



**King County**

**Metropolitan King County Council  
Regional Water Quality Committee**

**STAFF REPORT**

<b>Agenda Item:</b>	7	<b>Name:</b>	Mike Reed
<b>Proposed No.:</b>	2023-0034	<b>Date:</b>	April 5, 2023

**SUBJECT**

Proposed Motion 2023-0034 acknowledges the receipt of a report, as required by Council Proviso P4 of the 2021-2022 County Budget, addressing the presence and effects of toxics in wastewater effluents discharged by King County regional wastewater treatment plants.

**SUMMARY**

The Council included Proviso P4 in the 2021-2022 County Budget that required a broad study of the presence and effects of toxic chemicals in wastewater treatment plant effluents on Puget Sound Southern Resident Orcas, and their primary prey, Chinook salmon. That study has been completed, and a report, "Toxics in King County Wastewater Effluent, Evaluating the Presence of Toxic Elements in the Effluent of Treatment Plants" has been transmitted, as an attachment to Proposed Motion 2023-0034. That proposed motion, which has been dually referred to the Regional Water Quality Committee and the Committee of the Whole, acknowledges the receipt of the Report. While the report is extensive and broad, it includes among its conclusions the following:

*Researchers concluded that such long-lasting chemicals—such as PCBs, PBDEs and PFAS in King County’s treated effluent discharges contribute to the bioaccumulation potential in Southern Resident Orcas, and thus contribute to potential toxic effects.*

**BACKGROUND**

In the Council’s consideration of the proposed 2021-22 budget in Fall of 2020, Proviso P4 was added to respond to concerns about the ongoing health outcomes of Southern Resident Orcas in Puget Sound waters. Proviso P4 is provided below:

*Of this appropriation, \$300,000 shall not be expended or encumbered until the executive transmits a status report and a final report on toxics in King County wastewater effluent, evaluating the presence of toxic elements in the effluent of treatment plants, and a motion that acknowledges receipt of the final*

*report and a motion acknowledging the receipt of the final report is passed by the council. The motion should reference the subject matter, the proviso's ordinance, ordinance section, and proviso number in both the title and body of the motion. The report shall include, but not be limited to, a summary of the results of an evaluation of toxic elements in the effluent of treatment plants. The evaluation shall*

*comply with the following:*

*A. The evaluation shall be based on testing of the undiluted effluent of treatment plants and shall be compared with chemical elements being discharged as industrial wastes into the wastewater collection system; sampling of effluents shall be timed to include at least one seasonal period of high winter discharge volumes;*

*B. The evaluation shall address and report on the presence, origin, volume, toxicity, environmental fate, and impacts to the marine environment from toxics, including metals, volatile organic compounds, chemicals of emerging concern, and other toxics in the undiluted effluent of treatment plants;*

*C. While the evaluation shall be as broad as possible within costs, to the extent necessary to narrow the scope of the evaluation, in light of the extensive range of potentially toxic elements, the focus shall be on:*

*1. Those elements considered most toxic to the marine environment generally; and*

*2. Those elements considered potentially toxic to Southern Resident Orcas and the hierarchy of marine species upon which the Southern Resident Orcas depend;*

*D. The evaluation shall assess whole effluent toxicity of the discharges, to assess the impact of the complex mix of toxic elements on marine species. The assessment shall be designed to indicate whether undiluted wastewater effluent represents a potential source of deleterious toxic influence to Puget Sound marine organisms, and to Southern Resident Orcas and the hierarchy of the particular marine species upon which they depend;*

*E. The evaluation shall include an assessment of the accumulation of those toxic elements in marine organisms, either directly or through bioaccumulation, and shall discuss potential impacts on metabolic processes, behavior, and mortality. The assessment may be accomplished either through analysis of the tissue of selected species or through bioaccumulation modeling;*

*F. The evaluation shall describe potential wastewater treatment technologies that have the capacity, in part or in whole, to limit or control the discharge of toxics in wastewater effluents to a significantly greater extent than is currently being accomplished at King County treatment plants; and*

*G. The evaluation shall be contracted to an entity with the capacity to address the required elements of the evaluation. Preference shall be given to entities with a demonstrated history of evaluating and reporting on the impacts of wastewater effluents on the marine environment, including impacts on Southern Resident Orcas or their prey species, and that have the capacity for modeling the bioaccumulation of toxics.*

*The executive should file electronically a report on the status of the evaluation project by December 31, 2021, and the final report and motion required by this proviso by June 30, 2022, with the clerk of the council. The clerk shall retain the original and provide an electronic copy to all councilmembers, the council chief of*

*staff, and the lead staff for the regional water quality committee, as well as to the committee of the whole or their successors.*

In sum, the proviso was intended to require a robust assessment of the content and toxicity of King County regional treatment plant wastewater effluents, particularly as regards impacts on Southern Resident Orcas and their prey species. This information was seen as being potentially useful to policymakers in identifying and addressing any wastewater effluent-related impacts to the health of Southern Resident Orcas, their prey species, and Puget Sound generally.

