  - ▶ a special session on **virtual ergonomic evaluation** (organized by Peter Bröde, IfADo, Germany)
  - ▶ a special session on **sustainability in PPE** (organized by Henk Vanhoutte, ESF, Belgium)
  - ▶ etc.
- ▶ Additional information and earlier proceedings are available at: <http://www.es-pc.org/>



# Published documents

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**Karin EUFINGER**

Standards & Technical  
Regulations Manager

CENTEXBEL

*Protection against heat and flame - Requirements and test methods for garments with integrated smart textiles and non-textile elements*

Scope:

- Garments and assembly of garments providing protection against heat and flame, with integrated smart textiles and non-textile elements for enhanced health, safety and survival capabilities.

Not included: validating claims that the integrated smart textiles and non-textile elements substitute directly any protection provided by the garment

Examples for smart textiles and non-textile elements:

- Parts integrated into the protective garment
- Connections to transmit the data generated or exchange data with external devices

Not included are:

- Evaluation of the data storage or data transmission processes (including connectivity)
- External devices (e.g. smart phone, computer, data transmission nodes)



## Principle:

- Supplements the requirements of EN ISO 11612 and EN ISO 13688 but does not replace any of the requirements cited in those documents
- Sets additional testing and performance requirements linked specifically to the integrated smart textiles and non-textile elements, which depend on:
  - The functionality of the smart textiles or non-textile element
  - its needed efficacy during heat and flame hazards and risks from an electrical/electronic safety perspective

- 1) Apply same principle to other smart PPE (garments, other):
  - Identify the standards describing the requirements for the type of PPE
  - Identify the additional testing and performance requirements linked specifically to the integrated smart textiles and non-textile elements
  
- 2) Extend principles to:
  - Applications where the integrated smart textiles and non-textile elements replace one or more protective function
  - External devices and data processing/ storage
  - Other?

Do we need standards for smart PPE for specific risks?



# Standardization projects in progress

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- ▶ Warning clothing with active lighting/equipment for active luminous warning – requirements and test methods
- ▶ Smart textiles and electronic textiles

# Projects in progress

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**Wolfgang Quednau**

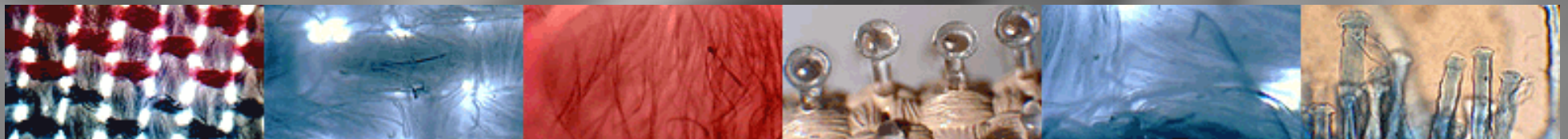
**BTTA GmbH**

**Convenor CEN/TC 162/WG 7**

# Warning clothing with active lighting for active luminous warning

Wolfgang Quednau – Convenor of WG 7 in CEN TC 162 (Visibility)

