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AMENDMENT 1
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Protective clothing — Performance requirements for protective clothing worn by operators applying pesticides and for re-entry workers

AMENDMENT 1: Surrogate test chemical

Habillement de protection — Exigences de performance pour les vêtements de protection portés par les opérateurs appliquant des pesticides et pour les travailleurs de rentrée

AMENDEMENT 1: Produit chimique de substitution pour essai

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Foreword

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This document was prepared by Technical Committee ISO/TC 94, *Personal safety — Personal protective equipment*, Subcommittee SC 13, *Protective clothing*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Protective clothing — Performance requirements for protective clothing worn by operators applying pesticides and for re-entry workers

AMENDMENT 1: Surrogate test chemical

Introduction, seventh paragraph, fourth sentence

Replace

"The test chemical selected for testing is an emulsifiable concentrate that is representative of a worst case scenario for penetration and repellency."

with

"The test chemical selected for testing is a pesticide surrogate that is representative of a worst case scenario for penetration."

6.2

Delete footnote 1, and replace the text in the main paragraphs with the following:

"Materials for Level C1 and Level C2 protective clothing shall be tested in accordance with ISO 22608, Method A, using 0,2 ml of test chemical. Three specimens shall be tested for each material. The test chemical shall be diluted pesticide surrogate EC-DY, an emulsion of Disperse Yellow 26 in water. Water grade 3 (according to ISO 3696) or deionized water shall be used to prepare the diluted solution with 2,5 % EC-DY. See Annex C concerning selection of test chemical and Annex G for composition of the test chemical.

For materials for protective clothing classified as Level C1, the upper limit for percent penetration shall be 40 %. For materials classified as Level C2, the upper limit for percent penetration shall be 5 %.

In addition, materials for protective clothing shall be tested for resistance to penetration according to ISO 22608 Method B if one or more of the following requirements are met:

a) the test results for materials for protective clothing classified as Level C1 are greater than 40 % but less than 48 % (i.e. at least one specimen shows its result greater than 40 % and the three test specimens show their result lower than 48 %).

b) the test results for materials for protective clothing classified as Level C2 are greater than 5 % but less than 6 % (i.e. at least one specimen shows its result greater than 5 % and the three test specimens show their result lower than 6 %).If the specimens are tested with both methods A and B, the results obtained by Method B shall be used for determining penetration classification and reporting requirements.

NOTE 1 For Method A, a gravimetric method, the difference in the mass of the collector layer before and after testing is used to calculate the % penetration. Method A is used in the first instance because this is the simpler and less-expensive of the two test methods. However, in some cases the increase in mass of the collector layer is due to water and/or water vapour penetration. Therefore, for validation Method B is required as the chemical analysis required for Method B confirms the amount of the actual dye/active ingredient that has penetrated.

For materials for protective clothing classified as Level C1, the three specimens tested shall have maximum penetration of 40 %.

For materials for protective clothing classified as Level C2, the three specimens tested shall have maximum penetration of 5 %.

NOTE 2 ISO 22608 is an accelerated laboratory test that differentiates the penetration performance of materials and seams. The maximum allowable penetration of 40 % is derived from the data analysis of cotton and cotton/polyester protective clothing used for operator exposure studies. The 40 % penetration limit for Level C1 protective clothing is based on analysis of lab data as well as operator exposure study data. Studies conducted with the reference fabric for Level C1 had less than 5 % penetration through the garment in operator exposure studies. Therefore, it is not possible to substitute laboratory penetration data for field penetration data. For this reason, the laboratory test data are used only to classify materials and seams. It cannot be used as default protection factors for risk assessment. References [4] and [5] provide additional information on the analysis to establish the 40 % limit value for Level C1 and the 5 % limit value for Level C2."

6.4

Replace paragraphs prior to NOTE 1 with the following.

"For Level C3 protective clothing, three specimens shall be tested for cumulative permeation in accordance with ISO 19918. Use(s) claimed by the manufacturer and stated in accordance with Clause 10 c) shall be used as the basis for conducting the permeation test. See Annex C concerning selection of test chemical and Annex G for composition of the test chemical.

