



Progress in PFAS Site Investigation Procedures: Recent Cases in Canada

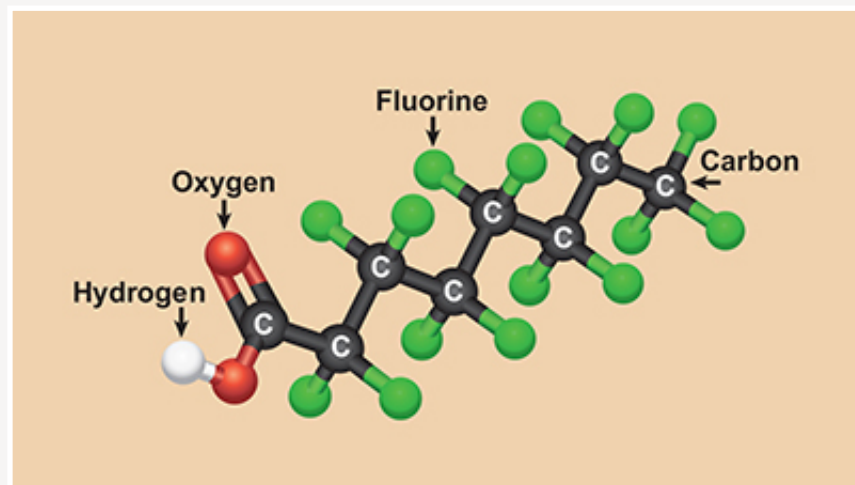
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Landscape: Per- and poly-fluoroalkyl substances (PFAS)

- › Commonly occurring, man-made substances
- › Everyday household, commercial and industrial products by virtue of its properties, including heat-, stain-, water- and stick-resistant surfaces
- › Long chain PFAS widely used from the 1970s through the early 2000s in aqueous film forming foam (AFFF) - perfluorooctane sulfonate (PFOS) legacy foam –
- › AFFF replaced by modern firefighting foams in the early 2010s
- › PFAS do not naturally attenuate or decompose and persist in the environment once released



Perfluorooctanoic acid (PFOA)
<https://www.niehs.nih.gov/health/topics/agents/pfc/index.cfm>

Environmental Site Assessments

- › PFAS can travel long distances through the air and other environmental media
- › Ubiquitous - potential for cross contamination of samples
- › Regulatory guideline concentration values are extremely low (in the ng/L range)



SNC-Lavalin, 2017

Environmental Site Assessments

- › Consistent and reliable information on sample collection for PFAS is sparse
- › Most guidance documents default to a conservative approach in implementing measures and controls for prevention of cross-contamination

1) Dillon Consulting Limited, 2015. Perfluorochemical (PFC) Sampling Methodology for 14 Wing Greenwood. Statement of Work, Detailed Testing Program: FFTA CFB Comox, 8 pp.

2) Government of Western Australia, Department of Environment Regulation. 2016. Interim Guidelines on the Assessment and Management of Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS), Contaminated Sites Guidelines, Department of Environment Regulation, Perth, Western Australia, 22 pp.

3) National Ground Water Association (NGWA), 2017. Groundwater and PFAS: State of Knowledge and Practice, NGWA Paper 120 p.

4) Transport Canada. Feb 2017. Per- and Polyfluoroalkyl Substances (PFAS) Field Sampling Guidance. 19p.



Starting out – Where we're coming from

- › Many sources of PFAS potentially present within field sampling kits and equipment
- › Sample containers
- › Water level tape
- › Sample tubing
- › Sample packaging
- › Monitoring Well construction material
- › *even residual PFAS that could remain on the field operator after having lunch sandwiches wrapped in aluminium foil.*

Food Packaging examples include food wrappers, paper/moulded fibre service ware, take-out food containers, pizza boxes, microwaveable popcorn bags, bakery bags, cake plates, bakery paper and single-use plate
(FoodinCanada.com, 2019)

<https://www.foodincanada.com/features/pfas-in-food-packaging/>



Starting out – Where we're coming from

- › Very conservative approach to restrict the presence or potential for any of these common materials to be present at the sampling Site. And this has caused many headaches
- › For good reason – but is this still warranted?



Where we are now

Although limited in number, emerging studies are showing that sampling materials are not all created equally (bad).

The Good	The Bad	The Unavoidable
Wear natural fibers (preferably cotton)	Water resistant, waterproof, or stain-treated (e.g., Gore-Tex™, coated Tyvek™)	Polyethylene, vinyl, or PVC rain gear. Wear cotton over fire-rated safety clothing
Bar soap is acceptable	Soap containing moisturizing lotions	Shower the night before sampling; Rinse with water in the morning
Long sleeves, 100% natural shirts, wide brimmed hats for insect and sun protection.	Sunscreen and insect repellants containing PFAS	100% natural sunscreen, and repellants containing DEET are acceptable

