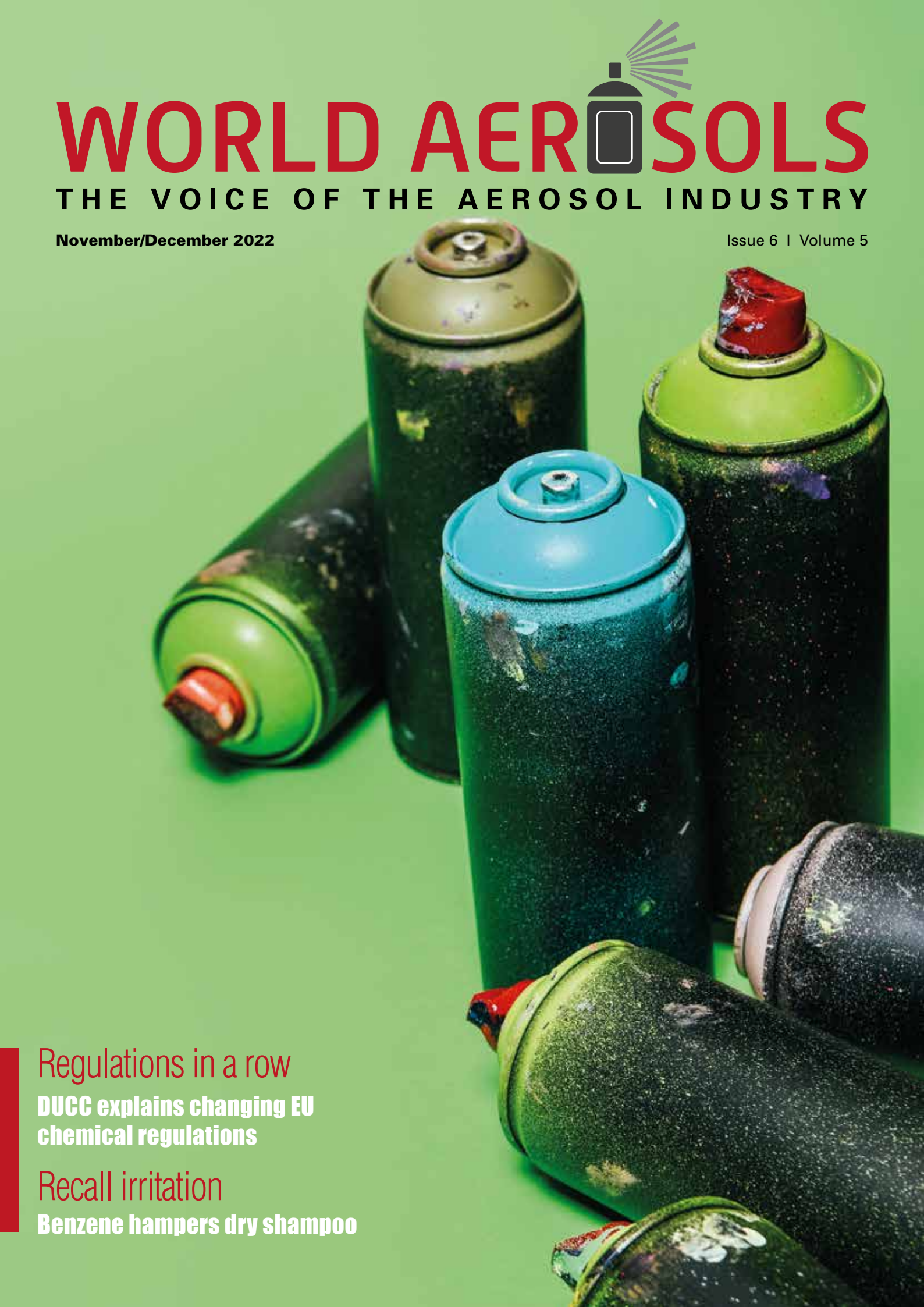
WORLD AEROSOLS

THE VOICE OF THE AEROSOL INDUSTRY

November/December 2022

Issue 6 I Volume 5



Regulations in a row

DUCC explains changing EU chemical regulations

Recall irritation

Benzene hampers dry shampoo

WORLD AEROSOLS
THE VOICE OF THE AEROSOL INDUSTRY

November/December 2022
Issue 6 | Volume 5

Woodcote Media Limited
Marshall House, 124 Middleton Road, Morden,
Surrey SM4 6RW, UK
www.worldaerosols.com

