# Standardized Approaches for Risk Ranking Portfolio of Sites Impacted with PFASs


***Ian Ross, Ph.D.*** (Ian.Ross@arcadis.com) (ARCADIS, Cheshire, UK)
Jake Hurst (Jake.Hurst@arcadis.com) (ARCADIS, Leeds, UK)
Jonathan Miles (Jonathan.Miles@arcadis.com) (ARCADIS, Leeds, UK)
Erika Houtz, Ph.D. (Erika.Houtz@arcadis.com) (ARCADIS, San Francisco, CA)
Jeffrey McDonough (Jeffrey.McDnonough@arcadis.com) (ARCADIS, Newtown PA)
Jeff Burdick (Jeff.Burdick@arcadis.com) (ARCADIS, Newtown, PA)



**Background/Objectives** Assessing portfolios of sites which have been used for fire training has become an important issue as drinking water supplies across North America are increasingly being found to be impacted by poly- and perfluoroalkyl substances (PFASs) which may have emanated from fire training activities. The risks posed to drinking water supplies by PFASs are becoming apparent as these contaminants are extremely persistent, very mobile in aquifers, and are regulated to parts per trillion levels as a result of their toxicological properties, potentially amplified by bioaccumulation. The plumes emanating from s source zones containing PFASs have the potential to travel some distance from a point source release, such as a fire training area (FTA) where large releases of PFAS foam occurred consistently for decades at the same location. To rationalize how to investigate a portfolio of FTAs and identify which may be most likely to pose harm to human health, a strategy has been developed, specific to PFAS, which evaluates the environmental site sensitivity of each FTA to develop an initial outline for a conceptual site model (CSM). The process of developing multiple PFAS specific outline CSMs as a Phase 1 desk study exercise, with subsequent risk ranking, is described.

**Approach/Activities** The outline CSM were developed based on the following criteria: 1) site geology and an adequate understanding of lithological units potentially exposed to PFAS; 2) site hydrology and hydrogeology and an understanding of the potential for PFAS retardation factors; 3) direction of groundwater flow and geochemical status given local conditions (i.e., available analytical data from existing wells located in the vicinity of the sites); 4) length of time the site has been releasing PFAS foams; 5) location of receptors, such as surface water, drinking water, and agricultural receptors (e.g., crop spray irrigation). This information is combined in an outline format to determine if a length of time that PFAS foams have been released, coupled with an understating of the local hydrogeology, indicates a potential PFAS travel distance. Combining this information with the identified location of potential receptors and the likely groundwater flow direction then enables site prioritization.

The initial list of sites is then evaluated using a further set of criteria, evaluating uncertainties, to prioritize the sites that are most likely to be impacting specific receptors, such as drinking water wells. The uncertainties in each stage are catalogued such that less reliable input data results in higher site prioritization. This risk ranked list of sites is generated prior to field mobilization to collect soil and groundwater samples to focus intrusive investigations to higher priority source areas

**Results/Lessons Learned** The presentation will describe application of this risk ranking process using a number of international portfolios of sites. The process of prioritization and management of inherent uncertainties will be described in detail with reference to application of this approach in multiple countries, with lessons learned as a result of implementing the process.