

## Draft agenda points and questions – meeting with PPE companies (protective clothing)

### Introduction

PPE can include items such as safety helmets, gloves, eye protection, hazmat suits, high-visibility clothing, safety footwear, safety harnesses, ear plugs, ear defenders and respiratory protective equipment (RPE). This document focuses on protective clothing.

## Agenda point 1 - Critical properties (performance) for protective clothing

### Questions

1. Please describe quantitatively critical properties (performance) for protective clothing, see table 1, in the form of comparable measurements / studies between performance for fluorochemistry and alternative non fluorochemistry?
2. Are these data available to us?

### Answer

As regards chemical, biological, radiological and nuclear (CBRN) protection equipment procured by French Ministry of Defence (FR MoD), minimum rating level of oil repellence is defined in accordance with standard NF EN ISO 14419, while minimum rating level of water repellence is defined in accordance with Bundesmann method (NF EN 39865). Indeed, technical challenges stem from the goal to reach the rating level both for oil and water repellence at the same time. CBRN protection equipment designed for FR MoD have to meet minimum standards defined by the North Atlantic Treaty Organization (NATO) AEP 38 document.

An additional list of standards to comply with for military textiles at large procured by FR MoD can be found below in new Table 1 lines. The standards are not limited to CBRN protection and are required depending on the use conditions of the equipment.

## Agenda point 2 – Standards for protective clothing need for PFAS

### Questions and remarks

3. Are there comparable quantitative test results between fluorochemistry and non-fluorochemistry available to us performed with the test standards listed in table 1 (*or others, please specify*)?
4. Please indicate which quantitative measurement results/limits are acceptable for your markets for the test methods listed in table 1 below (*or others, please specify*).

Table 1: Critical properties (performance) vs Standards for protective clothing (CEN/TC 162)

| Critical properties (performance)                                    | Standards for protective clothing (CEN/TC 162)                                                                                                      |
|----------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| Electrostatics                                                       | EN 1149 series <sup>1</sup>                                                                                                                         |
| Liquid chemicals                                                     | EN 13034:2005+A1:2009 <sup>2</sup><br>EN 14605:2005+A1:2009 <sup>3</sup><br>EN 16523-1:2015+A1:2018 <sup>4</sup>                                    |
| Protection against chemicals                                         | EN ISO 17491-3, -4:2008 <sup>5</sup><br>EN ISO 17491-4:2008 <sup>6</sup><br>EN ISO 19918:2017/A1:2021 <sup>7</sup><br>EN ISO 6530:2005 <sup>8</sup> |
| Liquid and gaseous chemicals, including aerosols and solid particles | EN 464:1994 <sup>9</sup>                                                                                                                            |
| Against rain                                                         | EN 343:2019 <sup>10</sup>                                                                                                                           |
| Splashes of molten metal                                             | EN 348:1992 <sup>11</sup>                                                                                                                           |
| For firefighting activities                                          | EN 469:2020 <sup>12</sup>                                                                                                                           |
| High visibility                                                      | EN ISO 20471:2013 <sup>13</sup>                                                                                                                     |
| Use, care and maintenance                                            | CEN/TR 14560:2018 <sup>14</sup><br>CEN/TR 15419:2017 <sup>15</sup>                                                                                  |

<sup>1</sup> EN 1149 series, <https://standards.cen.eu/dyn/www/f?p=204:105:0:::>

<sup>2</sup> EN 13034:2005+A1:2009, [https://standards.cen.eu/dyn/www/f?p=204:110:0:::FSP\\_PROJECT,FSP\\_ORG\\_ID:32982,6143&cs=1A0EC674842C38E0EA1FF3289F91BC76C](https://standards.cen.eu/dyn/www/f?p=204:110:0:::FSP_PROJECT,FSP_ORG_ID:32982,6143&cs=1A0EC674842C38E0EA1FF3289F91BC76C)

