DATE: December 19, 2019
TO: Water Commission
FROM: Gaylen Fair, Laboratory Supervisor
SUBJECT: Introduction to Polyfluoroalkyl Substances (PFAS)

Recommendation:
That Water Commission receive an introduction to Polyfluoroalkyl Substances (PFAS).

Background:
Per and polyfluoroalkyl substances (PFAS) is a large group of manmade chemicals that include perfluorooctanoic acid (PFOA), perfluorooctane sulfonic acid (PFOS), and many other chemicals that do not occur naturally in the environment. Dubbed the “forever chemical”, PFAS have been widely publicized because of the chemicals’ staying power in the environment and in our bodies – meaning PFAS don’t break down and can accumulate over time.

PFAS have been manufactured and used in a wide variety of applications around the world, both industrial and residential, since the 1940s. These chemicals are widely used because they are resistant to heat, water, and oil. PFAS are commonly found in every American household, and in products as diverse as non-stick cookware, furniture, clothing, cosmetics, lubricants, paint, carpets, pizza boxes, popcorn bags, and many others. PFOA and PFOS are two types of PFAS that are no longer manufactured in the United States, however they are still produced internationally and may be imported in consumer goods such as carpet, leather and apparel, textiles, paper and packaging, coatings, rubber and plastics.

While consumer products have been a large source of exposure to these chemicals for most people, drinking water has become an increasing concern due to the persistence of PFAS chemicals in the environment and their tendency to accumulate in groundwater. Groundwater contamination typically has been associated with an industrial facility where these chemicals were manufactured or used in other products, such as airfields where the chemicals have been used for firefighting or in areas near landfills that accept items containing PFAS.

Health Effects

Although there is some evidence that exposure to PFAS at certain levels can lead to adverse health outcomes in humans, health outcomes are still largely unknown. PFAS can be introduced into the body by eating or drinking contaminated food or liquid (including water), breathing in or touching products treated with PFAS, such as carpets or clothing. PFOA and PFOS are readily absorbed, but not readily eliminated from the human body. Health effects associated with long-term exposure include harmful effects to a developing fetus or infant; harmful effects to the immune system, thyroid and liver; and cancer.
The stability of PFAS means they are extremely persistent in our bodies and the environment. Some PFAS can last up to eight years in our bodies, leading to an accumulation over time. In a survey beginning in 1999, the Center for Disease Control tested blood serum (the clear portion of blood) of participants aged 12 years and older and measured PFAS in 98% of the participants, indicating widespread exposure to PFAS in the U.S. population. However, since PFAS compounds have been phased out by the Environmental Protection Agency (EPA), serum levels of PFOA and PFOS in the general population of the United States have decreased dramatically in recent years. For example, the average concentrations of PFOA and PFOS in the general population from 1999 was reduced by 70% and 85%, respectively in 2016.

Timeline of Imposed Limits

The Safe Drinking Water Act requires that the EPA issue a list of contaminants to be monitored by public water systems every five years. The third Unregulated Contaminant Monitoring Rule (UCMR 3) was published in May 2012, which required monitoring for 30 contaminants between 2013 and 2015, including PFAS. At the time of the UCMR3 monitoring, the method used for testing PFAS had relatively low reporting limits, ranging from 0.010ug/L or 10 parts per trillion (ppt) to 90ppt, depending on the specific compound. The reporting limit is the lowest concentration of a specific chemical that the laboratory can accurately measure, within specified limits of precision and accuracy.

The UCMR3 monitoring occurred from 2013 – 2015 to obtain data for 30 contaminants including PFAS. Because PFAS were an emerging contaminant of concern when the UCMR3 rule was published, there were no maximum contaminant levels (MCL), notification levels (NL) or other regulatory standards set by the EPA. However, the results of the nationwide monitoring revealed, the occurrence of these contaminants in drinking water, the number of people potentially being exposed, and an estimate of the levels of that exposure and forced EPA to develop health advisories for PFOA and PFOS.

In 2016, the EPA issued a health advisory level at 70 parts per trillion (ppt). Health advisories are non-enforceable and non-regulatory, and provide technical information to public health officials on the health effects, analytical methods, and treatment technologies associated with drinking water contamination. The health advisory level of 70 ppt offers a margin of protection for all Americans throughout their life from adverse health effects resulting from exposure to PFOA and PFOS in drinking water. The EPA advised municipalities that they should notify their customers of the presence if levels are over 70 ppt in community water supplies.