Managing Director
Peter Patterson
T: +44 (0)208 648 7082
E: peter@woodcotemedia.com

Editor
Tom Daldry
T: +44 (0)208 687 4139
E: tom@woodcotemedia.com

Editor
Paul Warner
T: +44 (0)208 687 4146
E: paul@woodcotemedia.com

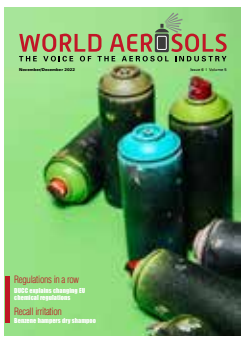
International Sales Manager
Andrew Sigamany
T: +44 (0)203 551 5753
E: andrew@worldaerosols.com

PRODUCTION
Alison Balmer
T: +44 (0)1673 876143
E: alisonbalmer@btconnect.com

SUBSCRIPTION RATES
£170/$270/€225 for
6 issues per year.
Contact: Lisa Lee
T: +44 (0)20 8687 4160
F: +44 (0)20 8687 4130
marketing@woodcotemedia.com

www.linkedin.com/groups/12133678
@WorldAerosols
www.facebook.com/World-Aerosols-943971962454668

ISSN 2631-6056



Front cover image courtesy of bigstock.com @LightField Studios

World Aerosols, ISSN 2631 – 6056, is published bi-monthly by Woodcote Media Ltd, 124 Middleton Road, Morden, Surrey SM4 6RW, UK. The US annual subscription price is USD270. Airfreight and mailing in the USA by agent named WN Shipping USA, 156-15, 146th Avenue, 2nd Floor, Jamaica, NY 11434, USA. Periodicals postage paid at Jamaica NY 11431.
US Postmaster: Send address changes to World Aerosols, WN Shipping USA, 156-15, 146th Avenue, 2nd Floor, Jamaica, NY 11434, USA. Subscription records are maintained at Woodcote Media Ltd, 124 Middleton Road, Morden, Surrey SM4 6RW, UK. Air Business Ltd is acting as our mailing agent.

Figure 4

Aer8® Refill Reuse Spray System by Aer Beatha

Michael Friel, founder and director of Aer Beatha, explains how its refill-reuse device addresses the challenges the industry is striving to solve

The aerosol spray industry still faces some major challenges: volatile organic compounds (VOC) emissions, global warming potential (GWP) contribution, explosion risk, flammability in storage-handling and in use, safety and solvent abuse concerns, fossil fuel-based risks (supply and cost) and refill-reuse sustainability demands. The European Aerosol Dispensers Directive (ADD) provides the legal basis for the safe use of aerosols by consumers. Aerosols are designed for single use only, as per the ADD. Refilling and reusing the existing aerosol spray canister would present enormous challenges, both legal and technical. The canister is designed for single use only, with optimised can weight and wall thickness.

Aer8® refill-reuse device

Carbon is the foundation of all life on Earth, required to form complex molecules like proteins and DNA. This element is also found in our atmosphere in the form of carbon dioxide (CO_2). Carbon helps to regulate the Earth's temperature, makes all life possible, is a key ingredient in the food that sustains us, and provides a major source of the energy to fuel our global economy.

Carbon dioxide is a medical gas. It is non-flammable, an extinguisher and is a sustainable resource with guaranteed long-term supply through carbon capture and storage technology.

