Preliminary Draft State Technical Support Document for PCB Variances on the Spokane River

Chapter 173-201A WAC, Water Quality Standards for Surface Waters of the State of Washington

June 10, 2020

Preliminary draft for public comment

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List of Acronyms

Abbreviation	Full Name
BMP	Best Management Practices
Comprehensive Plan	2016 Comprehensive Plan to Reduce Polychlorinated Biphenyls (PCBs) in the Spokane River
CR	Code Reviser
CFR	Code of Federal Regulations
CSO	Combined Sewer Overflow
CWA	Clean Water Act
DO	Dissolved Oxygen
DO TMDL	The Spokane River and Lake Spokane Dissolved Oxygen Total Maximum Daily Load
EPA	Environmental Protection Agency
HAC	Highest Attainable Condition
HHC	Human Health Criteria
iPCB	Inadvertently Produced Polychlorinated Biphenyl
Method 1668	Refers to most recent Clean Water Act-approved version of method
mgd	Millions gallons per day
mg/L	Milligram per liter
MTCA	Model Toxics Control Act
NLT	Next Level of Treatment
NPDES	National Pollutant Discharge Elimination System
PCB	Polychlorinated Biphenyl
pg/L	Picogram per liter
PMP	Pollutant Minimization Plan
POTW	Publicly owned treatment works
ppb	Parts per billion
ppm	Parts per million
ppq	Parts per quadrillion
RCW	Revised Code of Washington
RM	River Mile
Task Force	Spokane River Regional Toxics Task Force
TMDL	Total Maximum Daily Load
TSCA	Toxic Substances Control Act
ug/L	Micrograms per liter

Abbreviation	Full Name
WAC	Washington Administrative Code
WDOH	Washington Department of Health
WQS	Water Quality Standards
WRF	Water Reclamation Facility
WWTP	Wastewater Treatment Plant

Purpose of the Preliminary Draft

The Department of Ecology (Ecology) is conducting an informal preliminary review on several rulemaking documents, including the State Technical Support Document, related to the PCB variance rulemaking for the purpose of receiving informal public feedback prior to conducting a formal public review on the rulemaking. While Ecology intends to use the feedback to better inform the development of the draft rule and supporting documents, we will not formally respond to comments received.

Ecology is requesting feedback on the preliminary draft rule and supporting documents, from June 10 through July 25, 2020. You may submit comments through our online eComment system and through the mail.

Online: Submit online comments[1]

Mail: Marla Koberstein

Department of Ecology

Preliminary Draft Variance Comments

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[1] http://wq.ecology.commentinput.com/?id=3VtZr

Executive Summary

The Washington Department of Ecology (Ecology) has received five applications for a water quality standard individual discharger variance for the polychlorinated biphenyl (PCB) human health criterion in the Spokane River. This report specifically addresses the current Clean Water Act (CWA) related issues on the Spokane River resulting from PCB contamination, and focuses on five Washington NPDES-permitted municipal and industrial dischargers with expired and administratively extended NPDES permits. This report examines different regulatory approaches to reduce PCBs entering the river with an emphasis on the use of individual discharger variances, as authorized in 40 CFR 131.14 and WAC 173-201A-420. The goal of this effort is to reduce PCBs in the Spokane River and ultimately meet the water quality standards for PCBs.

The variances Ecology is consdering include multiple individual dischargers where the highest attainable condition (HAC) for each is based on the highest attainable interim effluent quality. Each discharger variance application included data and supporting narrative that was used by Ecology in the development of the individual HACs. The state technical supporting document details the methods, data, and calculations of the HAC for each discharger and a review of their current technology. The HACs are quantified using percent removal efficiency for all five dischargers. As part of the HAC, the discharger specific pollutant minimization plans (PMPs) to reduce PCBs in effluent are described as well as ongoing state PCB reduction activities.

The PMPs provide a multi-pronged approach to require PCB reductions and are integral in demonstrating that variance recipients are making reasonable progress towards the water quality criteria for PCBs. The PMP includes PCB reduction activities throughout the term of the variance. Ecology reviewed the PMP information submitted by the dischargers for reducing PCB loading to the Spokane River, the Spokane River Regional Toxics Task Force Comprehensive Plan, and discharger specific facility plans, to identify actions for each discharger. Ecology created a list of actions and a corresponding schedule that will require dischargers to conduct pollutant minimization activities throughout the term of the variance.

Ecology completed an evaluation of the feasibility of PCB removal technologies for each of the five dischargers. This evaluation provides the context of the HAC and justifies the use of the variance using federal factor three found in 40 CFR 131.10(g). In addition to an evaluation of treatment, WAC 173-201A-420 (3)(c) also requires an evaluation of alternative actions that were considered to meet effluent limits based on the underlying water quality criteria, and a description of why these options are not technically, economically, or otherwise feasible.

The dischargers must demonstrate reasonable progress in implementing PCB reduction activities and technology feasibility analyses, as detailed in the pollutant minimization plan. A variance will remain applicable only if the re-evaluation of progress is conducted at least every

5 years and results are submitted to EPA. During the review of each variance, Ecology will provide the public and stakeholders the opportunity to comment on the mandatory review and progress made towards meeting the highest attainable condition. The public input will inform the future continuance of the variance as well as refinement of the actions needed to continue to reduce PCBs.

Introduction

Ecology is considering amendments to Chapter 173-201A WAC Water Quality Standards for Surface Waters of the State of Washington. These amendments include the following:

- Amending WAC 173-201A-420 (Variance section)
- Creating a new variance section in the water quality standards (WAC 173-201A-620 and WAC 173-201A-622)
- Adding five individual discharger variances to the State Surface Water Quality Standards in WAC 173-201A-622.

Ecology is considering adopting five individual discharger variances to the water quality standards that meet the requirements of WAC 173-201A-420 (Variance section), for polychlorinated biphenyls (PCBs) for the Spokane River, in water resource inventory areas (WRIA) 54 and 57.

We are considering this rulemaking in response to receiving completed variance applications from five National Pollutant Discharge Elimination System (NPDES) permitted dischargers to the Spokane River in April 2019:

- Liberty Lake Sewer and Water District - Water Reclamation Facility (Liberty Lake)
- Kaiser Aluminum Washington LLC – Trentwood (Kaiser)
- Inland Empire Paper Company (Inland Empire Paper)
- Spokane County Regional Water Reclamation Facility (Spokane County)
- City of Spokane – Riverside Park Water Reclamation Facility (City of Spokane)

These variance requests initiated a review by Ecology on the completeness and merit for each application. The information in the application was used to aid the variance analysis. The applications can be found on the Ecology Updates to the Water Quality Standards web page[2]. Ecology reviewed the applications and determined that they meet the variance submittal requirements in the Washington State Surface Water Quality Standards, WAC 173-201A-420(3). The rulemaking announcement notice (CR-101 Form) for these variances and scoping notice for the environment impact statement was filed on June 12, 2019.

[2] https://ecology.wa.gov/Water-Shorelines/Water-quality/Water-quality-standards/Updates-to-the-standards

Spokane River Study Area

The Spokane River stretches 111 miles from the outflow of Lake Coeur d'Alene in northern Idaho to the confluence with the Columbia River at Franklin D. Roosevelt Lake in north eastern Washington (Figures 1 and 2). The river drains an over 6,000 square-mile basin located in Washington and Idaho. The river flows through the cities of Post Falls and Coeur d'Alene in Idaho, past Liberty Lake just west of the Idaho border, and then west through the urban areas of Spokane Valley and the City of Spokane in Washington. Hangman Creek (Latah Creek) and Little Spokane River are the primary tributaries to the Spokane River. Downstream and west of the urban centers, an impounded portion of the river becomes Lake Spokane. Seven dams along the Spokane River (Table 1) create a series of pools/reservoirs, the largest being the 23-mile long Lake Spokane. Downstream of Lake Spokane, the Spokane River forms the southern boundary of the Spokane Tribe of Indians reservation from River Mile (RM) 32.5 to the confluence with the Columbia River at Columbia River RM 639.0. Lake Spokane separates the upstream waters containing National Pollutant Discharge Elimination System (NPDES) dischargers from the downstream Spokane Tribal waters.

