Thinking about bubbles

That the use of foam continues to cause headaches for firefighters became obvious during the Fourth Firefighting Foam Conference that took place in July in the Reebok Stadium (UK). Here are some of the highlights of a most thought-provoking event.

CFOA, firefighting, foam and the future: David Johnson, Fire Chief, Essex FRS

David Johnson, foam lead on firefighting foam from the Chief Fire Officers Association and Fire Chief of Essex Fire and Rescue (UK), could not present in person due to industrial action by the Fire Brigades Union but Dr Klein gave his presentation in his place.

A mobile treatment unit for foam water runoff could be up and running two years from now.

Chief Johnson began by contrasting the absolute right to life of protected organisms such as newts, with the paradox that firefighters' could not train with the tools that would ultimately safeguard their own lives – and others' – in action. "This might seem amusing, but to my view there is a crisis in conflicting priorities between the interests of the environment and those of firefighters and their communities."

He highlighted guidance that made clear that unless there was a life risk then emergency crews should give higher consideration to protect the environment than to attempt to extinguish a fire, if there was little prospect of saving a building. "Such a simplistic approach is in my opinion flawed and fails to accept that emergencies have many facets beyond operational ones."

Johnson outlined that socio-economic contexts can put pressures that cannot be ignored on operations– eg the loss of a business in a small community could have a devastating impact. "And major fires that burn for long periods of time can attract the attention of politics," said Johnson, reminding attendees that the decision to extinguish Buncefield came from pressure by other European countries. "Safety, operational, social and economic factors must be allowed to influence operational decision making, not the fear of prosecution (by environmental departments). It this does not happen, investment in technology will not happen, and firefighting will only become a watching brief, consequences in nobody's interest."

Life safety, property protection, product safety and environmental stewardship: Dr Stephen Korzeniowski, DuPont USA

Dr Stephen Korzeniowski of DuPont USA, on his fourth time at the Reebok conferences, focused his presentation on life safety, property protection, product safety and environmental stewardship.

He pointed out that the fact that finding chemicals in the environment does not necessarily mean they are harmful – but it does raise questions about their fate and overall risk.

His first message was that AFFF foams do work and are the most effective agents today, "but the question today is are they still suitable for all Class B fires considering the potential environmental consequences. "But you need the right agent for the right fire and some agents work better than others. All agents have consequences, and to our knowledge nothing works as well as fluoro-surfactants for foams fighting Class B fires."

Industries are moving towards using less environmentally biopersistent molecules in their foam concentrate formulation, using molecules with six fluorinated carbon chains (C6) as opposed to potentially more biopersistent mixtures containing C8 and above fluorosurfactants. Many foams already use 99% C6 fluorosurfactants. But he said that replacing the C8 with C6 may not be a direct "drop in" replacement, meaning that many foams on the market would have to be reformulated and then undergo re-certification to the relevant fire standard. These compounds may take up to two or three years to requalify.

Dr Korzeniowski presented some of the toxicology and environmental studies conducted on C6 fluorotelomers, and the results showed that they have low toxicity, and are not classified as bioaccumulative by published regulatory criteria.

He emphasised that C6-based fluorotelomer agents in AFFF did not degrade to or behave like PFOS and that to believe otherwise was a misnomer. In addition, "PFOA is a potential impurity in the historical products but it is not added or used in manufacture."

The industry is moving to six carbon chains or less, and the tendency of bioaccumulation and toxicity is to become more favourable the shorter the carbon chains. Dr Korzeniowski also addressed concerns that 6:2 FTS was the same as PFOS – it is not, he said, The structure and properties are not similar. "Recent studies with 6:2 FTS and related surfactants has shown that they have low acute and aquatic toxicity, and are significantly lower in potential biopersistence than PFOS."

He outlined test results with rainbow trout and rats to show that 6:2 FTS was not bioaccumulative by regulatory standards.

Dr Korzeniowski ended his presentation with an outline of the voluntary 2010/15 *PFOA Stewardship Program: Guidance on Reporting Emissions and Product Content* pioneered in 2006 by the US Environment Protection Agency in partnership with industry, which contains two milestones.

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David Johnson, Chief of Essex FRS, qualified as "flawed" the current simplistic approach that (unless there is a life risk) places a higher consideration on protecting the environment than on attempting to extinguish a fire .

