PFAS detections in drinking water, 2016-2024

Karasaki, S., Pace, C., Cushing, L., Morello-Frosch, R. (2024). PFAS detections in water samples. Drinking Water Tool metadata, prepared by the Water Equity Science Shop, UC Berkeley.
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File name: PFAS_detections_final_060724.shp

Spatial Reference

Geographic Coordinate System	NAD 1983	Projected Coordinate System	NAD 1983 (Teale) Albers (Meters)
WKID	4269	Projection	3310
Authority	EPSG	Authority	EPSG
Angular Unit	Degree (0.0174532925199433)	Linear Unit	Meters (1.0)
Prime Meridian	Greenwich (0.0)	False Easting	0.00
Datum	D North American 1983	False Northing	-4000000.0
Spheroid	GRS 1980	Central Meridian	-120.0
Semimajor Axis	6378137.0	Standard Parallel 1	34.0
Semiminor Axis	6356752.314140356	Standard Parallel 2	40.5
Inverse Flattening	298.257222101	Latitude of Origin	0.0

Description

This shapefile contains data extracted and refined from California's State Water Resources Control Board (SWRCB) GeoTracker PFAS map[1], downloaded 6/1/2024. The data have been aggregated to a shapefile of 2,994 points representing locations where PFAS were measured or detected in drinking water wells that supply public water systems. We selected all sample locations with non-zero (liquid) sampling results for *any* PFAS across the state and flagged the subset of samples that exceed one or more of the six United States Environmental Protection Agency (US EPA) MCLs (see Table 1: PFAS Advisories, Limits, Goals, and Maximum Contaminant Levels (MCLs)).

Methods

Below are the basic steps we followed to prepare the GeoTracker data for our project:

- Load GeoTracker's raw data (available for download through their online platform).
- Filter out Chemical == "TOTPFOAPFOS" to avoid potentially double-counting PFOA/PFOS.
- Drop samples with NA coordinate values.
- Create a unique location identifier for sampling locations by concatenating latitude and longitude values into a string (we assume that these latitude-longitude strings constitute a unique location; more on this below).
- Group the dataset using the coordinate string prepared above, and collapse other identification-related values (i.e., Site.Name, Location.ID, Global.ID) that may share the same coordinates (e.g., if locations with Site.Name "A" and Site.Name "B" share the same coordinate string, then their new shared Site.Name is "A / B").
- Create a binary 0/1 column for detections using the Qualifier column ("<" ~ 0, ">" or "=" ~ 1).

- Group the dataset using the coordinate string to calculate summary statistics related to detection occurrences and values.
    - Since information on lab- and contaminant-specific detection limits are not provided by GeoTracker, our working assumption is that PFAS is "detected" if the Qualifier column is equal to “>” or “=.”
    - Note: the original data source (SWRCB) notes that sample values represent average values, if sample counts are greater than one.

The following steps were taken to Identify samples exceeding US EPA’s MCLs.

- Filter the GeoTracker dataset for drinking water samples using the filter Site. Use == “Drinking Water Wells.”
- For individual MCLs (PFOA, PFOS, PFHxS, PFNA, and HFPO-DA): select all locations with samples at or above 4 ppt for PFOA/PFOS, and 10 ppt for PFHxS/PFNA/HFPO-DA.
- For the Hazard Index (HI): (i) calculate the individual fractions for each chemical (in GeoTracker: HFPA-DA, PFBSA, PFNA, PFHXSA); (ii) add them up within each sample (we assume if sampling results share the same date for a given system, they are from the same sample); (iii) average the score for all samples taken within 365 days from the most recent sampling date (for the data used in this update: 2024-03-28); flag systems as exceeding the HI if their average HI value >= 1.

Attribute Table

Field Heading	Field Description
FID	ESRI generated field.
Shape	Point – ESRI generated field.
Site_Nm	Name of site, as provided by GeoTracker. These values were combined for PFAS samples that shared the same coordinate values.
Site_Us	Site use, as provided by GeoTracker.
lat_lng	Well coordinates.
dtct_ny	Indicates if any PFAS were detected; “none” = no PFAS detection, “at least one” = at least one PFAS detection.
ov_PFOA	PFOA detected above the US EPA MCL.
ov_PFOS	PFOS detected above the US EPA MCL.
o_HFPAD	HFPAD detected above the US EPA MCL.
ov_PFNA	PFNA detected above the US EPA MCL.
o_PFHXS	PFHXS detected above the US EPA MCL.
ovr_ttl	The sum of individual US EPA MCLs exceeded.

ovr_MCL	Binary 0/1. 0 = sample value(s) do not exceed any individual US EPA MCLs, 1 = at least one sample meets or exceeds at least one US EPA MCL.
avg_HI	Calculated hazard index
over_HI	Binary 0/1. 0 = hazard index does not exceed the US EPA HI MCL, 1 = hazard index meets or exceeds the US EPA HI MCL
over_ny	Binary 0/1. 0 = no exceedance of any US EPA MCL (including individual MCLs and the HI); 1 = match or exceedance of at least one US EPA MCL (including individual MCLs and the HI).
Status	"PFAS detected and exceeds MCL"; "Measured, no PFAS detected"; "PFAS detected"

Table 1: PFAS Advisories, Limits, Goals, and Maximum Contaminant Levels (MCLs)
Parts per trillion (ppt).

	OEHHA 2021 Public Health Goal (PHG)	US EPA 2022 Health Advisory (HA) Limit	US EPA 2023 MCL Goal (MCLG)	US EPA 2024 MCL
Compound	Non-enforceable			Enforceable
PFOA	.007 ppt	.004 ppt	0 ppt	4 ppt
PFOS	1 ppt	.02 ppt	0 ppt	4 ppt
PFHxS			10 ppt	10 ppt
PFNA			10 ppt	10 ppt
HFPO-DA (GenX)			10 ppt	10 ppt
PFNA	-	-	1 (unitless) hazard index	1 (unitless) hazard index
PFHxS	-	-		
PFBS	-	2,000 ppt		
GenX	-	10 ppt		

Note: PHGs, HA limits, and MCLGs are all non-enforceable and guide safe levels of contaminants in drinking water: PHGs set by OEHHA ensure safety based on health risk assessments; EPA HAs indicate concentrations where no adverse health effects are expected over specified exposure periods and aid in emergency response; and EPA MCLGs aim to prevent health effects but may not always align with

treatment capabilities. In comparison, MCLs are enforceable standards set by EPA under the Safe Drinking Water Act (SDWA) and are set as close as feasible to MCLGs considering treatment technology and cost limitations.

References

1. GeoTracker PFAS Map data (https://geotracker.waterboards.ca.gov/map/pfas_map). Accessed June 2024.