2<sup>nd</sup> June 2022



# History

## Harmonised visibility standards

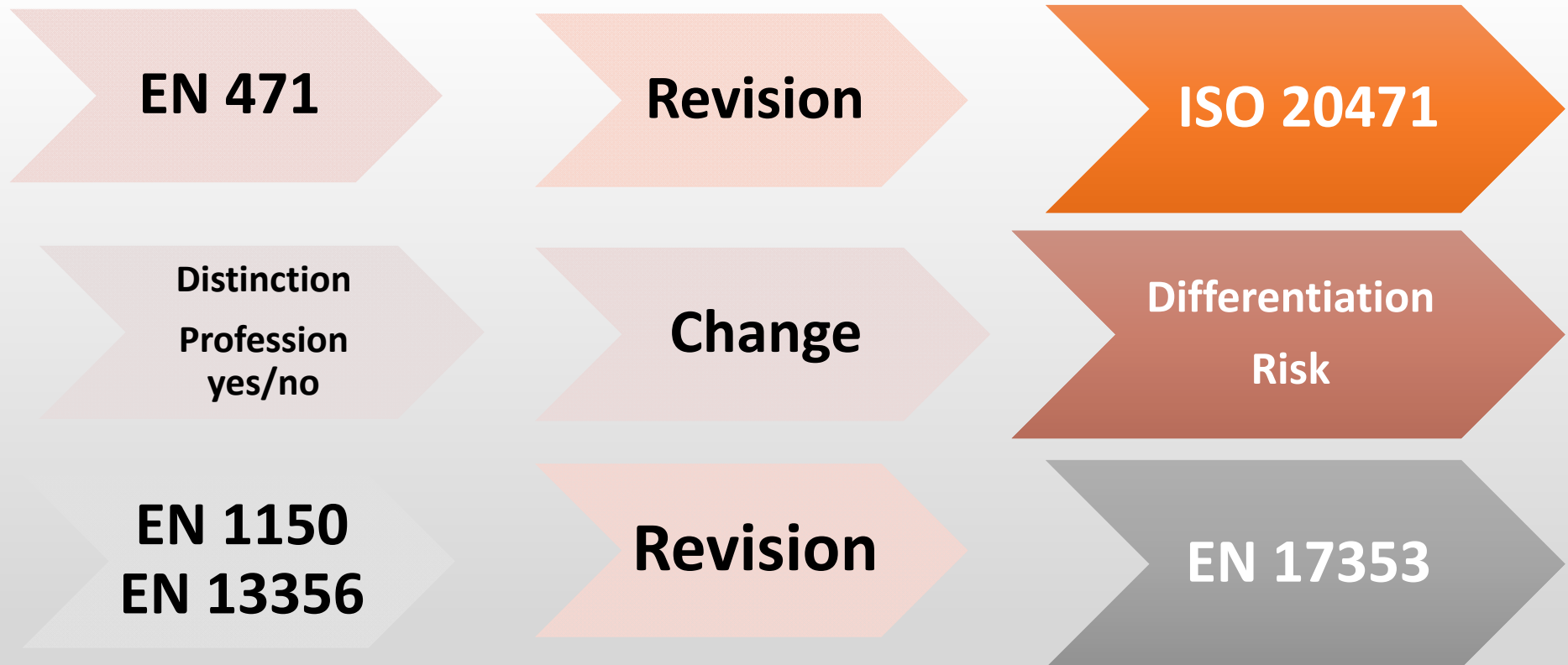
2013

EN 471  
„professional“

EN 1150  
„non-professional“

EN 13356  
accessories  
„non-  
professional“

# Development of standardisation for high-visibility





# Risk?

- Definition ISO 14121-1:

$$R = P \times H$$

R -> Risk

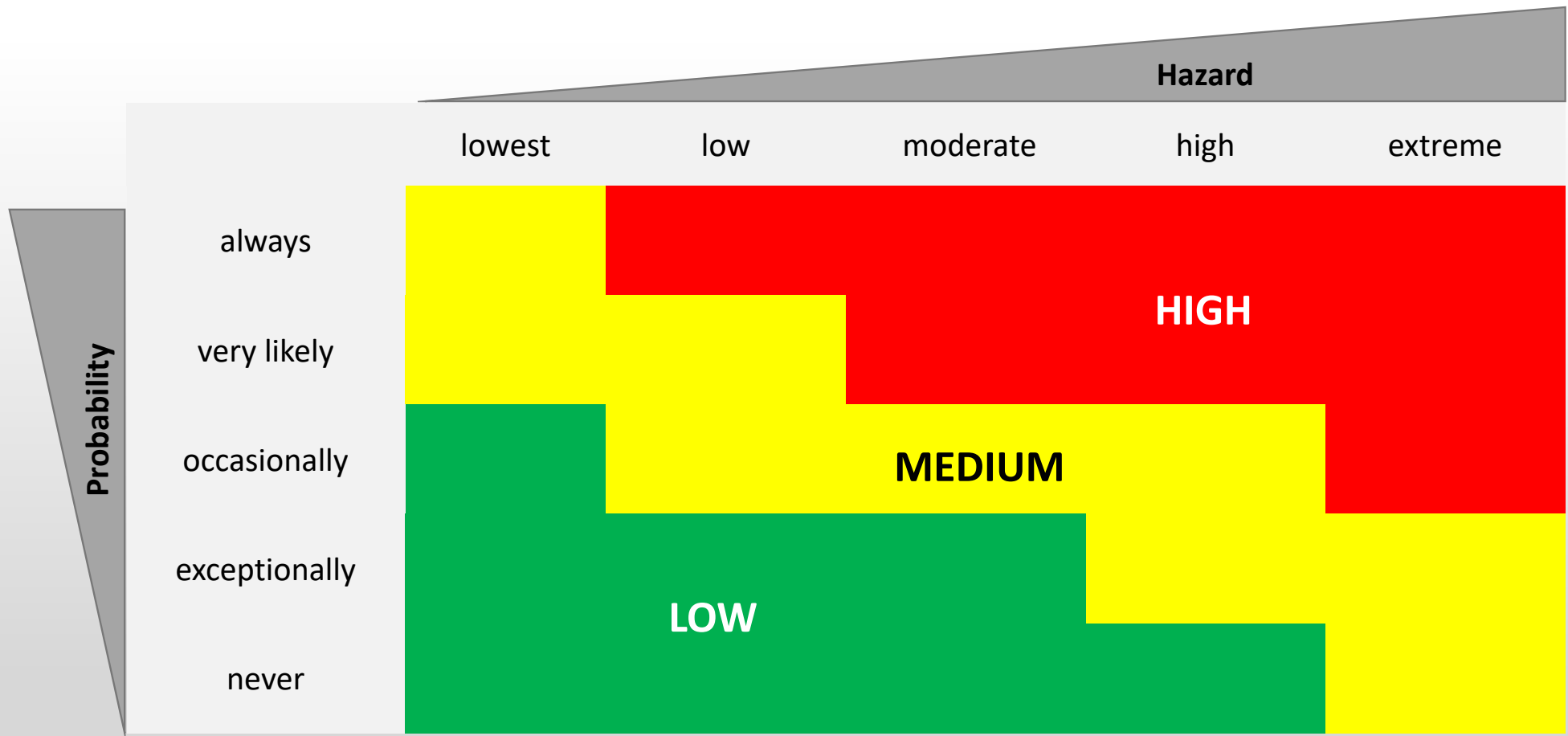
P -> Probability

H -> Hazard

- The risk (of not being seen) depends on a combination of the likelihood and the severity of the event.