First is to reduce PFOA and related chemicals from facility emissions and in product content by 95% no later than year-end 2010, and to work toward eliminating PFOA from emissions and in product content no later than 2015. Initial biomonitoring studies seem to prove that the program is working very well. "The bottom line is that choosing the best foam is a combination of performance, reliability and life safety balanced with toxicology and environmental impact," concluded Dr Korzeniowski.

Achieving requirements for Civil Aviation organisations: Luc Jacobs, Solberg

Luc Jacobs of foam manufacturer Solberg presented on his experience of recent work by the International Civil Aviation Organisation (ICAO) to create a better performing foam for ARFF operations, class C.

A number of manufacturers sent foam samples to be tested by ICAO's proposed new extinguishing requirements, and Solberg's was the only foam to pass.

Luc Jacobs of Solberg revealed that his foam was the only foam to pass ICAO's proposed new extinguishing requirements for ARFF operations, class C.

Jacobs was naturally proud that this was the case, but his presentation concentrated on concerns regarding the proposed class C requirements.

He outlined that the lab test for level C may not reflect the wide range of firefighting equipment used by different airports, such as aspirating nozzle, water sprays etc. He pointed out that while class C did not stipulate a particular type of steel for the test fire tray, heat output between mild and stainless steel could differ tenfold. "And these tests were conducted indoor, but we have experience of outdoor and indoor testing and there are big differences."

He also expressed reservations about reducing the rate of application of foam and where would the line be drawn. If required rates were reduced to 1.2 litres of foam per minute, in theory one fire truck could replace two – or if there were two, an airports category could increase. "So you have the same amount of foam and double the size of plane, which is a bit scary."

Jacobs warned against closely matching the critical application rate of a foam – below which it would not work and be consumed by the fire – with the requirements of a new standard. Safer would be to have a standard that says a foam should operate at six litres per minute, and have it still work to the standard at half that. Flexibility in application rates is needed.

To achieve the pass to class C, Solberg tripled the level of fluorosurfactant used in its class B – more so than its military spec product. "If you go for such a product then you get excellent performance but you have to be able to collect and burn it and that's the consideration."

Ecoguard fluorine-free firefighting foam: Dr Thomas J Martin, Chemguard

Dr Thomas J Martin, Chemguard, began by saying that, although fluorosurfactants are essential for AFFF foams and are not going away any time soon, fluorine-free foam products have been around for a long time and there is a present and growing customer base requiring them. Ecoguard was developed as a synthetic fluorine-free foam in response to this market demand. "Its key ingredient allows it to spread quickly and to be burnback

resistant." In addition, Ecoguard has low toxicity, being an optimized hydrocarbon surfactant blend, and is readily biodegradable. "Typical properties are that it has the appearance and effect of a low expansion foam, depending on the discharge device." Dr Martin presented the favorable results from aquatic toxicity and biodegradation testing for Ecoguard, adding that it had also been evaluated against AFFF for firefighting performance. "Ecoguard has about the same fast control and extinguishing time as an AFFF, but burnback is a slightly different story." Dr Martin was referring to the fact that, while AFFF foams form a film and spread across a fuel surface, Ecoguard does not. Instead, Ecoguard relies on a thick and extremely stable foam blanket for burnback resistance. "Ecoguard passes the UL test criteria for topside and sprinklers." To stress that Ecoguard is a viable alternative to AFFFs, Dr. Martin further commented, "Fluorine-free foams are a maturing technology that has been developed for a growing market and are qualified for use in specific areas where they pass the test requirements. As with other foams, there are trade-offs," alluding to the fluorosurfactant C8+ to C6 transition. "Our job as suppliers is to provide options."

Moussol, fluorine-free foam: Jan Knappert, Dr Sthamer-Hamburg

Jan began by correcting a previous speaker and pointing out that Dr Sthamer-Hamburg first developed Alcohol Resistant fluorine-free foam in 1953 and that the company had been leading in this industry since then.

"You've heard a presentation from Dr Annegret Biegel from the German Federal Environment Agency and in the UK we have an environment agency that gives firefighters and manufacturers a hard time to make sure foams don't harm the environment."