<sup>3</sup> EN 14605:2005+A1:2009, [https://standards.cen.eu/dyn/www/f?p=204:110:0:::FSP\\_PROJECT,FSP\\_ORG\\_ID:32983,6143&cs=1868F123B185CBECCA30C484231EB9233](https://standards.cen.eu/dyn/www/f?p=204:110:0:::FSP_PROJECT,FSP_ORG_ID:32983,6143&cs=1868F123B185CBECCA30C484231EB9233)

<sup>4</sup> EN 16523-1:2015+A1:2018  
[https://standards.cen.eu/dyn/www/f?p=204:110:0:::FSP\\_PROJECT,FSP\\_ORG\\_ID:67114,6143&cs=1753CA3DD9D58A4835043F014216B2C1A](https://standards.cen.eu/dyn/www/f?p=204:110:0:::FSP_PROJECT,FSP_ORG_ID:67114,6143&cs=1753CA3DD9D58A4835043F014216B2C1A)

<sup>5</sup> EN ISO 17491-3, -4:2008  
[https://standards.cen.eu/dyn/www/f?p=204:110:0:::FSP\\_PROJECT,FSP\\_ORG\\_ID:23098,6143&cs=12D3A8D6D32D899469296826BC259C835](https://standards.cen.eu/dyn/www/f?p=204:110:0:::FSP_PROJECT,FSP_ORG_ID:23098,6143&cs=12D3A8D6D32D899469296826BC259C835)

<sup>6</sup> EN ISO 17491-4:2008  
[https://standards.cen.eu/dyn/www/f?p=204:110:0:::FSP\\_PROJECT,FSP\\_ORG\\_ID:23099,6143&cs=10D51599070E9BD60C8715CAEBF4C7841](https://standards.cen.eu/dyn/www/f?p=204:110:0:::FSP_PROJECT,FSP_ORG_ID:23099,6143&cs=10D51599070E9BD60C8715CAEBF4C7841)

<sup>7</sup> EN ISO 19918:2017/A1:2021  
[https://standards.cen.eu/dyn/www/f?p=204:110:0:::FSP\\_PROJECT,FSP\\_ORG\\_ID:70836,6143&cs=1F09ABC9AAD96F9554D60B9F78952CF49](https://standards.cen.eu/dyn/www/f?p=204:110:0:::FSP_PROJECT,FSP_ORG_ID:70836,6143&cs=1F09ABC9AAD96F9554D60B9F78952CF49)

<sup>8</sup> EN ISO 6530:2005  
[https://standards.cen.eu/dyn/www/f?p=204:110:0:::FSP\\_PROJECT,FSP\\_ORG\\_ID:6778,6143&cs=10DC0A31382F43CA906841B78380B3F27](https://standards.cen.eu/dyn/www/f?p=204:110:0:::FSP_PROJECT,FSP_ORG_ID:6778,6143&cs=10DC0A31382F43CA906841B78380B3F27)

<sup>9</sup> EN 464:1994, [https://standards.cen.eu/dyn/www/f?p=204:110:0:::FSP\\_PROJECT,FSP\\_ORG\\_ID:6659,6143&cs=165B04976C33240ACD0DD3E668DD67408](https://standards.cen.eu/dyn/www/f?p=204:110:0:::FSP_PROJECT,FSP_ORG_ID:6659,6143&cs=165B04976C33240ACD0DD3E668DD67408)

<sup>10</sup> EN 343:2019, [https://standards.cen.eu/dyn/www/f?p=204:110:0:::FSP\\_PROJECT,FSP\\_ORG\\_ID:63371,6143&cs=1B18C11D02C518D1B6A214EAC88838727](https://standards.cen.eu/dyn/www/f?p=204:110:0:::FSP_PROJECT,FSP_ORG_ID:63371,6143&cs=1B18C11D02C518D1B6A214EAC88838727)

<sup>11</sup> EN 348:1992  
[https://standards.cen.eu/dyn/www/f?p=204:110:0:::FSP\\_PROJECT,FSP\\_ORG\\_ID:6616,6143&cs=147CE63961DE2AC855BCE710EC70E8A6D](https://standards.cen.eu/dyn/www/f?p=204:110:0:::FSP_PROJECT,FSP_ORG_ID:6616,6143&cs=147CE63961DE2AC855BCE710EC70E8A6D)