In July 2019, the California State Water Resources Control Board's (SWRCB) Division of Drinking Water (DDW) established an interim notification level of 14 ppt for PFOA and 13 ppt for PFOS and a response level of 70 ppt for the combined concentrations of PFOA and PFOS. Notification levels are established when there are no MCLs for a contaminant. If a notification level is exceeded, the drinking water system must notify the governing body where the drinking water customers reside. Response levels are levels of the contaminant at which SWRCB recommends the drinking water system take the affected water source out of service.

In August 2019, the notification levels were revised again based on updated health impact information provided by the Office of Environmental Health Hazard Assessment (OEHHA). The revised levels dropped down to 5.1 ppt for PFOA and 6.5 ppt for PFOS. The single response level remains at 70 ppt for the combined concentrations of PFOA and PFOS.
Currently, the OEHHA is developing public health goals for both PFOA and PFOS, which is the level of a contaminant in drinking water that does not pose a significant health risk. This is the next step in the regulatory process before establishing a MCL, a health-protective drinking water standard that public water systems must meet.

Testing for PFAS

From 2013 to 2015, UCMR3 required all large water systems (water systems serving over 10,000 people) to collect and analyze drinking water for PFOS and PFOA, including the City of Santa Barbara. In 2014, the City's Water Resources Laboratory (Laboratory) sampled the treated drinking water multiple times from the treatment plants and groundwater wells (one groundwater well was not sampled because it was being re-drilled, and was not in service at the time of sampling). All locations sampled as part of the UCMR3 monitoring did not detect PFAS, meaning the results were below the reporting limit.

Although the City did not detect PFAS, based on preliminary information from EPAs UCMR3 monitoring, 63 water suppliers in the United States had detected PFOA and PFOS in their drinking water supplies; 26 of these water systems are located in California. In March 2019, the DDW issued orders to 600 water system sites to test for PFAS. These water systems were selected based on their risk for potential contamination due to their proximity to facilities known to use, produce, or store PFAS chemicals, or because of proximity to a water system whose water supply is contaminated by PFAS.

The City did not receive an order to test for PFAS, however we wanted to be proactive in our sampling to determine if any of our sources had detection at the newly imposed lower limits. In September, October and November of 2019, the Laboratory sampled every drinking water source, both surface water and groundwater, for 17 PFAS including PFOA and PFOS. Additionally, the Laboratory sampled the wastewater and biosolids produced at the wastewater treatment plant, as those will likely be the next area for regulation. Below is a table of the drinking water results for PFOA and PFOS. Even with the lower reporting limits and notification levels, the City’s drinking water sources remain undetected for PFAS and PFOS. For reference, the reporting limits in 2014 for UCMR3 were 20 ppt and 40 ppt for PFAS and PFOS, respectively. In 2019, the reporting limit was 2 ppt for both PFAS and PFOS, 10-20 times lower than in 2014.

