



# Legal and Practical Considerations for Source Attribution of PFAS in Groundwater

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# PFAS History

The stability of the carbon-fluorine bond together with the increasing use of fluorocarbons in modern life (aerosol propellants, refrigerants, anesthetics, plastics) suggest that compounds containing the carbon-fluorine bond pose at least a potential threat to the environment. Of course, this possibility is overshadowed by the prob-

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## Degradation of Synthetic Organic Molecules in the Biosphere

NATURAL, PESTICIDAL,  
AND VARIOUS OTHER  
MAN-MADE COMPOUNDS

*Proceedings of a Conference*  
SAN FRANCISCO, CALIFORNIA  
June 12-13, 1971

NATIONAL ACADEMY OF SCIENCES  
WASHINGTON, D.C. 1972

NAS-NAE

DEC 20 1972

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# PFAS Applications

- Fire Suppression
- Textiles and Leather
- Paper Products
- Metal Plating & Etching
- Wire Manufacturing
- Industrial Surfactants, Resins, Molds, Plastics
- Photolithography, Semiconductor Industry
- Consumer products
- Many Others

# PFAS Characteristics

- Extremely Persistent (Fluorine-Carbon bond)
  - Persistence like DDT and PCBs
- Toxic at potentially very low (ppt) levels
  - Toxicity like Dioxins (PCDD & PCDF)
- Highly mobile
  - Mobility like TCE and Benzene
- Extremely Diverse & Changeable
  - 4,700+ varieties due to wide use historically and currently
  - Daughter products can be more toxic than parents

# Complexities/Drivers for PFAS Legal Framework

- Rapid expansion of sampling efforts, analytical processes and discovery of contamination
- Special sampling and analytical challenges (cross-contamination, expensive)
- Hundreds/thousands of compounds, including legacy, precursor and currently used substitute chemicals
- Multiple and varied sources
- Limited but growing toxicity and exposure data
- Short-chain compounds bio-oxidize to long-chain terminal compounds
- Limited and changing cleanup experience

# PFAS Characteristics Challenge Legal Processes

- High potential for evidence disputes over sampling and analyses
- Difficulty in identifying sources and potentially responsible parties—fate and transport, persistence, precursors, and contamination across media (Maine Dairy farm example)
- Ubiquity of potential sources

# Potential Contribution to Contamination Not Limited to Known Incidents or Releases

- Source research should include facilities with potential for releases
- Use open administrative records and FOIA plus state equivalent to obtain all public files and data in government hands.
- Government files also a good place for leads to aid sample design or focus on other data sources or possible involved parties.

# Potentially Liable Parties

- Basics of Proof and Legal Standards
- Source Attribution Approaches and Considerations
- Special Challenges



# CERCLA

## Basics of Proof and Legal Standards

Standard for Liability Under  
CERCLA/Superfund

Sections 104, 107, 113

Requires designation of PFAS as hazardous  
substance—multiple PFAS designations  
expected soon

Assigns liability based on release or  
threat of release of hazardous  
substance. Releases include spilling,  
leaking, discharging, injecting, leaching,  
dumping and other synonyms

Assigns liability to current owners and  
operators of facilities, owner/operators  
at time of disposal, arrangers for  
disposal, and transporters who select  
disposal site

# CERCLA

## Standards of Proof and Scope of Liability

**Strict, Joint and Several Liability under CERCLA 107 Limited to government plaintiffs and non-settling cleanup plaintiffs**

**Contribution Liability for other causes of action—based on equitable allocation of responsibility. Multiple factors like volume, toxicity, culpability, availability of other parties, etc.**

**Civil Actions—preponderance of evidence**

# RCRA 7002

- **Basics of Proof and Legal Standards**
- **Standard for Liability Under RCRA**
- **Section 7002 (Citizen's Suits provisions)**

