PFAS detections in drinking water, 2019-2023

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_040524.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]. The data have been aggregated to a shapefile of 2,927 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 EPA proposed 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 a given sample value is greater than 0.

○ 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 EPA's proposed MCLs.
- Filter the GeoTracker dataset for drinking water samples using the filter Site.Use == "Drinking Water Wells"
- For PFOA/PFOS: select all locations with samples above 4 ppt
- 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; flag systems as exceeding the HI if their average HI value >= 1.
- Select all locations identified as "Drinking Water Wells" in site use category

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
dtct_ny	Indicates if any PFAS were detected; "none" = no PFAS detection, "at least one" = at least one PFAS detection
dtct_cn	Sum of PFAS detections over 0
ovr_MCL	Binary 0/1. 0= PFOA/PFOS concentration(s) do not exceed the EPA proposed MCL, 1=sample for PFOS, PFOA or both meet or exceed the EPA proposed MCL exceed the EPA proposed MCL
avg_HI	Calculated hazard index
over_HI	Binary 0/1. 0= hazard index does not exceed the EPA proposed MCL, 1= hazard index meets or exceed the EPA proposed MCL
over_ny	"None"= no exceedance of proposed EPA MCL; " Meets or Exceeds at least one EPA threshold" = match of exceedance of at least one (of PFOA, PFOS, HI) EPA proposed MCL.
Status	"Exceeds at least one EPA threshold"; "measured no PFAS detected"; "at least one PFAS detected"

Table 1: PFAS Advisories, Limits, Goals, and Maximum Contaminant Levels (MCLs)

	OEHHA 2021 PHG	EPA 2022 health advisory limit	EPA 2023 MCLG	EPA 2023 MCL
Compound	non-enforceable			enforceable

PFOA	.007 ppt	.004 ppt	0 ppt	4 ppt
PFOS	1 ppt	.02 ppt	0 ppt	4 ppt
PFNA	-	-	1 (unitless) hazard index	1 (unitless) hazard index
PFHxS	-	-		
PFBS	-	2,000 ppt		
GenX	-	10 ppt		

References

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