<table>
<thead>
<tr>
<th>Location</th>
<th>PFOA (ppt)</th>
<th>PFOS (ppt)</th>
<th>Total PFAS (ppt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cater WTP Raw</td>
<td>ND (&lt;2.0)</td>
<td>ND (&lt;2.0)</td>
<td>ND (&lt;5.0)</td>
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<tr>
<td>Cater WTP Treated</td>
<td>ND (&lt;2.0)</td>
<td>ND (&lt;2.0)</td>
<td>ND (&lt;5.0)</td>
</tr>
<tr>
<td>Desal Plant Raw</td>
<td>Waiting results</td>
<td>Waiting results</td>
<td>Waiting results</td>
</tr>
<tr>
<td>Desal Plant Treated</td>
<td>Waiting results</td>
<td>Waiting results</td>
<td>Waiting results</td>
</tr>
<tr>
<td>High School Well Raw</td>
<td>ND (&lt;2.0)</td>
<td>ND (&lt;2.0)</td>
<td>ND (&lt;5.0)</td>
</tr>
<tr>
<td>Corp Yard 2 Well Raw</td>
<td>ND (&lt;2.0)</td>
<td>ND (&lt;2.0)</td>
<td>ND (&lt;5.0)</td>
</tr>
<tr>
<td>City Hall Well Raw</td>
<td>ND (&lt;2.0)</td>
<td>ND (&lt;2.0)</td>
<td>ND (&lt;5.0)</td>
</tr>
<tr>
<td>Vera Cruz Well Raw</td>
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<td>Ortega GTP Treated</td>
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<td>ND (&lt;2.0)</td>
<td>ND (&lt;5.0)</td>
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<tr>
<td>Alameda Well 2 Raw</td>
<td>ND (&lt;2.0)</td>
<td>ND (&lt;2.0)</td>
<td>ND (&lt;5.0)</td>
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<tr>
<td>Hope Ave Well Raw</td>
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<td>ND (&lt;2.0)</td>
<td>ND (&lt;5.0)</td>
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<tr>
<td>San Roque Well Raw</td>
<td>ND (&lt;2.0)</td>
<td>ND (&lt;2.0)</td>
<td>ND (&lt;5.0)</td>
</tr>
<tr>
<td>Los Robles Well Raw</td>
<td>ND (&lt;2.0)</td>
<td>ND (&lt;2.0)</td>
<td>2.2*</td>
</tr>
</tbody>
</table>

*Los Robles Well Raw has been resampled to confirm the results

Reducing Exposure to PFAS
There are several ways you can reduce exposure to PFAS. Reverse osmosis and activated carbon filters have been shown to reduce the levels of most fluorinated chemicals by a significant margin. This includes both large integrated filtration systems and smaller, less costly point-of-use filters. The City’s two surface water treatment plants implore each of these technologies: the desalination facility uses reverse osmosis and the Cater Water Treatment Plant uses activated carbon filters. The City’s groundwater wells have not shown any indication that PFAS levels are near the notification levels so additional treatment is not necessary at this time. City customers can reduce exposure to PFAS by dusting more frequently and washing hands thoroughly before meals.

Conclusion

PFAS, like other emerging contaminants, are the focus of active research and study, which means that new information is released as data becomes available. The City will remain diligent about testing our water sources to understand where any contamination may be present.
INTRODUCTION TO POLYFLUOROALKYL SUBSTANCES

Water Commission – December 19, 2019
Presentation Overview

• History/background
• Health Effects
• Timeline
• Testing for PFAS
• Reducing Exposure
What are PFAS?

• Per and polyfluoroalkyl substances (PFAS) is a group of manmade chemicals

• Includes:
  - Perfluorooctanoic acid (PFOA)
  - Perfluorooctane sulfonic acid (PFOS)

• Dubbed the “forever chemical” because they do not break down easily
History of PFAS

- PFAS have been manufactured since the 1940s
- Originally manufactured to enhance everyday products that resist heat, oil, grease, stains, and water.
- Used in a wide variety of applications:
  - Industrial
  - Residential
Where are PFAS Found?

- They are typically used in fire retardants, oil and water repellents, furniture, waterproof clothes, take-out containers and non-stick cookware.
- Drinking water can be a source in areas where water supplies have been contaminated.
HEALTH EFFECTS
Exposure & Health Effects

• PFAS are introduced into the body
  - Eating or drinking PFAS containing food and water
  - Breathing in or touching products treated with PFAS

• PFAS bioaccumulate and can increase to the point where adverse health effects are experienced
Exposure & Health Effects

• Scientists have found PFOA and PFOS in the blood of nearly all the people they tested (>95%)

• Fortunately, levels of PFOA and PFOS in blood have been decreasing since the EPA has phased out many PFAS compounds.
Exposure & Health Effects

• PFOA and PFOS can cause reproductive, developmental, liver, kidney, immunological effects and tumors in laboratory animals

• Human studies have shown consistent findings for increased cholesterol levels

• Limited human health findings
  - Lower infant birth weights
  - Harmful effects on immune system, thyroid and liver
  - Cancer
REGULATIONS FOR PFAS
Timeline of Imposed Limits
Concentration Limits of PFAS

• Concentration is expressed in terms of weight of a substance per unit volume.
• In water and wastewater analyses, mg/L is used to express concentration
• 1mg/L = 1 part per million
Concentration expressions