Where we are now

The Good	The Bad	The Unavoidable
<p>Nitrile gloves; Well-laundered, natural fiber clothing; Non-coated or plain Tyvek; HDPE; PVC; Neoprene; Polyurethane; Stainless Steel; Silicone; Ziploc bags; Double-bagged Ice; Fine point sharpies.</p>	<p>PTFE including Teflon® and Hostaflon®; Any products with “perfluoro” or “fluoro”; Gel or waterproof ink pens; LDPE; Plastic coated paper; Waterproof field books; Plastic clip boards; Binders or spiral hard cover notebooks.</p>	<p>Seats of the vehicles covered with well laundered cotton blankets; Safety footwear; High visibility safety wear shall be laundered, not “new”.</p>



Where we are now

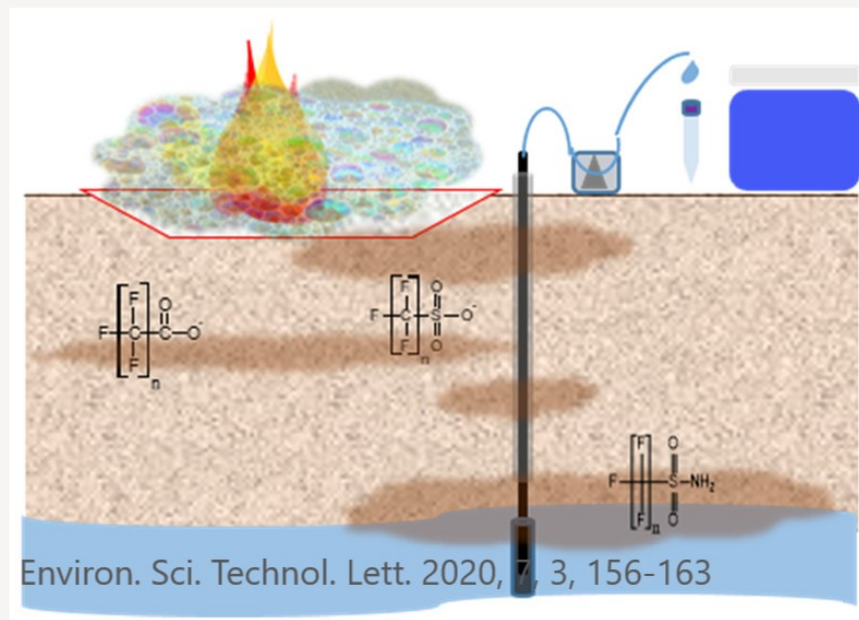


- › Use, dedicated and single-use equipment and materials.
- › Non-dedicated equipment to be appropriately decontaminated following standard protocol.



Sample collection and decontamination

- › Cross contamination as a result of use of non-dedicated equipment
- › Proper decontamination procedures are critical
- › Several approaches to decontamination of field equipment are available and it is up to the practitioner to apply the appropriate approach



Sample collection and decontamination

Drilling equipment:

- › Contractors notified investigation will focus on PFAS sampling;
- › PFAS containing lubricants or sealants, including PTFE containing greases, cannot be used for assigned drilling equipment
- › Bring the total anticipated amount of drill rods/augers/bits and tooling required



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Sample collection and decontamination

Decontamination 101

- › Wash equipment with a solution of Alconox, and PFAS-free water;
- › Rinse equipment with PFAS-free water;
- › Rinse equipment with PFAS free methanol;
- › Complete a final rinse equipment with PFAS-free water;



Sample collection and decontamination

- › Sample from least to most impacted location.
- › Same protocol applies for soil, sediment, surface water sampling equipment.



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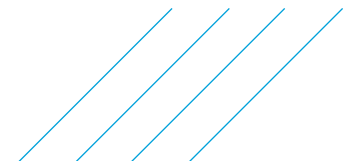
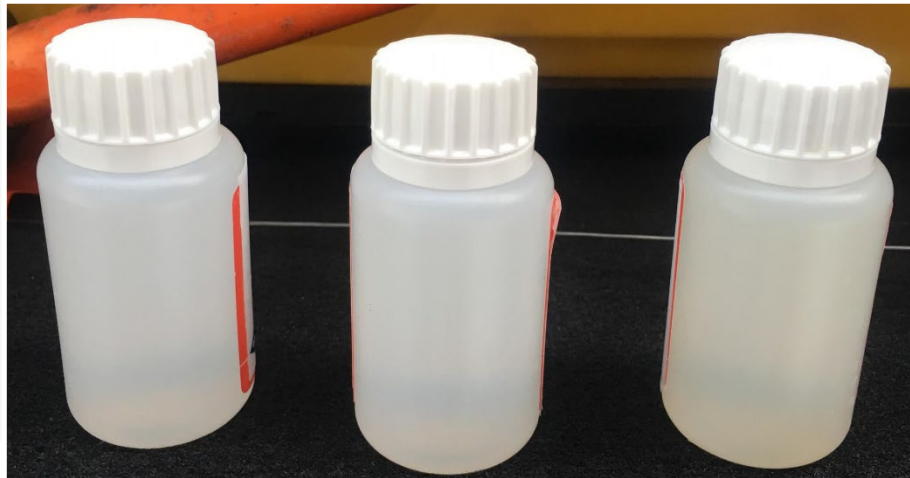
Sample collection and decontamination

- › Monitoring well installation materials kept in packaging prior to installation.
- › Adequate sand filter install
- › Complete thorough development
- › PFOS, some precursors adsorb to sediment
- › Monitor field parameters - Turbidity critical



Field QA/QC Sampling

- › **Field Duplicate** - collected in the field and submitted to the laboratory as two distinct samples. used to verify the precision of field and laboratory activities.
- › **Field Blank** – to verify that the sampling environment does not introduce PFAS and cross-contaminate samples during the sampling event. For the analysis of aqueous matrices, the field blank is collected by pouring PFAS-free reagent water that is stored in an acceptable sample container for PFAS sampling into an empty, clean sample container at the sampling site.



