

CARE CONCEPT OF THE FIREFIGHTER'S PPE

Description of the Challenge

The CARE Cycle

Codex Technologies' Care Concept

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History

Sir Percivall Pott, chimney sweeps and cancer

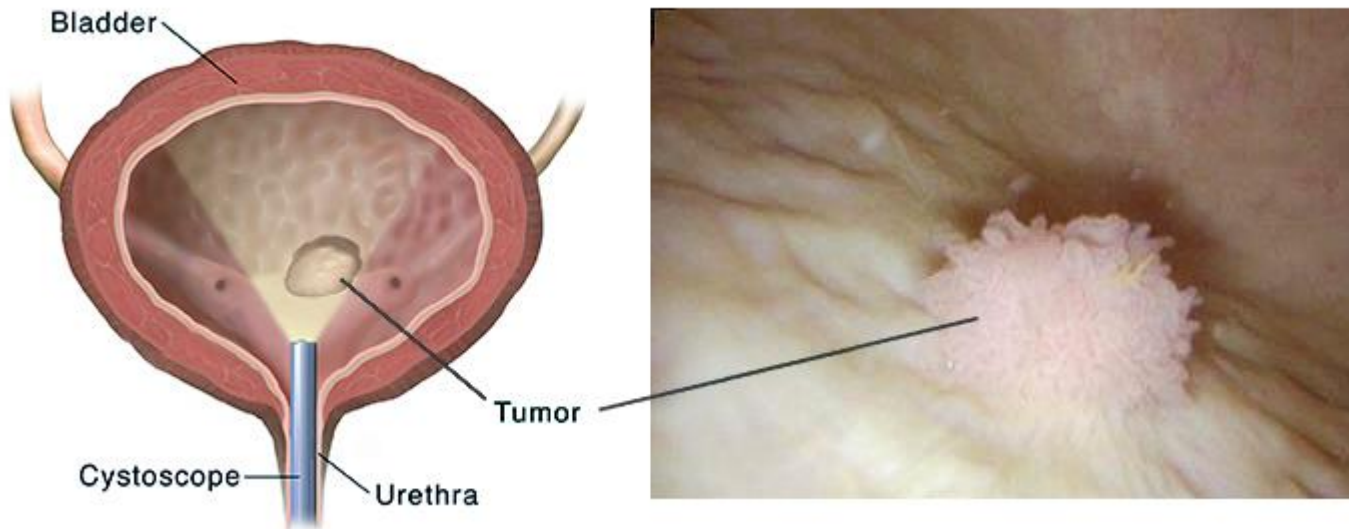
- Over 200 years ago, doctor and writer Sir Percivall Pott (1714-1788) made the connection between **soot and scrotal cancer**, known then as the chimney sweep's cancer
- Chimney Sweep's Carcinoma, also known as soot wart, was the first occupational cancer to be described



Exposure of Firefighters

Risk of cancer

- Publication of the International Agency for Research on Cancer (IARC) in 2022
- **Occupational exposure of a firefighter defined as carcinogenic to humans**



Occupational exposure as a firefighter is *carcinogenic to humans* (Group 1) on the basis of *sufficient evidence for cancer in humans*



The *IARC Monographs* classification indicates the level of certainty that an agent can cause cancer (*hazard identification*)

Higher level of certainty Lower level of certainty



Cancer types with *sufficient evidence* for cancer in humans:



Mesothelioma Bladder cancer

Cancer types with *limited evidence* for cancer in humans:



Colon cancer Prostate cancer Testicular cancer Melanoma of the skin Non-Hodgkin lymphoma

Prevention of Exposure

Reasons for PPE maintenance

• LEGAL FRAMEWORK

- Directive 2004/37/EC – carcinogens or mutagens at work Article 10 Hygiene and individual protection
- ISO 23616 Cleaning, inspection and repair of firefighters' personal protective equipment (PPE)
- CEN/TR 14560:2018
- Local legislation on Health&Safety (general and firefighting)