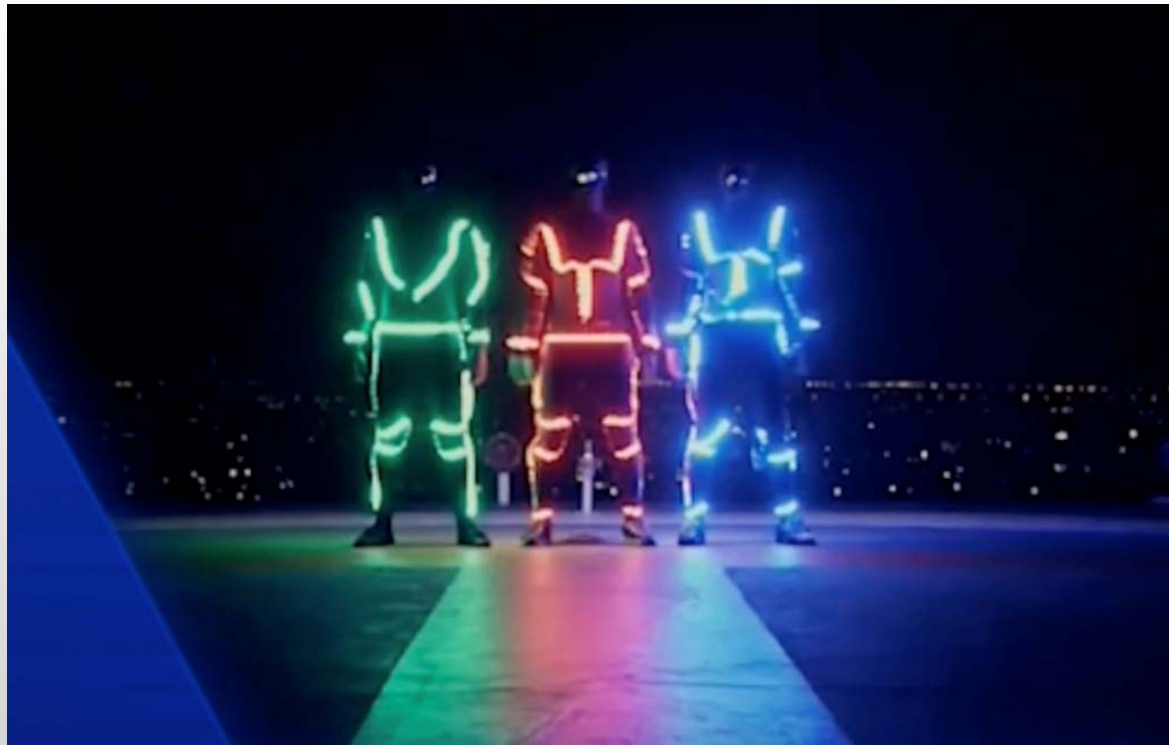
# Risk Class



# ISO 20471 + EN 17353

RISK LEVEL	VISIBILITY LEVEL	CHARACTERISTICS	SCOPE
<b>HIGHER RISK</b>	<b>HIGH VISIBILITY (ISO 20471)</b>	<ul style="list-style-type: none"> <li>• DAY AND DARKNESS</li> <li>• 360° (VISIBILITY FROM ALL SIDES)</li> <li>• DESIGN FOR SHAPE RECOGNITION</li> <li>• ENCIRCLING OF THE TORSO</li> <li>• QUANTITY AND QUALITY FOR DAY AND DARKNESS</li> </ul>	High visibility clothing is capable of signalling the user's presence visually, intended to provide conspicuity of the user in higher risk situations under any light conditions by day and under illumination by vehicle headlights in the dark.
<b>MEDIUM RISK</b>	<b>ENHANCED VISIBILITY (EN 17353)</b>	<ul style="list-style-type: none"> <li>• DAY / DAY AND DARKNESS / DARKNESS</li> <li>• 360° (VISIBILITY FROM ALL SIDES)</li> <li>• DESIGN FOR MOTION RECOGNITION AND/OR SHAPE RECOGNITION</li> <li>• QUANTITY AND QUALITY FOR DAY AND/OR DARKNESS</li> </ul>	Enhanced visibility clothing is capable of signalling the user's presence visually, intended to improve visibility of the user in medium risk situations by day and/or illumination by vehicle headlights in the dark.
<b>LOW RISK CATEGORY 0</b>	<b>VISIBILITY</b>	<ul style="list-style-type: none"> <li>• BRIGHT COLOURS</li> <li>• PIPING AND/OR RANDOM REFLECTIVE MATERIAL</li> <li>• ANY QUANTITY AND QUALITY</li> </ul>	NO STANDARD ANY CLOTHING

# FUTURE: Active Lightning



Published in June 2021:

DIN/TS 91418

Warning clothing with active lighting in addition to DIN EN ISO 20471 and DIN EN 17353

- Equipment for active luminous warning clothing
- Test methods and requirements

Source: [www.youtube.com](http://www.youtube.com)

# Scope DIN/TS 91418

...

Active luminous warning clothing is designed to ensure that the wearer is conspicuously visible in twilight and darkness, even without an external direct light source.

...



# The challenge is ...

... to have sufficient luminosity to be seen on the one hand but not to blind or distract viewers.



# The second challenge is ...

... to define the necessary electrical safety. I.e. to organise the cooperation of the experts for traffic safety and electrical engineering.