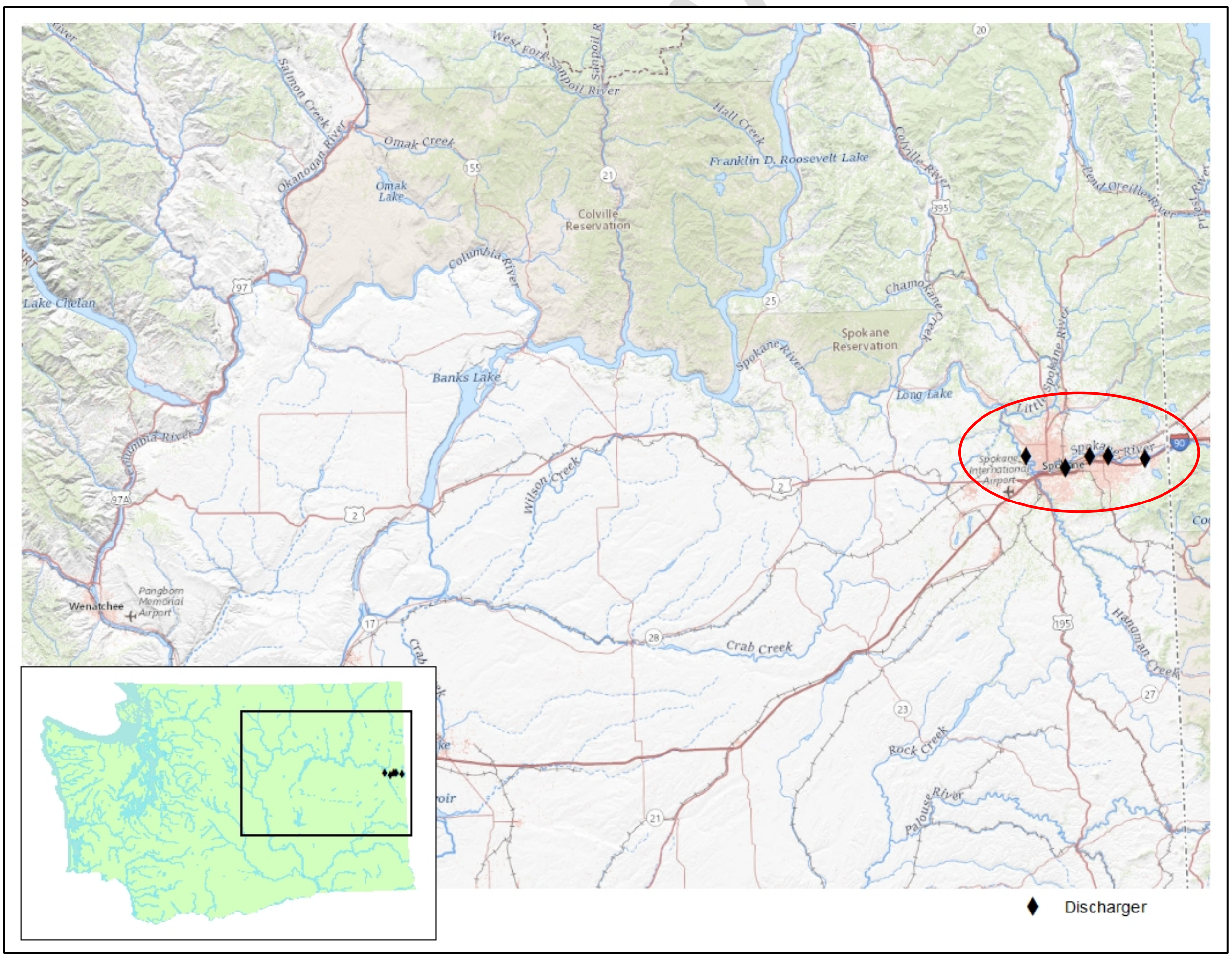

Figure 1. Spokane River dischargers in relation to Washington State.

The river historically supported anadromous salmonid runs and spawning. These runs were completely blocked in 1942 with the construction of the downstream Grand Coulee Dam, which created Lake Roosevelt, on the Columbia River. Subsequently, the salmonid runs that were blocked by the Grand Coulee Dam were blocked further downstream on the Columbia River by the 1950 construction of the Chief Joseph Dam.

Table 1. Dams on the Spokane River.

Dam	Year completed	River mile	Owner
Post Falls Dam (Idaho)	1908	100.8	Avista
Upriver Dam	1894/1933	80.2	City of Spokane
Upper Falls Dam	1922	74.5	Avista
Monroe Street Dam	1980	74.0	Avista
Nine Mile Dam	1908	58.1	Avista
Long Lake Dam	1915	33.9	Avista
Little Falls Dam	1911	29.3	Avista

This report specifically addresses the current Clean Water Act (CWA) related issues on the Spokane River resulting from PCB contamination, and focuses on five Washington NPDES-permitted municipal and industrial dischargers with expired and administratively extended NPDES permits. The five Spokane River discharges are located on waters that are listed as impaired (303(d) listed) for PCBs under the CWA (Figure 1). This report examines different regulatory approaches to reduce PCBs entering the river with an emphasis on the use of individual discharger variances, as authorized in 40 CFR 131.14 and WAC 173-201A-420. The goal of this effort is to reduce PCBs in the Spokane River and ultimately meet the water quality standards for PCBs.

National Pollutant Discharge Elimination System Permits

The federal Clean Water Act (CWA, 1972, and later amendments in 1977, 1981, and 1987) established water quality goals for the navigable (surface) waters of the United States. One mechanism for achieving the goals of the Clean Water Act is the National Pollutant Discharge Elimination System (NPDES), administered by the federal Environmental Protection Agency (EPA). The EPA authorized the state of Washington to manage the NPDES permit program in our state. Our state legislature assigned the power and duty for conducting NPDES permitting and enforcement to Ecology. The Legislature defined Ecology's authority and obligations for the wastewater discharge permit program in 90.48 RCW (Revised Code of Washington).

The following regulations apply to domestic wastewater NPDES permits:

- Procedures Ecology follows for issuing NPDES permits (chapter 173-220 WAC)
- Technical criteria for discharges from municipal wastewater treatment facilities (chapter 173-221 WAC)
- Water quality criteria for surface waters (chapter 173-201A WAC)
- Water quality criteria for groundwaters (chapter 173-200 WAC)
- Whole effluent toxicity testing and limits (chapter 173-205 WAC)
- Sediment management standards (chapter 173-204 WAC)
- Submission of plans and reports for construction of wastewater facilities (chapter 173-240 WAC)

These rules require any treatment facility owner/operator to obtain an NPDES permit before discharging wastewater to waters of the U.S.. They also help define the basis for limits on each discharge and for requirements imposed by the permit.

Under the NPDES permit program and in response to a complete and accepted permit application, Ecology must prepare a draft permit and accompanying fact sheet, and make them available for public review before final issuance. Ecology must also publish an announcement (public notice) telling people where they can read the draft permit, and where to send their comments, during a period of 30 days (WAC 173-220-050). After the public comment period ends, Ecology may make changes to the draft NPDES permit in response to comment(s). Ecology summarizes the responses to comments and any changes to the permit and records this information in the fact sheet appendices.

Polychlorinated Biphenyls (PCBs)

PCBs are a class of 209 individual human-made chemical compounds (congeners) consisting of a biphenyl molecule containing one to 10 chlorine atoms (Figure 2). They were marketed in the United States under several industrial trade names as mixtures of different congeners. The most common trade name is Aroclor. PCBs are characterized by long persistence, high bioaccumulation potential, and both cancer and non-cancer toxicity. PCBs are hydrophobic with low water solubility and they generally adhere to suspended solids, organic matter, and oils present in domestic and industrial wastewaters.

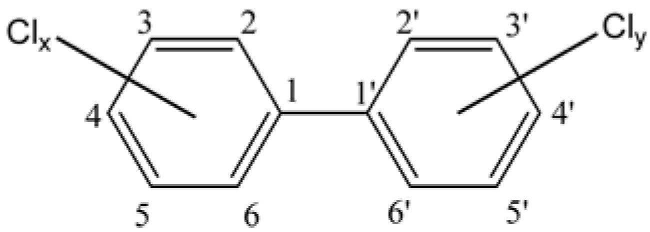

Figure 2. Structure of a polychlorinated biphenyl molecule (https://clu-in.org/).

