

MOVING TOWARDS A FLUORINE-FREE FUTURE

James Perriss, General Manager of the Fire Safety Group at Perimeter Solutions, explains how the company worked to retrofit a system to become fluorine-free



Foam is a vital part of the firefighting industry, and for a long time fluorosurfactants has been a key part of tackling fires. It is particularly useful in larger, flammable fires. However, it comes at a price. Research has shown that due to the lack of degradability, using AFFF is simply not sustainable for the future.

This has resulted in an increase in end users moving away from the traditional system, and on to a fluorine-free alternative that is less harmful to humans and the environment.

Until recently, many in the fire safety industry believed that it was impossible to completely retrofit and convert a fluorinated fire suppression system into one that is fluorine-free. Selecting a suitable fluorine-free foam (F3) with global listings and approvals that also holds the same or better fire performance is the starting point. A critical activity is identifying a design team capable of performing the extensive clean out required to ensure that per- and polyfluoroalkyl substances (PFAS) does not remain within the system and contaminate the F3 replacement.

Perimeter Solutions, a foam technology and equipment supplier, collaborated with Arcadis Australia and Wormald Australia to prove that a successful conversion is possible when they transitioned the X-Flight Aircraft Hangar fire suppression system at Brisbane Airport from AFFF to fluorine-free foam. Arcadis Australia, an environmental engineering consulting company, led the design and implementation of the project, which was necessitated after the

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Queensland Department of Environment and Science introduced a new firefighting foam management policy in 2016 to phase out PFAS containing foams.

“The transition to fluorine-free foam is one of the biggest steps we can take to reduce the potential for PFAS discharge and therefore make a positive impact on the environment,” says Peter Storch, Technical Director at Arcadis. “We were approached by X-Flight to advise on how to make the transition and we put together a comprehensive, qualified team to ensure the transition was a success.”

The project team consisted of a fire engineer, fire service contractor, a foam technology supplier and an environmental engineer. Once assembled, the team executed the project by securing airport permitting and approvals. The process then moved on to selecting a firefighting foam, designing and implementation of system modifications, and removal of AFFF foam concentrate and PFAS decontamination. The team then recharged the system with SOLBERG® RE-HEALING™ RF3 - a 3% fluorine-free foam concentrate, conducted proportioning testing, ensuring full collection and analysis of the discharged fluorine-free foam solution for waste management and reporting.

Arcadis used a proprietary, biodegradable cleaning agent to remove residual PFAS from the piping system and to reduce PFAS concentrations to levels below the newly established regulatory requirements. System modifications were designed and installed by Wormald, a fire system design and construction company, that

included foam proportioners and foam sprinkler heads tested with SOLBERG® RE-HEALING™ RF3 foam supplied by Perimeter Solutions.

“The foam selection was critical, and we decided on Perimeter Solutions’ SOLBERG® product due to its compatibility with the existing system, as well as its industry accreditations, approvals and global listings. SOLBERG® also had established precedence in similar aviation systems, so we had great confidence in this product,” said Storch.

SOLBERG® RE-HEALING™ RF3 is also the only F3 that has a UL 162 sprinkler listing through non-aspirated standard sprinklers at the same low application rates as fluorinated AFFF foams.

System Modifications

In addition, 320 foam sprinkler heads were replaced with models listed for use with SOLBERG® RE-HEALING™ RF3 foam concentrate. The Perimeter Solutions team conducted extensive testing at its fire test facility in Green Bay, Wisconsin, using the same model sprinkler heads originally installed at the X-Flight hangar. This testing verified the required fire performance at these low application rates could still be achieved with SOLBERG® RE-HEALING™ RF3 utilising the existing sprinklers installed. However, it was correctly decided by the engineering team that the system sprinklers should be changed to the UL 162 listed and approved Non-Aspirated Sprinklers from Reliable Automatic Sprinkler Co. - Model F156 -1/2" (1.27 cm), K-Factor 5.6 (0.16 gpm/ft²) - independently tested and UL 162 listed with the SOLBERG® RE-HEALING™ RF3.

PFAS Decontamination

As referenced earlier, decontamination of the foam supply

system is critical in the transition to a fluorine-free replacement. If the new system were to be contaminated with PFAS from residual AFFF in the foam supply piping, the PFAS-free benefits of the F3 would be lost.



Arcadis took the following approach to decontaminate the fluorinated fire suppression system:

- Replacement of the foam tank bladder as well as small, impacted piping system components where accessible
- The cleanup and reuse of small piping components that were to be reused in the F3 system
- In-situ cleaning of the large diameter piping system. Replacement items were decontaminated using Arcadis' V191 cleaning agent before either re-use or recycling, which included stainless steel pipe, pipe fittings, valves, strainers, and proportioners.

In-situ PFAS Cleanout

Arcadis conducted a robust cleanout process of the former

AFFF piping that was left in place by recirculating a biodegradable cleaning agent to maximize the mass removal of PFAS and minimize the amount of waste generated. The extent of the piping system decontamination ranged from the 250-mm diameter fire water pump discharge manifold through the alarm check valves, the proportioners, the isolation valve and through the 200-mm diameter foam supply test run.

Performance Testing

The performance testing was conducted by Wormald with support from Arcadis to verify compliance with National Fire Protection Association (NFPA) requirements for this new F3 system. Arcadis then worked closely with the local utility and airport authorities to gain approval for the first documented discharge of F3 proportioning waste to sewer, resulting in significant cost savings over offsite disposal.

The testing demonstrated that the new system would meet the requirements of the airport, the state of Queensland and the NFPA standard. It also resulted in the collection of 50,000 liters of foam mix. When disposed, the RF3 foam was accepted for discharge to the local sewage treatment plant

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based on test work conducted by the plant operator. The toxicity test work showed that the PFAS-free RF3 solution was compatible with the treatment facility activated sludge. The result of sewer acceptance

was substantial savings over offsite disposal costs.

Perimeter Solutions, Arcadis and Wormald proved that it is possible to change a fluorinated system to a F3 system – including cleanout, discharge and commissioning, with only minimal system changes. Organisations that understand PFAS, how to decontaminate surfaces and who work with fire engineers can make the transition. Also, contractors who understand how to design and modify an effective system are able to work with these organisations and make the same transition. This project demonstrates that transitioning does not require complete system replacement (which would be at a much higher cost). Only key elements of the fire system required modification, which requires evaluation on a case-by-case basis. While some big industry players believe that complete fire system replacement would be required to transition to F3, this project at Brisbane Airport demonstrates that is not the case.

There is also an industry misperception that F3 is not capable of replacing AFFF. When designed and engineered correctly, the UL listing for sprinklers is proof that the SOLBERG® RE-HEALING™ RF3 foam can be used in place of AFFF in sprinkler systems on hydrocarbon fuels, resulting in no loss of performance, while also introducing cost saving for disposal in ongoing performance testing. The transition to SOLBERG® RE-HEALING™ RF3 ensures compliance to current and changing firefighting foam regulations around PFAS and while reducing environmental liability of the foam user.

James Perriss is General Manager of the Fire Safety Group at Perimeter Solutions.

To find out more about our SOLBERG foam concentrates and suppression systems hardware visit www.solbergfoam.com