Jan went on to outline some of the foam used by German firefighters (most of whom are supplied by Dr Sthamer) – multipurpose, high expansion foam, used effectively for vehicle fires. "But there is increasing use of biofuels and conventional foams will have problems with the alcohol content. AFFF is not as effective tackling fuels enhanced with alcohols, so firefighters will have to change to alcohol resistant foam. At the same time, there is pressure to minimise foam usage in training and in anger."

If that wasn't enough, the environmental issue has resulted in many questions for manufacturers from the fire services.

The solution is a multipurpose foam that works as effectively as an AFFF and is also alcohol resistant. "We are still travelling this road, but in the meantime we have Moussol FF 3x6, which is alcohol resistant and fluorine free, self healing, and complying with EN 1658. Last week it passed class B ICAO and it is being used at Newquay Airport in the UK."

Jan finished his presentation by warning against firefighters putting all their eggs in one fluorine free basket. If a big event happens a state-of-the-art premium quality AFFF is needed.

A mobile treatment unit for water used during firefighting operations: Dr Martial Pabon, DuPont France

Dr Pabon's focus was on the treatment of foam water effluence collected from large incidents such as Buncefield. The goal, to extract the fluorosurfactant from the water, so that the concentrate part can be incinerated.

The alternative is to incinerate millions of litres of contaminated water rather than severl kilograms of surfactant. To put it in context, Dr Pabon estimated that at Buncelfield around 20 million litres of foam water were used. It costs around one euro to incinerate a litre of water.

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Two years ago, at the previous Reebok conference, a filtration technique was discussed using activated carbon. Today, Dr Pabon's research has moved to reverse osmosis, which has cost, performance and maintenance advantages over activated carbon.

Pabon explained how the first stage of the process uses electrocoagulation to rid the water of fuel droplets and other impurities. The second process uses reverse osmosis via a membrane.

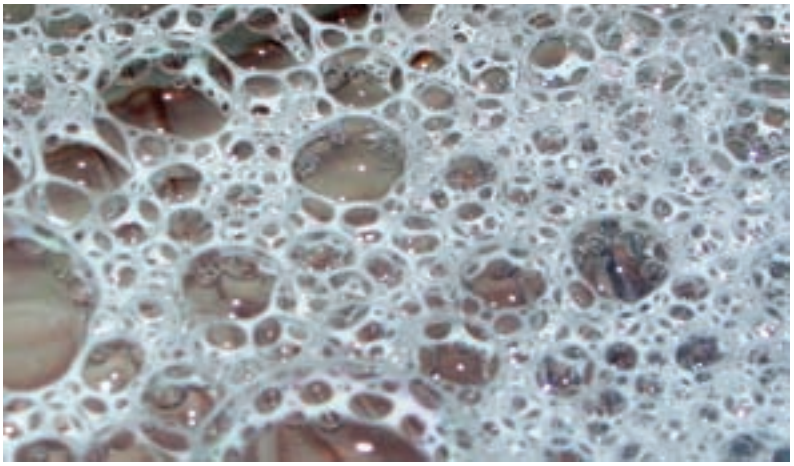
The process was tested with actual fire water with a concentration of 150ppm of fluorosurfactant. Following treatment the fluorosurfactant levels were below those capable to be detected by the equipment used by Pabon, and therefore well below those stipulated by water treatment regulators.

In large scale production, it is envisaged that such a treatment plant could treat 4.5 m^3 of water per hour, with costings around 0.5 dollars per m^3 – quite a difference from the one euro per litre of current incineration costs (1,000 times cheaper).

"Of course the equipment has to be purchased and that's why I was talking of using a mobile unit. We want to absorb the fixed cost of the equipment and electrocoagulation at 100,000 dollars, and reverse osmosis at 150,000 dollars. This is for treatment of 10 million litres of water in three months. This cost is perfectly reasonable and competitive compared to incineration."

Following a question and answer session, it was established that the unit could be scaled up for water treatment to start two years from now. It was also suggested that big refineries could have such a plant on site which under resilience arrangements could be available within two hours.

All the foam conference presentations will be posted on the Fire & Rescue website. To receive an email alert when they are available, sign up for Fire e-news on www.fireandrescue.net.



Dr Sthamer-Hamburg has launched the alcohol-resistant and fluorine-free Moussol FF 3x6, which complies with EN 1658 and has just passed class B ICAO.