## BT TA GmbH

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# Projects in progress

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**Karin EUFINGER**  
CEN/TC 248/WG 31

# Background

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Established 2008

Initial scope: Smart (Intelligent) Textiles

Current scope: Smart and electronic Textiles (as there was no CENELEC counterpart)

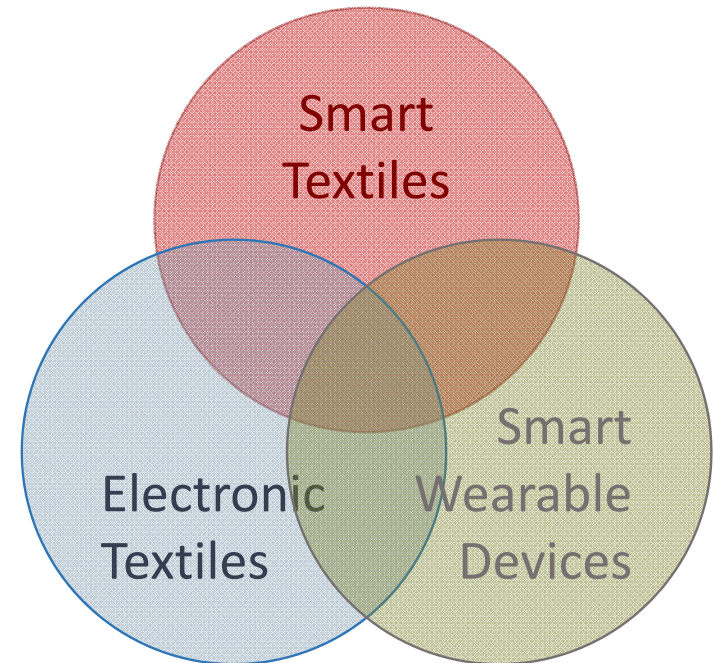
Working together with:

- ISO TC38 WG32 Smart Textiles (established 2018)
- IEC TC124 WG2 E-textiles (established 2019)
- CEN TC162 WG1, WG2 on M553; potentially coop with also other WG's for new topics

# Smart textiles & electronic textiles

Overlap:

- Smart textiles/  
intelligent textiles
- Electronic textiles/  
e-textiles
- Wearable intelligence/  
smart wearable devices



# Specific technology

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- Flexible/stretchable vs. rigid materials/ electronics:
  - Different mechanical properties required
  - Effect on materials behaviour (including electronic properties)
- Environment (temperature, humidity; e.g. for wearables closeness to human skin)
- Maintenance: washing, cleaning, etc.

# Specific standardisation needs

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Link between textiles/ textile products and

- Smart materials
- Electronic components/ devices

⇒ Smart textiles and electronic textiles are a category of their own and not simply an addition of the two parts !

⇒ Standards applicable to the one or the other often need to be modified to be applicable.

# Approach for standards development

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- Identify ‘missing links’ and necessary modifications; provide guidance on how to address these
- General smart textiles and electronic textiles testing and characterization
- Offer support to product specific standards development

CEN/ISO TR 23383:2020 - "Textiles and textile products — Smart textiles — Definitions, categorisation, applications and standardization needs" (revision of CEN/TR 16298:2011)

EN 16812:2016 "Textiles and textile products — Electrically conductive textiles — Determination of the linear electrical resistance of conductive tracks"

EN 16806-1:2016 "Textiles and textile products — Textiles containing phase change materials (PCM) — Part 1: Determination of the heat storage and release capacity"

# Pending publication

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EN/ ISO DIS 24584:2022 “Textiles - Smart textiles - Test method for sheet resistance of conductive textiles using non-contact type” (publication pending)

EN 17673:2022 Protection against heat and flame - Requirements and test methods for garments with integrated smart textiles and non-textile elements (CEN TC162)



# Under drafting

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CEN/TR WI 00248652 “Textiles and textile products - Textiles with integrated electronics and ICT - Definitions, categorisation, applications and standardisation needs”

# Future

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Increased cooperation with ISO TC38 WG32 Smart Textiles and IEC TC124 WG2 E-textiles

Increase support to product TC's (for the moment primarily interest from wearables).

What aspects of sustainability shall standardization of smart PPE take into account, while ensuring the protection level of the PPE?



Please see webpage of the event

# Notified body: information on challenges with certification of smart PPE

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Marco MEYER

RICOTEST

Notified body

Oral information on:

- Inflatable airbag for elderly people, detecting falls, connected to e.g. smart phone, initiating emergency call, when fall was detected  
Airbags are certified in the sector of motorcycling since more than 10 years, but application for elderly people is new and needed adaption and interpretation of existing requirements
- Certification of exoskeletons  
No standards available – also discussion on legal status ongoing  
mechanical action/response is innovative  
Exchange with all concerned parties necessary

## Open microphone

Short presentations from various stakeholders including participant



## Werner GROMMES

German Social Accident Insurance (DGUV)  
Institute for Occupational Safety and Health  
(IFA)

## Safety-critical aspects of illuminated workwear and wearables

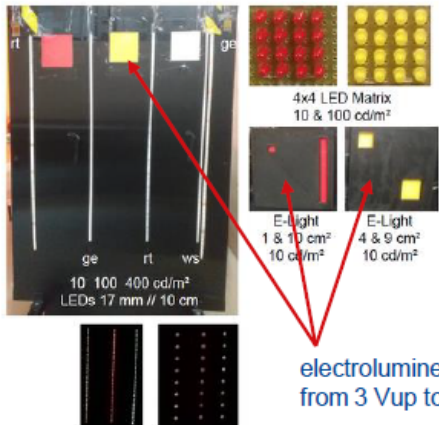
Online Workshop CEN-CENELEC Sector Forum PPE - Smart  
PPE – standardization for design