Field QA/QC Sampling

- › **Equipment Blank** - collected by passing laboratory-verified PFAS-free water over or through decontaminated field sampling equipment before the collection of field samples to assess the adequacy of the decontamination process and/or to evaluate potential contamination from the equipment used during sampling.
- › **Trip Blank** – Not Required (check project/jurisdiction requirement) - Trip blanks are a bottle of PFAS-free water that is prepared in the laboratory, travels from the laboratory to the site, and then gets transported back to the laboratory without having been exposed to any sampling procedures.

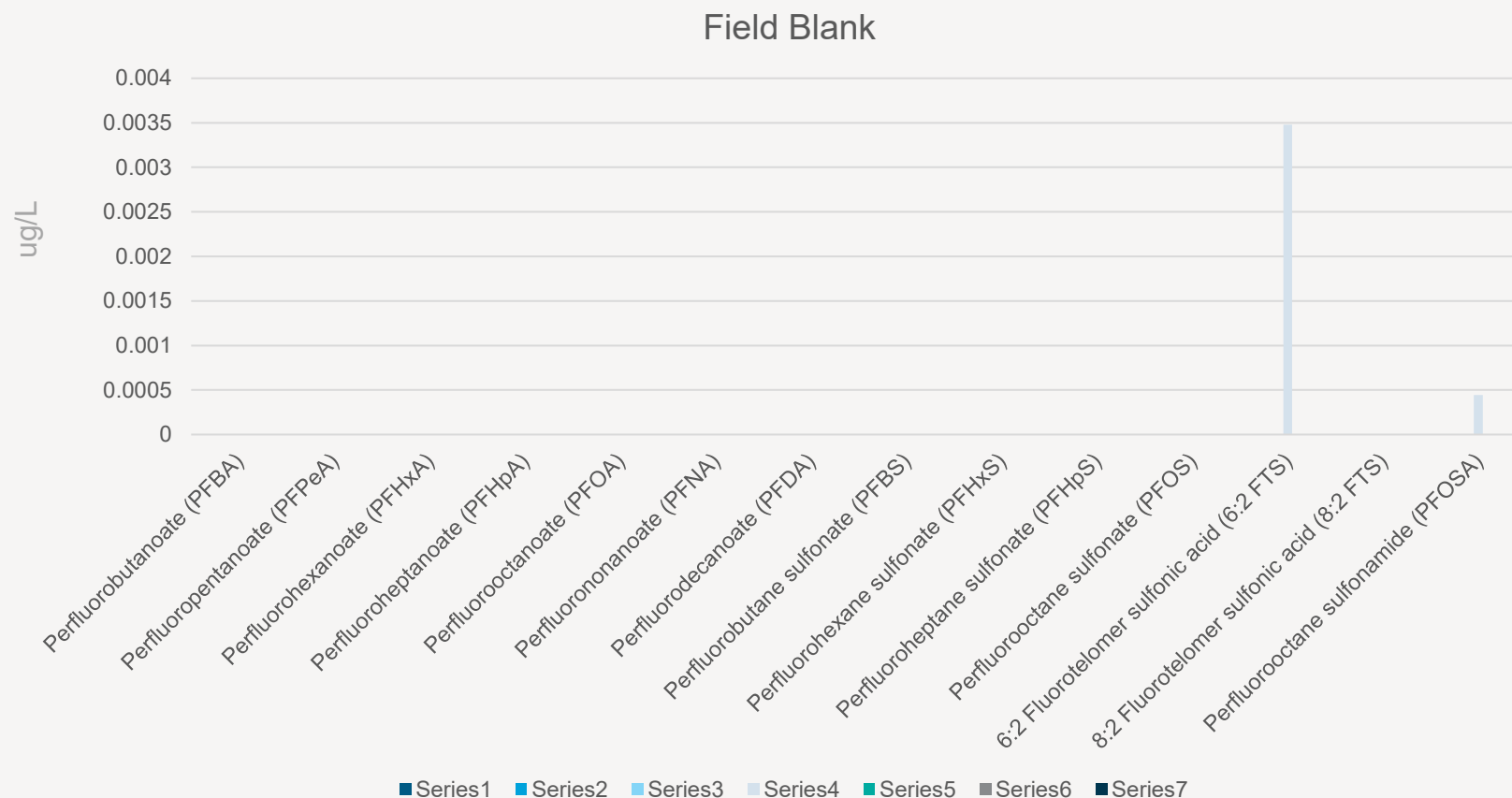


Decontamination Water Source

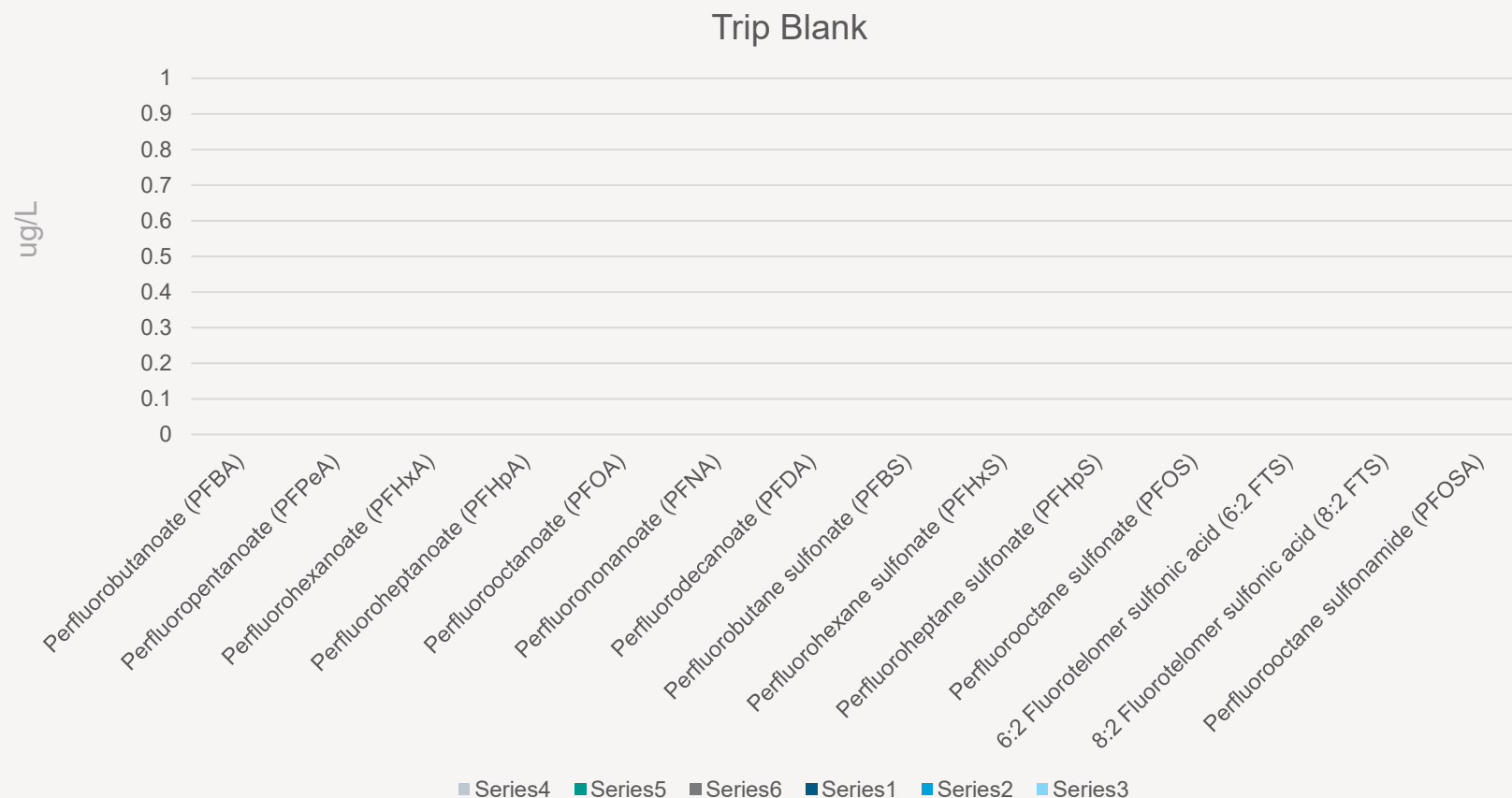
- › Commercial spring water can be utilized as PFAS-free water;
- › The water to be used must be characterized in advance to confirm it is PFAS free;
- › Alternatively, a pre-tested water source (preferably on site) can be utilized;