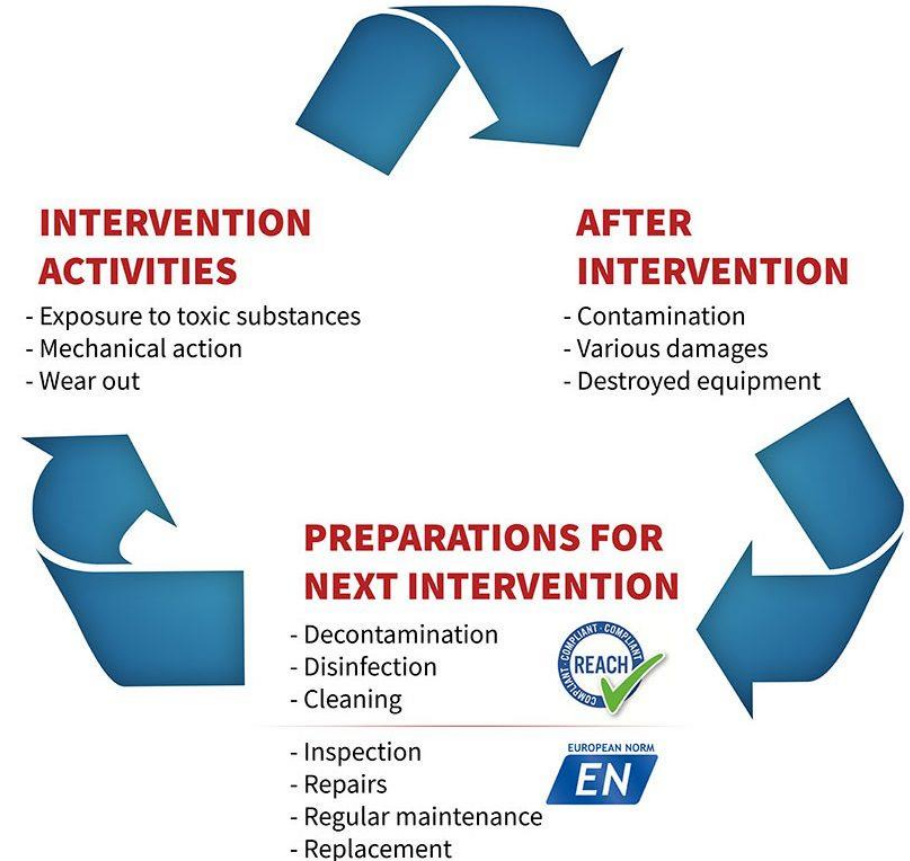
• MANUFACTURERS INSTRUCTIONS

- Clean and inspect for any damage after every use.
- Damaged PPE must be repaired before use.

• PROTECTION

- Any damage reduces the protective effect of PPE.

• HEALTH ASPECT



Collaboration



Collaboration of all stakeholders

- End users - firefighters
- Responsible persons in the firefighting organization
- Manufacturers of cleaning equipment and cleaning technology
- Manufacturers of cleaning agents
- Manufacturers of protective equipment
- Manufacturers of component parts of protective equipment
- Cooperation with relevant institutions responsible for supervising the implementation of measures in the field of H&S for firefighters.

