OPCW PROTECTIVE CLOTHING LEVELS (PCL)

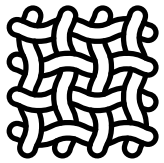
PCL 2-3: **Respiratory** hazard only. **Air-purifying respirator** and reusable clothing (e.g. lab coat). PCL 3 requires a **supplied-air respirator**.

PCL 4-5: Respiratory and **skin** hazards. Air-purifying respirator, **air-permeable chemical protective suit**, and rubber and nitrile **gloves**. PCL 5 requires a supplied-air respirator.

PCL 6-7: Respiratory and **liquid/splash** hazards. Air-purifying respirator, **chemical-resistant and impermeable suit**, and rubber and nitrile gloves. PCL 7 requires a supplied-air respirator.

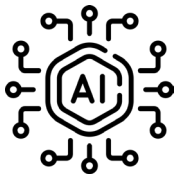
PCL 8: Respiratory and **gross liquid** hazards. A fully encapsulated **gas-tight suit**, **self-contained breathing apparatus**, and rubber and nitrile gloves.

PPE OF TOMORROW

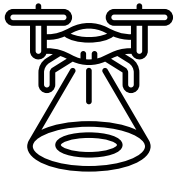


Nanofibres and **metal-organic frameworks** may be used in new PPE as they can **enhance filtration** of hazardous materials.

New materials are also more **lightweight** and **durable**, and possess self-cleaning properties.



Smart materials can contribute to creating highly **personalised safety solutions**, such as monitoring physiological indicators.



Drones, equipped with cameras and sensors, could provide **real-time monitoring** of industry sites and contaminated areas.

For more information:

Peter Hotchkiss | Science Policy Adviser |
peter.hotchkiss@opcw.org

Sarah Clapham | Science Policy Officer |
sarah.clapham@opcw.org

Science for Diplomats

Personal Protective Equipment

OPCW
Organisation for the Prohibition of Chemical Weapons

HISTORY OF PPE

In the 16th and 17th centuries, plague doctors wore a beaked mask with vinegar- or aroma oil-soaked sponges to block foul smells. Leather gloves and a long overcoat protected the skin, while a rod allowed them to examine patients without touching them.

On 22 April 1915, during the Second Battle of Ypres, the first large-scale chlorine gas attack took place. Soon after, chemically enhanced respirators were introduced, using reactive compounds to neutralise the toxic gases.

In late 1915 to early 1916, activated carbon was first used in air-purifying respirators to trap toxic gases.

HOW DO PROTECTIVE SUITS WORK?

Activated carbon is an important part of air-permeable chemical protection because it traps harmful chemicals. However, it offers only **limited protection against liquid hazards**.

For liquid hazards, a **fully encapsulated gas-tight suit** is required. This suit **blocks all toxic chemicals** (vapours, gases, and liquids). Because it also prevents air from passing through, a self-contained breathing apparatus (or an external air supply) is required. While highly **effective**, gas-tight suits are **heavy and cumbersome**, causing significant heat stress and physical strain.

Gas-tight suit:

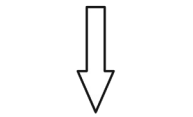
Respirator with self-contained breathing apparatus

Butyl rubber (and nitrile) gloves

Rubber boots

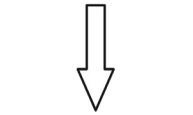
HOW DOES A GAS MASK FILTER WORK?

Ambient air

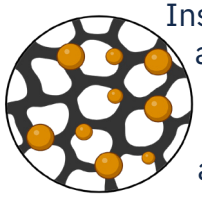


Particulate filtration: traps tiny particles like dust, smoke, and biological agents (e.g. anthrax).

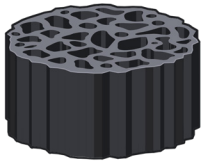
Adsorption: activated carbon layer adsorbs chemical vapours and gases.



Filtered air



Instead of soaking into the activated carbon like a sponge (**ab**sorption), the chemicals are attracted to and stick to activated carbon's surface. This process is called **ad**sorption.



Fun fact: Due to its high porosity, 1g of activated carbon has a surface area equal to more than 15 tennis courts!