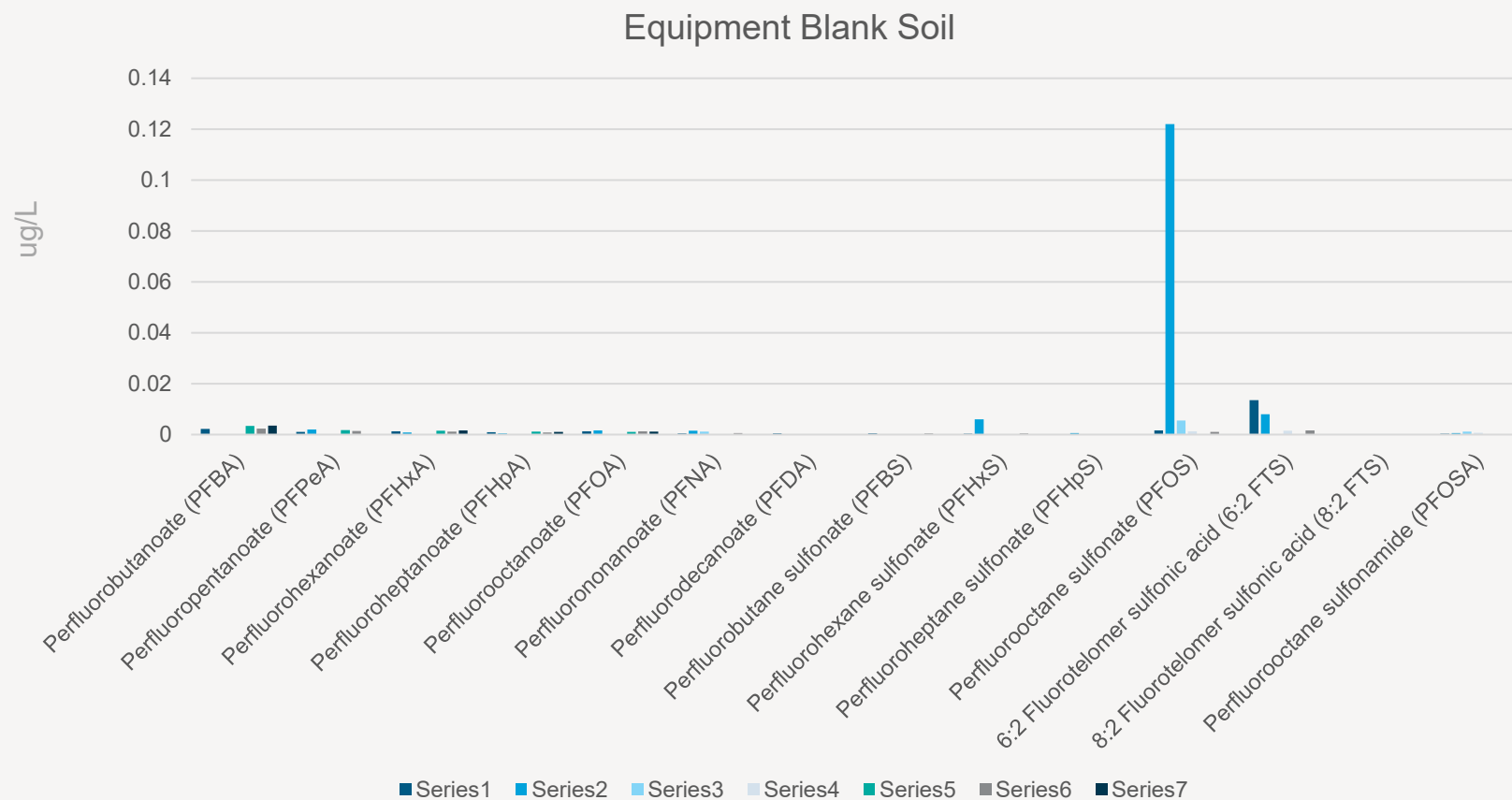
Evaluation of field and laboratory analytical data