Exposure of Firefighters

Direct vs. Indirect contamination

Direct contamination

- Direct contact with the source of contamination

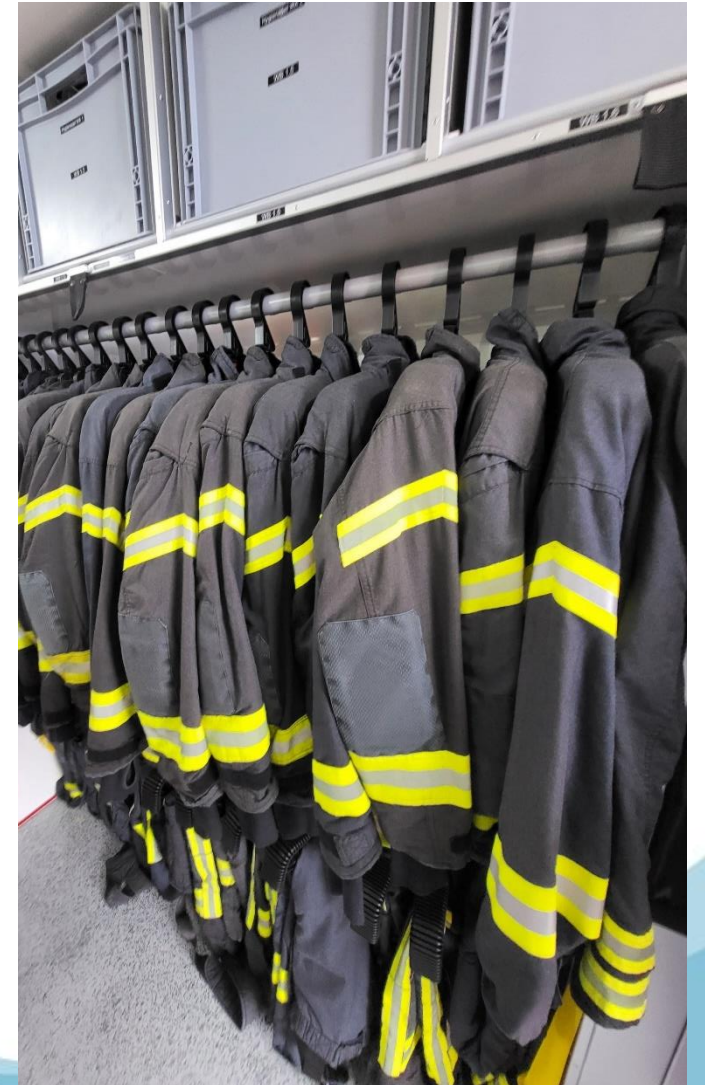
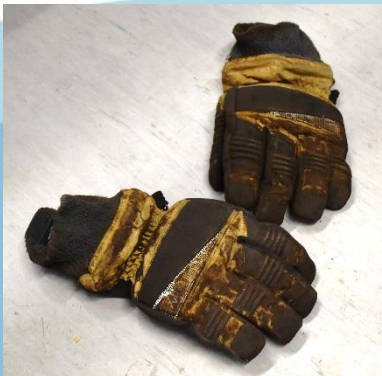
Indirect contamination

- A contaminated person or object makes contact with an uncontaminated person or object



Additional CARE challenge

- We deal exclusively with used equipment (new equipment is usually not cleaned, except during material testing)
- The complexity of individual pieces of equipment (many standards)
- Many different materials combined in one product



CLEANING METHODS

Decontamination with LCO₂

Wet washing (incl. disinfection and decontamination)

Reimpregnation

Decontamination in PPE washer

Decontamination efficiency

Codex Technologies cleaning technology



Step 1:
Pre-washing with detergents and water



Step 2:
LCO₂ extraction technology, due to its properties, penetrates through all pores and layers. Residue after 40/60 °C wet washing.

Decontamination efficiency

Proof of Decontamination efficiency

- Proving the decontamination efficiency with laboratory tests

Sample data:
 Order code: LCO2 Decontaminated membrane
 Sample description: LCO2 Decontaminated membrane
 Time of sampling: /
 Delivery Details: Sample meets acceptance criteria
 Sample acquisition date: 28.01.2022
 Report date: 21.02.2022

Laboratory identification number: Lab.No.: 2022 - 0132

Analysis:

MESUREMENTS:

Parameter	unit	result	method	start / end analysis
PAH-polycyclic aromatic hydrocarbons; sum of 16 PAH	mg/kg d.m.	8,17 #	calculation	28.01.2022 21.02.2022
Benzo(a)pyrene	mg/kg d.m.	0,31	SIST EN 15527:2009	28.01.2022 21.02.2022
Benzo(b)fluoranthene	mg/kg d.m.	0,47	SIST EN 15527:2009	28.01.2022 21.02.2022
Benzo(g,h,i)perylene	mg/kg d.m.	0,41	SIST EN 15527:2009	28.01.2022 21.02.2022
Benzo(k)floranten	mg/kg d.m.	<0,35	SIST EN 15527:2009	28.01.2022 21.02.2022
Fluoranten	mg/kg d.m.	0,74	SIST EN 15527:2009	28.01.2022 21.02.2022
Indeo(1,2,3,c,d)piran	mg/kg d.m.	0,37	SIST EN 15527:2009	28.01.2022 21.02.2022
Naftalen	mg/kg d.m.	0,86	SIST EN 15527:2009	28.01.2022 21.02.2022
PAO- Dibenzo(a,h)antracene	mg/kg d.m.	<0,35	SIST EN 15527:2009	28.01.2022 21.02.2022
PAH-Fluorene	mg/kg d.m.	<0,35	SIST EN 15527:2009	28.01.2022 21.02.2022
PAH-Acenaphthene	mg/kg d.m.	<0,35	SIST EN 15527:2009	28.01.2022 21.02.2022
PAH-Acenaphthylene	mg/kg d.m.	1,22	SIST EN 15527:2009	28.01.2022 21.02.2022
PAH-Anthracene	mg/kg d.m.	0,48	SIST EN 15527:2009	28.01.2022 21.02.2022