# Statutory Citizen Suits—RCRA 7002

PFAS contamination can meet all elements of this cause of action

1. Any person may bring, includes individuals, organizations, governments
2. Applies to solid or hazardous waste
3. Applies when there “may” be an “imminent and substantial endangerment” to health or the environment. Broadly defined. “Imminent” does not mean immediate. “Endangerment” includes the threat of harm.
4. May be filed against any person who generated, transported or disposed and who caused or contributed to the endangerment. Can include Federal agencies.
5. Attorneys fees to those who substantially prevail
6. Limited exceptions

# Common Law

**Basics of Proof and Legal Standards**

**Common Law Torts**

**Negligence**

**Nuisance**

**Trespass**

**Broad range of targets, from manufacturers to downstream users**

# PFAS Torts in the Courts

Cases brought by municipalities, water authorities and similar entities. Plaintiffs include:

- Pa. American Water Company, Pa
- Santa Clarita Valley Water Agency, Cal.
- City of Tucson, Arizona
- Emerald Coast Utilities Authority, Fla.
- City of Stuart, Fla.
- Gadsden Water Works and Sewer Board, Ala.
- Town of Barnstable, Mass.
- Suffolk County Water Authority, N. Y.
- City of Westfield, Mass.
- Town of Southampton and Hampton Bay Water District, N. Y.
- Cape Fear Public Utility Authority, N. C.
- Warminster Municipal Authority, Pa.
- Horsham Water and Sewer Authority, Pa.

# More PFAS in the Courts

- Private Class Actions, mostly against manufacturers, mostly on tort theories (product liability, trespass)
- More than 40 sites have some kind of active litigation
- Multidistrict litigation management in District of South Carolina for AFFF cases in federal courts. Private and governmental plaintiffs.

# Source Attribution: Approaches and Considerations

- Data bases that help identify potential contributing facilities
- Data bases tracking sample results and identified contamination
- Robust conceptual site model
- Examples



# Databases

## Data bases for potential facilities



- Toxic Release Inventory for 270+ PFAS (initial reports from only 38 facilities)
- California facilities receiving WC 13267 orders
- Proposed TSCA Section 8 rule requiring PFAS reporting from vast array of facilities regardless of amount.
- Multiple federal, state, and private sector tracking of facilities
- Data bases identifying facilities with potential to have history of PFAS use/releases, e. g military installations, plating, carpet manufacturing, etc.

# Databases

- [https://www.ewg.org/interactive-maps/pfas\\_contamination/](https://www.ewg.org/interactive-maps/pfas_contamination/)
- <https://pfasproject.com/pfas-contamination-site-tracker>
- <https://www.epa.gov/toxics-release-inventory-tri-program/tri-chemical-list-reporting-year>
- [https://www.waterboards.ca.gov/pfas/drinking\\_water.html](https://www.waterboards.ca.gov/pfas/drinking_water.html)

# Source Attribution

## POTWs, Metal Platers, Landfills, etc.

State Water Resources Control Board

**WATER CODE SECTION 13267 ORDER FOR THE DETERMINATION OF THE PRESENCE OF PER- AND POLYFLUOROALKYL SUBSTANCES**

**ORDER WQ 2019-0005-DWQ**

Pursuant to Water Code section 13267, The State Water Resources Control Board (State Water Board) requires you to submit information as described below. Failure to comply with this Order may subject you to civil liability of up to \$5,000 per day for each day in which the violation occurs.

Your site is identified in **Attachment 1** as a facility that has accepted, stored, or used materials that may contain per- and polyfluoroalkyl substances (PFAS). Therefore, you are required to submit the information in **Attachment 2** to the appropriate Regional Water Quality Control Board (Regional Water Board) identified in the cover letter.



**I. BACKGROUND**

**A. WHAT ARE PFAS?**

PFAS is a family of more than 3,000 man-made and mostly unregulated chemicals that have been produced since the mid-1900s. They are mobile, persistent, and bioaccumulative. They are resistant to degradation in the environment and when degradation occurs, it often results in the formation of other PFAS compounds. The PFAS compounds have very different physical and chemical properties. Currently the key classes of concern are perfluoroalkyl sulfonic acids such as the long-chain, more commonly known PFAS, perfluorooctanesulfonate (PFOS) and perfluorooctanoic acid (PFOA).