The research effort has now been completed, and the Report, entitled “Toxics in King County Wastewater Effluent, Evaluating the Presence of Toxic Elements in the Effluent of Treatment Plants” has been transmitted as attachment to Proposed Motion 2023-0034. The proposed motion has been assigned to the Regional Water Quality Committee and the Committee of the Whole for review.

### **Toxics in Puget Sound—Wastewater Effluents**

King County’s Wastewater Treatment Division (WTD) operates three regional wastewater treatment plants, as well as two smaller local plants, that process wastewater from a service area that covers much of King County, as well as small parts of Snohomish and Pierce counties. Wastes are collected from throughout the service area from residential, commercial, and industrial dischargers; industrial wastes are “pre-treated” before discharge into the system. Regional treatment plants use biological, chemical and physical processes to remove solids, organic matter, and pathogens from effluents.

The report notes that King County’s treatment plants were designed to remove organic material and solids, and to disinfect pathogens. Although some chemicals are removed in these processes, the plants were not specifically designed to remove the types of chemical pollutants that are of increasing concern. The report notes further that

- Chemical pollutant types include certain types that are regulated, and many more that are unregulated.
- “Priority Pollutants” are regulated by the U.S. Environmental Protection Agency (USEPA); they include certain metals and other pollutants; Priority pollutant chemicals are commonly found in many everyday products and in a variety of industrial, commercial, and domestic settings. For priority pollutant chemicals, Washington State Department of Ecology has developed water quality criteria for the protection of aquatic life that identify levels that protect against death and against reproductive and growth effects.
- “Chemicals of Emerging Concern” (CECs) is a broad category of emerging toxics that are not regulated in wastewater effluents. They include a wide range of long-lived organic chemicals, pesticides, human hormones, flame retardants, chemicals used in plastics, pharmaceuticals, personal care products, food additives, and others.
- Some CECs, such as per- and polyfluoroalkyl substances (PFAS), are known as “forever chemicals” because they last in the environment for a long time without breaking down and can accumulate in some animal tissues. PFAS are used in fire-fighting foams, cooking utensils, carpets, clothing, food packaging, and other

household products and are found in urine, feces, dishwater, and laundry water that are discharged to the wastewater system.

- Another group of chemicals, polybrominated diphenyl ethers, or PBDEs, are used as flame retardants in several applications, including textiles, plastics, wire insulation, and automobiles. Some PBDEs are also very long-lived and can accumulate in some animal tissues. Pharmaceuticals and personal care products are not regulated as priority pollutant organic chemicals and are primarily found in domestic wastewater sources and medical wastes.
- Other chemicals found in Puget Sound are associated with ongoing economic and social uses and activities, such as:
  - creosote-treated pilings,
  - use of copper in boat paint,
  - leaks and spills from automobiles,
  - automobile tire wear,
  - chemicals used as coatings and flame retardants in clothing and on other domestic products,
  - pharmaceutical medications that pass through the human body, and
  - personal care products.

### **Research Team**

In order to respond to the requirements of Proviso P4, the Wastewater Treatment Division contracted with a scientific research team, including members from Washington State University's Puyallup Research and Extension Center, the University of Washington Tacoma, and the National Oceanic and Atmospheric Administration (NOAA). This team was contracted to assess toxic chemicals found in wastewater effluent and in Puget Sound. DNRP assisted with some aspects of the study. A contract laboratory, SGS-AXYS Environmental of Victoria, British Columbia, provided support for specialized chemical testing.

### **Research Process**

The process for undertaking the science work was coordinated among the participating researchers and the Wastewater Treatment Division. Chemistry data that has been historically collected by WTD for industrial waste discharges into the system, influent to regional plants, and effluent from regional plants, as well as toxicity data from regional treatment plants was compiled.

Treated effluent from each of the three regional treatment plants—West Point, South Plant, and Brightwater treatment plants--was sampled by DNRP staff; one sample was collected during the winter of 2020/2021, and another during a dry period in the summer of 2021. DNRP also collected six samples of the waters of Puget Sound Central Basin in the summer of 2021, using DNRP's research vessel Sound Guardian.

Effluent samples and Puget Sound samples were tested at the University of Washington's Tacoma laboratory and SGS-AXYS Environmental, to assess the presence and amounts of priority pollutant chemicals, CECs, pesticides, various types of flame retardants, chemicals used in plastics, pharmaceuticals, personal care products and food additives.

Dry season effluent was tested at Washington State University's Puyallup laboratory to assess its toxicity to juvenile Chinook salmon. More than 300 juvenile Chinook were placed in containers holding different ratios of effluent and water mixes for ten days; the different ratios were used to represent various dilution, or mixing, with clean fresh water. Following the ten-day period, the fish were evaluated for a variety of potential health effects. They were then euthanized, and tissues were evaluated for biochemical changes caused by the effluent, and for chemicals that accumulated from the effluent. The results of evaluating the treated effluent, Puget Sound water, and fish tissue chemistry were used to assess whether exposure to specific chemicals in effluent may be affecting the health of Chinook salmon. To the extent possible, data was also used to estimate whether exposure of salmon to chemicals in effluent may be affecting the health of Southern Resident Orcas in Puget Sound that feed on Chinook salmon.