RESULTS DES-infection CONTROLLER		KT4-6	
Testorganism :	<i>Enterococcus faecium</i>	Serialnumber :	195676
Process information			
Testdate	:	14-09-2020	
Machine	:	PPE	
Formula	:	03	
RESULTS FOR EACH STARTVALUE [cfu/cm ²]			
10 ³	10 ⁴	10 ⁵	10 ⁶
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
DEGREE OF REDUCTION:		10 ⁶	
Remarks:			

LCO₂ and wet washing

It is important to estimate when LCO₂ decontamination, wet washing and reimpregnation are required due to safety and health requirements.



Impregnation

Waterproof is not the same as water repellent

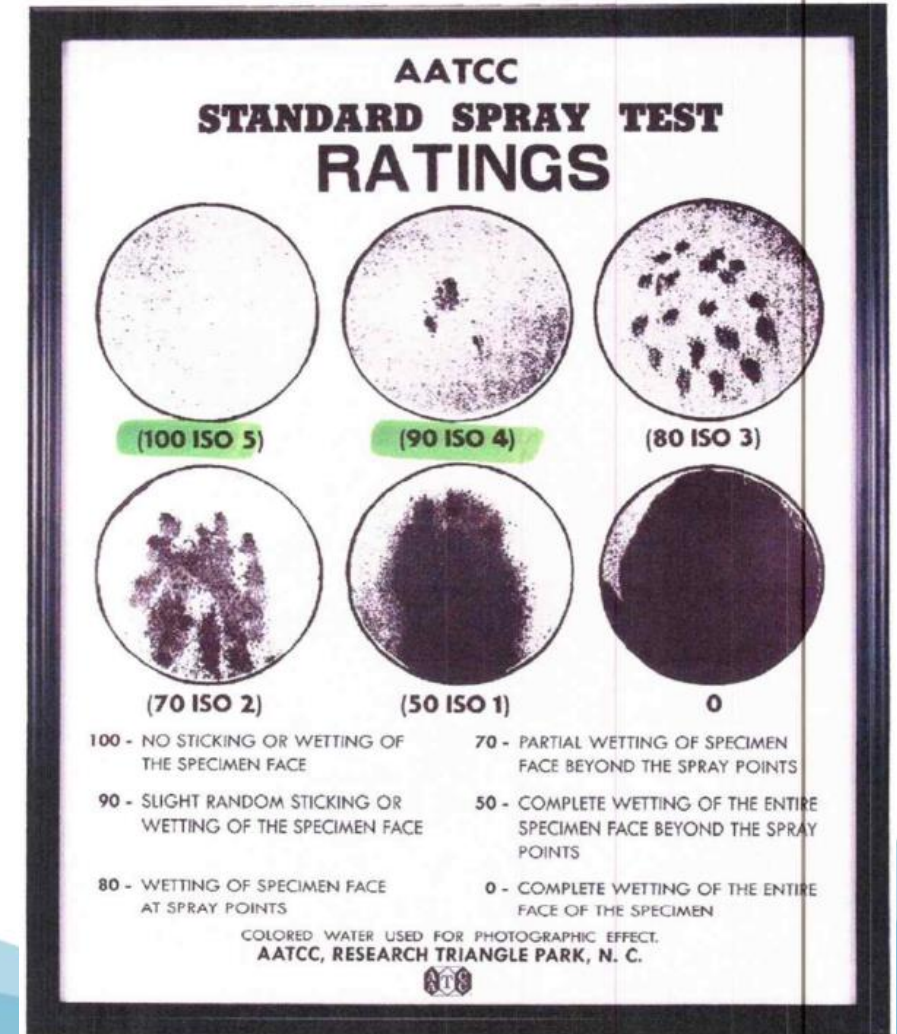
- Impregnation provides protection against water, oils/fats and chemicals
- The impregnation can be damaged due to various factors or rinses

6.2.2 Resistance to Penetration test by liquid chemicals

Three specimens in the machine direction and three in the cross direction of the component assembly or garment assembly shall be tested in accordance with EN ISO 6530 after pre-treatment as in accordance with 5.3 using a chemical application time of 10 s using the following liquid chemicals.