PFAS are manufactured globally and have been used in the production of a wide range of industrial and household products. PFAS are found in many products such as dental floss, non-stick cookware, food packaging materials, non-stick products (e.g., Teflon™), waterproof and water repellent textiles, water repellent furniture, carpet, polishes, waxes, paints, cleaning products, medical garments, and fire-fighting foams (Aqueous Film-Forming Foams or AFFF). PFAS are used in the Aerospace, Automotive, Chemical, Electronics, Metal Coatings and Plating, and Textiles industries due to their friction-reducing characteristics. Potential firefighting sources of PFAS include airports

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State Water Resources Control Board

**WATER CODE SECTIONS 13267 AND 13383 ORDER FOR THE DETERMINATION OF THE PRESENCE OF PER- AND POLYFLUOROALKYL SUBSTANCES AT CHROME PLATING FACILITIES**

**ORDER WQ 2019-0045-DWQ**

Pursuant to Water Code sections 13267 and 13383, The State Water Resources Control Board (State Water Board) requires you to submit information as described below. Failure to comply with this Order may subject you to civil liability of up to \$5,000 per day for each day in which the violation occurs.

Your site is identified in **Attachment 1** as a chrome plating facility that has stored and/or used fume suppressants or other substances that may contain per- and polyfluoroalkyl substances (PFAS). Therefore, you are required to submit the information in **Attachment 2** to the appropriate Regional Water Quality Control Board (Regional Water Board) identified in the cover letter.

**I. BACKGROUND**



**A. WHAT ARE PFAS?**

PFAS is a family of more than 3,000 man-made and mostly unregulated chemicals that have been produced since the mid-1900s. They are mobile, persistent, and bioaccumulative. They are resistant to degradation in the environment and when degradation occurs, it often results in the formation of other PFAS compounds. The PFAS compounds have very different physical and chemical properties. Currently the key classes of concern are perfluoroalkyl sulfonic acids such as the long-chain perfluorooctanesulfonate (PFOS) and perfluorooctanoic acid (PFOA).

PFAS are manufactured globally and have been used in the production of a wide range of industrial and household products. Historically, fume suppressants used in chrome plating operations often contained PFOS as an active ingredient. Although PFOS-based fume suppressants have not been used in California since September 2016, these newer non-PFOS fume suppressants may contain other PFAS.

PFAS are also found in many products such as dental floss, non-stick cookware, food packaging materials, non-stick products (e.g., Teflon™), waterproof and water repellent textiles, water repellent furniture, carpet, polishes, waxes, paints, cleaning products, medical garments, and fire-fighting foams (aqueous film-forming foams, AFFF). PFAS

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State Water Resources Control Board

**WATER CODE SECTIONS 13267 AND 13383 ORDER FOR THE DETERMINATION OF THE PRESENCE OF PER- AND POLYFLUOROALKYL SUBSTANCES AT PUBLICLY OWNED TREATMENT WORKS**

**ORDER WQ 2020-0015-DWQ**

Pursuant to Water Code sections 13267 and 13383, the State Water Resources Control Board (State Water Board) requires you to submit information as described herein. Failure to comply with this Order may subject you to civil liability of up to \$10,000 per day for each day in which the violation occurs.

Publicly owned treatment works (POTWs) are potentially significant receivers of per- and polyfluoroalkyl substances (PFAS) and have the potential to discharge these wastes to the environment. Potential discharges include, but are not limited to, wastewater effluent to surface waters and/or percolation basins, biosolids, and reverse osmosis concentrate/retentate from some treatment facilities. **Attachment 1** presents a conceptual model of PFAS emissions from a POTW (Interstate Technical Regulatory Council (ITRC), Per- and Polyfluoroalkyl Substances, March 2020). Your agency has been identified as owning or operating one or more POTWs in California that have a design capacity at or exceeding one million gallons per day (mgd), which is the scope of this Order. Additional orders may be issued in the future for facilities with less than an average dry weather design flow of 1 mgd capacity. **Attachment 2** presents a list of agencies and facilities to comply with under this Order.

