

CRC CARE

Case Study

[Home](#) / [Our research](#) / [Case studies](#) / Fighting fire-fighting foam

Fighting fire-fighting foam

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Category: Case Studies

- *Chemicals used in fire-fighting foams are a health hazard*
- *CRC CARE has developed a clay-mineral mix that cleans up the hazardous chemicals*
- *Clean-up technique trialled and operational at Australian Defence sites*
- *The CRC is funding a project to assess the performance of different labs and methods in analysing these contaminants*

Perfluorochemicals (PFCs) have been commonly used to improve the ability of fire-fighting foam to smother fire. In such 'aqueous film-forming foams', or AFFFs, these chemicals have been used on fires at thousands of emergency and training sites worldwide over the past half-century. They are also widely used to treat fabrics and leather, and in paper products, food packing and insecticides.

Threats to people and wildlife

PFCs can be dangerous to human health. In particular PFOS (perfluorooctane sulfonate) and PFOA (perfluorooctanoic acid) are two commonly used PFCs that are known to enter ecosystems and move up food chains, accumulating in animal and human tissue, including the liver and blood. PFCs have been linked to bladder and liver cancer, endocrine disruption, and developmental and reproductive toxicity, including neonatal mortality,¹ and are potentially lethal to animals.

Are there safe levels of PFCs?

The Stockholm Convention on Persistent Organic Pollutants has listed PFCs as chemicals of concern to human health.² The US EPA standard for PFOS levels for both drinking water and wastewater is 0.2 parts per billion (ppb).³ PFC-contaminated animal food chains in the US have had PFOS levels as high as 59,500 ppb.⁴

PFOS and PFOA in the environment

PFOS and PFOA are increasingly being phased out of modern foams. Concentrations in human blood appear to be decreasing in the US, although they are still rising in China.⁵ Today they remain significant residual contaminants at many sites globally, for example, at many of the world's 49,000 airports (including 450 civilian and military airports in Australia).

Foams are also deployed on fires at traffic, truck and railway accidents and even building fires. As at airports, the chemicals can escape into the surrounding urban or rural environment and contaminate water supplies.

Analysing with confidence

Australia does not yet have the infrastructure to ensure the quality and comparability (across different laboratories) of PFOS/PFOA measurements. To address this gap, two CRC CARE Participants – the [National Measurement Institute](#) and [Environment Protection Authority Victoria](#) – are collaborating in a CRC CARE-funded project to develop and demonstrate PFOS/PFOA 'proficiency testing', which assesses

Cleaning up with clay

Aware of the high adsorption properties of clay-based materials, scientists at CRC CARE identified one clay type that was especially effective in trapping the contaminant PFCs. By tailoring its mineral constituents, researchers were able to fine-tune the clay's adsorption properties to achieve full recovery of the PFCs.

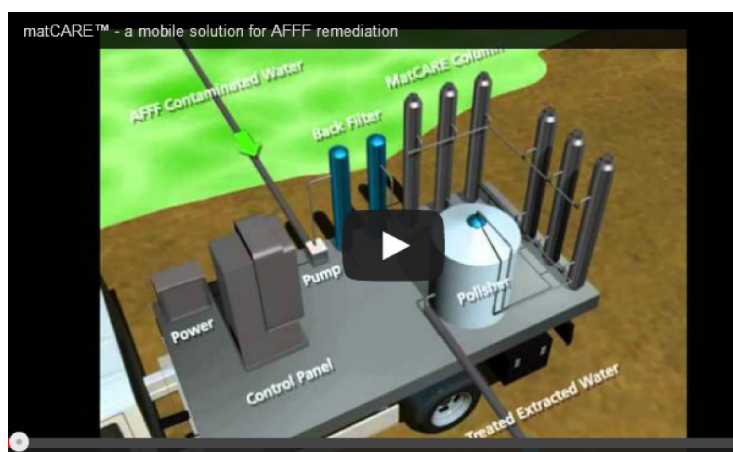
In further laboratory trials this modified clay, named **matCARE™**, remediated both water and soil, removing PFOS, PFOA and other fluorinated surfactants to below detection limits.

Defence against AFFFs

Based on this research, CRC CARE has established remediation facilities at Royal Australian Air Force sites in Edinburgh (SA), Pearce (WA) and Townsville (Qld), where years of foam use, mainly in fire-fighter training, had caused substantial PFC contamination. Treatment has so far resulted in the clean up of over 1 million litres of water to less than the reporting level of 5 ppb.

To further improve the clean up of PFCs, CRC CARE has developed an anionic surfactant test kit (astkCARE™), which can be used to detect AFFFs.

As research reveals more about the long-term effects of PFCs on people and animals, it is likely that governments and communities will demand increasing restrictions on their use, as well as lower levels of environmental contamination. This new technology from CRC CARE is ready to play a key role in the response.



References

1. Betts, KS (2007). 'Perfluoroalkyl acids: what is the evidence telling us?', *Environmental Health Perspectives* vol. 115, iss. 5, pp. A250-256.
2. Stockholm Convention (2009). **Governments unite to step-up reduction on global DDT reliance and add nine new chemicals under international treaty.** United Nations Framework Convention on Climate Change COP4.
3. USEPA (2013). **Emerging Contaminants – Perfluorooctane Sulfonate (PFOS) and Perfluorooctanoic Acid (PFOA).** USEPA Fact Sheet.

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