PCBs were produced for commercial uses from about 1929 to 1976, when Congress, under the Toxics Substances Control Act (TSCA), banned PCBs for most uses in 1976 and restricted inadvertent PCB (iPCB) concentrations in 1979. PCBs had a wide application in industry because they are chemically stable, non-flammable, have a high boiling point and good electrical insulating properties. PCBs were used mainly in heat transfer fluids in electrical transformers and capacitors, and also in heat transfer and hydraulic systems, vacuum pumps and lubricants, surface coatings, adhesives, plasticizers, inks, insulating materials, and pesticides (UNEP 2007; ATSDR 2019). PCBs are still entering the environment from old paints, caulking and electrical equipment that were manufactured before PCBs were banned for all uses in 1979. Sources of iPCBs continue to be generated through manufacturing processes and are released to the environment.

Regulatory Levels for PCBs

Water Quality Standards (WQS) – Spokane River.

Washington State Surface Water Quality Standards (WQS) are comprised of three parts – designated uses, water quality criteria, and antidegradation – that can be used to address PCBs in freshwaters.

Designated uses.

Designated uses are required to be protected under the CWA and Washington's WQS. The designated uses applied to the Spokane River are found in Table 2.

Table 2. Designated uses applied to the Spokane River.

Designated Use	Description
Aquatic Life	WAC 173-201A-200 (1) Aquatic life uses are designated based on the presence of, or the intent to provide protection for, the key uses identified in (a) of this subsection. It is required that all indigenous fish and nonfish aquatic species be protected in waters of the state in addition to the key species described below. (a)(iii) Salmonid spawning, rearing, and migration. The key identifying characteristic of this use is salmon or trout spawning and emergence that only occurs outside of the summer season (September 16 – June 14). Other common characteristic aquatic life uses for waters in this category include rearing and migration by salmonids
Recreation	Primary contact recreation
Water Supply	Domestic, industrial, and agricultural water supply; stock watering
Wildlife habitat	Miscellaneous use
Harvesting	Miscellaneous use (human health based)
Commerce/navigation	Miscellaneous use
Boating	Miscellaneous use
Aesthetics (WAC 173-201A-200(4)	Miscellaneous use

Water quality criteria.

In many instances, designated uses are protected by calculated numeric criteria. Acute and chronic water quality criteria protect aquatic life from the toxic effects of PCBs. In addition, numeric human health criteria (which is protecting the harvest use) protect people from the toxic effects of ingesting PCBs that bioaccumulate in fish and shellfish tissue and from drinking untreated surface water (Table 3).

Table 3. Aquatic life and human health criteria for PCBs in the Spokane River.

Designated use	Water Quality Criteria (ug/L)	Source
Aquatic life: Salmonid spawning, rearing, and migration	Acute criterion: 2.2 Chronic criterion: 0.014 (24-hour average)	WAC 173-201A-240
Harvest + Domestic water	0.000007 (Duration of exposure of 70 years)	40 CFR 131.45

The PCB criteria for aquatic life are consistently met in the Spokane River. The Spokane River is currently assessed as not meeting the 170 ppq PCB human health-based criterion based on concentrations of PCBs in fish tissue. The 2016 PCB criterion of 7 ppq has not yet been part of a Water Quality Assessment to-date and therefore has not been assessed. However, if waters were not meeting 170 ppq, it can be assumed that the 7 ppq PCB human health criterion will also not be met. The downstream Spokane Tribe PCB criterion is 1.3 ppq, and the upstream Idaho PCB criterion is 190 ppq.

Antidegradation.

The area of the Spokane River addressed in this report is on the CWA 303(d) list as "impaired" for PCBs, thus the Tier 1 antidegradation requirements apply to those waters. The Tier 1 requirements relevant to those waters (WAC 173-201A 310 (1) and (2)) are as follows:

> Tier I—Protection and maintenance of existing and designated uses.
> (1) Existing and designated uses must be maintained and protected. No degradation may be allowed that would interfere with, or become injurious to, existing or designated uses, except as provided for in this chapter.
>
> (2) For waters that do not meet assigned criteria, or protect existing or designated uses, the department will take appropriate and definitive steps to bring the water quality back into compliance with the water quality standards.

Other Regulatory Levels for PCBs in the Environment

Washington Department of Health Fish Consumption Advisories

The EPA Subsistence Comparison Value for total PCBs is 0.00983 mg/kg. In 2001, the WDOH evaluated PCB concentrations in Spokane River fish tissue and concluded a public health hazard existed for adults, based on consumption of rainbow trout, mountain whitefish, and largescale suckers. In 2003, WDOH and Spokane River Regional Health District issued a fish advisory based on PCBs for mountain whitefish, rainbow trout, largescale suckers, and smallmouth bass (McBride, pers. comm.).

Federal Toxic Substances Control Act (TSCA).

In addition to the many sources of PCBs from past uses (legacy sources), TSCA allows existing and new products to contain PCBs, either as unintentional contaminants or as inadvertent byproducts during manufacturing. Current TSCA regulations generally allow up to 50 parts per million (ppm) of inadvertent PCBs in products. PCB-11, a contaminant found in yellow pigment used in print inks, has a TSCA allowance of 250 ppm. The EPA requires manufacturers to report PCBs in consumer products at levels above 2 ppm, or 2,000,000,000 ppq. In comparison, Washington's surface water quality criteria is currently 7 parts per *quadrillion* (ppq) for PCBs – that is equivalent to 0.000000007 ppm.

PCBs are found at levels below 50 ppm in many commonly used products. Sources of PCBs are discussed later in the Sources of PCBs section and additional information about PCBs can be found in Ecology's PCB Chemical Action Plan (Ecology Publication 15-07-002). The EPA provides summary information on PCB use, chemistry, health effects, and laws and regulations at its Learn about Polychlorinated Biphenyls (PCBs) web page[3].

State Model Toxics Control Act (MTCA)

The MTCA is Washington State's environmental cleanup law. MTCA funds and directs the investigation, cleanup, and prevention of sites that are contaminated by hazardous substances. It works to protect people's health and the environment, and to preserve natural resources for the future. Sediment quality standards are used to remediate sediments to the point at which they have no adverse effects on the aquatic ecosystem, and correspond to no significant health risk to humans. The sediment cleanup objective and cleanup screening levels for total PCB in freshwaters is 110 ug/kg and 2500 ug/kg, respectively. RCW 70.105D.030[4] (2)(d) requires the

[3] https://www.epa.gov/pcbs/learn-about-polychlorinated-biphenyls-pcbs

[4] https://app.leg.wa.gov/RCW/default.aspx?cite=70.105D.030

cleanup standards in these rules to be "at least as stringent as all applicable state and federal laws."

Water Quality Assessment

Every two years, states are required to prepare a list of water bodies that do not meet water quality standards. This list is called the CWA 303(d) list. In Washington State, this list is part of the Water Quality Assessment (WQA) process.

To develop the WQA, Ecology compiles its own water quality data along with data from local, state, and federal governments, tribes, industries, and citizen monitoring groups. All data in this WQA are reviewed to ensure that they were collected using appropriate scientific methods before they are used to develop the assessment. The WQA divides water bodies into five categories. Those not meeting standards are given a Category 5 designation, which collectively becomes the 303(d) list.

- Category 1 – Meets standards for parameter(s) for which it has been tested.
- Category 2 – Waters of concern.
- Category 3 – Waters with no data or insufficient data available.
- Category 4 – Polluted waters that do not require a TMDL because they:
- 4a. – Have an approved TMDL project being implemented.
- 4b. – Have a pollution control program in place that should solve the problem.
- 4c. – Are impaired by a non-pollutant such as low water flow, dams, or culverts.
- Category 5 – Polluted waters that require a TMDL – the 303(d) list.

Further information is available at Ecology's Water Quality Assessment web page[5].

The CWA requires that a TMDL be developed for each of the water bodies on the 303(d) list.