This Order requires completion of the following tasks:

1. Conduct sampling and analysis for each POTW listed in **Attachment 2** and submit the results of the sampling according to the requirements found in **Attachment 3**, Technical Sampling and Reporting Requirements.
2. Complete the questionnaire in **Attachment 3 (Sections C.3 and D)** for each of the POTWs listed in **Attachment 2**. The information required by the questionnaire shall be submitted electronically.

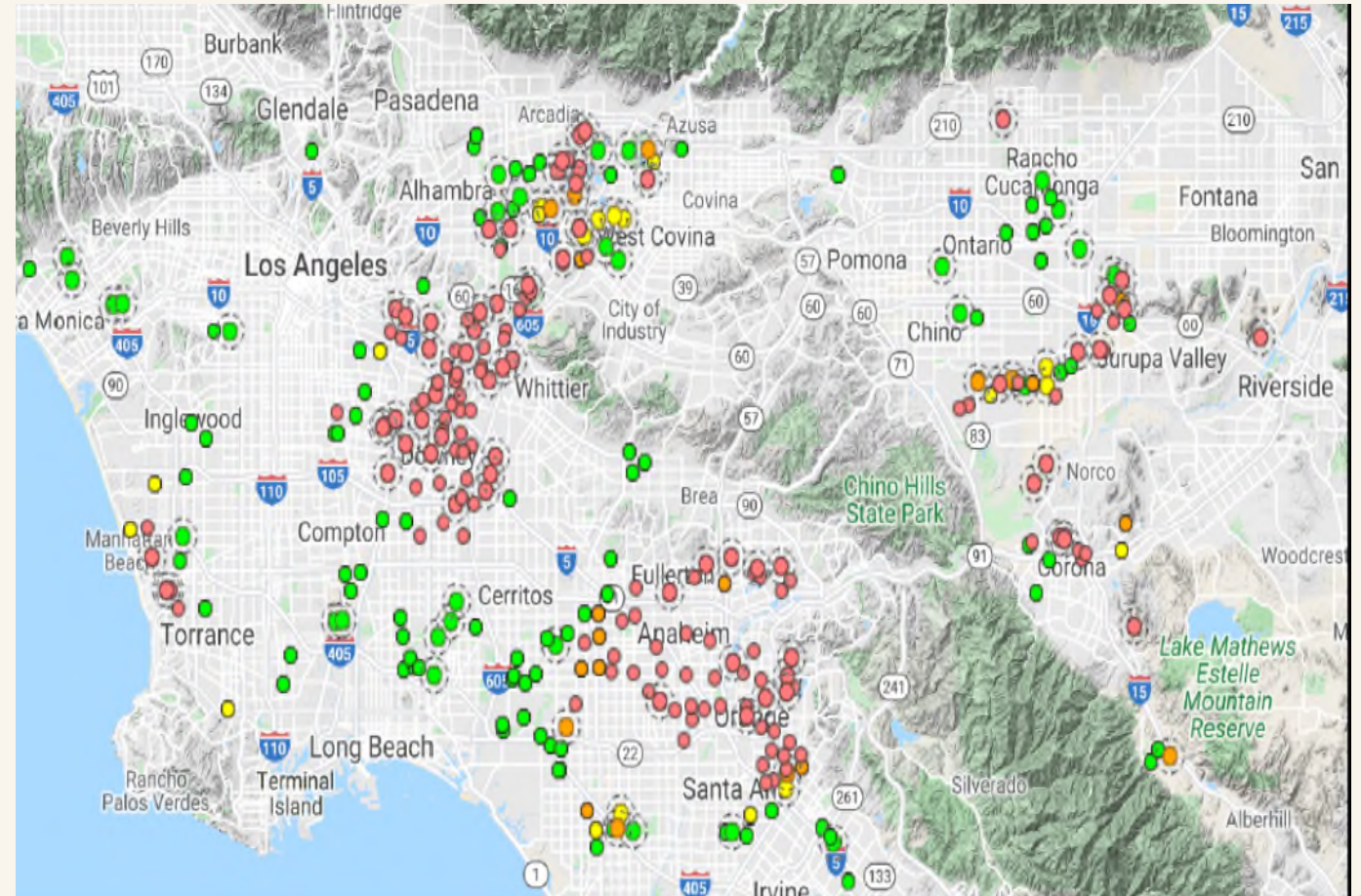
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# Source Attribution: Data Bases of Known Contamination