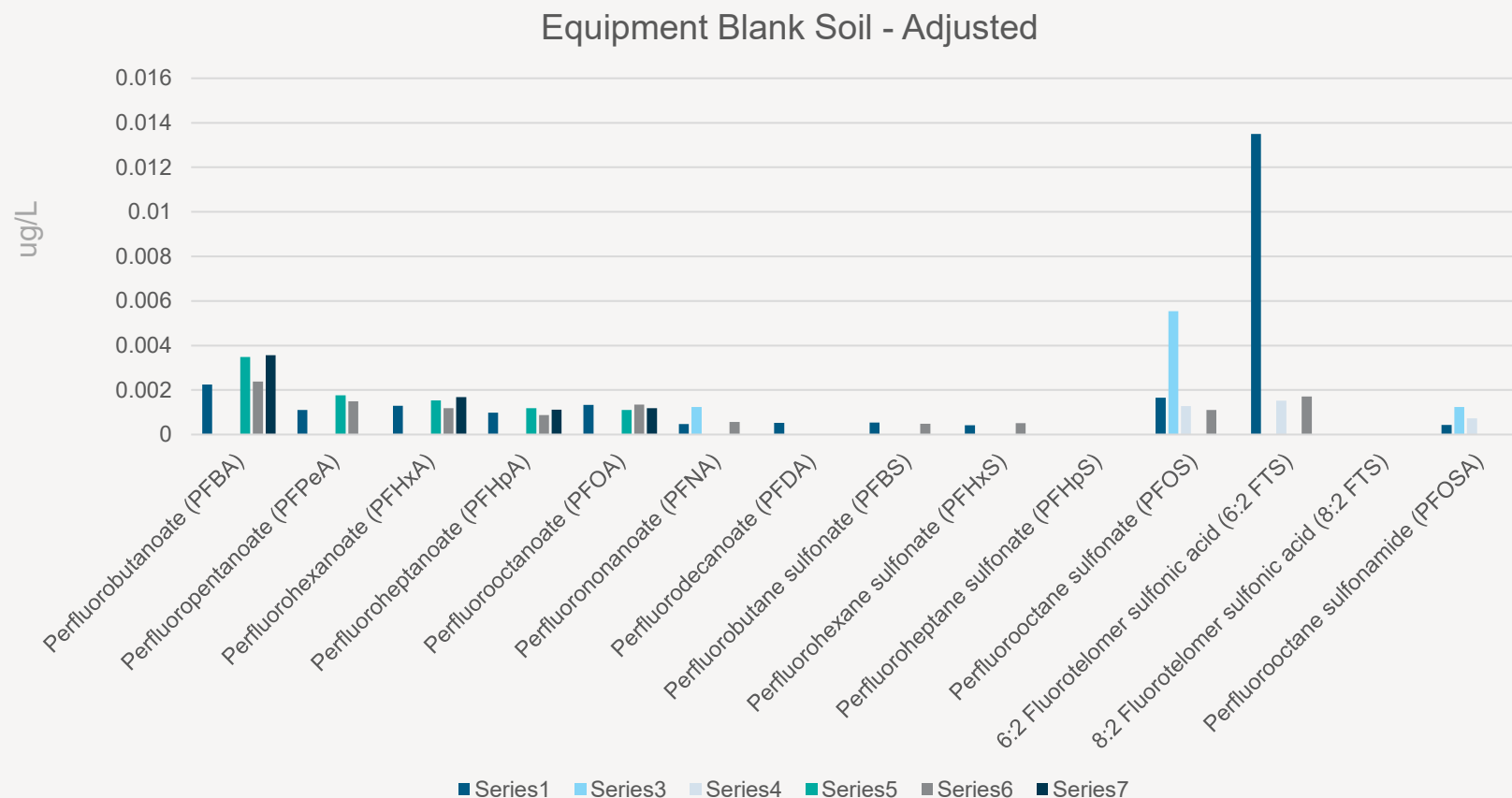
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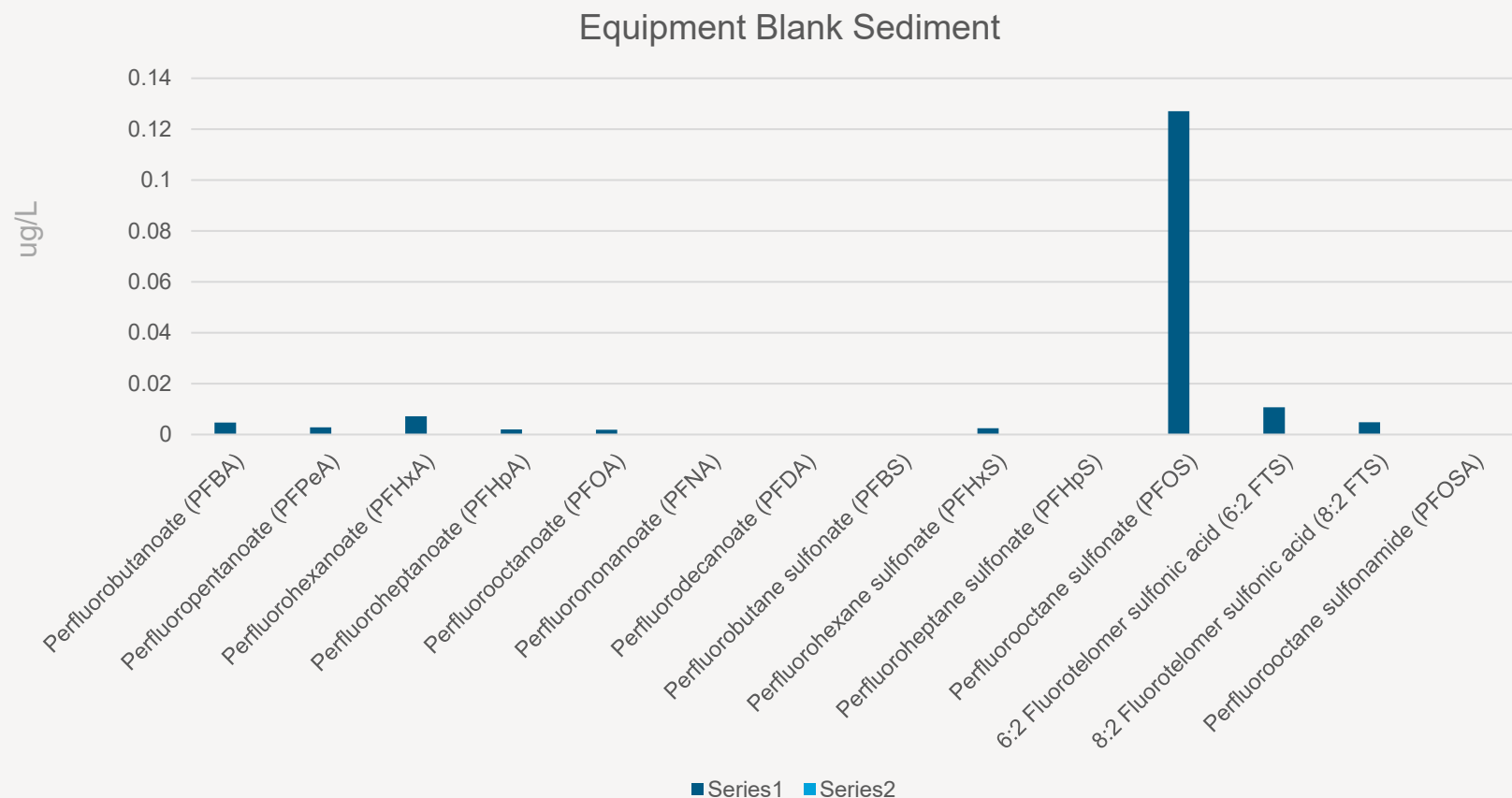