• Parts per million (ppm) =
  - 1 second in ~11.5 days
  - 1 grain of sugar in 273 sugar cubes

• Parts per billion (ppb) =
  - 1 second in 31.7 years
  - 1 inch in 15,783 miles

• Parts per trillion (ppt) =
  - 1 second in 31,700 years
  - 1 drop in 20 Olympic size pools
Regulatory Timeline

• 2012 Unregulated Contaminants Monitoring Rule 3 (UCMR3) is published
  - 30 contaminants selected to be monitored
  - Included 6 PFAS
  - No regulatory standards/limits

• 2013-2015 UCMR3 monitoring conducted by public water systems (PWS)
  - Approx. 6,000 PWS participate
  - Results evaluated for prevalence and levels of exposure
Regulatory Timeline

• 2016 EPA issues health advisory for PFAS
  - 70ppt (combined)
• Health advisories are non-regulatory and non-enforceable
• Offer a margin of protection from a lifetime of exposure
Regulatory Timeline

- July 2019, Division of Drinking Water (DDW) established response level and interim notification levels
- Notification Levels:
  - 14ppt for PFOA
  - 13ppt for PFOS
- Response level:
  - 70ppt (combined PFAS)

- Notification Levels are health based advisory levels established when there is no Maximum Contaminant Levels (MCL) for a chemical.
- If concentrations are greater than the Notification Level, certain requirements and recommendations apply.
- Response levels are the level of a contaminant at which DDW recommends taking a water source out of service
Regulatory Timeline

• August 2019 DDW revised notification levels
• Notification Levels:
  - 6.1ppt for PFOA
  - 5.1ppt for PFOS
• Response level remained the same:
  - 70ppt (combined PFAS)
Regulatory Timeline – What’s Next?

- Public Health Goals are currently being developed, the level at which a contaminant in drinking water does not pose a significant health risk.
- MCL may be established soon after.
- MCLs must be met by all water systems.
TESTING FOR PFAS
City of Santa Barbara Water Supplies
Testing for PFAS

• The City’s Water Resources Laboratory supports the water & wastewater sections in analytical testing needs.
• Participated in UCMR3 monitoring in 2014
  - Included sampling for PFOA and PFOS
  - Collected samples of treated water at treatment plants and groundwater wells
  - All PFAS results were below the reporting limits
Results from UCMR3 Monitoring

• From nationwide monitoring, 63 water suppliers detected PFOA and PFOS in their water supplies (26 in CA)

• March 2019, DDW issued orders to 600 water system sites to test for PFAS
  - Sites selected based on their risk for potential contamination
Testing for PFAS in City water

• City of Santa Barbara did NOT receive an order from DDW to test for PFAS, but we wanted to be proactive about testing.
• Sampled to determine if City sources would detect PFAS at the newly imposed lower limits
  - 2014 results were <20ppt and <40ppt for PFAS and PFOS, respectively
  - 2019 limits are 5.1ppt and 6.5ppt
Testing for PFAS in City water

• From September thru December 2019, lab staff collected PFAS samples from all water system sources for 17 PFAS compounds
  - Surface Water Treatment Plant & Desalination Plant
  - All groundwater wells
  - Also collected at wastewater treatment plant
City of Santa Barbara PFAS Results

- Health Advisory Level (EPA)
  - Total PFAS: 70ppt
- Notification Levels (DDW)
  - PFOA: 5.1ppt
  - PFOS: 6.5ppt
- Response Level (DDW)
  - Total PFAS: 70ppt

All city water sources below notification and response levels
REDUCING EXPOSURE
Reducing exposure to PFAS

- Water treatment systems for PFAS removal
  - Reverse osmosis
  - Activated carbon filters

- Know what is in your water
- Dust more frequently

- Watch out for packaged food
  - Popcorn bags
  - Take out containers
  - Fast-food wrappers

- Avoid stain-resistant clothes/carpets
- Check personal-care products
- Avoid Teflon or non-stick cookware
- Wash hands before meals
Future of PFAS

• Continued research and study to understand toxicity
• Additional regulations from DDW & EPA
• City will continue to test water as necessary
• Communicate to community
QUESTIONS?