Carbon dioxide and other compressed gas propellants are used today but the spray performance is not equivalent to

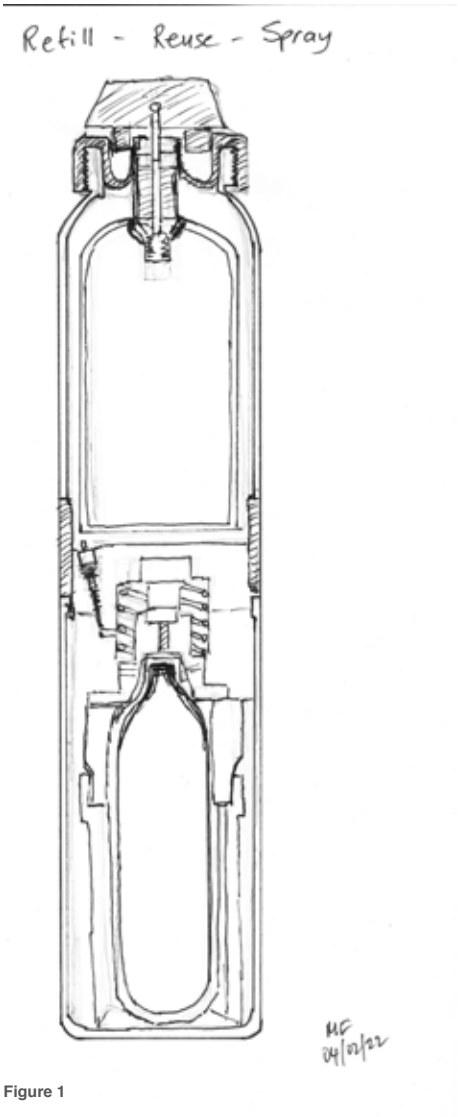


Figure 1

liquefied gas propellants (butane/propane). Carbon dioxide has limited solubility and low pH in aqueous media. The resulting formulation stability challenges, together with gas filling efficiencies and pressure drop in use, limits its application. Liquefied propellant gases are by far the most commonly used in aerosol sprays; they have no affect on pH, constant pressure and good spray characteristics.

Aer Beatha's refill-reuse spray device addresses the challenges facing the aerosol industry. The refill-reuse spray is a two-chamber device, with carbon dioxide liquefied propellant in a high pressure chamber connected to a low pressure formulation chamber via a pressure regulator. The regulator and two-chamber device is described in detail in Aer Beatha's patents. The device is suitable for all types of aerosol spray applications - industrial, adhesives, paints and varnishes, automotive, food, janitorial, household, insecticide, cosmetic, pharmaceutical and veterinary. The commonly used high VOC and GWP liquefied propellants are replaced by zero VOC and low to zero GWP propellants (nitrogen, carbon dioxide, air, argon, helium, argon).

Aer Beatha's regulator valve and two-chamber system addresses the limitations of compressed gas propellants. The key benefits of the regulating valve technology are pressure reduction and maintenance. It reduces the pressure from 5.5-6 MPa in the liquid carbon dioxide cylinder (high pressure chamber) and sets the pressure to any selected value in the range 0.2 to 2MPa (the usual range for aerosol sprays) in the low pressure chamber. The regulator tops up the pressure when it falls during use (spraying). The device is illustrated in figures 1 and 2.

High pressure chamber

There are many manufacturers of small high pressure cylinders with different gases and combinations. Carbon dioxide is the most commonly used gas. The steel cylinders are manufactured by the deep drawn process and come in a wide variety of sizes with different neck designs (threaded/unthreaded, different diameters) as well as different closure types. The cylinders have a thin metallic membrane to contain the high pressure liquefied compressed gases. The membrane has to be pierced or punctured to release the gas.

Refillable carbon dioxide cylinders are envisaged in the future, like the Sodastream refill return system.