[5] https://ecology.wa.gov/Water-Shorelines/Water-quality/Water-improvement/Assessment-of-state-waters-303d

Spokane River PCB Actions

Administrative Actions

From 2003 to 2004, Ecology conducted a PCB source assessment for the Spokane River. In 2006, Ecology shared a draft *Spokane River PCBs TMDL [:] Water Quality Improvement Plan*[6] (no longer available on the Ecology website) with EPA, the Spokane Tribe, the state of Idaho, dischargers, and interested members of the public. Ecology subsequently deferred final development of the TMDL water clean-up plan, with its associated implementation requirements, due to insufficient monitoring data at that time. Ecology revised the draft report with updated information in 2009, and issued the report in 2011 as the *Spokane River PCB Source Assessment 2003-2007*[7]. This report found that PCB loading to the river was divided into three main source categories: City of Spokane stormwater (44%), municipal and industrial discharges (20%), and Little Spokane River (6%). PCB loading from Idaho at the state line represented the remaining 30% of the load.

Ecology chose to focus directly on PCB source control efforts, including a requirement for Spokane River dischargers to form a task force to develop and promote source control strategies in an effort to reduce discharges of PCBs to the river. The concept of the task force was initially put forth by Spokane County and Spokane Riverkeeper, and permits were issued to the five Washington dischargers in 2011. Ecology has issued administrative extensions for each of the five NPDES permits that are beyond their original expiration date. The permits required formation and participation in a task force, subsequently named the Spokane River Regional Toxics Task Force (Task Force). Information on Task Force membership and past and current actions can be found on the Task Force webpage[8]. Subsequent work on the river, including studies, upgrades to wastewater treatment systems, construction of CSOs, and source control efforts have all resulted in reductions in PCBs entering the river.

Permitting and Variance Requests

The freshwater human health criterion for PCBs set to protect the designated uses of fish harvest and water supply is seven (7) picograms per liter (pg/L). Picograms per liter are also referred to in this report as parts per quadrillion or ppq. The Spokane River does not meet the Washington State surface water quality standards for PCBs when it was last evaluated in the water quality assessment when the PCB criteria was 170 ppq, therefore Ecology will not

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[6] https://fortress.wa.gov/ecy/publications/SummaryPages/0603024.html

[7] https://fortress.wa.gov/ecy/publications/documents/1103013.pdf

[8] http://srrttf.org/

authorize a mixing zone for PCBs for any of the five dischargers. A mixing zone is an allotted distance surrounding the discharge location to the receiving water in which dilution may occur. Without a mixing zone for PCBs, the end-of-pipe permit limit is equal to the state's water quality criterion (currently 7 ppq).

For facilities that have sources and must treat for PCBs, meeting the water quality criterion at the point of discharge (end-of-pipe) is generally considered infeasible due to limitations in wastewater treatment technology. This situation led five dischargers to apply for discharger-specific variances that would apply to PCBs at each of their individual points of discharge.

Variances are a regulatory tool that may be granted by Ecology per the requirements in WAC 173-201A-420 and as approved by EPA per federal regulations in 40 CFR 131.14. Individual discharge variances provide an interim effluent condition that reflects the greatest pollutant reduction achievable, while also requiring further pollutant minimization actions throughout the term of the variance.

This report uses the discharger's variance application information submitted to Ecology in April 2019, as well as additional information and analyses to evaluate whether and how variances could be used to reduce PCBs entering the Spokane River. A variance for any individual discharger would result in a new time-limited discharger-specific water quality standard from which permit limits would be derived. The derivation of PCB permit effluent limits from the variance are detailed in the rule implementation plan (Ecology Publication 20-10-018). Ecology has initiated rulemaking to evaluate the five individual variance requests and to make a determination for each discharger on whether they will receive a variance.

The Variance Approach

Each discharger that has applied for a variance currently has an active NPDES permit:

- Liberty Lake Sewer and Water District (herein referred to as Liberty Lake)
- Kaiser Aluminum Washington LLC (herein referred to as Kaiser)
- Inland Empire Paper Company (herein referred to as Inland Empire Paper),
- Spokane County Regional Water Reclamation Facility (herein referred to as Spokane County)
- City of Spokane Riverside Park Water Reclamation Facility (herein referred to as City of Spokane).

The five dischargers are seeking variances because of concerns that a 7 ppq limit for PCBs is unattainable given current available treatment technologies.

A water quality standard variance is a time-limited designated use and time-limited criterion for a specific pollutant(s) or water quality parameter(s) that reflect the highest attainable condition during the term of the water quality standard variance. A variance allows for reductions in pollutants over time to reach the underlying water quality standard. The variance must also include the duration necessary to achieve the highest attainable condition.

For each individual discharger variance, Ecology must specify the highest attainable condition. The highest attainable condition for individual discharger variances, according to 40 CFR 131.14, includes a quantifiable expression of:

1) Highest attainable interim criterion; or
2) The interim effluent condition that reflects the greatest pollutant reduction achievable; or
3) If no additional feasible control technology can be identified, the interim criterion or interim effluent condition that reflects the greatest pollutant reduction achievable with the pollutant control technologies installed at the time the State adopts the WQS variance, and the adoption and implementation of a Pollutant Minimization Program (or Plan).

The quantifiable expressions above are referred to as HAC #1, HAC #2, and HAC #3 throughout this document to reference the path each individual discharger will pursue in their respective variance.

Ecology will consider the information provided in the variance applications, information and analysis from our permit managers and facility engineers, as well as additional input that may be provided through the rulemaking process, to develop the variances and determine whether it is appropriate to adopt one or more of them into the standards.

The individual discharger variances must demonstrate the need for the variance using one of the six federal factors listed in 40 CFR 131.10(g), or the additional factor listed in 40 CFR 131.14. We are using 40 CFR 131.10(g)(3) and therefore must show that human-caused conditions or sources of pollution prevent the attainment of the criteria and designated uses and cannot be remedied.

In developing the variances, Ecology would establish a time-limited interim standard specific to each variance that would be used to set discharge effluent limits, providing an avenue for NPDES permitted dischargers to meet their facility-specific numeric permit limits. Additionally, the variances would require implementation of pollutant minimization plans, the purpose of which are to continually reduce sources of PCB pollution to the Spokane River. The variances require regular reviews of progress towards the underlying WQS, and provides opportunities for adaptive management to meet the requirements of the variance. Ecology will evaluate progress made under the requirements of the variance in concert with the permit reissuance cycle (at least every five years).

A federal regulation establishing variances as a tool for meeting water quality standards was published in August 2015 at 40 CFR 131.14. Additionally, Ecology adopted revised state regulations for variances in August 2016. Together, these regulations provide a process for dischargers to apply for, and Ecology to consider, adopting a variance through state rulemaking procedures. As with any proposed rule change, a variance might or might not be formally adopted, depending on the outcome of the rule adoption process. If any of the variances were adopted by the state of Washington into Washington's Surface Water Quality Standards, they would require review and approval by the EPA under the federal Clean Water Act.

The No Variance Approach

The alternative to a water quality standard variance is to reissue permits to the five dischargers. Permits would be issued using the water quality criteria for PCBs (currently 7 ppq).

Existing EPA-approved methods for NPDES compliance monitoring currently cannot measure PCBs as low as the 7 ppq human health criterion. EPA method 608.3, approved for NPDES compliance monitoring, can only detect PCBs as low as 50,000 ppq.

In November 2016, EPA disapproved most of Ecology's rule submittal package regarding the development of toxics water quality standards for the human health criteria and promulgated federal criteria for most of the disapproved criteria (EPA 2016b). The promulgation of federal standards set different standards than Ecology had adopted: 192 total, 143 disapproved by EPA, 45 approved, 4 deferred action.

In 2019, three years after initially disapproving most of Washington WQS, EPA sent Washington State a letter informing Washington that they were now going to take action to reverse their disapproval and approve the criteria Washington submitted to EPA in 2016. On June 16, 2019, Washington filed a lawsuit to stop EPA from changing our human health criteria. On May 13, 2020 EPA published the final rule (EPA 2020) in the federal register to withdraw certain federal water quality criteria applicable to Washington, including PCB criterion of 7 ppq, and replace the criteria with the criteria Washington submitted to EPA in 2016. The final rule is effective June 12, 2020.

