SECTION I

Introduction

The intent of the *Quick Selection Guide to Chemical Protective Clothing* is to assist workers, supervisors, safety and health professionals, spill responders, industrial hygienists, and others in the initial selection of protective clothing materials against specific chemical challenges on the job. This is accomplished by use of the color-coded tables, which summarize the chemical breakthrough performance of 19 common barrier materials against almost 800 chemicals organized in 95 chemical classes.

This guide is a summary of chemical resistance data and should not be the sole basis for the final selection of the chemical protective clothing. The following sources offer comprehensive information on tested products and test reports:

Performance Data

- Manufactures of Chemical Protective Clothing. Links to manufactures' web sites including performance data are listed in Section VII.
- Krister Forsberg's *Instant Gloves + CPC Database for Windows* (1999). 9th edition includes data from 11,000 chemical permeation and 3000 degradation tests. Instant Reference Sources, Inc. http://www.instantref.com/cpc.htm

- Chemical Protective Clothing Performance Index by Krister Forsberg & Lawrence H. Keith 2nd Edition (1999) John Wiley & Sons, Inc., http://www.wiley.com

Visit the Chemical Protective Clothing Web site http://www.kristerforsberg.com/cpc/ for access to manufacturers' Web sites. The Chemical Protective Clothing Web site will also announce updates of this guide.

Contact the manufacturers for the latest test results (see Section VII).

The *Quick Selection Guide to Chemical Protective Clothing* also provides users with knowledge about the permeation process and other factors that adversely affect protective clothing. The chemical index in Section III also provides the users with hazard ratings of tested chemicals as a basis for risk assessment. This Guide also contains a discussion on the selection, use, care and maintenance, and disposal of protective clothing (Section II). Finally, a glossary of terms common to chemical protective clothing related health and safety terminology, and a section on relevant standards for chemical protective clothing has been included to assist the users of the Guide.

Rational for Selecting Chemical Protective Clothing

All chemicals, including water and table salt, present some level of risk to workers. In large part, this level of risk is determined by the amount of the chemical that is inhaled, absorbed, ingested, injected, or otherwise contacts or enters the body (the "dose") and the inherent toxicity of the chemical. Inhalation hazards have traditionally been of greatest concern; however, dermal (skin) hazards are much more common. There are many types and degrees of dermal hazard. Chemicals that can damage the skin, such as corrosives, cause a reaction, such as sensitizers and irritants, or produce toxicity by permeation through the skin present dermal hazards. The purpose of chemical protective clothing is the prevention of contact with chemicals potentially hazardous to the skin, thus lowering the risk of injury or illness.

Chemical protective clothing ranges in complexity from simple finger cots to fully encapsulating gas-tight suits. Although a wide variety of well-designed and constructed products are available, research has shown that toxic chemicals can easily pass through or damage some of these clothing materials and have direct contact with the skin and/or be absorbed into the blood. This led to a considerable amount of research by chemical protective clothing manufacturers, users of chemical protective clothing, researchers, and others to find the materials of construction best suited for specific chemical challenges. This work largely began in 1981 when Henry III and Schlatter published a paper* on "The Development of a Standard Test Method for Evaluating Chemical Protective Clothing to Permeation by Liquids." Henry III and Schlatter developed a specific permeation test cell (see Figure 1). The method and the test cell were adopted by ASTM's committee as Standard Test Method F739 in 1981 and have also been adopted as European (EN374-3)

* Henry, N.W. and C.N. Schlatter, "The Development of a Standard Test Method for Evaluating Chemical Protective Clothing to Permeation by Liquids," Am. Ind. Hyg. Assoc. J., 42:202, 1981.

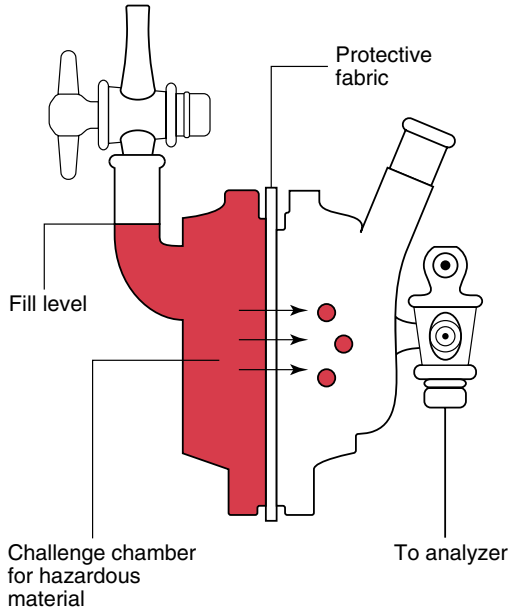

Figure 1 Permeation Test Cell Schematic.

and International standards (ISO 6529). Most of the chemical resistance testing has been conducted using the *ASTM F739-99, Standard Test Method for Resistance of Protective Clothing Materials to Permeation by Liquids or Gases Under Conditions of Continuous Contact* or previous versions of this test method from the American Society for Testing and Materials (ASTM). This laboratory test method provides both a breakthrough time and a steady-state permeation rate based on direct contact of the challenge liquid or gas with the normal outside surface of the protective material. The breakthrough time is the time to the first indication of the presence of the test liquid or gas in the collection media on the other side (normal inside surface) of the test material. Thus, the data given in this guide are based on laboratory tests of either degradation or permeation. The recommendations are not based on actual use of the materials as protective clothing. Nevertheless, if the glove, boot, or suit is not damaged and has no defects, the laboratory test data should be equal to the worst-case chemical challenge in the work environment. You have to be aware of the fact that conditions in workplaces such as those having elevated temperatures, flexing, pressure, tears, etc., may reduce the breakthrough times significantly.

In Section VI you will find all published test methods including ASTM F 1407 Permeation Cup method used as field test.

How to Use This Guide

A three-step process in this guide completes the selection of the barriers offering the best chemical resistance. First, the chemical name or synonym is found in the alphabetically sorted CHEMICAL INDEX. The second step is to use the Chemical Class number, which appears to the left of the chemical name to search the SELECTION RECOMMENDATIONS. This section is in numerical order by chemical class. The final step is to find the chemical within the class listing and note the color-coded recommendations by barrier material. For example, to find the recommendations for protection from acetaldehyde, the user must first find the chemical class number in the Chemical Index section. We find the chemical acetaldehyde listed first in the CHEMICAL INDEX. This listing shows a class number of 121. This is the chemical class for Aldehydes (aliphatic and alicyclic) under the ASTM *F-1186*, *Standard Classification System for Chemicals According to Functional Groups*. This listing also

shows the chemical abstract service (CAS) number assigned to acetaldehyde as 75-07-0. The main purpose for listing the unique CAS number is to be sure that this chemical is the one that we are interested in and not another chemical by a similar name. The next column under acetaldehyde lists the "Risk Code" for hazard ratings. For acetaldehyde, it is listed as an "X." This means that the chemical has received a designation of "harmful." The next step is to go to the Selection Recommendations section and find chemical class number 121. Acetaldehyde is listed first within this group. Reading the color codes from left to right, we find, for example, Butyl rubber as recommended barrier (color coded green) with ">8" representing greater than 8-hours resistance to acetaldehyde.