— For protection against diluted formulations, the test shall be conducted for 1 h using pesticide surrogate EC-DY (an emulsion of Disperse Yellow 26), diluted with water grade 3 (according to ISO 3696) or deionized water to 2,5 % EC-DY.

— For protection against concentrates for short duration, the test shall be conducted for 15 min using pesticide surrogate EC-DY (without dilution).

Additional testing may be required to determine cumulative permeation through material for specific pesticides. For additional testing, the procedure, test methods, and pass criteria shall be the same as that for EC-DY stated above. The test chemical shall be the specific pesticide formulation, either concentrated or diluted with water, in accordance with the pesticide product labelling.

Materials for protective clothing classified as Level C3 shall have a maximum cumulative permeation of 1 μg/cm^2 for all three specimens tested with pesticide surrogate EC-DY."

7.2, first and second paragraph

Replace with the following:

"Specimens with seams used in Level C1 protective clothing shall be tested in accordance with ISO 22608, Method A, using 0,2 ml of test chemical. Three specimens shall be tested for each type of seam. The test chemical shall be diluted pesticide surrogate EC-DY, an emulsion of Disperse Yellow 26 in water. Water grade 3 (according to ISO 3696) or deionized water shall be used to prepare the diluted solution with 2,5 % EC-DY. The seam shall be tested by placing the specimen such that the seam is centred along the length so that the test chemical falls directly on it. The test shall be repeated if the test chemical does not fall directly onto the seam during application. The specimen shall be discarded, and the test repeated with a new specimen. All types of seams used in the construction shall be tested if more than one type of seam is used.

For seams for protective clothing classified as Level C1, the upper limit for percent penetration shall be 40 %.

In addition, the seam for protective clothing shall be tested for resistance to penetration according to ISO 22608 Method B if one or more of the following requirements for that seam are met:

a) the test results for materials for protective clothing classified as Level C1 are greater than 40 % but less than 48 % (i.e. at least one specimen shows its result greater than 40 % and the three test specimens show their result lower than 48 %);

b) the test results for materials for protective clothing classified as Level C2 are greater than 5 % but less than 6 % (i.e. at least one specimen shows its result greater than 5 % and the three test specimens show their result lower than 6 %).

If the specimens are tested with both methods A and B, the results obtained by Method B shall be used for determining whether the seam meets the penetration classification requirement."

7.3, second and third paragraph

Replace with the following:

"Use(s) claimed by the manufacturer and stated in accordance with 10 c) shall be used as the basis for conducting the permeation test.

— For protection against diluted formulations, the test shall be conducted for 1 h using pesticide surrogate EC-DY, diluted with water grade 3 (according to ISO 3696) or deionized water to 2,5 % EC-DY.

— For protection against concentrates for short duration, the test shall be conducted for 15 min using pesticide surrogate EC-DY (without dilution).

Additional testing may be required to determine cumulative permeation through seams for specific pesticides. For additional testing, the procedure, test methods, and pass criteria shall be the same as that for pesticide surrogate EC-DY stated in this clause. The test chemical shall be the specific pesticide formulation, either concentrated or diluted with water, in accordance with the pesticide product labelling."

Figure 1

Replace with the following:

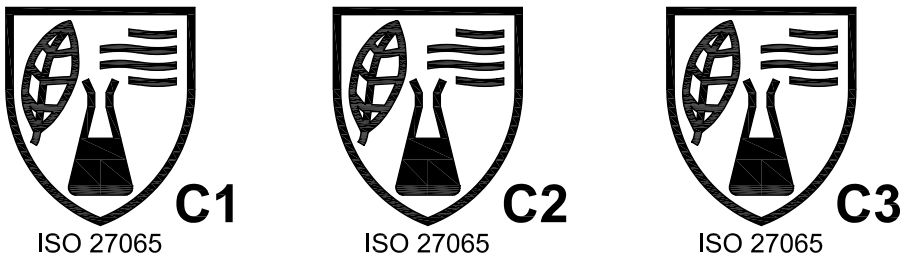

Figure 1 — Placement of text for ISO 7000-3126 pictogram

Annex C, second paragraph

Replace with the following:

"For the study, Method A was used to measure percent penetration through six woven and nonwoven fabrics. Analysis of variance showed that formulation chemistry had a significant impact on penetration. Prowl® 3.3 EC showed the highest penetration values across all fibre types, fabric constructions,

and fabric finishes. Those results, combined with desirable characteristics such as colour and ease of analysis and shipment, were used to select 5 % Prowl® 3.3 EC as the reference liquid. Dunnett's multiple comparisons test was used to compare the test chemicals and 5 % Prowl® 3.3 EC for all six fabrics. Analysis of the data indicates that, in general, mean percent penetration of 5 % Prowl® 3.3 EC is either similar to, or higher than, other test chemicals. Further testing was conducted using 5 % Prowl® 3.3 EC and two additional formulations, 5 % Roundup® and 2 % ready-mixed glyphosate with surfactant. Thirty-seven woven fabrics with and without repellent finish were tested with each formulation. In general, the formulations behaved similarly, with percent penetration for Prowl® 3.3 EC slightly higher than for the other two formulations. As there was no major difference in percent penetration and as Prowl® 3.3 EC represented the formulation types with the highest penetration, there was no rationale for testing with multiple formulations. See References [5] and [6] for further details of the study. A pesticide surrogate test chemical EC-DY was developed based on studies conducted in 2016 with 65 formulations representative of commonly used pesticide formulation types[7]. In 2017 and 2018 the studies were conducted to develop and validate the surrogate. Validation included testing of materials with Prowl® 3.3 EC and pesticide surrogate EC-DY. Based on the studies conducted 2016-18, EC-DY replaced Prowl® 3.3 EC as the test chemical representative of the worst case scenario. In the future, additional formulations can be added if data supports the need for testing with more than one formulation."

Annex F, first paragraph, last sentence

Replace

"The risk assessment often serves as the basis for determining the PPE to be used to mitigate risk, taking into account the part of the body that needs the most protection[7]."

with

"The risk assessment often serves as the basis for determining the PPE to be used to mitigate risk, taking into account the part of the body that needs the most protection[8]."

Annex G

Add the following annex after Annex F, before the Bibliography.

Annex G
(normative)

Surrogate test chemical

Surrogate test chemical EC-DY shall be used for penetration and permeation tests specified in this document. The composition of the surrogate test chemical is given in Table G.1. The surrogate test chemical is based on studies conducted for the selection of test chemicals and development of a surrogate test chemical. No studies have been conducted to determine the shelf life of the mixture. However, based on the chemicals in the mixture, shelf life of two years or more is expected.

Table G.1 — Composition of Surrogate Test Chemical EC-DY

Chemical	CAS #	Function	Nominal Composition % in mass fraction	Calculated Nominal Composition g/l	Company (if applicable)
Disperse Yellow 26	16611-15-7	Dye (replaces active ingredient)	10	100	
Soprophor BSU	99734-09-5	Emulsifier	2	20	Cytec Solvay Group
Aerosol® OT-A ND	NA - Blend	Emulsifier	18	180	Cytec Solvay Group
Benzylalkohol	100-51-6	Co-solvent	25	250	
Solvesso 200 ND	64742-94-5	Solvent	45	up to 1 l	Exxon Mobil

To ensure consistency in the formulation used for testing, several batches of surrogate produced by HPC Standards were tested. The information required for ordering the EC-DY surrogate and the technical grade of disperse yellow 26 dye required for the preparation of standards is given below.

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Fax: +49 34291 33 72 39

contact@hpc-standards.com
www.hpc-standards.com

Bibliography

Add the following reference as number [7].

[7] Shaw, A., Pallen, C., Durand-Réville, J., Briand O., Ramos H. Protective clothing for pesticide: Development of a database to validate ISO 27065 test chemical. *J Consum Prot Food Saf* , 2018. https://doi.org/10.1007/s00003-018-1151-3

Renumber the Bibliography subsequently.