Discharger Information

The five Washington NPDES dischargers to the Spokane River are unique and each have different combinations of influent streams and treatment technologies that affect PCB concentrations in their effluent (Table 4). These dischargers were required to upgrade or modify their treatment facilities as part of their last permit reissuances in 2011. Requirements to improve their facilities were based on limiting nutrients and biochemical oxygen demand as specified in *The Spokane River and Lake Spokane Dissolved Oxygen Total Maximum Daily Load (TMDL)* (Moore and Ross, 2010) (DO TMDL). The goal of the DO TMDL is to achieve the water quality standard for dissolved oxygen to protect aquatic life in Lake Spokane.

Dischargers were required to identify and install technologies to meet permit required nutrient loads. Kaiser met their permit requirements with minor modifications to their treatment system, while other discharges installed advanced technologies that remove extremely small nutrient-containing particulates from the effluent. Additionally, EPA issued permits to three upstream Idaho dischargers (City of Coeur d'Alene, City of Post Falls and Hayden Area Regional Sewer Board) that included nutrient management requirements and advanced treatment technology requirements based on Washington's DO TMDL. The advanced treatment identified to meet the DO TMDL is also effective at removing particulate-bound PCBs – although PCBs in the dissolved phase are not captured by these technologies. An Ecology evaluation of the feasibility of PCB removal technologies for each of the five dischargers is found in the Overview of Treatment Technologies section.

Table 4. Spokane River discharger information including annual average daily discharge.

Discharger (listed upstream to downstream)	Type of wastewater discharge	2019 Annual average daily discharge (million gallons per day or MGD)	Treatment System
Liberty Lake	Municipal	0.79 MGD	Secondary biological treatment with chemical coagulation followed by tertiary membrane filtration (upgrades completed in 2018)
Kaiser	Industrial	6.77 MGD	Settling lagoon and walnut shell trace oil filtration system (2003)
Inland Empire Paper	Industrial	6.67 MGD (>50% is typically non-contact cooling water)	Secondary biological treatment followed by tertiary membrane filtration (upgrades completed in January 2020)
Spokane County	Municipal	8.00 MGD	Membrane bioreactor with chemical phosphorus removal (constructed in 2011)
City of Spokane	Municipal	30.78 MGD	Secondary biological with chemical coagulation followed by tertiary membrane filtration (upgrades to be complete by 2021)

Measuring PCBs in the Environment

Effluent and ambient water monitoring samples for PCBs generally use one of two methods: EPA Method 608 (EPA 1984) – 40 CFR 131.36) or 1668 (EPA 2010). EPA Method 608 was updated to Method 608.3 (EPA 2016a). EPA Method 1668 is a much more sensitive method than 608.3; however EPA Method 608.3 is the analytical method required and approved for measuring compliance of PCB limits in NPDES permits (40 CFR 136.1; 40 CFR 122.44(i)(1)).

While Method 608.3 is the method approved by EPA to determine compliance with permit limits, Ecology may require dischargers to use Method 1668 to measure lower concentrations of PCBs in their effluent. Ecology and the dischargers often use Method 1668 to measure individual PCBs (congeners) which can be useful in identifying and tracking PCB sources and evaluating the effectiveness of source control efforts. Method 1668 provides the main source of detectable effluent measurements for the advanced treatment plants discharging to the Spokane River. EPA has not yet approved the use of Method 1668 for measuring compliance with numeric effluent limits and thus, Method 608.3 remains the method approved by EPA for NPDES permit compliance.

Method 1668 is effective at measuring PCBs at the low concentrations found in effluent (in particular those facilities that have advanced solids removal technologies) and in ambient water. However, there is a higher level of uncertainty using 1668 to measure low levels of PCBs due to the sensitivity of the method and sample matrix interferences. In addition to measuring PCBs in the samples, this method will also measure low levels of PCBs that may be present in sampling equipment, laboratory water used in instruments for measuring samples, and in the environment during sample collection and analysis.

PCBs are ubiquitous in the environment and can be introduced into water samples, laboratory materials, and instruments used to measure PCBs. Even in laboratories designed to limit PCB contamination in the processing of water samples, PCBs can be found in the air, on glassware, solvents, filtered laboratory water, and other laboratory equipment or materials.

One way to address this uncertainty is to collect and analyze specially prepared "clean" samples, or "blanks." Blanks are analyzed with the environmental samples and are used to control the quality of the results. Blanks capture the contamination that occurs during sample collection in the field and during chemical analyses. There are a variety of blanks used during sample processing and the use of analytical equipment including rinsate blanks, trip blanks, and method blanks. Data quality of samples are reinforced using these blanks, field duplicates, and matrix spikes.

PCBs are routinely measured in blanks associated with processing and measuring water samples. PCB contamination can be accounted for by adjusting the sampling results based on the PCB concentrations measured in the blanks in a process called blank censoring. The concentration of PCBs in blanks is subtracted from the concentration reported in the water sample. If the PCB amount for a given congener in the water sample is less than the selected multiplier of the PCB congener in the blank, then that congener is not included in the calculation of total PCBs. The higher the blank censor multiplier, the higher level of confidence that the PCB detected is from the water sample and not PCB contamination acquired during sample collection or the analytical procedure.

Blank censoring can influence the reported PCB concentrations in sample and provide a level of confidence in the data. To blank censor a water sample, the amount of PCBs in blanks is multiplied by a value that is selected depending on the level of confidence you want to achieve. Often a 10x factor is applied to blanks to represent a high level of certainty or confidence that the PCB measured in a water sample originated from the water sample and not during sample processing. An example of the influence of blank censoring is shown for 20 samples collected at Nine Mile Falls from 2014 to 2018, located downstream of the five Spokane River dischargers (Table 5). The average, median, and range of reported PCB concentrations reported vary with the blank censor factor selected.

Table 5. Comparison on blank censoring factors for samples collected at the Nine Mile Falls station.

Blank censoring factor	Range (pg/L)	Median (pg/L)	Geometric mean (pg/L)
Uncensored	87 – 245	162	160
3x censored	59 – 233	99	111
5x censored	21 – 221	57	62
10x censored	5 - 98	21	24

PCB Concentrations in the Spokane River

The Spokane River Regional Toxics Task Force has collected and consolidated PCB data, analyzed using EPA Method 1668 that included results from 2014 to 2018 in a PCB database. Samples were collected at locations ranging from the upstream Lake Coeur D'Alene outlet down to Nine Mile Falls in Washington (Figure 3). A description of the PCB concentrations collected at the different stations can be found in Table 6. Data are presented using 3x blank censoring.

Table 6. PCB concentrations measured at nine sampling stations on the Spokane River.

Description	River Mile	Sample Size	Range (pg/L)	Geometric mean ± standard deviation (pg/L)
Near Lake Coeur d'Alene	109	13	0.9 – 47.4	6.90 ± 3.43
Downstream of Post Falls WWTP	100	8	5.3 – 251.9	18.4 ± 3.67

Description	River Mile	Sample Size	Range (pg/L)	Geometric mean ± standard deviation (pg/L)
Downstream of Liberty Lake WRF	90	20	1.1 – 108.1	11.3 ± 3.0
Upstream of Kaiser Aluminum	86	12	0.2 – 259.2	8.59 ± 6.90
Downstream Kaiser Aluminum	84	24	10.7 – 411.7	104 ± 2
Downstream of Inland Empire Paper	80	6	60.4 – 129.1	91.1 ± 1.3
Downstream of Spokane County WRF	78	25	9.1 – 265.8	91.8 ± 2.0
Upstream of City of Spokane	72	24	51.9 – 403.5	125 ± 2
Downstream of City of Spokane	57	20	58.6 – 233.4	111 ± 2

Figure 3. Pictorial of ambient Spokane River PCB concentrations from stations collected below the outlet of Lake Coeur d'Alene to Nine Mile Falls.

Sources of PCBs

Several sources and types of sources of PCBs to the Spokane River have been identified (SRRTTF Comprehensive Plan; LimnoTech 2016a, LimnoTech 2016b). These sources can be categorized into legacy sources, new sources, and sources from environmental transport (LimnoTech 2016a). Legacy PCBs are those PCBs produced intentionally through 1979. 'New' sources of PCBs include those that have been inadvertently generated through the manufacture of numerous products and materials since 1979 and that continue to be produced. PCBs also enter the Spokane River watershed through environmental source areas through long-distance transport routes. Examples of these sources are in Table 7.