- Federal Reporting under SDWA; CERCLA sites; USGS sampling
- DOD sampling
- State conducted and state mandated sampling
- Environmental Working Group and Northeastern University Data Compilations
- California's Groundwater Ambient Monitoring and Assessment Program (GAMA)

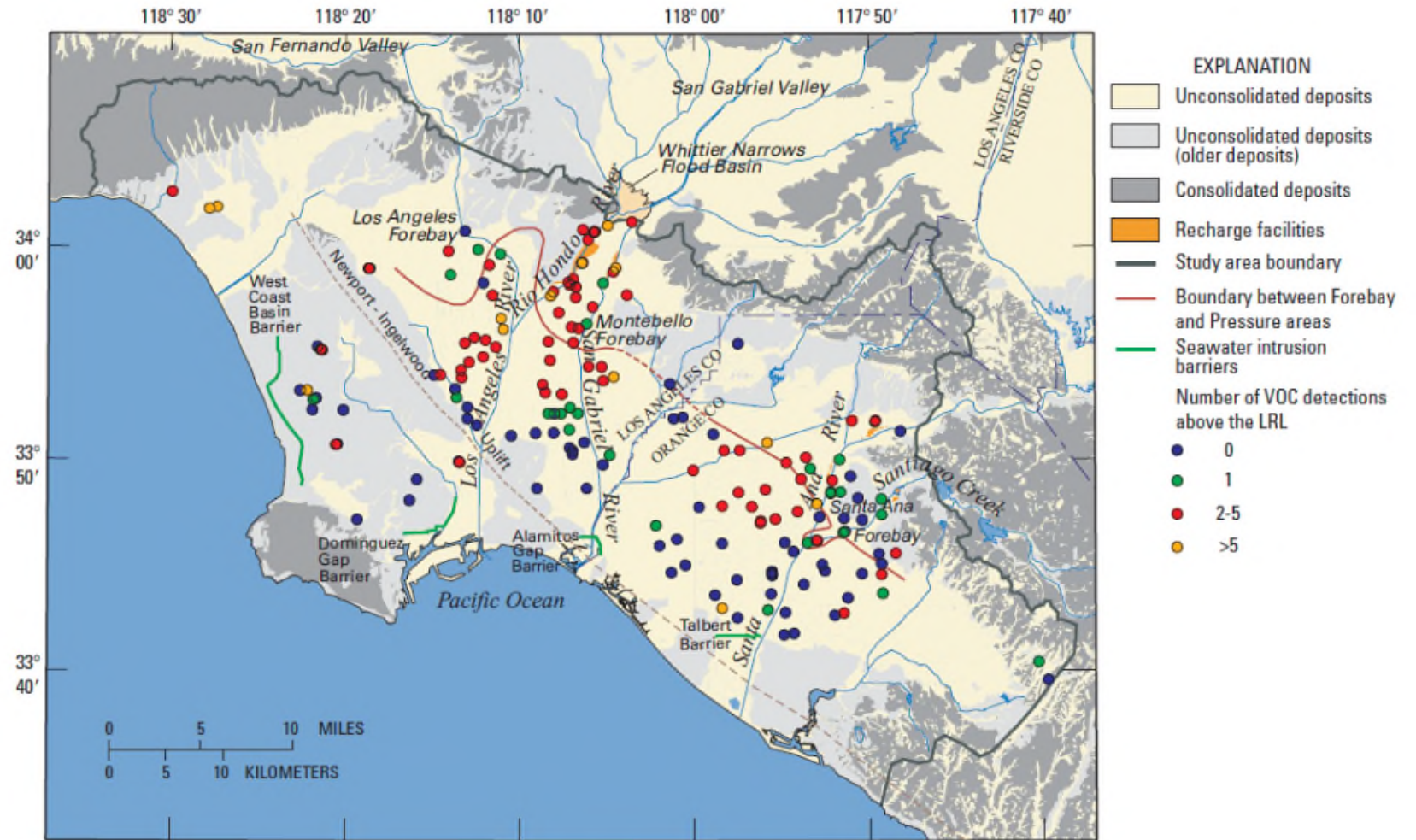
# PFOS Distribution

- Groundwater Ambient Monitoring & Assessment (GAMA)
- Perfluorooctanoic sulfonate (NL = 6.5 NG/L)
- 506 Drinking water wells
- 250 (49.41%) above NL



