

**Ansell**



## MANAGING CBRN THREATS



# INTRODUCTION



“ CBRN are weaponised or non-weaponised materials that, if released, may pose significant threats and cause great harm. ”

A potential CBRN (Chemical, biological, radiological, nuclear) incident is a constantly evolving threat – regardless if it's in an accident or a deliberate attack. Possessing the knowledge, capability, preparedness, and training to overcome these challenges is key to managing any CBRN threat. For military and civil defence units such as armed or special forces, national home guard organisations, coast guards and CBRN defence units around the world, their survival depends on it. They are the chosen few who are tasked with handling these kinds of incidents and substances – as first, second or third responders – and they must be properly protected.<sup>1</sup>

## HOW YOU COULD BE EXPOSED TO CBRN THREATS

CBRN are weaponised or non-weaponised materials that, if released, may pose significant threats and cause great harm. CBRN warfare agents were originally developed for use in war but the risk of such agents and other hazardous materials being used in an act of terrorism is a very real threat we face today.

**A chemical attack is the spreading of toxic chemicals with the intent to cause harm. A wide variety of harmful chemicals could be made, stolen or otherwise acquired for use in an attack, and they include:**

- Chemical weapons or chemical warfare agents (CWAs) developed for military use that have no other purpose other than to harm humans (e.g., Sarin)
- Other CWAs and chemical toxins of biological origin that could contaminate through skin contact (e.g., Sulphur mustard) or inhalation (e.g., Vx)
- Toxic industrial chemicals (TICs) and commercial chemicals that can be extremely hazardous but do have important industrial uses (e.g., Acrolein, dimethyl sulphate)
- TICs that consist of chemical hazards (e.g., Carcinogens, reproductive hazards, corrosives, or agents that affect the lungs or blood) and physical hazards (e.g., Flammable, combustible, explosive or reactive)<sup>2</sup>

1. Centre for the Protection of National Infrastructure <https://www.cpni.gov.uk/chemical-biological-radiological-and-nuclear-cbrn-threats>

2. National Library of Medicine. Chemical, Biological, Radiological and Nuclear (CBRN) Casualty Management Principles, Conflict and Catastrophe Medicine. 2013 Jul 18 : 747–770. Published Online, Jul 18.

# SETTING STANDARDS THROUGH RIGOROUS TESTING

The American National Fire Protection Association (NFPA) has established more detailed standards on chemical protective clothing (CPC) for hazmat teams, first responders and other emergency rescue teams. Because of its intended areas of use, these standards are typically more demanding than the European CEN standards for chemical protective clothing.

As an example, the NFPA 1991 standard, now incorporated into NFPA 1990 standard, specifies the requirements for vapour protective ensembles intended to offer the highest level of chemical protection. These ensembles must be designed to protect emergency response personnel during hazardous exposure situations and CBRN terrorism incidents involving specific chemicals in a vapour or liquid splash environment. These requirements also correspond to EPA/OSHA (Environmental Protection Agency/ Occupational Safety and Health Administration) level A in the USA. The European EN (European Norm) standards on the other hand, do not include any criteria for CBRN protection.

**Some key NFPA 1991 requirements include:**

- Highest MIST (Man-in-Simulant Tests) protection factor requirement
- Permeation barrier testing conducted at 32°C and after the sample is flexed and abraded
- Testing of garment components and seams to a broad range of chemicals, including TICs and CWAs with concentrations of ≥95% for 1-hour
- Optional criteria for liquefied gas permeation testing and chemical flash fire exposure testing (Pyroman™)

**This makes the NFPA 1991 standard the most demanding standard for chemical protective clothing in the world.**



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**vapour protective ensembles intended to offer the highest level of chemical protection.**



# CHEMICALLY TESTED



Products in this category undergo permeation tests against warfare agents by e.g. a reputable European third-party testing institute and according to the FINABEL O.7.C test method.

This is considered by many industry experts to be the best method for permeation testing against warfare agents.

FINABEL O.7.C is a separate method developed for high hazard materials. This method uses a 50 µL aliquot of the agent added to the fabric and uses a pinpoint detection system, meaning the moment any chemical is detected, the test is ended, and this is the failure point. This test must be conducted across a 24-hour period.

As for the American NFPA 1991 standard, a 1-hour test against warfare agents Sulphur Mustard and Soman will be required. Additional tests according to an ASTM F739 (American Society for Testing and Materials) based test method will also be required to assess its cumulative permeation. Cumulative permeation must not exceed 1.25 µg/cm<sup>2</sup> over the course of the hour for Soman and 4 µg/cm<sup>2</sup> for Sulphur Mustard.