Werner Grommes @ DGUV/IFA



## Warning clothing with active lighting in addition to DIN EN ISO 20471 and DIN EN 17353 Equipment for active luminous warning clothing -Test methods and requirements

Distance 1 – 50 – 100 – 150 m



electroluminescence  
from 3 V<sub>up</sub> to 250 V<sub>pp</sub>

### Active cooperation for DIN EN ISO 20471 on purchased illuminated warning clothing :

#### Investigations on:

- High visibility vests
- warning jackets
- warning caps

#### Further examinations:

- range in darkness
- glare at 1 m distance
- electromagnetic compatibility
- electrical safety
- determination of minimum and maximum luminance
- luminance measurements

**USB-Powerbanks**  
 - Lithium Ion  
 - Lithium Polymere  
 - without test certificate

safety critical  
 because worn directly on  
 the human body

cable harness > short >  
 "explosion"



# Safety-critical aspects from the experience of many tests



+18,64kcd/m²  
11\_



+78,1kcd/m²  
1,7\_



~ 2 Mio cd/m²  
top glare effect



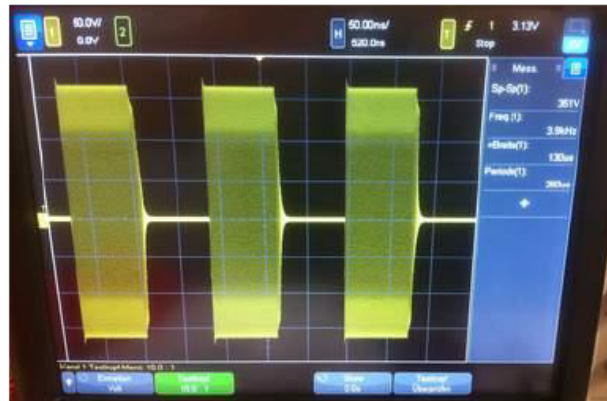
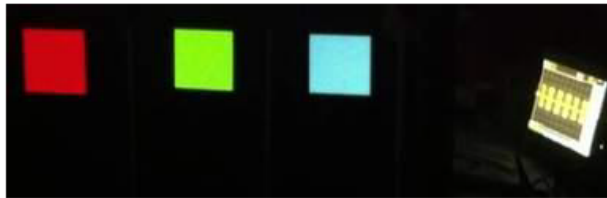
acceptable luminance without glare  
~ 800 cd/m²



# Electro Luminescence wearables

3V battery > high voltage transformer > 370 Vpp

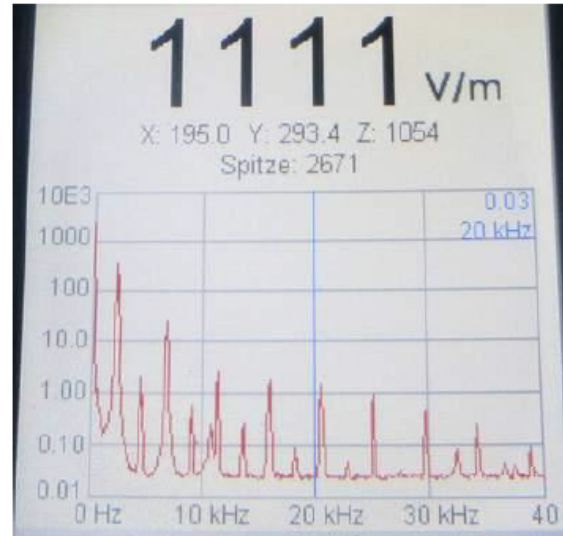
## luminous surfaces



strong pulsating interference signal



~ 1 kV/m  
harmonics up to  
40 kHz



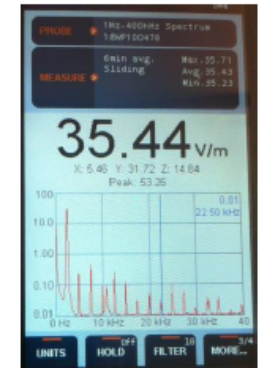
3V Battery  
HV transformer  
3 V to 370 Vpp (1,5 KHz)  
electric-field ~1000 V/m

**The problem:**  
- electrical safety  
- implant wearers

## luminous tubes



## defibrillator+lead & pacemakers



# Examples from industry and R&D

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**Boudewijn WISSE**

CTO and Founder [LAEVO exoskeletons](#)

Challenges of a manufacturer of an innovative product, where even the legal status is at discussion and certainly no standards available to get the product certified and on the market

e.g. exoskeletons

- Certification as PPE (or as medical device) is challenging, when there are no standards available

# Question time

What do you consider as smart PPE?