# VOC Distribution

- USGS (Shelton, et al) *Low-Level Volatile Organic Compounds in Active Public Supply Wells as Ground-Water Tracers in the Los Angeles Physiographic Basin, California, 2000*



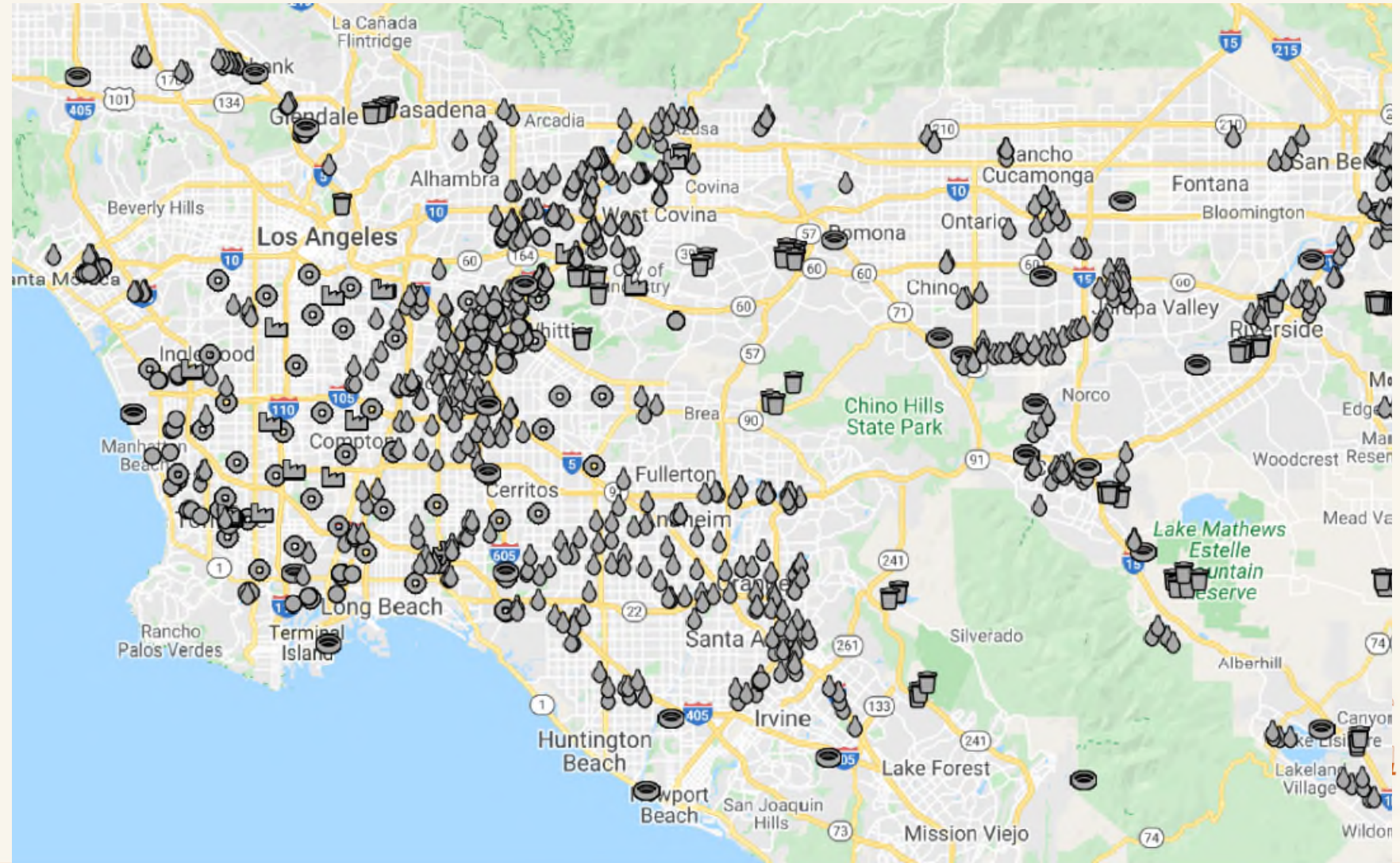
**Figure 3.** The sampling well network and the number of detections of volatile organic compounds above the laboratory reporting limit, Los Angeles physiographic basin, California. VOC, volatile organic compound; LRL, laboratory reporting limit.