Table 7. Three difference source categories of PCBs and examples of each source.

Source category	Example
Legacy	Clean-up sites, PCB-containing transformers, leaching of old paint, caulks, and other materials from older buildings, contaminated soils, and aquatic sediments in Spokane River.
New	PCBs inadvertently generated in new product production (e.g., personal care products, magazines, clothing, petroleum-based products) and then entering the wastewater as influent.
Environmental transport	Atmospheric deposition, upstream waters, glacial meltwater, runoff from land

The focus of the Task Force work has been to identify and reduce sources of PCBs to the river. In 2016, the Task Force developed its *2016 Comprehensive Plan to Reduce Polychlorinated Biphenyls (PCBs) in the Spokane River* (Comprehensive Plan). The plan defined source areas and environmental compartments containing PCBs, as the places where PCBs were used, inadvertently released, systematically discarded or accumulated. Legacy PCBs in building materials and in contaminated soils were determined to be the largest source areas.

In order to reach the river, PCBs must have a delivery mechanism. For example, PCBs can be carried from an area with contaminated soil through groundwater and seep into the river or they can move through the air, deposit on land, and be carried into the river by stormwater. The Comprehensive Plan evaluated PCB loading (flow x concentration) for each identified delivery mechanism. When added together, the primary delivery mechanisms for PCBs to enter the Spokane River are WWTPs, contaminated groundwater, and stormwater/combined sewer overflows. Lake Coeur d'Alene and the Little Spokane River have much lower concentrations than the sources mentioned above, but due to the higher flows (total water volume) from these sources the load (flow x concentration) contributions are similar in magnitude.

PCB cleanup under State Model Toxics Control Act

Under the Model Toxics Control Act (MTCA), Ecology has initiated clean-up actions at 20 sites along the Spokane River contaminated from past uses of PCBs. Activities have been completed at the majority of these sites; monitoring remains ongoing at three sites to ensure the sites remain protective of human health and the environment. In addition to those sites where remediation of PCBs was achieved at levels required by MTCA, Ecology has identified five sites that require some level of PCB remediation (Table 8). These sites are subject to MTCA clean-up actions.

Table 8. Sites on the Spokane River that require remediation for PCBs.

Cleanup Site Name	Address
Kaiser Aluminum & Chemical Corporation	15000 E Euclid Ave; Spokane, WA
Spokane Fire Dept. Training Facility	Rebecca & Mission; Spokane, WA
Alaska Steel & Supply	3410 Desmet E; Spokane, WA
US DOE BPA Bell Maintenance HQ	2400 E Hawthorne Rd; Mead, WA
Pacific Steel & Recycling	1114 N Ralph St; Spokane, WA

Information on cleanup sites can be found at Ecology's Clean-up Site Search online database[9]

PCBs in Products

PCBs can be found in many commonly used products. In a general consumer product study, Ecology analyzed pigments and dyes for four individual PCB congeners thought to be inadvertently produced (Ecology 2014). The sampling categories were packaging, paper products, paints and paint colorant, caulks, and a miscellaneous category consisting of two printer inks and two food samples. Ecology found PCBs in all product categories in amounts ranging from 32 thousand pg/L to 445 trillion pg/L (Table 10).

In a follow-up study, Ecology sampled products that Ecology considered likely to contain inadvertent PCBs at the parts per billion level, including paints, packaging, children's products and common consumer goods (Ecology 2016). One goal was to examine general consumer products, such as children's clothing, dyes, cosmetics, body care products, and comic books. Another goal of the study was to inform future purchasing programs for state agencies. Of the 216 samples from the 2014 and 2016 Ecology studies, 156 samples (72%) contained total PCBs over 1.0 ppb. The highest total PCB concentration found was for one breakfast cereal's plastic packaging material: 2,320 ppb.

[9] https://apps.ecology.wa.gov/gsp/SiteSearchPage.aspx

Concurrent to the Ecology studies, the City of Spokane sampled municipal products for PCBs (City of Spokane, 2015). PCBs were detected in 39 of the 41 product samples. The findings from these studies show that inadvertent PCBs are relatively common in many everyday products.

Table 10 provides a selection of some of the products (all from Washington) sampled across the three studies and the levels of PCBs found in the samples. The table also includes the TSCA regulatory level (materials containing less than 50 parts per million (ppm) are not considered PCB-contaminated; 40 CFR 761.3) and the surface water quality criterion for PCBs of 7 ppq (40 CFR 131.45). Concentrations are presented in parts per million (ppm), parts per billion (ppb), and parts per quadrillion (ppq) to help with comparisons. For details of the studies and the products tested, as well as PCB information for many more products purchased and used in Washington State, please refer to the individual studies, all of which are available on the internet.

Table 10. PCB concentrations measured in consumer products.

Product/s tested	Total PCBs (ppq)	Total PCBs (ppb)	Total PCBs (ppm)	Reference
Caulk and glazing pre-PCB ban, 36 samples from 4 schools (NE USA)	54,600,000,000 - 445,000,000,000,000	54,600 – 445,000,000	54.6 - 445,000	Osemwengie and Morgan, 2019
5 motor oils and lubricants	623,000. – 2,375,000.	0.623 – 2.375	0.000623 – 0.002375	City of Spokane, 2015
3 yellow traffic marking paints (wet)	730,000. – 64,880,000.	0.73 – 64.88	0.00073 – 0.0688	City of Spokane, 2015
3 white traffic marking paints (wet)	410,000. – 3,330,000.	0.41 – 3.33	0.00041 – 0.00333	City of Spokane, 2015
3 road de-icers	38,000 - 1,952,000	0.038 – 1.952	0.000038 – 0.001952	City of Spokane, 2015
Regular unleaded gasoline	935,000	0.935	0.000935	City of Spokane, 2015
One hydroseed mix	2,509,000,000	2,509	2.509	City of Spokane, 2015
PVC pipe and 2 pipe repair materials	1,110,000 - 17,780,000	1.110 – 17.78	0.001110 – 0.01778	City of Spokane, 2015
One hand soap	37,000	0.037	0.000037	City of Spokane, 2015
One laundry detergent	174,000	0.174	0.000174	City of Spokane, 2015
One dish soap	83,000	0.083	0.000083	City of Spokane, 2015
One shampoo	58,000	0.058	0.000058	City of Spokane, 2015

Product/s tested	Total PCBs (ppq)	Total PCBs (ppb)	Total PCBs (ppm)	Reference
One toothpaste	32,000	0.032	0.000032	City of Spokane, 2015
Three toothpaste products	100,000 - 110,000	0.10-0.11	0.00010-0.00011	Ecology 2016
Five clothing samples	1,300,000 - 16,600,000	1.3 – 16.6	0.0013 – 0.0166	Ecology 2016
11 cosmetic/body care products	100,000 - 7,800,000	0.1 – 7.8	0.0001 – 0.0078	Ecology 2016
8 caulk products (only one contained quantified PCBs)	390,000,000	390.0	0.390	Ecology 2016
17 plastic products	2,000,000 - 2,320,000,000	2.0 – 2,320.0	0.0020 – 2.320	Ecology 2016
12 printed materials/newsprint	2,400,000 - 53,500,000	2.4 – 53.5	0.0024 – 0.0535	Ecology 2016
2 yellow mustard products	50,000 - 160,000	0.05 – 0.16	0.00005 – 0.00016	Ecology 2016
Three body soaps	1,320,000 - 7,810,000	1.32 – 7.81	0.00132 – 0.00781	

PCBs in Fish Hatcheries

The Washington State Department of Ecology undertook a screening-level study to evaluate hatchery contributions of PCBs to the Spokane River (Ecology, 2018). PCBs were detected in all samples. PCB concentrations in hatchery discharges ranged from 147–219 pg/L. In feed samples, PCB concentrations ranged from 3.9–31.5 ug/kg. PCB concentrations in fish caught from Lake Spokane four months after their release were higher (20.5–28.7 ug/kg) than in pre-released fish (4.0–11.3 ug/kg), suggesting that most of the PCB body burden in post-released fish was accumulated after being released into the environment.

