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REPORT

DIRTY WATER:
TOXIC "FOREVER" PFAS CHEMICALS ARE PREVALENT IN THE DRINKING WATER OF ENVIRONMENTAL JUSTICE COMMUNITIES

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Executive Summary

Per- and polyfluoroalkyl substances (PFAS) are a large class of thousands of synthetic chemicals widely used for their oil and water repellency, temperature resistance, and friction reduction in products such as nonstick cookware, water-resistant clothing, and food packaging. PFAS are linked to multiple serious health harms, such as cancer, developmental and reproductive harm, and immune system toxicity. Unfortunately, their widespread use, extreme resistance to degradation (they are often referred to as "forever chemicals"), high mobility (i.e., their ability to spread easily in the environment), and tendency to build up over time in plants, animals, and humans have resulted in widespread PFAS contamination. Monitoring shows that virtually all people residing in the United States have some level of PFAS in their bodies and that we are exposed through many routes, including our drinking water, food, consumer products, soil, and air. In response to mounting evidence of harm, scientists and public health experts from around the world are sounding the alarm on this very large, very dangerous group of chemicals.

California has taken the first steps toward addressing this public health and environmental crisis through a series of investigations of potential PFAS contamination sites, including monitoring drinking water sources near landfills and airports. This report, accompanied by a set of online interactive maps, analyzes the initial data from this monitoring program.[1]

Initial data indicate the following:

1. Even the limited testing conducted to date shows that PFAS pollution in California is widespread, potentially affecting 16 million Californians.
2. PFAS pollution is more intense in communities already overburdened by multiple sources of pollution and by other factors that make them more sensitive to pollution, putting those vulnerable communities at greater risk of harm from PFAS exposure.
3. Testing is far too limited, making it impossible to know the full scope of the PFAS problem.
   a. Current testing covers only 3 percent of public water systems; information is still lacking for thousands of water systems and private wells.
   b. Monitoring is only conducted for 18 individual PFAS out of thousands.
4. Communication of relevant test results and potential exposure risks to communities has fallen short.

Comprehensive action is needed to address the state's widespread PFAS pollution, including expanded monitoring, immediate support for and access to clean water for the most vulnerable communities, broad regulation and cleanup of PFAS contaminated water, safe disposal requirements for PFAS waste, restriction of PFAS use, and accountability for polluters for the costs and damages associated with PFAS.

This report summarizes what is known now about the state of PFAS contamination in California and who is potentially affected and proposes policy recommendations for the state to act quickly to protect the health of its most vulnerable communities.

Introduction

Per- and polyfluoroalkyl substances (PFAS) are a large class of thousands of man-made chemicals widely used for their oil and water repellency, temperature resistance, and friction reduction. Various industries manufacture PFAS and/or use PFAS in items such as cookware, food packaging, personal care products, firefighting foam, and textiles.

Quite simply, the use of PFAS has grown into a global environmental and public health crisis. PFAS are a public health perfect storm for many reasons:

- They are **extremely persistent "forever chemicals."** They either don't break down in the environment, or they break down into other persistent PFAS.
- They tend to be **highly mobile,** which means they can spread quickly throughout the environment once released. They are now found in our drinking water, air, food, and homes.
- They are very **difficult and expensive to remove** from water, soil, and the food web.
- They can **bioaccumulate**, or build up in plants, animals, and humans. They are now found in the bodies of virtually all people residing in the United States.[2]
- They can be **toxic in very small doses** (at the low parts-per-trillion level [ppt]). PFAS have been linked to serious health effects such as cancer, hormone disruption, kidney and liver damage, developmental and reproductive harm, and immune system toxicity.[3]
- They are **widely used** in industrial and commercial processes and found in a wide variety of consumer products.[4]
- They are prolific. There are currently **over 9,000 known different variations** of these dangerous chemicals.[5]

Concerns about PFAS have only increased during the pandemic, as these chemicals are **associated with reduced antibody response to vaccines**, resulting in decreased vaccine effectiveness for serious diseases such as tetanus, diphtheria, and COVID-19.[6] Further, PFAS are associated with increased risk of asthma, increased cholesterol (which can contribute to heart conditions), immune system dysfunction, and kidney and liver disease, all of which are serious underlying medical conditions that might contribute to a higher risk for severe illness from COVID-19, and likely other infectious diseases.[7]

Some PFAS have been shown to build up in the human body and take decades to be eliminated.[8] This buildup starts even before birth. Babies and young children are exposed to PFAS through fetal exposure during pregnancy and through contaminated infant formula or breast milk.[9] Unfortunately, children are particularly susceptible to the harmful effects of PFAS and other toxicants due to the rapid growth and complex developmental events they undergo.[10]

PFAS are especially dangerous because of how chemically similar the various types are. Different PFAS are often linked to similar health risks such as interference with immune systems or hormone function. Thus, there is a real concern that when people are exposed to multiple different PFAS over time, these chemicals will affect the same biological systems and cause greater harm than any single PFAS on its own.[11]

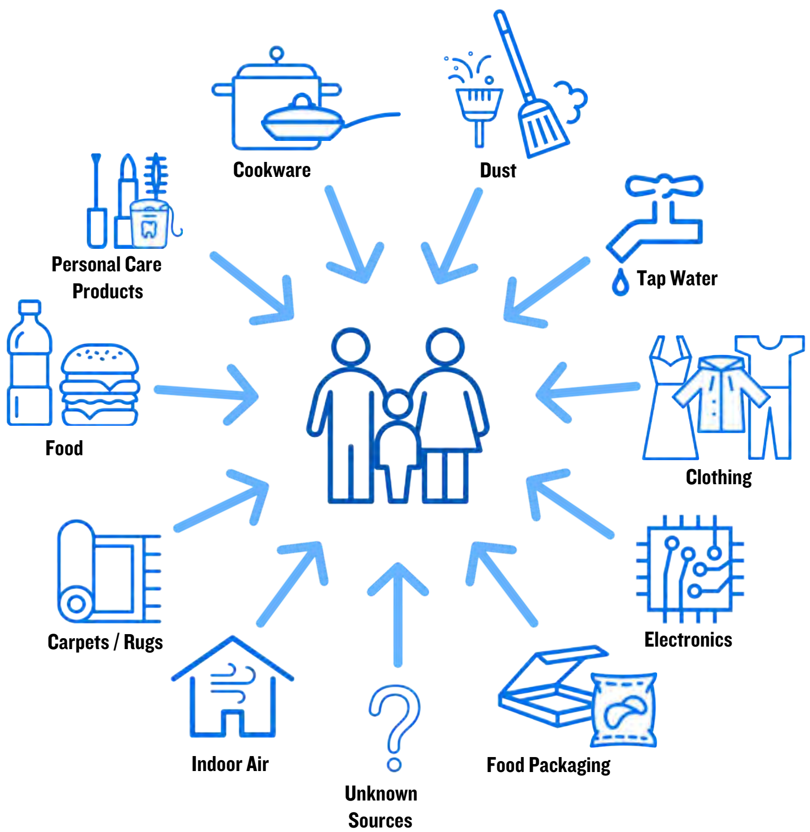
Despite this, managing the risk of PFAS has focused primarily on one PFAS chemical at a time. This approach has failed to control widespread exposures to PFAS—as other PFAS have been rushed in to replace any restricted ones (also referred to as "regrettable substitution")—and has resulted in inadequate public health protection. To address the problem of PFAS pollution and effectively reduce the human and environmental risks from all PFAS, scientists are now urging policymakers to manage these chemicals as a class (that is, to monitor and regulate all PFAS chemicals together, rather than individually).[12] All efforts to address PFAS pollution should take this as a starting point, whether it be phasing out use, monitoring, or cleaning up PFAS.

THE PFAS DRINKING WATER CRISIS IN CALIFORNIA

The extensive use of PFAS has led to their ubiquitous presence in the environment. They are found virtually everywhere: air, soil, water, food, plants, wildlife, and in the bodies of people.[13] Every day, people can be exposed to mixtures of PFAS chemicals from multiple sources including drinking water, eating food, breathing air, or coming into contact with dust, carpets, paints, waxes, clothing, upholstery, and personal care products like cosmetics and dental floss (Figure 1).

PFAS contamination and exposures are a major concern in California for many reasons. Not only does contaminated water pose a risk to users of water systems with contaminated sources, but it also potentially takes drinking water sources out of circulation in a state where water resources are already under strain because of drought and other pollution. Further, many communities across the state already face high environmental burdens, which PFAS exposures compound. For example, one health impact linked to PFAS exposure that is particularly important for California is asthma.[14] Over five million Californians have been diagnosed with asthma at some point in their lives, usually as children. Asthma risks from PFAS are further heightened for those already burdened by other forms of toxic exposure, such as air pollution.[15]

FIGURE 1: PEOPLE ARE EXPOSED TO PFAS FROM MULTIPLE SOURCES.



For millions of people, including those affected by asthma, drinking water is likely the main source of PFAS exposure.[16] PFAS contamination of drinking water comes from many sources, including industrial facilities, landfills, wastewater treatment plants, and firefighting-training sites at airports and military bases.[17] However, there is a lack of monitoring, guidance, and regulation for PFAS-contaminated drinking water at the federal level. In the face of federal inaction, states such as California have taken the lead in addressing the PFAS crisis in drinking water.

To date, most efforts to address PFAS have been in states where PFAS were, or still are, manufactured. But manufacturing is not the only source of significant PFAS drinking water pollution. In California, other potential contamination sources include airports, refineries, and military bases, which are heavy users of PFAS-containing products. To better understand the scope of the problem, in March 2019, the California State Water Resources Control Board (Water Board) announced a three-phase PFAS investigation of potential contamination sites and any nearby drinking water sources.[18] The first phase included drinking water sources in the vicinity of airports and landfills, for which there are now four rounds of testing data.[19] Wastewater treatment plants, oil terminals and refineries, and metal plating facilities are also currently being investigated by the Water Board, but the data are not yet available.

This report provides a summary of the first phase of testing data, which shows widespread PFAS pollution of California's drinking water. Further, the testing data indicate that this pollution is more intense in already overburdened communities. Because PFAS are so persistent, and the sources of pollution so diverse, PFAS contamination must be addressed with a comprehensive set of actions beyond simply cleaning up drinking water—such as stopping the pollution in the first place—with a focus on protecting already vulnerable communities from this growing public health threat.

This report is accompanied by a set of online interactive maps that combine California's initial PFAS testing data with information on the communities potentially affected, including their demographics and the severity of the pollution burden they already face.[20]

Methods Summary

The goal of this analysis was to examine potential exposure to PFAS through drinking water for California communities at the census-tract level. To do this, we analyzed the PFAS test results for drinking water sources included in the first phase of the Water Board's PFAS investigation. At the time of the analysis, four consecutive rounds of testing were available, containing data from April 1, 2019, to June 30, 2020.[21] Our analysis focused on "total PFAS," or the sum of the 18 PFAS tested for, rather than individual PFAS chemicals, since all PFAS are of concern for public health. Then, using water system boundary information available from the Division of Drinking Water, the highest total PFAS level recorded for each public water system was mapped to the census tracts served by that public water system.[22]

An additional goal of this analysis was to better understand who is potentially affected by PFAS-contaminated drinking water in California and, particularly, the equity implications of those exposures. To do this, we examined the relationship between the PFAS results and California's CalEnviroScreen 3.0 (CES) scores, which measure the environmental burden at the census-tract level. CES identifies communities that are disproportionately burdened by and vulnerable to multiple sources of pollution.[23] The top 25 percent most impacted communities are identified as "disadvantaged communities" for the purpose of allocating funds from the state's cap-and-trade climate program (Senate Bill 535). By examining the overlap of CES scores and PFAS results at the census level, we identified census tracts that may be the most vulnerable to PFAS-contaminated drinking water.

For a full description of our methods, please see Appendix A.

Findings

PFAS CONTAMINATION IS PREVALENT IN CALIFORNIA WATER SYSTEMS

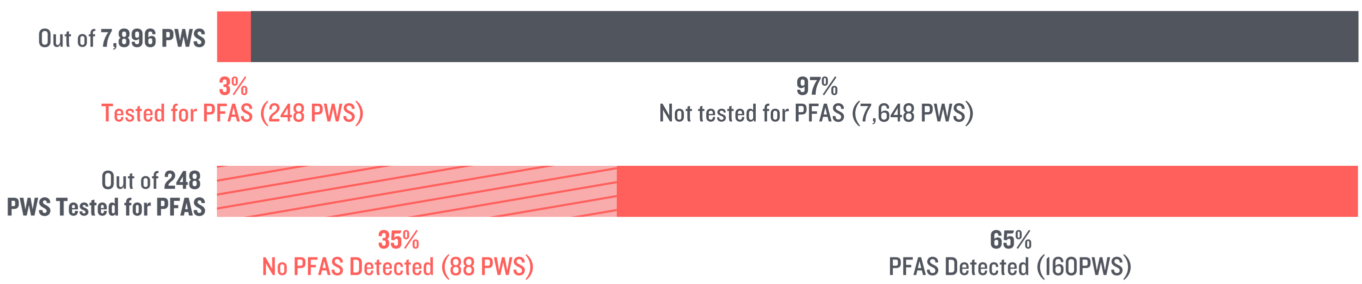
Our analysis shows widespread PFAS contamination of California drinking water. From the data released so far, we know that millions of Californians are at risk due to PFAS contamination of their drinking water—and there are still thousands of small public water systems and private wells, which serve more than 19 million Californians, yet to be tested for PFAS.

Out of the 248 public water systems tested so far (which cover half of California's residential population), PFAS have been detected in 160 (Figure 2). These 160 public water systems are primarily the larger systems in the state and serve more than 16 million people combined (approximately 42 percent of California's population).

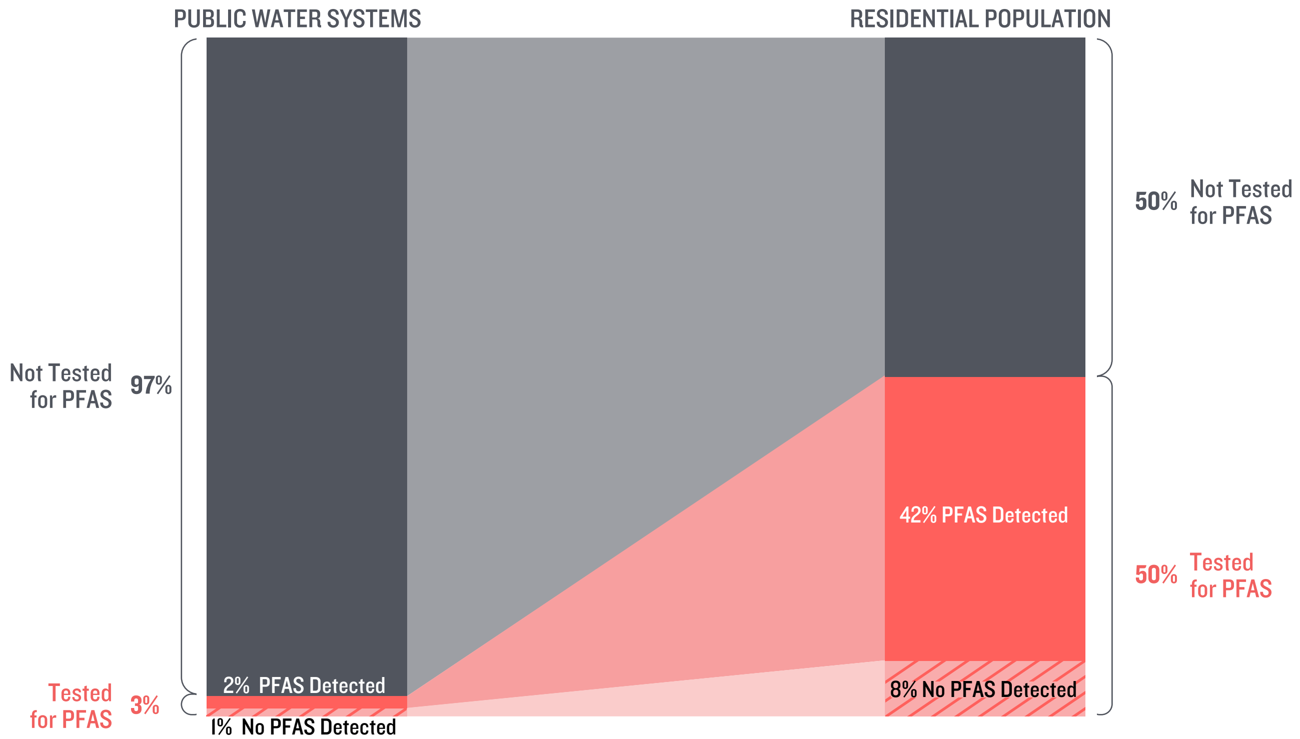
It is also worth noting that, while the testing to date covers half the population, it still represents only 3 percent (248 out of 7,896) of public water systems in California and only includes 18 different PFAS chemicals, suggesting that the magnitude of PFAS pollution in the state could be far greater and that many smaller communities have been left unmonitored.

FIGURE 2: CALIFORNIA PUBLIC WATER SYSTEMS TESTED FOR PFAS AND POPULATION SERVED

California Public Water Systems (PWS) Tested for PFAS



Public Water Systems Tested and Residential Population Served

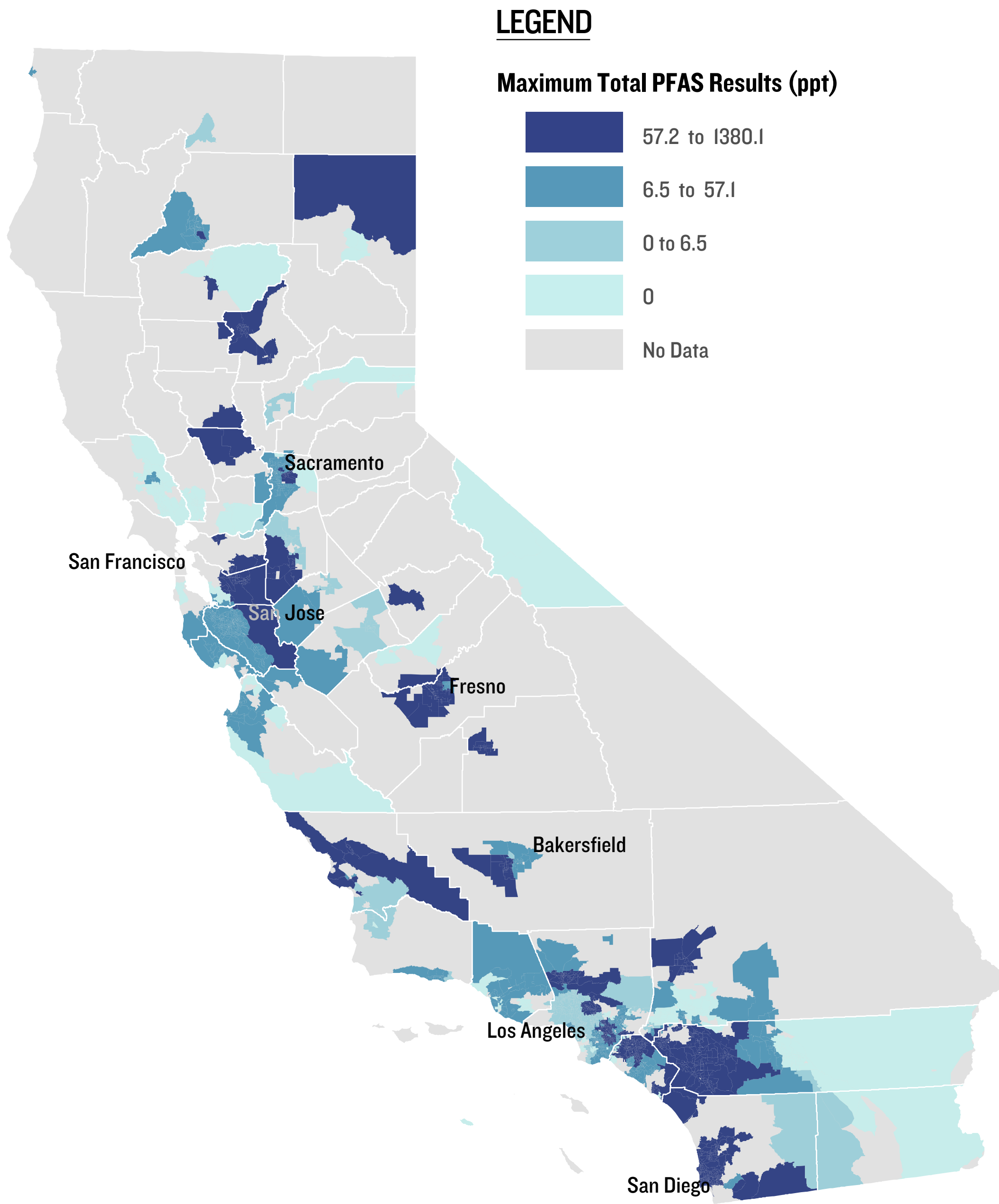


	# of PWS	% of Total PWS	Residential Population Served	% of Total Residential Population Served
Total PWS in California	7,896	--	38,441,719	--
PWS Not Tested for PFAS	7,648	97%	19,078,479	50%
PWS Tested for PFAS	248	3%	19,363,240	50%
PWS with PFAS Detected	160	2%	16,123,916	42%
PWS with No PFAS Detected	88	1%	3,239,324	8%

The location of PFAS contamination depicted in Figure 3 shows that contamination is not contained to a specific region of California but is found in a majority of the communities that were tested for PFAS across the state. With PFAS detected in more than half of the water systems tested, it is likely that PFAS will also be found in many of the 7,648 water systems that have yet to be tested for PFAS (all in grey).

FIGURE 3: POTENTIAL EXPOSURE TO PFAS IN CALIFORNIA DRINKING WATER BY CENSUS TRACT.

The 18 PFAS chemicals tested were summed at each sampling source for each quarter. The highest result for a source in each water system was then assigned to each of the census tracts within the water system's service area. This represents the highest potential exposure, or worst-case scenario, for each water system. The PFAS levels are divided into non-detects (0) and terciles for levels of PFAS detected, where each tercile contains an equal number of census tracts, ranked from low to high total PFAS results.



PFAS POLLUTION IS HIGH IN DISADVANTAGED COMMUNITIES

To better understand who was potentially affected by PFAS drinking water contamination, we incorporated data from CalEnviroScreen 3.0 (CES) into our analysis. Senate Bill 535 requires the California Environmental Protection Agency (CalEPA) to identify disadvantaged communities based on geographic, socioeconomic, public health, and environmental hazard criteria, and CES is the tool used to do so.[24] CES scores across the state are reflected in Figure 4.

By incorporating CES scores into our analysis, we can begin to examine the interaction between PFAS pollution and communities already burdened by other forms of pollution (e.g., air pollution, pesticide use) and socioeconomic and health factors (e.g., poverty, cardiovascular disease). To do this, we overlaid PFAS pollution levels over CES scores and looked for areas of overlap. The resulting map (Figure 5) identifies those census tracts that face the most disproportionate pollution and socioeconomic burdens as well as higher potential exposure to PFAS-contaminated water. Specifically, when we overlay more vulnerable communities (as captured by high CES scores) identified in Figure 4 with the highest levels of PFAS pollution identified in Figure 3, we can see that these communities have either not been tested for PFAS (marked in gray) or have very high levels of PFAS pollution (darkest blue-green). Communities in Fresno, Los Angeles, San Joaquin, and Tulare Counties appear to be at particular risk. A list of PFAS results and CES scores by city and county can be found in Appendix C.

FIGURE 4: CALENVIROSCREEN 3.0 SCORES BY CENSUS TRACT IN CALIFORNIA

Census tracts are shaded based on CES's scores, which identify communities that are disproportionately burdened by and vulnerable to multiple sources of pollution. This map shows the CES percentile scores by census tract, divided into terciles from low to high pollution burden: 0 to 32 percent, 33 to 66 percent, and 67 to 100 percent.

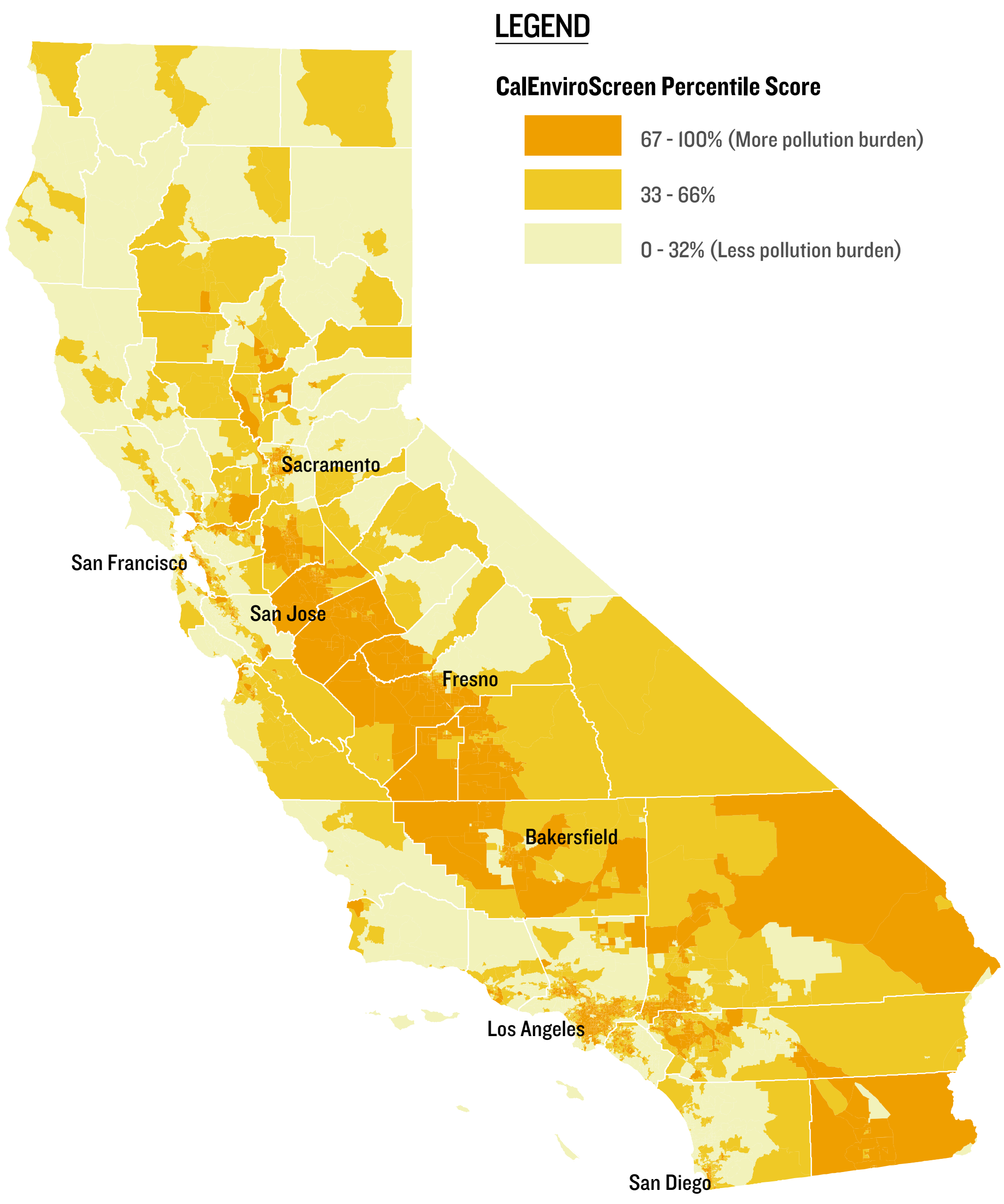
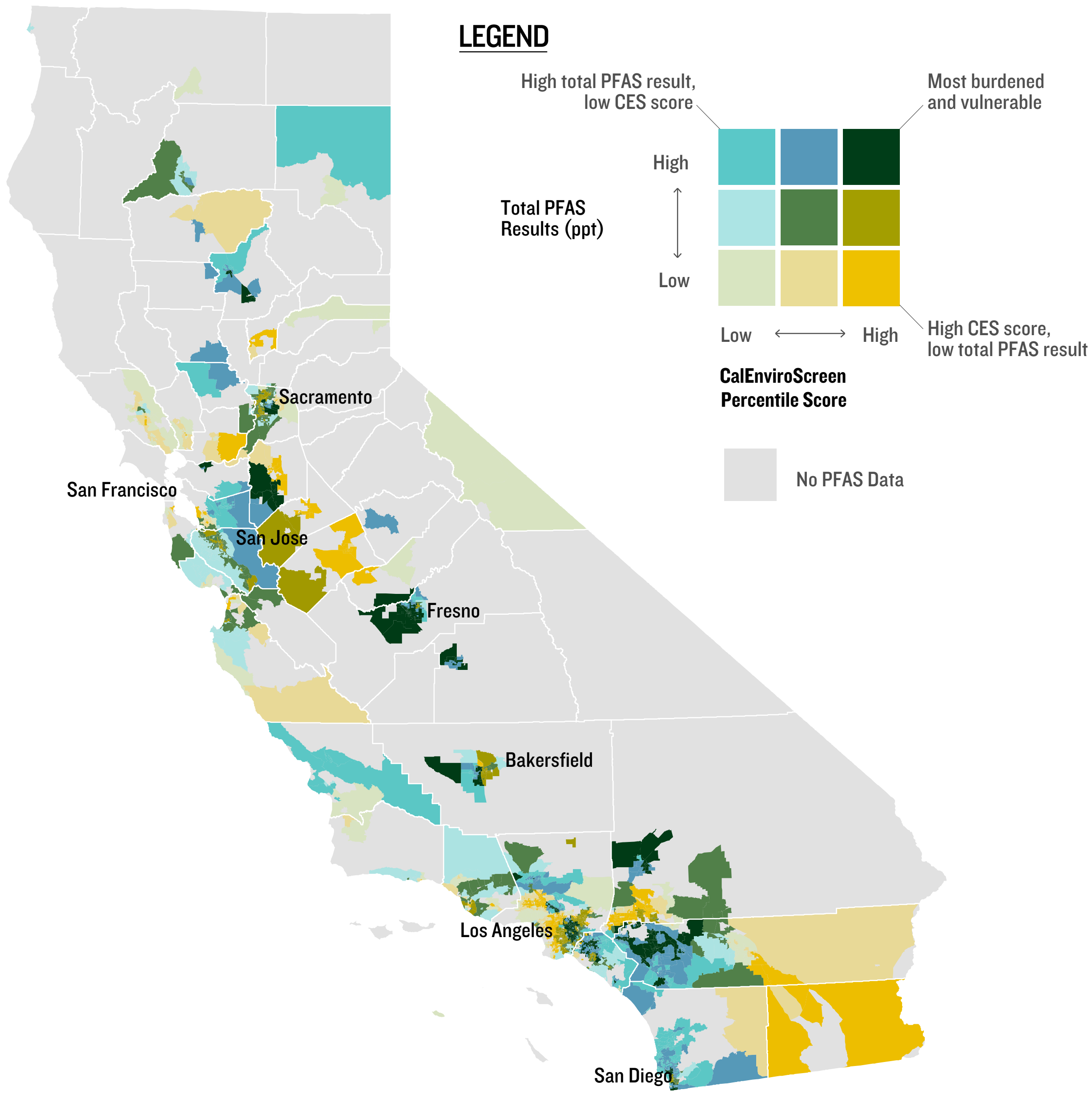


FIGURE 5: CALENVIROSCREEN 3.0 AND POTENTIAL EXPOSURE TO TOTAL PFAS

The summed PFAS results are divided into terciles, where each tercile contains an equal number of census tracts. The CES percentile scores are divided into terciles from low to high pollution burden: 0 to 32 percent, 33 to 66 percent, and 67 to 100 percent. The census tracts that have both summed PFAS results higher than 57.2 parts per trillion (top tercile) and a CES percentile score higher than 66 percent are identified as the communities with the greatest overlapping burden; they are the most disproportionately burdened according to CES and potentially have the highest exposure to PFAS.

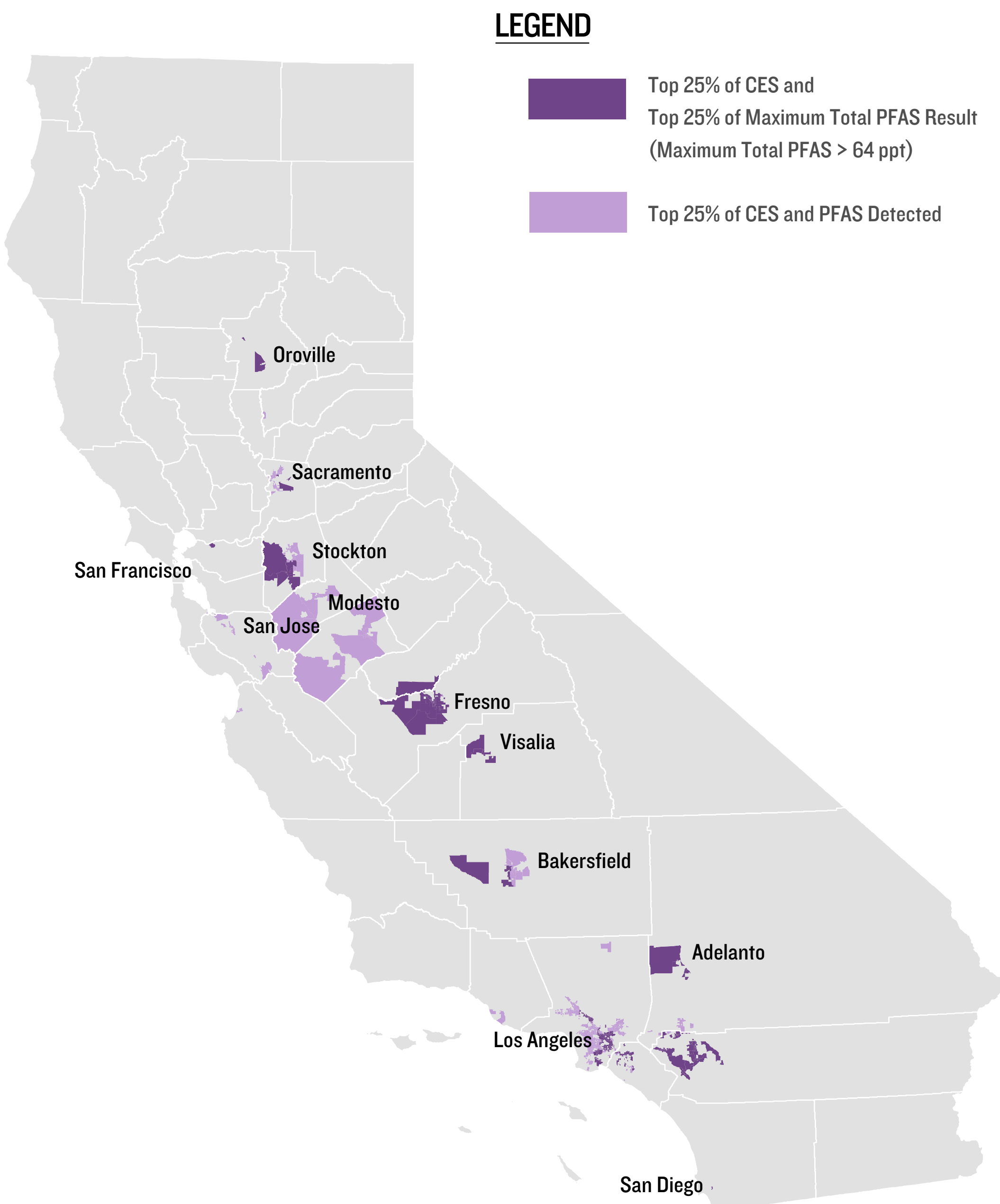


PFAS POLLUTION IS ESPECIALLY HIGH IN THE MOST DISADVANTAGED COMMUNITIES

When we look closely at the most vulnerable communities (i.e., communities with the highest 25 percent of CES scores, which have been recognized by the state as disadvantaged communities for the purpose of allocating funds from the state's cap-and-trade program), we see that many of these communities also have very high levels of PFAS pollution.[25] PFAS testing data are available for 77 percent of these disadvantaged communities, of which 69 percent have had PFAS detected in their water system. Further, at least 20 percent of these tested communities have the highest levels of PFAS detections (top quartile), compounding the very high burdens they already face (Figure 6). However, it is important to note that approximately a quarter of these communities have yet to be monitored for PFAS. Considering their existing vulnerabilities, it is critical that this data gap be filled as quickly as possible.

FIGURE 6: TOP 25 PERCENT OF BURDENED COMMUNITIES IN CALIFORNIA

The following map identifies census tracts that have both top 25 percent CalEnviroScreen 3.0 scores and top 25 percent maximum total PFAS results. These identified communities face potential exposure to high levels of PFAS pollution in addition to high levels of pollutants already accounted for in CES's metrics.



This pattern of high PFAS pollution overlapping with high levels of other burdens continues to hold when we look at the top 10 water systems with the highest levels of PFAS pollution (Figure 7). These 10 public water systems recorded maximum total PFAS levels between 227.8 and 1,380.1 ppt, tens to hundreds of times higher than many state standards for individual PFAS. Eight out of the 10 serve communities that are relatively more disadvantaged than the average California community, and the PFAS pollution only adds to their preexisting environmental burdens.

FIGURE 7: TOP 10 PUBLIC WATER SYSTEMS WITH HIGHEST TOTAL PFAS

The map identifies the 10 water systems that have the highest total PFAS values among those tested so far. The table outlines the size of the population served, the population's demographic characteristics, and the CalEnviroScreen 3.0 score (a high CES score indicates higher burdens facing the community). The highlighted values in the table indicate an area where the population served by the water system has a value higher than or equal to California's overall state average, i.e. where the community is more disadvantaged.

	PUBLIC WATER SYSTEM NAME	MAXIMUM TOTAL PFAS (ppt)	RESIDENTIAL POPULATION	% PEOPLE OF COLOR	% LESS THAN HIGH SCHOOL EDUCATION	% UNEMPLOYMENT	% POVERTY	% HOUSING BURDEN	CalEnviroScreen Score
1	City of Fresno (CA1010007)	1380.1	533,366	66.3	25.5	13.8	52.6	20.5	45.8
2	City of Corona (CA3310037)	1276.1	168,432	61.3	16.0	9.6	28.9	14.7	30.2
3	City of San Diego (CA3710020)	698.9	1,339,958	51.9	13.1	8.5	31.3	18.7	18.5
4	Cal-Water Service Co.-Oroville (CA0410005)	524.7	10,556	35.4	21.5	16.4	63.7	18.9	34.4
5	Cal-Water Service Co.-Visalia (CA5410016)	409.6	140,868	54.4	19.9	10.4	44.8	17.0	35.6
6	City of Pleasanton (CA0110008)	374.5	73,067	40.9	4.9	5.3	10.7	10.6	14.2
7	Zone 7 Water Agency (CA0110010)	340.3	40	49.5	8.9	5.4	16.2	10.3	16.1
8	CALAM - Suburban (CA3410010)	306.2	111,768	48.0	10.9	13.3	44.1	19.7	32.6
9	Santa Clarita Water Division (CA1910017)	276.5	124,673	43.1	10.7	9.0	21.0	13.2	18.0
10	City of Lathrop (CA3910015)	227.8	23,384	64.6	24.1	12.3	38.1	13.9	51.2
			California State Average	61.3	18.2	6.2	16.3	19.0	27.6

Definitions

People of Color	Percent of population that do not identify as white-non-Hispanic
Less than High School Education	Percent of population over 25 with less than a high school education
Unemployment	Percent of the population over the age of 16 that is unemployed and eligible for the labor force
Poverty	Percent of population living below two times the federal poverty level
Housing Burden	Percent housing-burdened low-income households

Higher than or equal to California's overall state average

THE FULL EXTENT OF THE PROBLEM MAY BE MUCH WORSE

Current testing data do not reveal the full extent and impact of PFAS on California's drinking water. There are still thousands of public water systems that are yet to be tested. In addition, out of the 248 systems that had PFAS results from active sampling sites, only 45 percent of the systems were tested all four quarters.

The problem may be compounded by contaminated sources not included in this analysis. Out of the 398 public water systems monitored for PFAS, 150 were removed from this analysis because they only had results from an offline or a standby sampling site, and therefore do not contribute to exposure. Offline sites are not permitted to produce and distribute water to the distribution system until an approval has been received, and standby sources are used only for short-term emergencies of five consecutive days or less.[26] However, this puts additional limitations on the state's water systems. Given California's dire water situation, these sources may well be needed in the future. While not included in this analysis, offline and standby sites are thus pertinent in assessing the state's contamination.

Further, the state's monitoring program so far does not consider most small water systems or domestic wells. Many rural and disadvantaged communities rely on small water systems or domestic wells, which already struggle to address other drinking water contaminants. The full scope of the problem cannot be known until these drinking water sources are also tested.

Another limitation in understanding the full extent and impact of PFAS on California's drinking water is the limited number of PFAS currently monitored for. The state is only testing for 18 PFAS. However, there are thousands of possible PFAS that could be in the environment. In another study of tap water in five U.S. cities, the estimated total PFAS (measured by total "extractable" organic fluorine) was significantly greater than the sum of 15 individual PFAS that were measured.[27] In addition, the landscape will change further as the PFAS used today are replaced with new ones. For example, 40 new subclasses of PFAS were recently identified in firefighting foam and firefighting-foam-impacted groundwater.[28] It seems clear that far more PFAS and other organofluorine compounds are present in our water systems than can be currently identified with targeted, chemical-specific testing.

Policy Recommendations

Despite the known health risks of PFAS and the known contamination of our water, food, air, soil, homes, and the environment, there are no national requirements for PFAS monitoring or cleanup. As a result, numerous states have opted to act on their own to protect their citizens from the risk of PFAS exposure, including requiring expanded monitoring and setting drinking water standards.[29] While California has taken important initial steps toward evaluating the prevalence of certain PFAS chemicals in drinking water and their associated health risks, the state can and should do more to protect its residents from this public health crisis. For example, California has yet to set an enforceable standard for any PFAS in drinking water or any other environmental media, something other states have already done.

Preliminary testing data show that the magnitude of PFAS contamination in the state is enormous. An alarming number of sites with unsafe levels of contamination have been identified in the first phase of the Water Board's testing for a limited number of PFAS. Additional phases of testing will surely reveal many more sites and types of PFAS contamination. Californians' drinking water and public health is at risk, especially in many of the most vulnerable communities. Our analysis shows that, even with the limited testing data available, at least 69 percent of state-identified disadvantaged communities have PFAS contamination in their public water systems. Almost a quarter of these communities face the highest levels of PFAS contamination in the state.

The shortcoming of California's efforts to measure and reduce exposure to just a small subset of PFAS chemicals is that the PFAS problem will persist unless we identify and reduce the many other PFAS that pose similar risks to human health and the environment. Considering the long-term harm of PFAS, both known and potential, managing PFAS collectively as a class is the most effective approach to protecting public health and the environment from PFAS-associated harms. Scientists recommend this approach due to the extreme persistence of all PFAS and their potential to bioaccumulate, spread rapidly, and cause harm to human health and the environment.[30]

The long-lasting and serious effects of PFAS pollution are not easily reversed. Action is urgently needed to protect Californian communities—especially those already overburdened with cumulative exposure to multiple different types of pollution—from this ubiquitous chemical.

Our recommendations for addressing this public health crisis are the following.

I. TO PROTECT DRINKING WATER

Expand Monitoring

While the Water Board's PFAS site investigation is a good start to understanding the extent of PFAS contamination in California, it is critical that the Water Board look at the total PFAS burden residents face, not just the few PFAS that are currently monitored. Additionally, testing shows that sources of PFAS contamination are not easily predicted. Investigations therefore cannot be based solely on known historical or current PFAS usage. For example, Michigan conducted a full statewide public water system survey alongside site-specific investigations of known or likely PFAS contamination. The public water system survey identified several instances of contamination that would not have been captured by the site-specific investigations.[31] Finally, the focus on public water systems neglects residents reliant on domestic wells for their drinking water and potentially leaves them unprotected.

California should:

- **Expand testing coverage** – The Water Board should validate an alternative test method, such as the TOP (total oxidizable precursor) or TOF (total organofluorine) assay, which produce a better estimate of the amount of total PFAS present in drinking water.[32] Both this alternative test method and targeted testing for specific PFAS should be used together in the Water Board's PFAS monitoring program to better capture the full extent of PFAS contamination in California.
- **Perform a statewide public water system survey** – A full survey of all public water systems should be performed at least once, ideally every couple of years, to capture PFAS contamination not found by the Water Board's targeted site investigation and to identify changes in PFAS production and use.
- **Ensure rural disadvantaged communities are prioritized for testing** – Our findings show that disadvantaged communities may be facing higher levels of PFAS contamination. However, rural disadvantaged communities, which usually rely on small water systems or domestic wells and already struggle to address other drinking water contaminants, have little data available.
    - **Test private wells** – Rural communities often rely on private domestic wells and already face exposure to contaminants such as arsenic, 1,2,3-TCP, or nitrates in their drinking water. PFAS testing of these wells is therefore important because PFAS could add to these existing burdens.
    - **Integrate PFAS testing into existing efforts** – California already has several ongoing efforts, such as the Water Board's SAFER program, to address the drinking water contaminants these communities face. The state should integrate PFAS testing into these programs to maximize resources and identify risks for these hard-to-reach communities.
    - **Provide support for costs** – These communities will need additional support from the state to pay for the cost of testing.
- **Improve granularity of data collection and communication of potential impacts for water system users** – To improve its ability to respond, the state should collect more detailed data on where PFAS-contaminated water is being delivered in a given public water system. This information should then be shared with potentially affected residents so that communities better understand their risk and can take actions to protect themselves.

Address PFAS Contamination in Drinking Water

California has yet to regulate any PFAS chemical in drinking water. The Water Board recently set notification and response levels for three PFAS chemicals—PFOA, PFOS, and PFBS—and has asked the Office of Environmental Health Hazard Assessment (OEHHA) to set notification and response levels for six additional PFAS found in California drinking water.[33] However, this process is slow and likely to take many years, and response levels do not require treatment of drinking water. Instead, they allow public water systems to choose between treating the water, taking the contaminated source offline, or notifying customers that their drinking water is over the response level. (It is worth noting that response levels are often not adequately health protective and allow more contamination than any finalized drinking water standards would likely allow.)

Even if the regulatory process was quicker, with thousands of PFAS variations to consider, it is impossible for California's continued focus on individual chemical regulation to be adequately protective of public health. Instead, the Water Board should address PFAS in a class-based manner, which is the most effective and health protective approach to managing these chemicals. Managing PFAS as a class rather than regulating chemical by chemical will lead to lower overall exposures and better protection for all Californians, especially vulnerable populations such as pregnant women, children, workers, and those already disproportionately impacted by other pollution. In addition, the chemical-by-chemical approach would allow a regulated PFAS to simply be replaced with another nonregulated but similarly problematic PFAS. This could also lead to inefficient water treatment, where a technology that is installed to treat one specific PFAS is insufficient to treat a broader range of PFAS chemicals likely to be regulated at a later date.

California should:

- **Set a treatment technique for the PFAS class** – One way for the Water Board to address PFAS as a class would be to set a treatment technique standard. A treatment technique is triggered when a set threshold for a drinking water contaminant is exceeded. For PFAS, the threshold should be set based on the best available method for estimating *total* PFAS. The Water Board should require water systems to remove PFAS using treatment techniques such as reverse osmosis or an equivalent treatment train (sequence) when the threshold is exceeded. With proper operation and maintenance, many of the treatment techniques for PFAS would have the added benefit of removing most other contaminants of concern from the drinking water.[34]
- **Prioritize clean water access to already overburdened communities** – Many of the communities facing the highest levels of PFAS contamination in their drinking water have been identified as disadvantaged communities by California. These communities are already overburdened with environmental pollution and have technical and financial obstacles to addressing drinking water contaminants and should thus have priority for access to clean water. California should provide financial and technical assistance to these communities to address PFAS contamination and provide clean drinking water consistent with California's Human Right to Water in the interim.
- **Develop clear PFAS response guidance** – Some public water systems' response to finding contaminated drinking water sources in their systems has been to take them offline.[35] While we appreciate the fact that these systems have taken proactive steps to protect their consumers, this is an unsustainable approach to managing widespread PFAS contamination in a drought-prone state. For example, Downey's municipal water system receives its water supply from a mix of locally pumped groundwater and imported water from the Central Basin. More than half of the wells that the city of Downey owns and uses for drinking water show concentrations of PFAS exceeding the Response Levels.[36] If Downey decides to take any of these drinking water wells offline, it will put the community's water supply at risk. Instead, the state and public water systems need to invest in PFAS treatments, and the Water Board should actively provide guidance for responding to PFAS. This is especially important considering that new, unidentified PFAS—often with properties that make them more difficult than traditional pollutants to contain and clean up—are constantly being discovered.[37]
- **Invest in better, low-cost solutions to remove PFAS** – Addressing PFAS can be costly. Considering the extent of PFAS contamination and the risk it poses to Californians, the state and public water systems should collaborate to invest in, and create incentives to develop safer, more comprehensive, and lower-cost technologies to remove PFAS from water systems.

2. TO ADDRESS THE BROADER PROBLEM OF PFAS POLLUTION

Stop Adding to the Problem

California should also prioritize ending existing uses of PFAS. Studies show that phasing out the use of certain PFAS reduces exposure to these chemicals over time.[38] In addition, once released into the environment, PFAS are costly and energy intensive to clean up, and these efforts cannot fully reverse the damage inflicted on public health and the environment. The most efficient method to protect the public and environment from PFAS exposure and harm is to stop the production and use of PFAS wherever possible.

California should:

- **Phase out all nonessential uses of PFAS** – To limit further harm to our health and the environment, we should stop all nonessential uses of PFAS immediately.[39] Products that use PFAS should be assessed using the following questions:

   a. Is the product currently essential for health and safety and the functioning of society?

   b. What function do PFAS provide in the product and is the function essential?

   c. Are PFAS necessary to provide this function? Is there a safer chemical or functional alternative?

   PFAS use should be considered essential only if the answers to the above three questions are yes. For example, if a product is essential for health and safety (e.g., firefighting foam), but there are other, safer chemicals that can serve the same function as PFAS in the product, this use is not essential. Both administrative programs, like the Safer Consumer Products program, and the state legislature can help phase out nonessential uses.

- **Invest in the development of safer alternatives** – The state should explore multiple approaches for incentivizing and investing in safer alternatives for those uses of PFAS deemed currently essential for health or safety, or those that are otherwise currently critical for the functioning of society, so that all uses of PFAS can eventually be phased out.

Ensure Safe Disposal of PFAS Waste

Not only will the treatment of PFAS-contaminated water produce highly contaminated treatment-related waste (spent filters, reverse osmosis membranes, etc.), but the continued use of PFAS in various applications will generate PFAS waste for which we currently do not have adequate disposal solutions. PFAS are very resistant to degradation, and current disposal methods (incineration, regeneration, and landfilling) do not result in their destruction but rather reintroduce PFAS into the environment.[40] This is especially dangerous for fence-line communities located near landfills, incinerators, and regeneration/recycling facilities.

California should be proactive on this issue and prepare for the inevitable challenges ahead. This involves both interim and long-term solutions:

- **Interim: Require storage of highly contaminated PFAS waste** – California has already recognized interim storage as a preferred approach to PFAS waste (SB1044).[41] The state should enact a moratorium on all PFAS disposal, starting with highly contaminated waste, until CalEPA determines that a safe disposal method has been developed. Until then, the state should require the storage of highly contaminated PFAS waste in a way that avoids adding to the high pollution burdens already shouldered by fence-line and overburdened communities.

- **Long term: Incentivize the development of safe disposal technologies** – California should prioritize and support funding and other incentives for research and development on disposal methods that destroy the entire PFAS class and that ensure any degradation products are captured so that harmful PFAS, fluorinated reaction intermediates, and hydrogen fluoride are not released into the environment.

Hold Polluters Accountable

Make those responsible for the pollution pay their fair share of the costs – Water systems and their ratepayers or taxpayers alone should not have to pick up the tab for addressing PFAS pollution. Those responsible for polluting our environment and our bodies with PFAS should also shoulder a fair share of the costs. The state should work with water systems and local governments to ensure that the manufacturers of these chemicals are held responsible. One avenue for action is litigation, such as the cases brought by New York and New Jersey against manufacturers Solvay and 3M.[42] In addition, legislative approaches may also be needed.

The longer we wait to take action, the more PFAS enter California's air, water, and soil and accumulate in the bodies of its residents. The state must take steps to ensure that all Californians have access to clean water by improving monitoring and testing for PFAS, cleaning up contaminated water, providing clean water to disadvantaged communities in the interim, and eliminating nonessential uses of PFAS in products and applications.

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