## What is happening outside Europe in standardization?

# Overview: What is happening outside Europe in standardization?

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**Karin Eufinger**  
Centexbel



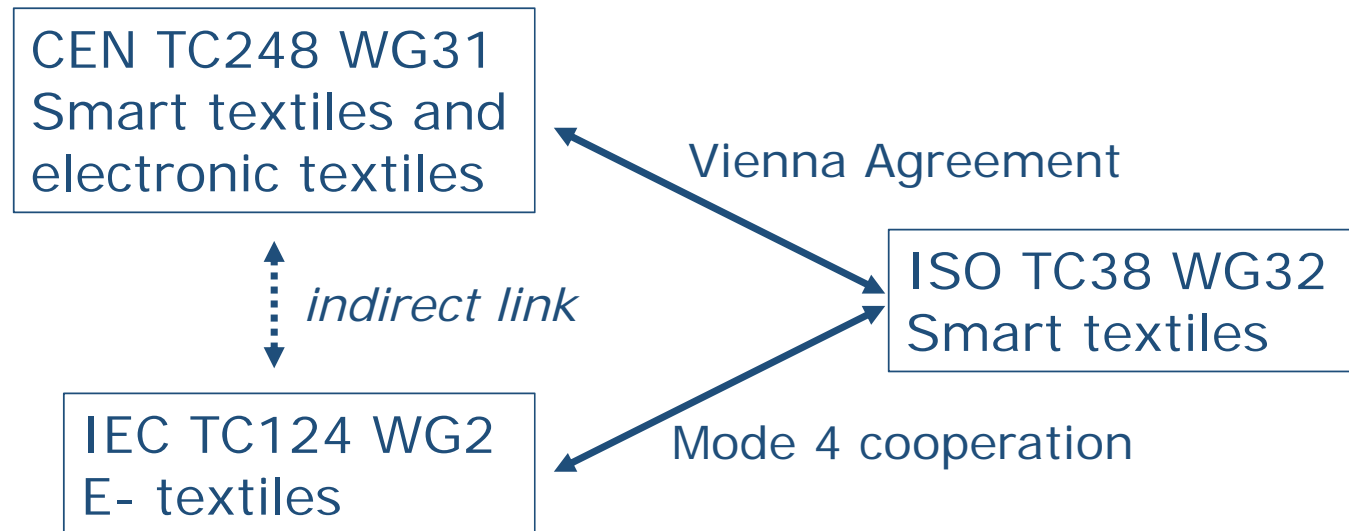
**Sara Gobbi**  
ASTM International



# Developments in ISO and IEC

ISO TC38 WG32 Smart textiles

IEC TC124 WG2 E-textiles



# ISO TC38 WG32 Smart textiles

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## Focus:

- Textile properties
- Textiles for smart and electronics applications
- General guidance and modified test methods for textiles with smart and electronic properties

# ISO TC38 WG32 Smart textiles

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## Publications:

ISO 24584 “Textiles — Smart textiles — Test method for sheet resistance of conductive textiles using non-contact type” (CEN)

ISO/TR 23383:2020 “Textiles and textile products — Smart (Intelligent) textiles— Definitions, categorisation, applications and standardization needs” (CEN)

# ISO TC38 WG32 Smart textiles

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Under development:

ISO/PWI 13505 “Textiles – Smart textiles – Determination of the heating performance of thermal clothing with an integrated heating device”

ISO/PWI 17971 “Textiles - Determination of screen touch property”

# IEC TC124 WG2 E-textiles

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## Focus:

- Electronic properties of e-textiles (e-textiles as components in electronic devices)
- Materials for e-textiles
- Wearable products

# IEC TC124 WG2 E-textiles - Publications



IEC 63203-201-1:2022 “Wearable electronic devices and technologies - Part 201-1: Electronic textile - Measurement methods for basic properties of conductive yarns”

IEC 63203-201-2:2022 “Wearable electronic devices and technologies - Part 201-2: Electronic textile - Measurement methods for basic properties of conductive fabrics and insulation materials”

IEC 63203-201-3:2021 “Wearable electronic devices and technologies - Part 201-3: Electronic textile - Determination of electrical resistance of conductive textiles under simulated microclimate”

IEC 63203-204-1:2021 “Wearable electronic devices and technologies - Part 204-1: Electronic textile - Test method for assessing washing durability of leisurewear and sportswear e-textile systems”

IEC TR 63203-250-1:2021 “Wearable electronic devices and technologies - Part 250-1: Electronic textile - Snap fastener connectors between e-textiles and detachable electronic devices”

# IEC TC124 WG2 E-textiles – Under development



IEC 63203-201-4 (NP) “Wearable electronic devices and technologies - Part 201-4: Electronic textile - Determination of abrasion resistance of conductive fabrics”

IEC 63203-204-1 (CDV) “Wearable electronic devices and technologies - Part 204-1: Electronic textile - Test method for assessing washing durability of e-textile products” (revision)

IEC 63203-204-2 (CD) “Wearable electronic devices and technologies - Part 204-2: Electronic textile - Test method to characterize electrical resistance change in knee and elbow bending test of e-textile system”

# IEC TC124 WG2 E-textiles – Under development (preliminary)



PWI 124-7 “Future IEC 63203-20X-X: Wearable electronic devices and technologies - Part 20X-X: Test method for measuring triboelectric nanogenerator performance of fabric under sliding contact separation mode”

PWI 124-8 “Future IEC 63203-20X-X: Wearable electronic devices and technologies - Part 20X-X: Test method for measuring performance of fabric based piezoelectric nanogenerator on stretching mode”

PWI 124-9 “Future IEC 63203-402-X: Wearable electronic devices and technologies - Part 402-X: Performance of stress measurements in wearables”

PNW 124-182 “Future IEC 63203-403-1 ED1: Wearable electronic devices and technologies - Part 403-1: Test methods of surface electromyography sensors for wearable applications”