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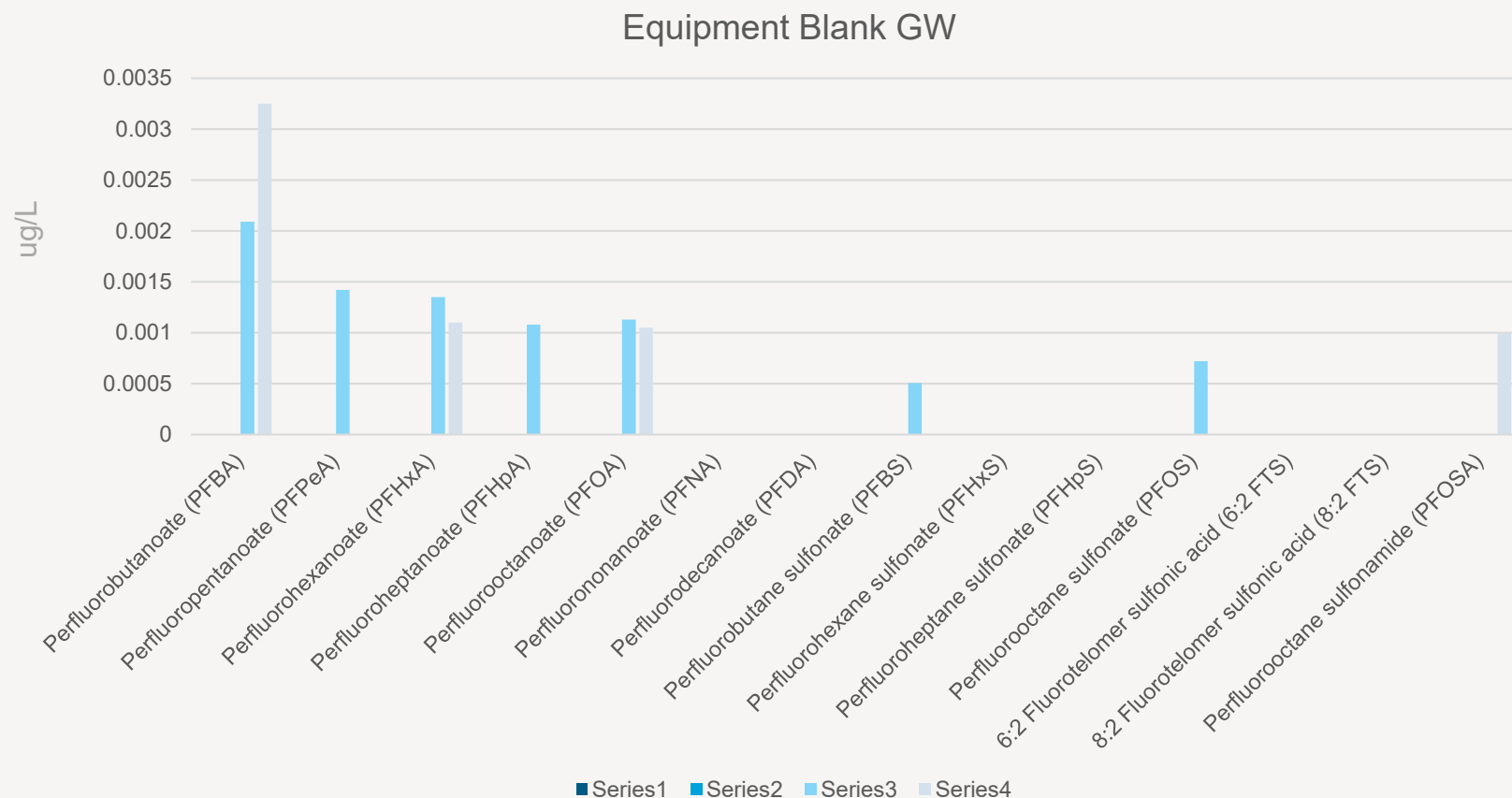
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