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Standard Guide for Documenting the Results of Chemical Permeation Testing of Materials Used in Protective Clothing[1]

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INTRODUCTION

Promulgation of standard test methods for measuring the resistance of protective clothing materials to permeation by liquid or gaseous chemicals has fostered the generation of increasing volumes of material performance data. Not all data have been nor will be generated using Test Method F739.

To be useful, such data should be combined with information that specifies detailed characteristics of each test. These characteristics include information on the material specimens, challenge chemicals, test apparatus, analytical method used and test conditions (for example, temperature). The sensitivity or detection limit of the test system is of particular importance in comparing the data from different sources during the protective clothing selection process.

To date, most reports on permeation testing have not included such specificity. This guide, therefore, presents a standard format for recording all required information and data. The standard format is intended to facilitate the use of electronic databases to store, retrieve and apply test results.

1. Scope

1.1 This guide provides a format for documenting information and performance data from a permeation test.

1.2 Documented information and data are grouped into five major categories that define important aspects of each test:

1.2.1 Protective Clothing Material,

1.2.2 Test Method,

1.2.3 Challenge Chemical,

1.2.4 Test Results, and

1.2.5 Source of the Data.

1.3 Use of this guide is facilitated by adherence to the procedures outlined in a standard test method.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

F739 Test Method for Permeation of Liquids and Gases through Protective Clothing Materials under Conditions of Continuous Contact

3. Significance and Use

3.1 This guide is intended to encourage thorough and consistent documentation of permeation testing and its results.

3.2 Uniform information and performance data increase the likelihood of selecting proper chemical protective clothing material (CPC) by permitting direct comparisons of one product with another.

[1] This guide is under the jurisdiction of ASTM Committee F23 on Personal Protective Clothing and Equipment and is the direct responsibility of Subcommittee F23.30 on Chemicals.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

3.3 A standard format for test information and data also encourages computer storage of test results for easy retrieval, comparison and correlations.

4. Data Fields

4.1 The reporting format is shown in Annex A1, Fig. A1.1.

4.2 If a particular data field is not applicable to the testing performed, insert "not applicable" in the field. If a particular piece of data has not been obtained, insert "no data" or "unknown" in the field.

4.3 A description of each field of information follows.

4.3.1 *Description of Product Evaluated*—A positive identification of the specific CPC product material evaluated.

4.3.1.1 *Condition Before Test (field 1)*—Notes the prior conditioning of the material specimen before testing. Examples are "new," "laundered," after two weeks production usage," and "after decontamination." Any laundering or decontaminating procedures should be briefly described or referenced.

4.3.1.2 Manufacturer (field 2)—The name, address and telephone of the product producer. If unknown, then enter the source or supplier of the product.

4.3.1.3 *Product Identification (field 3)*—The manufacturer's code or catalog number, or "brand name" which uniquely describes the product tested.

4.3.1.4 *Lot Identification or Manufacture Date (field 4)*—The production lot/batch identification or date which uniquely identifies the product which was evaluated. If this information cannot be found, enter the earliest date that the specific test product (sample) was known to exist, for example, the purchase date, supplier's stocking date, and so forth.

4.3.1.5 *Thickness (field 5)*—(mm). The nominal thickness of the barrier material. Where polymers are coated on substrates, a coating thickness may be available from the manufacturer.

4.3.1.6 *Material Type (field 6)*—A generic description of the type of chemical resistant material that was tested. Examples are "neoprene," "natural rubber," and "nitrile rubber."

4.3.1.7 *Description (field 7)*—Includes items such as type of support fabric, supporting or substrate material basis weight, weight of material or substrate, and treatments such as surface chlorination.

4.4 *Challenge Chemical*—The chemical (mixture) to which the material specimen was exposed. The exact identity of the chemical is essential for the user to determine if the data will be applicable to his situation. Provision is made for three component mixtures. More components can be entered if necessary.

4.4.1 *Chemical Name(s) (field 8)*—The name(s) of the component(s) (of interest) of the challenge chemical(s).

4.4.2 *CAS Number(s) (field 9)*—The unique registry number(s) assigned by the Chemical Abstracts Service of the American Chemical Society for each chemical component of the challenge chemical.

4.4.3 *Concentrations (field 10)*—The concentration of the components of the challenge chemical. If the challenge chemical is a mixture, the concentration of each component is reported. For example as volume % for liquids or gases, mg/L for dissolved solids, and weight % for solids.

4.4.4 *Chemical Source (field 11)*—The manufacturer or supplier, catalog number, and the lot of the challenge chemical.

4.5 *Test Method*—A description of the test method and testing parameters used to generate the test results.

4.5.1 *Standard Test Method Used (field 12)*—Reference the specific standard test method used (for example, Test Method F739). If no standard test method was used, list "none."

4.5.2 *Deviation From Standard Test Method (field 13)*—Some testing conditions such as low volatile, insoluble, or very toxic chemicals, may require modifications to the standard test method. The differences could include description of an alternate permeation test cell.

4.5.3 *Testing Laboratory (field 14)*—Include the name, address, and telephone number of the testing laboratory.

4.5.4 *Analytical Method (field 15)*—A general, not specific description of the method used to analyze for the challenge chemical. An example is "GC/FID."

4.5.5 *Temperature (field 16)*—The temperature, in degrees Celsius (°C), at which the testing was carried out.

4.5.6 *Specimen Area Exposed (field 17)*—The surface area in square centimetres (cm^2), of the test specimen exposed on the challenge side of the test cell.

4.5.7 *Collection System (field 18)*—Will normally be "open loop" (single-pass), "closed loop" (recirculating), or "closed loop/aliquot replacement" (recirculating with aliquot replacement), and so forth. Include information on the sampling frequency, for example, "one sample every 5 min." Include information on the sample volume, for example, "continuous analysis," or "aliquot sample volume of 0.001 L."

4.5.8 *Collection Medium (field 19)*—The sorbent in which the chemical is collected for analysis. Examples are "nitrogen," "air," "saline solution," "5 % methanol/95 % water," and "gauze."

4.5.9 *Collection Medium Quantity (field 20)*—The volume of sorbent in the collection system. Units are litres (L) for liquids or gases and milligrams (mg) for solids. This data item is "not applicable" to solid sorbent or open loop collection systems.

4.5.10 *Collection Medium Flowrate (field 21)*—The flowrate of the sorbent through the collection system. The units are litres per minute (L/min) for liquids and gases. This field is "not applicable" for solid sorbent collection media.

4.5.11 *Breakthrough Detection Concentration (field 22)*—The typical concentration of each component of interest or individual chemical determined to be in the collection medium at the observed breakthrough time reported below in 4.6.4.

If no breakthrough was measured, the limit of quantification is reported. This is the minimum concentration of each component of interest or individual chemical that has been determined to give a measurable analytical instrument response in the test system. The units are micrograms per litre (µg/L).

4.5.12 *Test System Sensitivity Factor* (*SF*) (field 23)—A factor for comparing data produced in a given system with data from another system.

4.5.12.1 For closed loop and aliquot/replacement systems the factor is calculated by

$$SF_1 = C^*V/A \quad (1)$$

where: