SAFETY

Fluorine free fire-fighting foams

***Niall Ramsden* of ENRg Consultants and Lastfire Project Coordinator explains how the Lastfire initiative is helping drive a smooth transition to fluorine-free fire-fighting foams.**

For many years the effective fire-fighting foams for flammable liquid fires – whether they are life threatening fires during helicopter crashes or asset destroying events such as tank fires – have all contained chemicals in the 'fluorosurfactants family' that give them special properties to reduce fuel pick up and spread rapidly over burning fuel surfaces. Without getting too involved in the detailed chemistry, different types have been used, including those based on both C8 carbon chain length and C6 types.

Despite ongoing arguments that some of the shorter chain variants are not an environmental or health hazard, the consensus seems to be that they all have associated problems – and this is certainly the approach that regulators appear to be taking. The recently published draft regulations by ECHA (the European Chemical Agency) for public comment effectively ban all such chemicals in fire-fighting foams and are suggesting a staged transition process for their total replacement to be completed within 12 years from the introduction of the regulations. This might seem like a long time – but there is much to be done.

Whilst some still argue that such chemicals are essential in foams, most end users are taking a more pragmatic approach. They have accepted the inevitable and are moving towards formulations that do not contain any of these 'forever' chemicals. As a result, extensive research is concentrating on the effective use of fluorine-free types of foam.

Those companies who have not accepted this change and are moving to alternative fluorosurfactant based types of foam could well be required to change again, with the consequent high 'regret spend' – so it is important to get the decision right first time.

Some might see this as a crisis, but it is better to regard it as an opportunity to establish improved and optimised foam application techniques validated through critical testing, because current design standards are based on very limited testing and, thanks to good operating procedures and prevention measures, on very limited incident experience.

Test programme

Lastfire (**www.lastfire.org.uk**) is an international forum of oil companies developing best practice guidance in storage tank fire hazard management, with a focus on amassing data and carrying out extensive test work to enable logical, rational and cost-effective decisions on the transition process based on facts rather than opinions and marketing hype.

Since *Petroleum Review* first highlighted the work of the initiative in August 2018, even larger scale tests have been carried out in conjunction with Dallas Fort Worth Fire Training and Rescue Centre in the US, and also at the test/training centres at Centro Jovellanos in Spain and FER at the Szazhalombatta Refinery in Hungary. These have evaluated the effectiveness of both conventional and novel application techniques, including subsurface application of fluorine-free foams.

Further tests are planned in Europe in 3Q2020 once the current COVID-19 crisis is under control; the first will be on 5–10 October. A new purpose-built test pit currently under construction at Vernon, France, funded by Lastfire and Gesip (a France-based consortium of fuel storage companies), will measure 50 metres in length and allow a range of tests using different foam agents and application equipment. It will provide a unique opportunity to carry out truly large-scale 'real life' representative testing.

Through cooperative agreements with other organisations, smaller scale tests are also planned to optimise foam properties and test foams with different non-hydrocarbon fuels such as alcohols and ketones.

Spreading the word

The Lastfire test work has been supplemented by networking with other interested parties, including the American Petroleum Institute, where, amongst others, Lastfire members Caltex in Australia and BP in Germany (who have already started the transition process to fluorine- free foams) shared their learning experiences.

A planned 'Foam Summit' in Europe in September 2020 has been postponed due to the current pandemic. However, a series of web-based presentations on all aspects of the transition process is being planned.

Transition assurance

The full transition to a non-fluorinated foam involves many aspects, not just testing fire performance, and will take some time to achieve. In the interim, and still important when transition is completed, it is critical that foam stocks are managed correctly.

With this in mind, Lastfire has also developed a 'procurement to disposal' best practice guidance and assessment tool. The objective is to provide a protocol with which, on a site-specific basis, the complete life cycle of foam

A new purpose-built test pit currently under construction at Vernon, France, will provide a unique opportunity to carry out truly large-scale 'real life' representative testing of fire-fighting foams

All photos: Lastfire

Fire-fighting foam manufacturers, suppliers and users are looking to develop improved and optimised foam application techniques validated through critical testing

from procurement to disposal can be analysed and formalised. In this way an operator can demonstrate due diligence in its selection and use of foam, a safety critical product, ensuring that it is fit-for-purpose in terms of extinguishing capability on an ongoing basis whilst minimising the consequences of its use to as low as is reasonably practicable.

Already tested in pilot studies at refineries and tank farms, this tool can be used by a facility to assess current arrangements on a true risk basis and then determine whether changes in products, systems or site procedures are required and/or are cost justified.

Ten key elements are covered:

- Assessment of needs
- Foam concentrate procurement specification and procedures
- Site foam storage and stock management
- Site foam concentrate assurance
- System specification and design
- Testing of foam application equipment and systems
- Environmental fire-fighting foam management assurance
- Site logistics for foam application
- Training and exercising for foam application
- Scenario specific emergency response plans

For each element there is a 'key question' and supplementary 'sub-questions' that can be used to assess a facility's practices. Objectives, options and good practice guidance and proof (the documentary and/or physical evidence required to show compliance) are provided for each element.

Firefighting foam is a safety critical product and, as such, detailed performance-based specifications should be developed and implemented as part of the procurement process. But all too often this is not done to the required levels. Thus, Element 2 of the best guidance and assessment tool – foam concentrate procurement specification and procedures – is considered to be one of the most important in the whole assurance process and is described here in more detail as an example of how the process works.

The objective is to ensure that the foam concentrate procured meets all technical risk reduction and commercial requirements, and that sufficient certified information is available to make informed decisions related to its safe and effective use.

The key question is: 'Has there been a detailed fit-for-purpose foam concentrate procurement specification developed?'

Some examples of the sub-questions in Element 2 are:

- Is there a formal foam concentrate procurement specification in place?
- Does the specification include provision for a foam concentrate type suitable for all fuels on site, including any water-soluble flammable liquids?
- Is the nominal proportioning rate (percentage) appropriate for the fuels and proportioning equipment on site?
- Is there a requirement for all foam concentrate on site to have been batch tested to an appropriate fire performance standard (Lastfire fire test is the most appropriate for tank fires)?
- Has sufficient environmental/ toxicity data been provided to carry out a full environmental impact assessment of using the concentrate in major incidents?
- Has sufficient data been provided to establish the effect of the foam concentrate on the site waste-water treatment plant (WWTP) along with an assessment of the plant's effectiveness in managing the foam?
- Is a shelf life guarantee of at least 10 years in place with a programme of retained sample testing in place to monitor and quantify concentrate degradation, with a requirement for the supplier to make a full replacement if the guarantee conditions ae not met?
- Is full MSDS (material safety data sheet) and test certification, including details of initial physical properties available?

A basic 'traffic light' ranking system is provided so that priorities can be set for any changes that might be required.

From field experience this process identifies improvements for short- and long-term foam application and stock management, so even without the current transition concerns, it has proved invaluable to those who have applied it.

Get involved

Lastfire, through in-house member and coordinator experience, commitment and expertise, continues to be a driving force for developing and implementing cost-effective long-term firefighting foam policies. Although the focus is on storage tank application, the findings are applicable to all users.

Working with all relevant stakeholders, including the Energy Institute (EI), the initiative is keen to hear about and share experiences of all aspects of foam transition through networking and discussions. Proposed updates of *EI MCOSP Part 19 – Fire Precautions at Refineries and Bulk Storage Terminals* will take account of this work. For further information, please contact **info@lastfire.org**