



Crossing the border:
Before entering a world where
chemical hazards lie in wait,
you need to be well-protected.

The Second Skin

CHEMICAL PROTECTIVE SUITS (CPS) are essential when working with hazardous chemicals. Innovative properties meet the increasingly stringent requirements of industrial users and first responders. Dräger therefore conducts its research into the future generations of CPS in collaboration with customers and scientists from a variety of disciplines.

THEY MUST BE VERY SPECIAL suits, if engineers, chemists, anthropologists, and firefighters are involved in their development. Experts in these and other professions are working together on the next generation of chemical protective suits (CPS) from Dräger. One of the many focal points in this process is collaborative research with real-world users.

“In 2009 alone, more than 70 volunteer testers from a variety of countries participated in this ‘Customer Process Monitoring’ program for future CPS developments,” says Dräger portfolio manager Gunnar Brors, who adds, “We look at the users with all of their personal protective equipment on and also at their typical deployment conditions.”

Potential for changes can be found in the material, cut, and components of the suits, as well as in the basic concept, which differentiates fundamentally between chemical protective suits designed for multiple uses over an extended period of time and suits designed for just one-time use or for being used only a very few times.

The level of protection and other parameters of the suits are defined in various international standards, ranging from National Fire Protection Association (NFPA) 1991–2005 in the U.S. to Europe’s EN 943-1:2002 (industrial applications), EN 943-2:2002 (emergency teams), and German Fire Protection Association (GFPA) Guideline 08/1:2002-11, as well as EN 1073-2 (radioactive particles), EN 14126 (infective agents), and ATEX (electrostatic charging).

With a suit certified according to one of these standards, the user can expect to don the chemical protective suit, seal it, and then have up to 30 minutes of liquid- or gas-tight protection while working. Besides the protection provided against various substances, other important factors involved in the selection of a chemical protective suit are ease of maintenance and above all ergonomics, because the conditions under which CPS users work are extremely demanding.

Every innovation counts

That’s something that anyone can understand—anyone, at least, who’s ever slipped into a gas-tight chemical protective suit with a heavy compressed air breathing apparatus on their back and then tried to pick up and assemble the small parts for a difficult repair despite the thick protective gloves. Freedom of motion, vision, and fine motor skills are severely restricted. On top of that, the microclimate inside the suit is characterized by rapidly increasing humidity and heat.

A study by the Technical University of Munich published in the German Journal of Sports Medicine (Volume 58, No. 5, pp. 132 ff., 2007), which addresses the effect of reduced heat exchange in firefighter protective equipment on dynamic physical performance, demonstrated that this leads to substantially greater stress on the body. Every innovation that makes it easier for the users to perform their work counts.

“The manufacturers have accomplished quite a lot since the first mod-

ern chemical protective suits appeared nearly 60 years ago,” reflects Robert Betzinger, a Dräger portfolio manager who is responsible for industrial CPS applications. The materials such as neoprene and Viton/butyl used back then have been replaced by modern materials like HIMEX, the multi-layered elastomer from Dräger used to make the pro-ET line of chemical protective suits. Such materials have a sandwich-like structure of different materials with complementary properties.

Because chemical protective suits are often needed when working under difficult conditions—in industrial sectors ranging from petrochemicals and chemicals to oil and gas supply and even waste disposal—mechanical strength is one of the most important properties besides chemical resistance. One example cited by Betzinger is maintenance and repair work carried out under conditions of confined space entry, such as cleaning tanks with their narrow entryways.

An easy choice

One advantage that industrial customers have over firefighters when it comes to working in chemical protective suits is that they generally know exactly what substances the employees must be protected against. There are specialty chemical protective suits like the Work-Master UMEX, which can protect personnel handling cryogenic hazardous substances at temperatures down to -80° Celsius. The large range makes it easier to choose the right chemical protective suit for each work step. The customers >



These are people, not robots. Protective suits must be fine-tuned to the protection and requirements of hard-working bodies.

Innovation cycles for the second skin with special properties are getting shorter and shorter

> highly value not only the protective properties, but also ease of maintenance. While observing a large German chemical company involved in the development of the next generation of Dräger CPS, Betzinger noticed that their goal is to ensure that the shortest possible time elapses between the decontamination, cleaning, and testing of the used chemical protective suit and when the suit is ready to be worn again.

There are also alternatives to a gas-tight CPS under certain conditions: The extremely lightweight and liquid-tight, limited-use Dräger SPC 3800 chemical protective suit made of Tychem® F, for example, is ideal for performing work with low mechanical loads in contact with liquid chemicals. Compared to a gas-tight CPS with a heavy breathing apparatus, these CE-certified coveralls made of fiber layers with welded seams offer the user greater freedom of movement.

Limiting such suits to a specific use also makes storage, decontamination, cleaning, and maintenance easier. Eric Metzner, a sales engineer at Dräger, can

confirm the demand for maintenance-friendly and easy-to-use suits. Hygiene is also an important factor here, as maintenance of multiple-use suits is often problematic, particularly in tropical countries with a hot, humid climate.

Learning from practice

Unlike industrial users, public fire departments face such a wide range of possible hazardous substances and goods when deployed that they depend on their chemical protective suits to provide the greatest protection possible. This applies equally to volunteer fire departments, professional fire departments, and fire departments at industrial plants, which are often even more specifically equipped. All wearers agree that the suits need to be more ergonomic, however. This applies to the fit in general, and in particular to donning the personal protective equipment and working with tools and equipment while wearing the CPS.


Henry Kratina, an emergency planning specialist at the Dresden Fire Department, also cites weight and ventilation as key factors, in addition to aspects such as the legibility of the pressure indicator on the compressed air breather apparatus while in the suit. The Dresden Fire Department is one of the Dräger customers involved in the development of new chemical protective suits.

Innovations are important to improve the wearer-friendliness of fully encapsulating CPS, confirms Michael Kämpfer, head of the Training Department at the Rüsselsheim Fire Department.

Thirty-five professional firefighters and 221 volunteers (175 of whom are certified to use breathing apparatuses) protect Rüsselsheim from fire. All of the professional firefighters and 63 of the volunteer firefighters are certified to use breathing apparatuses and have been instructed in the use of CPS. Not all fire departments are this well-positioned, however. Kämpfer and Reinhard Döll, head of the Technology Department at the Rüsselsheim Fire Department, agree that the easier it is to don the chemical protective suit and the less problematic it is to work in it, the more people will be certified to wear them.

Increasingly rapid innovation

Dräger has been developing and producing chemical protective suits for more than 50 years. “The innovation cycles for the second skin with very special properties have become shorter and shorter during that time,” say the portfolio managers Betzinger and Brors. And the same applies to the pace at which the development engineers present new properties and solutions—from innovative materials to more comfortable fits and optimized visors to better connections between suit, boots, and gloves, or innovations for a suit closure system comprising a zipper with a seal system. Among the places where Dräger will be showcasing its CPS portfolio is the A+A (Düsseldorf, November 2009). **Peter Thomas**

Further information online, including:
 Product information
www.draeger.com/98/cps