Variance Justification

Legacy PCB pollution has led to PCB contamination in the Spokane River. In addition, PCB contamination in consumer products (new and legacy) and in waste streams has led to elevated concentrations in the environment, including in aquatic life. Sources of PCBs to the Spokane River include discharge effluent from point sources, as well as unpermitted non-point pollution. Human caused conditions or sources of PCBs prevent the attainment of the fish harvest and water supply uses (40 CFR 131.10(g)(3)) in the Spokane River. The City of Spokane requested use of Factor 6 of 40 CFR 131.10(g), however, Ecology decided that Factor 3 best supported all five dischargers.

Treatment technology that would reduce PCBs in the Spokane River to levels that achieve the human health criterion necessary to protect for the fish harvest and water supply uses in the river is not presently available. All dischargers, with the exception of Kaiser, have already installed technology that at a full scale operation, achieves the greatest reduction for PCBs.

Evaluation of technology will be conducted throughout the term of the variance to determine if additional technologies that are more effective at eliminating and/or removing PCBs become available. Dischargers with the most effective available technology installed will continue to reduce PCBs through pollutant minimization plans (Factor 3 of 40 CFR 131.10(g)). Kaiser will evaluate technologies and install the most effective treatment technology for their wastewater system during the term of their variance.

Although most dischargers have the most effective treatment technology already installed, continued optimization of their systems and periodic evaluations of additional technology that may become available in the future will continue to occur.

Variance Duration

The proposed duration of the individual discharger variances is anticipated to be 20 years for the four dischargers using HAC #3 (City of Spokane, Spokane County, Inland Empire Paper, and Liberty Lake) (40 CFR 131.14(b)(1)(ii)(A)(3)) and 10 years for Kaiser using HAC #2 (40 CFR 131.14(b)(1)(ii)(A)(2)), as described in the Variance Approach section of this document. The PMP actions described in this document (Table 24-25) will require funding and resources to reduce PCB levels in effluents and overall to the Spokane River. The PMP actions in Table 24-25 will be reevaluated during the mandatory interim reviews and adaptively modified.

City of Spokane

The proposed duration of the City of Spokane variance is 20 years, with reevaluations no less frequently than every 5 years. The City of Spokane is currently in the process of making a significant investment into its wastewater infrastructure as described in the City of Spokane's Integrated Clean Water Plan (ICWP). The 20-year timeline of the plan coincides with the end of the current annual payments on $200 million in "green" revenue bonds that were sold in late 2014 to fund the ICWP projects and would be the earliest the City of Spokane anticipates being able to consider additional treatment options. The City of Spokane will continue to optimize its treatment system and implement PCB reduction actions over the course of the 20-year variance in order to comply with the PCB human health criterion. Specific PCB reduction actions over the duration of the variance can be found in the Pollutant Minimization Plan (Table 24 and 25).

Inland Empire Paper

The proposed duration of Inland Empire Paper variance is 20 years, with reevaluations no less frequently than every 5 years. The duration of this variance request is 20 years based on the expectation that advanced water treatment and PCB management actions by Inland Empire Paper, in concert with efforts of other dischargers and the Task Force, will reduce PCB levels in fish tissue and ambient waters to a level that will comply with the PCB human health criterion and achieve the designated uses of fish harvesting and water supply. The anticipated evaluations and PCB reduction actions are anticipated to continue for 20 years. Specific PCB reduction actions over the duration of the variance can be found in the Pollutant Minimization Plan (Table 24 and 25).

Spokane County

The proposed duration of the Spokane County variance is 20 years, with reevaluations no less frequently than every 5 years. Spokane County has identified several measures that could achieve additional PCB reductions. Because these potential measures are unproven, they will require considerable evaluation, including pilot testing to evaluate their efficacy and feasibility. If one or more of these measures are shown to be effective, Spokane County will secure the necessary funding and design to implement the measure(s). Spokane County requests a 20-year variance to complete the activities to reduce PCBs and comply with the PCB human health criterion. Specific PCB reduction actions over the duration of the variance can be found in the Pollutant Minimization Plan (Table 24 and 25).

Liberty Lake

The proposed duration of Liberty Lake variance is 20 years, with reevaluations no less frequently than every 5 years. Liberty Lake's most recent upgrade included chemical coagulation and membrane filtration. The district is currently optimizing the operation of the facility to achieve effluent criteria in the current NPDES permit and identifying other measures to reduce PCBs in discharge. In addition, Liberty Lake has begun to evaluate reuse options to reduce or eliminate the effluent discharge to the Spokane River. If alternatives are effective, significant time will be needed to evaluate, plan, acquire funding, implement, and comply with the PCB human health criterion. Specific PCB reduction actions over the duration of the variance can be found in the Pollutant Minimization Plan (Table 24 and 25).

Kaiser

The proposed duration of Kaiser's variance is 10 years, with reevaluations no less frequently than every 5 years, in order to complete the actions identified in the pollutant minimization plan and to review and implement additional technologies to reduce PCBs in effluent in order to comply with the PCB human health criterion. Specific PCB reduction actions over the duration of the variance can be found in the Pollutant Minimization Plan (Table 24 and 25).

Time-limited Designated Use

Federal regulations (40 CFR 131.14(b)(ii)) require a highest attainable interim use for waterbody variances. However, Washington State regulations (WAC 173-201A-420) require a time-limited designated use for individual discharger, multi-discharger, and waterbody variances. The highest attainable interim use and time-limited designated use are considered equivalent. The time-limited designated use for individual discharger variances applies at the point of compliance and not to the waterbody. The point of compliance for dischargers is the point of discharge.

The individual variances included in this rulemaking address the PCB human health criterion that is protective of fish harvest and water supply uses in the Spokane River. The Washington Department of Health (WDOH) has administered fish consumption advisories based on PCBs for mountain whitefish, rainbow trout, largescale suckers, and smallmouth bass. The fish consumption advisory has led to limited fish harvest on the Spokane River. The time-limited designated uses for the duration of the individual variances is **limited fish harvest and limited water supply** based on PCB concentrations detected in tissues and ambient waters and WDOH consumption advisory for the Spokane River that are applicable at the point of compliance for the discharges.

Variance Progress and Mandatory Interim Review/ Public Notification

In accordance with 40 CFR 131.14(b)(v), a water quality variance with a term greater than five years is reevaluated at least every 5 years after EPA approval for the duration of the variance. Ecology will provide a written summary of this mandatory interim review to EPA within 30 days of completion of the reevaluation. This review will include:

- A summary of PCB water quality monitoring data for the facility and progress towards meeting the human health criterion for PCBs.
- A summary of progress on PCB reduction activities and completed work.
- Determination of the feasibility of PCB treatment technology to attain the human health criterion for PCBs.
- A status evaluation of the impaired designated use.

- Recalculation of the facility's highest attainable condition, including revisions to the greatest level currently achievable and the pollutant minimization plan. The reevaluation will describe any adjustments needed to permit limits if the HAC has been updated.
- A summary of in-river PCB concentration upstream and downstream of facility effluent outfalls in the Spokane River.

During the review of each variance, Ecology will provide the public and stakeholders the opportunity to comment on the mandatory review and progress made towards meeting the highest attainable condition using Method 1668 and end-of-pipe compliance using Method 608.3. The public input will inform the future continuance of the variance as well as refinement of the actions needed to continue to reduce PCBs.

The dischargers must demonstrate reasonable progress in implementing PCB reduction activities and technology feasibility analyses, as detailed in the pollutant minimization plans. A variance will remain applicable only if the reevaluation of progress is conducted at least every 5 years and results are submitted to EPA.

Treatment Technology

Spokane County, the City of Spokane, and Liberty Lake own and operate municipal wastewater treatment facilities that continuously discharge effluent year-round to the Spokane River. Each of the three treatment facilities have been designed and constructed based on the timing of installation and their ability to accommodate a range of flows and pollutants specific to each facility. The influent to each facility is based on the number and types of users within their individual service areas. All three municipalities were required to upgrade their wastewater treatment facilities to meet their Spokane River DO TMDL wasteload allocations. Table 11 provides a description of the design capacity and number of connections for each publicly owned treatment works (POTWs).