# GeoTracker PFAS Map

## GEOTRACKER PFAS MAP

### PFAS SAMPLING LOCATIONS

- Locations with PFAS Investigative Orders
  - ✈ Airport
  - 🏭 Chrome Plating
  - 🗑 Landfill
  - 🏠 Wastewater Treatment Plants
- Other Locations with PFAS Data i
  - Cleanup Program Site
  - Military Cleanup Site
  - Military Privatized Site
  - WDR Site
  - GAMA - Priority Basin Project (USGS)
  - GAMA - Water Replenishment
- District
- Water System Wells - [GAMA DATA](#)
  - 💧 Drinking Water Wells i



# Challenges and Limitations

- Confounding chemistry—challenges posed by breakdown products
- Approved analytical methods limited to a small subset of PFAS compounds
- Fingerprinting PFAS in its infancy
- Ubiquity of Sources
- Uncertainties about cleanup levels and cleanup technologies



# Robust Conceptual Site Model

- Sufficient soil and groundwater data
- Rigorous sampling & analysis plan
- Cross-contamination and related potential for evidentiary disputes over sampling and analysis

# Robust Conceptual Site Model

- Fate & Transport modeling
  - Historical flow regime important (e.g. localized pumping)
- Chemistry analysis
  - Variety of PFAS used in making AFFF and found as contaminants or breakdown products in AFFF

# Robust Conceptual Site Model

- Chemistry & Statistics
- Targeted analysis
- High-resolution mass spectral analysis
- Statistical analysis
- Isomer patterns
- Transformation products

# Source Attribution

POTWs

Metal Platers

Landfills

# Robust Conceptual Site Model

- Are there unique markers associated with sources of PFAS?
- POTW Sources—PFAS % increases through treatment
  - Groundwater re-injection of treated wastewater may have markers (e.g. fecal steroids, disinfectants, caffeine, sweeteners, pharmaceuticals, consumer product fragrances)?
- Metal Plating—PFAS anti-fuming agents
  - Metal plating markers (e.g. chrome6, or other dissolved metals)?

# Caveats

- Things in this area are rapidly changing. Almost every day brings a significant piece of news. We made considerable effort to be sure this is current, but it won't be for very long.
- We aren't offering legal advice here. Every situation and every site warrants a careful analysis of the facts and the law.

# References

- <https://pfas-1.itrcweb.org>
- <https://pfasproject.com>
- [https://www.ewg.org/interactive-maps/2019\\_pfas\\_contamination/map/](https://www.ewg.org/interactive-maps/2019_pfas_contamination/map/)
- <https://www.epa.gov/pfas/epas-pfas-action-plan>
- <https://nj.gov/dep/srp/emerging-contaminants/>
- <https://www.michigan.gov/pfasresponse/>
- [https://www.waterboards.ca.gov/drinking\\_water/programs/](https://www.waterboards.ca.gov/drinking_water/programs/)
- <https://3msettlement.state.mn.us/>
- <http://chm.pops.int/TheConvention/ThePOPs/TheNewPOPs/tabid/2511/Default.aspx>

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