### **Research Findings**

The study found that, while most priority pollutant chemicals and CECs were at levels that were not projected to affect salmon or other aquatic species—that some specific CECs were at levels that may affect juvenile Chinook salmon. Researchers also concluded that some long-lasting chemicals in treated effluent, such as PCB's, PBDE's, and PFAS may accumulate in Chinook salmon and could contribute to health effects in Southern Resident Orcas.

More specific findings of the report are distributed among the report's responses to specific proviso requirements. Among those findings are the following:

- Between eight and ten priority pollutant organic chemicals were detected in influent, and treated effluent at the three regional treatment plants in 2021.
- In the six samples collected from Puget Sound, a total of 148 CECs and other toxics were measured in treated effluents. A novel testing method identified more than 250 other possible chemicals that may be present in treated effluents—this method does not produce estimates of the levels of identified chemicals, but only notes their presence or absence.
- Researchers concluded that regional treatment plants were found to contribute PCBs to Puget Sound “at levels that would be expected based on effluent studies of other treatment plants, the size of discharges, and the widespread presence of PCB's”.
- While priority pollutants in effluents are at levels that meet state criteria, and are described in the report as unlikely to cause acute or chronic effects—even at very low levels, some chemicals may cause changes to protein, hormone or other physiological levels within fish or other aquatic organisms.
- Researchers concluded that most CEC's evaluated were not expected to affect Southern Resident Orcas or other wildlife, based on the observation that most CEC's were expected to break down relatively quickly in Puget Sound, or were not likely to accumulate in fish tissues.
- The Report notes, however, that some long-lasting chemicals like PCB's, bioaccumulate to higher levels in fish and marine mammal tissues; PCB's are documented at high-enough levels in Southern Resident Orcas and are considered the primary contaminant suspected of reducing their reproductive success. Other long-lived chemicals found in treated effluent, such as PDDE's and PFAS, are also likely to accumulate in wildlife, including Southern Resident

Orcas. Researchers concluded that such long-lasting chemicals—such as PCBs, PBDEs and PFAS in King County’s treated effluent discharges contribute to the bioaccumulation potential in Southern Resident Orcas, and thus contribute to potential toxic effects.

- Measured and predicted levels of pharmaceuticals and other CECs in fish tissues were compared to levels that might affect fish. Results of this comparison indicated human hormones could be causing adverse effects and that a chemical used in plastics (known as bisphenol A) and an antimicrobial medicine (triclosan) could also be of concern. Nine other pharmaceuticals were also identified as being a high priority for future research based on their potential to accumulate from levels in Puget Sound waters to levels in fish tissues that could possibly cause effects. Uncertainties about the strength of the conclusions about the potential for effects from specific CECs remain.

Proposed Motion 2023-0034, to which the Report is attached, provides for the acknowledgment of receipt of the report. Proposed Motion 2023-0034 has been jointly assigned to the Committee of the Whole, and the Regional Water Quality Committee; the measure is currently in the custody of RWQC for initial consideration.

## **ANALYSIS**

The proviso that initiated this research and reporting process signaled the Council’s and the region’s concern with the potential impacts of toxic effluents being discharged into regional waters; specific concern was directed to impacts on Southern Resident Orcas and their primary prey species, Chinook salmon. Significant concerns regarding the presence of toxics in wastewater effluents are identified in this report. While there is a level of uncertainty regarding the specific impacts of such toxics the referenced species, the report suggests that such impact may be substantial. There is ongoing work by other regional authorities regarding water quality concerns in Puget Sound; it may be useful to communicate these results to such authorities, and together consider an approach towards determining policy direction. The Committee may wish to consider potential followup actions, including identification of policy implications and alternatives arising from the report; asking researchers to identify key additional research questions that may contribute to policy choices, and pursuing such additional research;ss explore the possibility of developing additional restrictions or limitations on discharges determined to be contributing to deleterious health outcomes for Southern Resident Orcas and Chinook salmon, including seeking a broader understanding of the legal opportunities and limitations associated with any such policy alternatives.

## **INVITED**

- Kamuron Gurol, Director, Wastewater Treatment Division
- Jenifer McIntyre, Washington State University School of the Environment
- C. Andrew James, University of Washington Tacoma Center for Urban Waters
- James Meador, NOAA Fisheries, Northwest Fisheries Science Center
- Jim Simmonds, Comprehensive Planning Supervisor, Wastewater Treatment Division

## **ATTACHMENTS**

1. Proposed Motion 2023-0034 (and it's attachment)
2. Fish Advisory Evaluation
3. Wastewater Effluent Discharge Assessment