<sup>12</sup> EN 469:2020, [https://standards.cen.eu/dyn/www/f?p=204:110:0:::FSP\\_PROJECT,FSP\\_ORG\\_ID:63013,6143&cs=1468ACE394F638F27BB45A2E03DFBDEC2](https://standards.cen.eu/dyn/www/f?p=204:110:0:::FSP_PROJECT,FSP_ORG_ID:63013,6143&cs=1468ACE394F638F27BB45A2E03DFBDEC2)

<sup>13</sup> EN ISO 20471:2013 [https://standards.cen.eu/dyn/www/f?p=204:110:0:::FSP\\_PROJECT,FSP\\_ORG\\_ID:30182,6143&cs=1ECA362937B4D0E8B641C9F80D8E88876](https://standards.cen.eu/dyn/www/f?p=204:110:0:::FSP_PROJECT,FSP_ORG_ID:30182,6143&cs=1ECA362937B4D0E8B641C9F80D8E88876)

<sup>14</sup> CEN/TR 14560:2018  
[https://standards.cen.eu/dyn/www/f?p=204:110:0:::FSP\\_PROJECT,FSP\\_ORG\\_ID:66982,6143&cs=17067BF89BD9A0B10910D342106B34226](https://standards.cen.eu/dyn/www/f?p=204:110:0:::FSP_PROJECT,FSP_ORG_ID:66982,6143&cs=17067BF89BD9A0B10910D342106B34226)

<sup>15</sup> CEN/TR 15419:2017

| Critical properties (performance)                                                    | Standards for protective clothing (CEN/TC 162) |
|--------------------------------------------------------------------------------------|------------------------------------------------|
|                                                                                      | CEN/TR 17330:2019 <sup>16</sup>                |
| Others ?                                                                             |                                                |
| <b>Answer:</b>                                                                       |                                                |
| Oil repellence                                                                       | NF EN ISO 14419                                |
| Water repellence                                                                     | NF EN ISO 4920, NF EN 29865                    |
| Flame retardancy                                                                     | NF EN ISO 14116                                |
| Textiles – Behavior in fire and classification method based on the destroyed surface | NF G 07-184                                    |
| Safety against fire                                                                  | NF P 92-501, NF P 92-507                       |

## Agenda point 3 - Potential alternatives to PFAS

In the ongoing restriction work of PFAS in EU/EEA, a range of non-fluorinated alternatives to PFAS have been identified

- Hyperbranched functionalized polymers (dendric polyurethanes)
- Paraffins (hydrocarbons)
- Waxes (fatty acid esters)
- Silicones (polydimethylsiloxanes abbr. PDMS)
- Polymeric compounds such as non-fluorinated (meth)acrylates
- Plasma treatment
- Graphene structures
- Other?

### Questions

5. For these above listed non fluorinated alternatives (and possibly other) to fluorochemistry, what are the biggest specific challenges to phase in those non fluorinated alternatives that may be feasible for your applications?
6. Have you evaluated other fluorochemicals / materials as substitutes for the currently used fluorochemistry? If so, please specify this chemistry.

### Answers

5. Reaching the same level of performance for oil repellence is a major challenge. The alternatives must also preserve the original properties of the treated surface such as, for textiles, the colours, mechanical properties, breathability, or washability. The alternative treatment must be abrasion resistant, robust against environmental conditions (heat, cold, salt, etc.) and durable.

6. Others chemicals or materials have been reported in the literature, such as nanomaterials (silica nanoparticles, polymer whiskers). A promising approach consists in a combination of a chemical functionalisation and a physical texturation at the microscopic or nanoscopic level.