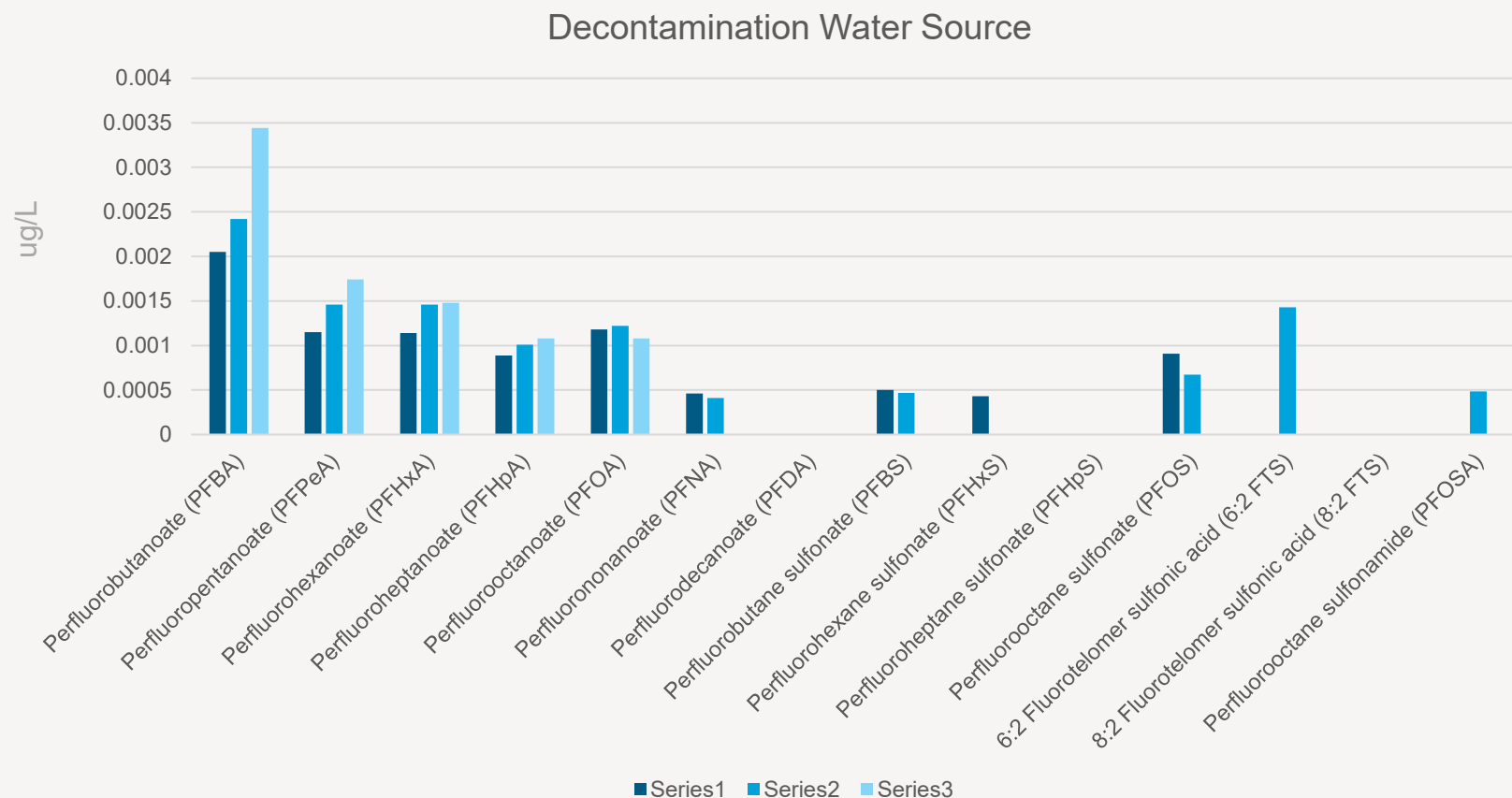
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Evaluation of field and laboratory analytical data