CWA	EFFECT	CONTAMINATES	ROUTES TO EXPOSURE
<b>Sulphur Mustard (HD)</b> CAS# 505-60-2	Incapacitating (skin damaging), Lethal	Ground	Skin contact
<b>Lewisite (L)</b> CAS# 541-25-3	Incapacitating (skin damaging), eyes and respiratory tract, Lethal	Ground	Skin contact
<b>Tear gas (CN, CS etc.)</b>	Incapacitating (eye irritating)	Air	Eye contact
<b>Sarin (GB)</b> CAS# 107-44-8	Lethal	Air	Inhaling
<b>Soman (GD)</b> CAS# 96-64-0	Lethal	Ground and Air	Skin or inhaling
<b>Tabun (GA)</b> CAS# 77-81-6	Lethal	Ground	Skin or inhaling
<b>VX</b> CAS# 50782-69-9	Lethal	Ground	Skin or inhaling

# BIOLOGICALLY TESTED

**Biological warfare or terrorism agents are defined as any pathogen (Bacterium, virus or other disease-causing agent) or biotoxin (poisonous substance produced by a living organism) that can be used in an attack against humans, plants, or animals to cause illness, death, fear, societal and economic disruption.**

**Examples of biological warfare agents are:**

- Bacillus anthracis (bacteria)
- Ebola virus (virus)
- Yersinia pestis (bacteria)
- Botulinum toxins produced by Clostridium Botulinum (bacteria)

In the EU, chemical protective suits should be tested against bloodborne or biological infective agents according to the EN 14126 standard.

In the American NFPA standard, biological protection qualities are carried from the extensive chemical testing in accordance with NFPA 1991 and 1994 classes 1 and 2, which define chemical barrier materials that are also efficient against biological agents. **It is widely accepted that gastight suits certified to NFPA 1991 are the most recommended protective clothing during a CBRN emergency.**

# RADIOACTIVE AND NUCLEAR TESTED

Radioactive materials are used every day in laboratories, medical centres, food irradiation plants, and for various industrial uses. **If stolen or otherwise acquired, many of these materials could be used in a “radiological dispersal device” (RDD). One type of RDD is the “dirty bomb”, which uses a conventional explosion to disperse radioactive material over a targeted area.**

**Chemical protective suits that provide protection against radioactive particulate contamination (e.g., Contaminated dust) can be certified to the European EN 1073-1 or -2 standard for protective clothing against radioactive particles contamination.** The EN 1073-2 standard was developed with the nuclear industry in mind, but does not provide any criteria for protection against ionising radiation (e.g., Gamma rays and X-rays). Also, particulate protection can be carried from extensive chemical testing in accordance with NFPA 1991 and 1994 classes 1-3, which define chemical barrier materials that will be efficient against radioactive particulate contamination.



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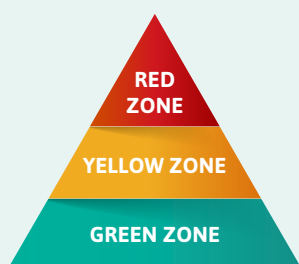
# IT'S ALL ABOUT THE DIFFERENT LEVELS OF PROTECTION

The levels of protection needed against various CBRN agents vary depending on the type of exposure. First responders and others in direct contact will need the highest form of protection due to the concentration and nature of the contact. In most cases, only fully certified Type 1/Level A suits should be considered.

Those giving medical attention or those decontaminating people or materials that have been in direct contact with CBRN agents will be in the next category. In this scenario, a lower form of protection but a high-performance barrier along with respiratory protection will be needed as direct contact is less likely and the amount of exposure will be less, but contact is still possible.

The third group will be those in the zone just around or outside of these two groups. Direct contact is not expected and extremely unlikely. This means that a lower protection level is sufficient but there remains a need to protect against accidental exposure.

## CBRN Personal Protective Equipment Selection Matrix for Emergency Responders<sup>3</sup>



**RED ZONE:** Areas where significant contamination with chemical, biological, radiological, or nuclear (CBRN) agents have been confirmed or is strongly suspected but area has not been characterised. The area is presumed to be life threatening from both skin contact and inhalation.

**YELLOW ZONE:** Areas where contamination with chemical, biological, radiological, or nuclear (CBRN) agents is possible but active release has ended and initial monitoring exists.

**GREEN ZONE:** Areas where contamination with chemical, biological, radiological, or nuclear (CBRN) agents is unlikely. This zone covers the area beyond the expected significant dispersal range of the initial event and secondary contamination range caused by traffic and emergency responders.

3. OSHA/NIOSH Interim Guidance (April 2005) <https://www.osha.gov/emergency-preparedness/cbrn-matrix>

## CONSULT A SPECIALIST TO GET THE BEST RECOMMENDATIONS

In conclusion, making an informed decision on your Personal Protective Equipment (PPE) selection will undoubtedly require extensive research and a deeper understanding of the risks in managing CBRN threats.

Speak to our safety experts to discover the different types of materials and equipment designed to protect in the event of a CBRN incident.



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