> **"Refilling and reusing the existing aerosol spray canister would present enormous challenges, both legal and technical"**

Regulator block

The regulator block contains a piston, a channel and a coiled spring. On piercing the carbon dioxide cylinder, there is a flow of gas through the piston-channel, from the high to the low pressure chamber. The piston closes at a set force defined by the spring and surface area of piston. The pressure in the low pressure chamber is determined by this arrangement.

Over pressure release valves can be added to the low pressure side of the regulator block to avoid high pressure build up in the event of regulator failure. Similarly a release valve is added to vent the low pressure chamber upon refilling. On the exterior, there is a switch moving from 'Released' to 'Locked' positions and vice versa (replacing cylinder or refilling upper chamber).

Figure 2


Figure 3

Low Pressure Chamber

The low pressure chamber has a standard one-inch aerosol valve held in place by a threaded ring. The valve and accompanying actuator are matched to the formulation and pressure of the low pressure chamber to generate desired spray profile/characteristics. A number of arrangements are possible within the low pressure chamber.

Bag on Valve (BOV) technology is well established and is used to dispense products which are unstable in contact with the propellant. BOV uses heat seal flexible multilayer laminate film technology. A bag can be cut to any shape, folded and sealed by heating. Bags in any shape and volume can be purchased from suppliers. The bags provide a protective environment. Wine bag in a box is an example of heat seal flexible film. As the product is removed, the bag collapses.

One option is that a full BOV could be fitted/inserted in the low pressure chamber by releasing the pressure in the upper chamber (slide lever), removing the actuator, unscrewing the threaded valve ring, removing the empty bag and inserting the full bag. Then repeating the instructions in reverse order. Ready to spray. This is most suited to the consumer market where there is an expectation to use the product.

Ready to go refills pouches

A second option is for the BOV system be refilled in store or at home by the following steps: releasing pressure in the upper chamber, and removing the actuator.

> **The commonly used high VOC and GWP liquefied propellants are replaced by zero VOC and low to zero GWP propellants"**

Then liquid formulation could be refilled through the valve stem using a large volume syringe or automatic dosing or vending machine. Butane-based lighters (ignition products), solder tools and kitchen burners are refilled from a bulk dispenser. This arrangement would reduce the number of refill BOVs consumed.

A third option is a removable-replaceable flexible laminate membrane bag. The bag would have a wide neck, soft drink bottle diameter (15-20mm), easy to pour into, a rubber lid to seal contents, with the one-inch valve pressing down on it, holding it in place. The rubber lid will have an opening for the valve stem. The valve stem will seal to the hole in the ring lid. The bag could be replaced at regular intervals with wear and tear.

Regardless of the option and material selected, once the bag is charged with formulation and the spray pressurised, an aerosol product can be dispensed in any orientation. The spray performance is dependent on the low pressure chamber pressure setting, actuator and formulation surface tension. No drop off in spray performance is detected as the regulator provides constant pressure throughout. Spray performance is shown in upright and inverted positions in figures 3 and 4.

In cases where formulation droplets break up and a more powerful spray is required, compressed gas can be added to the spray.

Spray performance

Using water-based formulations, Summit Valve Company BOV and actuators samples were tested in the low pressure chamber at several pressures, 3, 5 and 7 Bar. The spray rate and characteristics were measured. At the higher pressure, higher spray rates were obtained. The actuator together with the pressure, determined the spray form (mist, cone, jet) and droplet size. Spray rates were measured from 0.8g/s at 7Bar, 1g/s at 5Bar and 1.2g/s at 3Bar using the same actuator. The spray ranged from very fine mist to a fine spray.

Using the refillable removable flexible membrane and Summit Valve Company actuators, the results were the same as BOV samples.

Summary:

- A spray system with replaceable formulation and propellant refills.
- A spray system with refillable formulation pouches.
- A spray system capable of refillable formulation and propellant refills.

For more information:
Visit:aerbeatha.com/en/aerosol-technology