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TO: Mayor and City Council

THROUGH: Steve Powers, City Manager

FROM: Peter Fernandez, PE, Public Works Director

SUBJECT:

Drinking Water and the 2019 algal bloom season.

Ward(s): All Wards
Councilor(s): All Councilors
Neighborhood(s): All Neighborhoods
Result Area(s): Safe, Reliable and Efficient Infrastructure

ISSUE:

To inform Council on drinking water treatment during the 2019 algal bloom season.

RECOMMENDATION:

Information only.

SUMMARY:

The City of Salem successfully protected its drinking water from the impacts of harmful algal blooms that occurred in Detroit Reservoir during spring, summer and early fall 2019. Between April and October 2019, the City regularly tested water in Detroit Reservoir and the North Santiam River for two cyanotoxins produced by algal blooms: total Microcystin and Cylindrospermopsin. Cyanotoxins at levels above health advisory limits for vulnerable persons were detected 59 days during the season before the water entered the Geren Island Water Treatment Facility.

Multiple treatment methods were used to successfully remove the cyanotoxins from the raw water that entered the Geren Island Water Treatment Facility, including: Powdered Activated Carbon (PAC), pre-filtration, robust regular slow-sand filtration, and increased post-filtration dosages of chlorine. At no time did any treated water leaving the Geren Island Water Treatment Facility and entering the distribution system test at an official, minimum detection level for cyanotoxins or health advisory level, as defined by the Oregon Health Authority.

FACTS AND FINDINGS:

Watershed Conditions

Based on sample results and data analyzed by Oregon State University's *Prediction Lab*, the 2019 algal bloom season for Detroit Reservoir was from April 1 through October 31. The 2019 season was more severe than that observed in 2018. Algal blooms occurred earlier in the season, were more intense, and continued much longer than in 2018. Toxin levels were stronger, particularly from early -June through mid-August.

Testing and Sampling

Beginning in August 2018, near the end of the 2018 season, through the end of the 2019 season on October 31, 2019, the City's laboratory at the Willow Lake Water Pollution Control Facility performed a total of 1,462 individual sample analyses for the cyanotoxin Cylindrospermopsin and 2,264 sample analyses for Total Microcystins. The 3,726 sample analyses cost a total of $116,000. While a significant cost, the amount was considerably less than the amount spent on testing during the 2018 algal season, when samples were sent to out of state testing labs for analysis. Depending on where the sample was drawn, the analysis results were available the same day the sample was drawn or the next day. Results were posted on the City's website the day after the sample results were available.

Treatment Efforts

There were 59 days in 2019 when the Total Microcystins cyanotoxin levels tested at the North Santiam River's raw water intake to Geren Island were at, or exceeded, the 0.3 µg/L Health Advisory Level for Vulnerable Persons. Process testing showed that the introduction of PAC to the raw water in the intake channel combined with the use of the roughing, or pre-filter, removed the large majority of the cyanotoxins. Well-performing slow sand filters and increased dosages of chlorine removed the remaining cyanotoxins. The increased dosages of chlorine served as a final barrier to any residual cyanotoxin remaining in the finished water. Newly constructed chlorine reduction equipment was used to reduce the chlorine levels back to normal prior to the water entering the distribution systems of Salem and Turner. At no time during the algal season did any finished water

enter the distribution system with an official detectable level or advisory level of toxin, as defined by the Oregon Health Authority. The PAC treatment process was in operation a total of 70 days, from June 19 through August 28, 2019.

Public Information

The City's Public Information Team made considerable efforts prior to the start of algal season to educate the public about the City's drinking water. Public information emphasized precautions to prevent a reoccurrence of the 2018 health advisories and the future use of ozone in 2021. The City webpages contained information about water quality and treatment methods. Water quality sample test results were posted on the City's webpage each day after the samples were taken and analyzed. Early in the algal season, the City responded instantly and assertively to a trolling attack on social media that had purposely spread misinformation regarding the safety of the water. The combination of successful water treatment methods and proactive public information efforts achieved the goal of improving the public's confidence in the City's water system.

Looking Ahead to 2020 and Beyond

City staff are in the process of conducting post-algal season process reviews and debriefings. Lessons learned from the 2019 season will be applied to next year's algal season. In cooperation with the federal government, a new vertical profiler data collection sonde has been installed at the log boom at Detroit Reservoir. This device will provide the City will real-time water conditions at different depths of the reservoir. Design work is proceeding on the installation of a new ozone treatment facility at Geren Island. The ozone treatment method will oxidize most cyanotoxins; and combined with slow sand filtration and chlorine, will prevent the presence of cyanotoxins in the City's finished drinking water. The ozone treatment facility is anticipated to be completed in spring 2021.

BACKGROUND:

Overview of Salem's Water System

Salem's drinking water originates in the Mount Jefferson watershed on the western slopes of the Oregon Cascades. The water is stored behind Detroit Dam and Big Cliff Dam and then released into the North Santiam River. Salem draws its source water from the river, treats it at our water treatment facility on Geren Island and transmits the finished water to customers in Salem, Turner, Orchard Heights, and Suburban East Salem Water District. Because the water in the North Santiam River is typically of very high quality, the City uses a water treatment process called slow sand filtration. This process involves passing the water through a biological layer (called a "schmutzdecke") that rests on top of a layer of sand. After passing through the biological layer, the water infiltrates through the sand layer where it is collected, treated with chlorine and soda ash to keep the water disinfected and at the proper pH and sent through transmission pipelines to our customers.

2018 Algal Bloom Season

The North Santiam watershed has the potential for algal blooms generally between the months of May through October. City staff make visual observations of water conditions in the Detroit Reservoir throughout the year. The City conducts water quality samples throughout the year, but at a higher frequency during algal season. In May and June 2018 low concentrations of algae-based cyanotoxins passed through the treatment facility and were detected in Salem's water distribution

system. As a result of those detections, the City issued two separate water quality health advisories that advised children under age six, pregnant women, nursing mothers, and those with liver or kidney conditions to not drink the water. During the advisories, staff from the City of Salem, Marion County, and the Oregon Army National Guard, along with community volunteers, distributed a total of 571,000 gallons of bottled and bulk water to members of the public over a period of thirty-one days.

Preparations for the 2019 Algal Bloom Season

In response to the 2018 algal bloom season and associated water quality advisories, the City implemented a variety of measures to improve the community's ability to protect itself from algal-based cyanotoxins. Those measures included:

- Purchase of two analysis equipment sets that allow in-house testing of water samples at the City's Willow Lake Pollution Control Facility laboratory;
- Improved ability to monitor and assess the North Santiam Watershed water quality through Oregon State University's *Prediction Lab* algal forecasts;
- Improvements to the Geren Island Water Treatment Facility's PAC treatment system, South Channel, South Settling Basin, Roughing Filter, and slow-sand filters;
- Installation of chlorine reduction equipment in the transmission system that allows operators to increase the chlorine dosage to remove cyanotoxins and then reduce the levels to normal prior to distribution to customers;
- Construction of a pump station and valves to better serve the City of Turner when higher dosages of chlorine are in effect;
- Purchase and outfitting three emergency water distribution trailers, additional water storage tanks, and rehabilitation of the City's water tanker truck and tanker trailer; and
- Development and implementation of the *Comprehensive Cyanobacteria Toxin Response Plan for Salem's Drinking Water* to guide the City's sampling, testing, treatment, emergency response, and public information efforts.

Mark Becktel, AICP
Operations Division Manager