Evaluation of field and laboratory analytical data



What's coming up?

- › Moving forward, foregoing use of methanol.
- › Substantial volume of methanol required as part of the decontamination protocol,
- › Complication to bringing methanol in large volumes to site,
- › Moving it around daily or finding storage options while on-site,
- › Disposal or return to the office any unused quantities of methanol.



SNC-Lavalin, 2020



What's coming up?

- › Use of laboratory supplied PFAS-free deionized water is preferred for cleaning and decontamination.
- › Commercially available deionized water may be used for cleaning and decontamination if the water is verified to be PFAS-free.
- › Municipal drinking water may be used for cleaning or decontamination if the water is known to be PFAS-free.
- › Alconox®, Liquinox®, and Citranox® can be used for equipment cleaning and decontamination.
- › Sampling equipment can be scrubbed using a polyethylene or Polyvinyl chloride (PVC) brush to remove particulates.
- › Use of fingerprinting to rule out artefact sources of contamination from QA/QC data



Thank you

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California State Water Quality Control Board (CSWQCB), 2020: Per- and Polyfluoroalkyl Substances (PFAS) Sampling Guidelines for Non-Drinking Water. September 2020. SWRCB PFAS Website: <https://www.waterboards.ca.gov/pfas/>

DDW PFAS Website: https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/PFOA_PFOS.html

EPA, 2017: *Basic Information about Per- and Polyfluoroalkyl Substances (PFASs)*

Includes Information on Perfluorooctanoic Acid (PFOA), Perfluorooctyl Sulfonate (PFOS), and All Other PFASs, and on PFCs. https://19january2017snapshot.epa.gov/pfas/basic-information-about-and-polyfluoroalkyl-substances-pfass_.html



*Our values are the essence of our company's identity.
They represent how we act, speak and behave together,
and how we engage with our clients and stakeholders.*

S~~A~~*F*~~E~~*T*~~Y~~

I~~N~~T~~E~~G~~R~~I~~T~~Y~~~~~~~~~~~~~~~~

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*We put safety at the heart of
everything we do, to safeguard
people, assets and the environment.*

*We do the right thing,
no matter what, and are
accountable for our actions.*

*We work together and embrace
each other's unique contribution
to deliver amazing results for all.*

*We redefine engineering
by thinking boldly, proudly
and differently.*