# ASTM International



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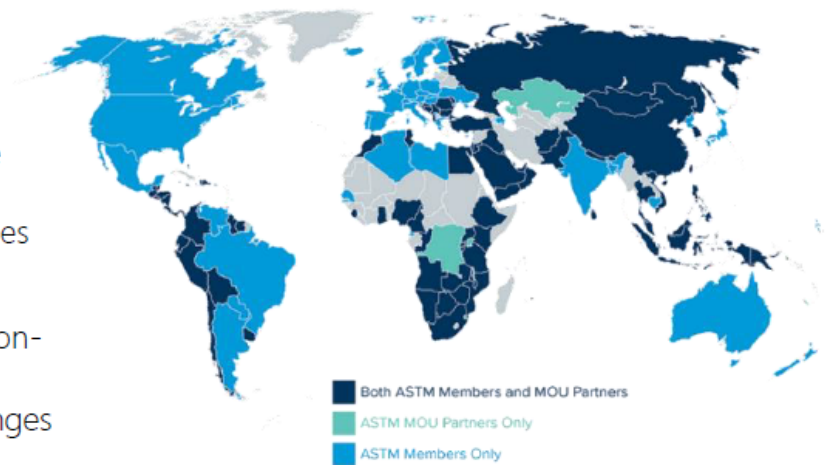
- 8,000+ International Members from 135 countries
- 8,400+ ASTM standards used in 83 countries



A highly agile, independent, non-governmental, non-profit, member-led standards body

- uniquely positioned to help society solve challenges and seize opportunities

## Globally recognized for quality and relevance



# Smart textiles and PPE: update

- **ASTM D13.50** on Smart Textiles
  - Next meeting at ASTM June Committee week in Seattle, WA on Monday, June 13th from 10:30am-1:30PM
  - The subcommittee is looking to update/revise their scope so not to overlap with AATCC RA111
  - **D8248** Standard Terminology for Smart Textiles
  - **WK61479** Standard Test Method for Durability of Smart Garment Textile Electrodes Exposed to Perspiration
  - **WK61480** Standard Test Method for Durability of Smart Garment Textile Electrodes after Laundering
- **AATCC RA111** Electronically Integrated Textiles Formed 2016. Scope: To develop methods and terminology for the testing of electronically integrated textiles.
- **ASTM F15** F3463 Standard Guide for Ensuring the Safety of Connected Consumer Products
- **ASTM F48** on Exoskeletons and relevant CoE
  - Exo Technology CoE expects to have an RFP out later this year for Research to Standards (R2S) projects. One of the potential areas for a R2S project is the interface between exoskeletons and PPE.
  - The CoE is in the planning stages of an international Exo workshop for 2023

# ASTM International

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## Contact Information

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# Question time

Does the market need standards for smart or innovative PPE?



# Conclusions

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**Henk VANHOUTTE**  
Chair PPE SF

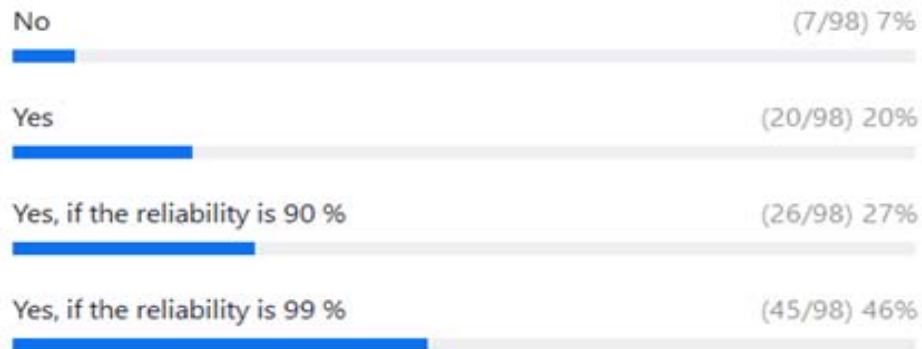
# Results of polls

## Q1.

Poll ended | 1 question | 98 of 151 (64%) participated

1. Q1. Should AI be allowed to determine protective action of smart PPE (e.g. amount of cooling necessary to keep the user healthy in a hot environment)? (Single Choice) \*