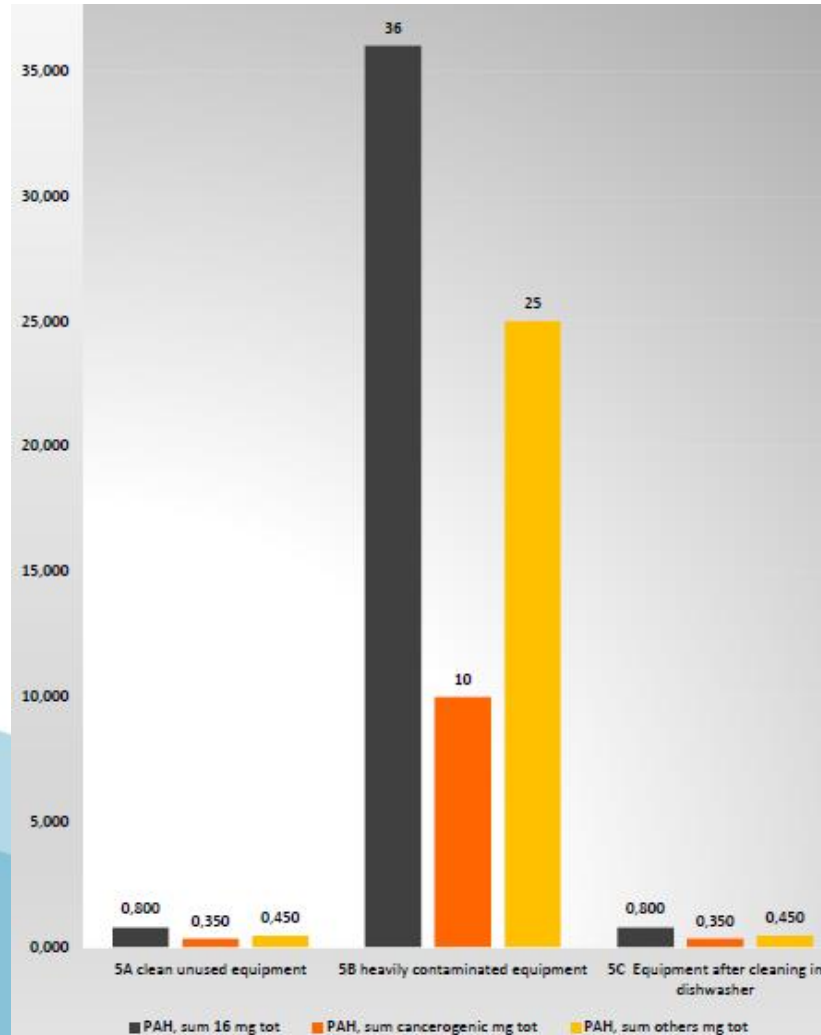
Table 4 — Chemical penetration testing

Chemical	Mass (%)	Temperature of chemical ± 2 °C
H ₂ SO ₄	30	20
C ₈ H ₁₀ (o-xylene)	100	20



PPE Washer

Decontamination of helmets and RPD sets



Report: Analysis of substances which are harmful to health and carcinogens (PAH) on sooty breathing apparatus before and after pre-treatment and washing in a PPE washer

REPORT ALS:
T 1822525. I.L 2.
Dat. 2018-10-03

Inspection of PPE

- Routine and advanced inspection of the PPE is essential to ensure the expected level of protection
- **Any damage to the PPE reduces its reliability**
- PPE must be inspected after each/before any further use
- The inspection can be carried out by the PPE manufacturer or by a qualified and authorized person or organization
- It is important to understand the equipment as a whole and all its components
- A planned action plan based on the results of the inspection

Inspection of PPE

- Damaged PPE may endanger the safety of the user
- Physical injuries such as cuts, burns, etc.



Repairs

- Authorized repair service of several major producers of firefighting protective equipment
- Use of the original materials supplied by producers, as required by producers and EN standards



Thank you for your attention!



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