Environmental Forensics Applied to Per- and Polyfluoroalkyl Substances (PFAS)

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Introduction. Per- and polyfluoroalkyl substances (PFASs) are considered emerging contaminants due to recent discovery and a changing regulatory landscape. Primarily due to their recent emergence in the environmental industry, the overall understanding of PFAS nature and extent is weak, especially when compared to our knowledge of the behaviour of petroleum constituents, chlorinated solvents and metals. A broad assessment of where and why PFASs occur in the environment is needed to help practitioners and facility owners predict what they may find if/when they sample for these emerging contaminants, and how transformation in the environment affects the PFAS signature in impacted media.

Methods. CH2M has performed desktop evaluations of over 1,000 potential PFAS release locations, and characterization of potentially impacted media at over 100 sites. For this assessment, we have compiled and handled data from various sources as "big data", that is multiple data sets were combined to define the general findings of the assessments. The multiple data sets evaluated included the following:
- Investigations across multiple international military entities,
- Published information from other broad-scale assessments,
- Unregulated Contaminant Monitoring Rule (UCMR) List 3 testing, and
- Compiled information from international studies (e.g., Canada, Europe and China).

The types of data that were evaluated included:
- Analytical results, including PFOS, PFOA, and precursor compounds,
- Co-contaminants, such as petroleum contaminants and chlorinated solvents,
- Types of PFAS released (AFFF, stain repellents, chrome plating mist suppressants),
- Ages of suspected or documented release events, and
- Distance from potential source areas to sample locations.

Results and Discussion. The data were assessed to provide useful information for facility owners to allow prediction of most likely results if/when future sampling is conducted. An example of the types of information evaluated includes the types of aviation facilities assessed and what PFAS were present, at what levels. Another example of the type of findings from this evaluation project is the use of radar plots or spider plots to define different populations of PFAS that can be used to distinguish between potential sources, such as AFFF versus residential or commercial PFAS sources (e.g., carpet, clothing, food packaging).

Conclusions. We conducted a robust evaluation of data compiled from multiple sources to provide predictive information for practitioners and facility owners. The types and ages of releases, types of sites, and analytical results were evaluated and general patterns determined. This information can be used to understand the potential for an individual site to include a problematic release to an environmental media, and a rough understanding of the sorts of PFAS that would be present in the various media. This information can be useful if/when sampling occurs and can help teams in investigative planning, and ultimately remediation.