98/98 (100%) answered

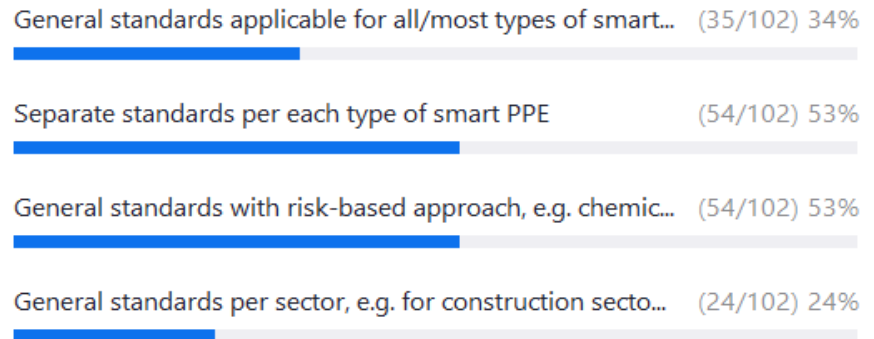


## Q2.

6:16 | 1 question | 102 of 150 (68%) participated

1. Q2. Do we need standards for smart PPE for specific risks? (Multiple Choice) \*

102/102 (100%) answered



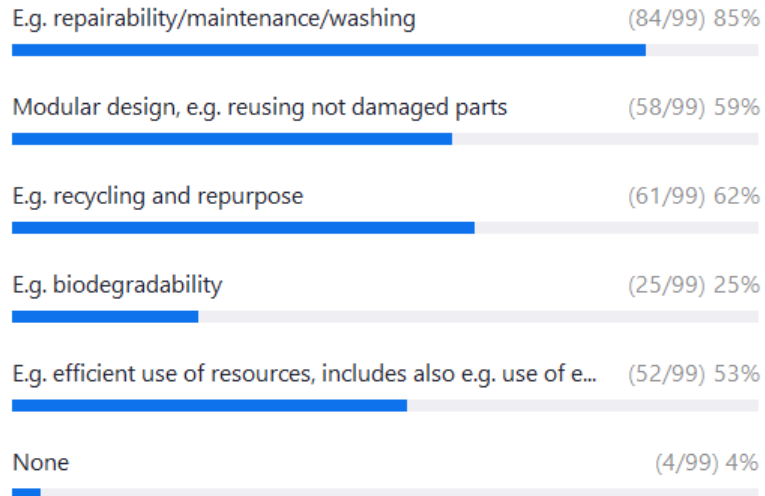
# Results of polls

## Q3.

Poll ended | 1 question | 99 of 152 (65%) participated

1. Q3. What aspects of sustainability shall standardization of smart PPE take into account, while ensuring the protection level of the PPE? (Multiple Choice) \*

99/99 (100%) answered

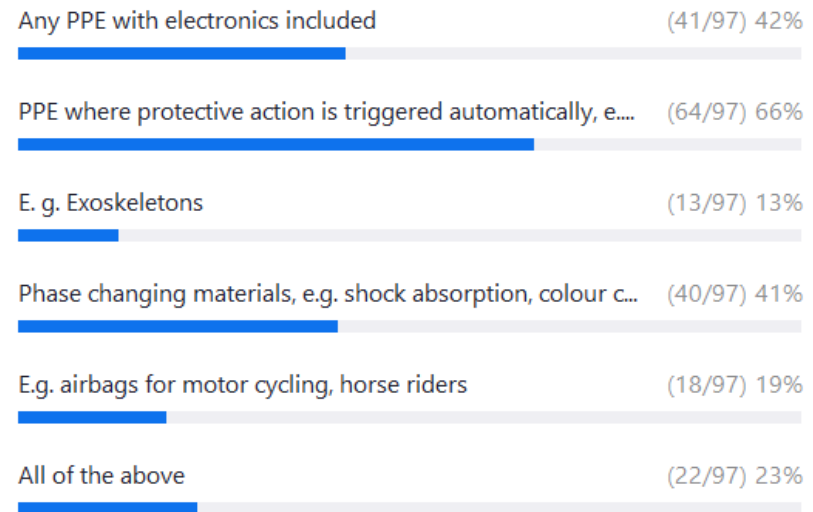


## Q4

Poll ended | 1 question | 97 of 140 (69%) participated

1. Q4. What do you consider as smart PPE? (Multiple Choice) \*

97/97 (100%) answered



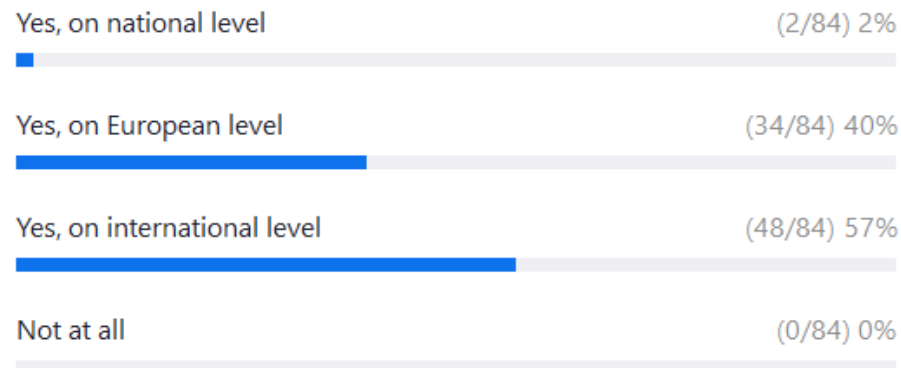
# Results of polls

## Q5.

Poll ended | 1 question | 84 of 139 (60%) participated

1. Q5. Does the market need standards for smart or innovative PPE?  
And what would be the most successful? (Single Choice) \*

84/84 (100%) answered





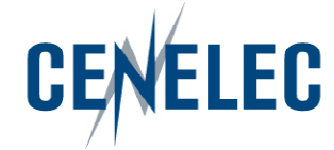
# Summary of the day

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- Over 160 participants from different stakeholders
- Poll results (see earlier slides)
- The workshop shows the interest in and need for standardization of smart PPE.
- to be continued for sure

## **Next workshop of the PPE sector forum (together with health sector):**

[CEN and CENELEC workshop on Personal Protective Equipment \(PPE\) – Medical Devices \(MD\) dual use products](#) – save the date: 5<sup>th</sup> October 2022



European Standardization Organizations

# Thank you!

Next webinars

2022-06-08/09 - [Putting Science Into Standards workshop](#) #Standards4AI

2022-06-30 - [Webinar 'The potential of European Standards to support the European strategy towards a Green and Sustainable Environment'](#)