[https://standards.cen.eu/dyn/www/f?](https://standards.cen.eu/dyn/www/f?p=204:110:0:::FSP_PROJECT,FSP_ORG_ID:65002,6143&cs=18D38E936501A138A7C0EB6CFFDB7E8FB)

[p=204:110:0:::FSP\\_PROJECT,FSP\\_ORG\\_ID:65002,6143&cs=18D38E936501A138A7C0EB6CFFDB7E8FB](https://standards.cen.eu/dyn/www/f?p=204:110:0:::FSP_PROJECT,FSP_ORG_ID:65002,6143&cs=18D38E936501A138A7C0EB6CFFDB7E8FB)

<sup>16</sup> CEN/TR 17330:2019

[https://standards.cen.eu/dyn/www/f?](https://standards.cen.eu/dyn/www/f?p=204:110:0:::FSP_PROJECT,FSP_ORG_ID:39246,6143&cs=1557EDC845AD3EF1A19867E8E23C7F2EA)

[p=204:110:0:::FSP\\_PROJECT,FSP\\_ORG\\_ID:39246,6143&cs=1557EDC845AD3EF1A19867E8E23C7F2EA](https://standards.cen.eu/dyn/www/f?p=204:110:0:::FSP_PROJECT,FSP_ORG_ID:39246,6143&cs=1557EDC845AD3EF1A19867E8E23C7F2EA)

#### References :

- *Biologically Inspired Omniphobic Surfaces by Reverse Imprint Lithography*, René Hensel, Andreas Finn, Ralf Helbig, Hans-Georg Braun, Christoph Neinhuis, Wolf-Joachim Fischer, and Carsten Werner, *Advanced Materials*, 26: 2029-2033 (2014)
- *Rational design of perfluorocarbon-free oleophobic textiles*, Shabanian, S., Khatir, B., Nisar, A. et al., *Nature Sustainability* 3, 1059-1066 (2020)
- *Cotton fiber hot spot in situ growth of Stöber particles*, Zorko, M., Vasiljević, J., Tomšič, B. et al., *Cellulose* 22, 3597-3607 (2015)
- *Fabrics coated with lubricated nanostructures display robust omniphobicity*, Cicely Shillingford, Noah MacCallum, TakSing Wong, Philseok Kim, and Joanna Aizenberg, *Nanotechnology* 25 014019 (2014)

## Agenda point 4 – Quantities of PFAS in protective clothing

### Questions

7. What are the quantities of PFAS<sup>17</sup> used in protective clothing applications in the EEA?
8. Annex I of the PPE regulation<sup>18</sup> (EU 2016/425) divides PPEs into three risk categories. What share of the quantities of PFAS are used in the three risk categories, respectively?
9. Do you apply industrial re-impregnation of PFAS in your products? If so, what quantities of PFAS are used for industrial re-impregnation of your products?

## Agenda point 5 – Emissions and waste management

### Questions

10. What are the quantities of emissions of PFAS from reimpregnation of your products?
11. What measures can be taken to minimize the emissions from reimpregnation? What are the costs associated with these measures?
12. How are your PFAS containing protective clothing dealt with at end-of-life?
13. What are the quantities of emissions of PFAS from protective clothing in the waste phase?
14. What measures can be taken to minimize the emissions from the waste phase? What are the costs associated with these measures?

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<sup>17</sup> PFAS here defined as having the following structural formula: X-(CF<sub>2</sub>)<sub>n</sub>-X' with n equal to or larger than 1 and X, X' not being H (thus including X-CF<sub>3</sub>), meaning fluorinated substances that contain at least one aliphatic carbon atom that is both, saturated and fully fluorinated, i.e. any chemical with at least one perfluorinated methyl group (-CF<sub>3</sub>) or at least one perfluorinated methylene group (-CF<sub>2</sub>-), -, including branched fluoroalkyl groups and substances containing ether linkages, fluoropolymers and side chain fluorinated polymers.

<sup>18</sup> EU 2016/425, <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32016R0425>

### Suggested company contacts

|                                                    |
|----------------------------------------------------|
| <b>Invited PPE companies/associations</b>          |
| European Safety Federation                         |
| European Textile Service Association (ETSA)        |
| Elis                                               |
| Blåkläder                                          |
| Fristads                                           |
| Swedol                                             |
| Swedish Armed Forces Materiel Administration (FMV) |
| Tranemo textil                                     |