Table 11. Design capacity and connections for publicly owned treatment works in the Spokane River.

Discharger	Number. of Domestic/ Residential Hookups	Number. of Non-Domestic (Commercial/ Industrial) Users	Design Criteria – Flow (MGD)
Liberty Lake Sewer and Water District	3,107	290	2.0 max month, 3.0 peak
Spokane County	26,689	1,416	8.5 max month, 13.8 peak
City of Spokane	77,520	5,203	68.1 max month, 94.6 peak

While the majority of wastewater sent to the municipal wastewater treatment facilities is domestic in nature, all three POTWs provide service to commercial and industrial customers as well. The Federal Water Pollution Control Act as amended by the Clean Water Act requires federal, state, and local governments, as well as industries and the public, to control pollutants that pass through or interfere with treatment processes in POTWs, or which may contaminate sewage sludge. In 1986, EPA granted Ecology authority to implement its own pretreatment program in accordance with state and federal rules and regulations.

For some larger municipalities, including the City of Spokane and Spokane County, Ecology delegates responsibility for permitting, monitoring, and enforcement of industrial users discharging to their treatment systems to provide more direct and effective control of pollutants.

In 1987 and 2011, Ecology granted the City of Spokane and Spokane County, respectively, authority to implement and manage their own pretreatment programs under state and federal rules and regulations. For non-delegated POTWs, such as Liberty Lake, Ecology is responsible for administering pretreatment permits where necessary.

The individual NPDES permits issued to the municipalities require the permit holders to work with Ecology to ensure that all commercial and industrial users comply with the pretreatment regulations in 40 CFR Part 403 and any additional regulations that EPA may promulgate under Section 307(b) (pretreatment) and 308 (reporting) of the CWA. Municipalities have NPDES permit requirements to identify any categorical industrial users (CIU), significant industrial users (SIUs) or potentially significant industrial users (PSIUs), as defined by 40 CFR 403.6 and 40 CFR Chapter I, Subchapter N.

Industrial users discharging to Liberty Lake that meet the criteria of being a CIU or SIU are required to have a state waste discharge permit in order to discharge process wastewater to the POTW. Liberty Lake's wastewater system does not receive flow from significant industrial users (SIU's). CIUs and SIUs identified in the City of Spokane and Spokane County collection systems must be issued a permit by the City or County, and permits are reviewed by Ecology.

It is important to note that while some industrial or commercial-type facilities are not required to have pretreatment permits, they may still be contributors of PCBs to the POTWs.

Spokane County

In response to the DO TMDL, Spokane County proposed a new facility to support a septic elimination program and to treat the wastewater generated in the greater Spokane Valley area. The goal was to eliminate failing septic systems that were discharging to groundwater that influenced the nutrient loading in the Spokane River. In December 2011, Spokane County began operation of a new membrane bioreactor at the Spokane County Regional Water Reclamation

Facility to meet the requirements of the DO TMDL. The treatment facility is located in an industrial portion of the City of Spokane Valley, approximately 0.5 mile south of the Spokane River, just north and west of the BNSF railyard. The service area consists of approximately 37,000 acres and includes the cities of Spokane Valley, Millwood, portions of Liberty Lake, and unincorporated Spokane County.

Spokane County's service area is divided into two main basins- the north valley service area and the Spokane Valley service area. The north valley service area encompasses approximately 13,000 acres with an average daily flow of roughly 2.2 million gallons per day (MGD). The south valley service area encompasses approximately 24,000 acres with daily flows close to 5.7 MGD. Spokane County's collection system is comprised of mostly PVC piping, installed between 20 to 40 years ago. The north valley service area has approximately 130 miles of gravity sewer pipe and 11 miles of force main. The south valley service area has 360 miles of gravity pipe and has 11 miles of force main. As previously mentioned, Spokane County is delegated to administer their own pretreatment program and has seven permitted industrial users.

The Spokane County's treatment facility is a step-feed nitrification/denitrification membrane bioreactor that utilizes chemical phosphorus removal. The treatment system is comprised of screening and grit removal, primary clarification, biological treatment, chemical precipitation, membrane filtration, disinfection, and solids handling. The treated effluent is discharged into the Spokane River near river mile 78.5.

Table 12 summarizes the PCB data submitted by Spokane County in their variance application and includes data collected from October 2012 through June 2019. Most of the effluent sampling events did occur concurrently with influent sampling. All data summarized in Table 12 reflects 3x censoring.

Table 12. Spokane County PCB levels in influent and effluent from 2012 to 2019.

Statistic	Influent (pg/L)	Effluent (pg/L)
Minimum	15,164	23
Average	27,897	188
Median	25,088	121
95th percentile	50,531	694
99th percentile	74,824	792
Maximum	88,159	810
Number of Samples	42	29

City of Spokane

The City of Spokane completed construction of the Riverside Park Water Reclamation Facility, a combined storm and sanitary sewage interceptor and primary treatment system, in 1958. The treatment facility was upgraded from a primary treatment system to provide secondary treatment in 1977. The facility provides treatment for the City of Spokane, parts of the West Plains, and portions of Spokane County in North Spokane. The facility also takes additional flows in excess of Spokane County's treatment capacity and flows from Airway Heights, as needed to meet the required quality of the reclaimed water facility. Riverside Park Water Reclamation Facility is located along the north bank of the Spokane River, approximately 3 miles northwest of downtown Spokane, just east (and upstream) of Riverside State Park.

The City of Spokane's collection systems consists of approximately 865 miles of sanitary sewer lines. Of those 865 miles, it is estimated 465 miles are separate sanitary sewer, and the other 400 miles are combined sewer and stormwater. Built in the 1950's, the City of Spokane original wastewater collection system carried flows directly to the Spokane River and Latah Creek. During rainfall and snowmelt events, stormwater runoff from roofs, parking lots, and streets overwhelmed the collection system. To mitigate this capacity problem, the City of Spokane utilized combined sewer overflows (CSOs) which allowed untreated wastewater and stormwater to be discharged directly to surface water. In the late 1980's, Ecology, through chapter 173-245 WAC and the CWA, required municipalities with CSOs to prepare CSO reduction plans with the goal of no more than one overflow per year per outfall.

In the 1980's and 1990's, the City of Spokane separated much of the combined sewers in north Spokane. The City of Spokane has more recently invested in construction of large CSO tanks, meant to hold combined wastewater during storm events and allow the flows to be metered back into the collection system to the treatment plant. The added storage capacity has allowed the City of Spokane to both eliminate outfalls and reduce the number of overflow events, which results in far less raw sewage and untreated stormwater reaching the river. Twenty CSO outfalls remains in the City of Spokane and are regulated through the City of Spokane's NPDES permit. The City of Spokane is also delegated to administer their own pretreatment program and currently has 13 industrial users under permit.

The City of Spokane's treatment facility is an extended aeration activated sludge treatment system with chemically enhanced primary treatment (CEPT) for phosphorus removal. The treatment systems are comprised of headworks, CEPT, biological nutrient removal treatment, clarification, disinfection, and solids handling. The City of Spokane is currently installing their Next Level of Treatment (NLT), tertiary membranes with microfiltration, to meet the Spokane River DO TMDL with a projected operational date of 2021. Treated effluent is discharged to the Spokane River at river mile 67.4.

Table 13 summarizes the effluent PCB data submitted by the City of Spokane in their variance application and includes data collected from March 2013 through November 2018. The data summarized in Table 13 reflects 3x blank censoring.

Table 13. City of Spokane's PCB levels in influent (2015 to 2020) and effluent (2013 to 2018).

Statistic	Influent (pg/L)	Effluent (pg/L)
Minimum	3,368	93
Average	10,378	550
Median	9,141	447
95th percentile	19,332	1409
99th percentile	20,800	1609
Maximum	20,824	1680
Number of Samples	52	29

Liberty Lake Sewer and Water District

The Community of Liberty Lake formed the Sewer and Water District in 1973 to both provide drinking water and wastewater treatment. The community formed the district in response to the recognized need to protect the water quality of Liberty Lake. The district was well established before the incorporation of the City of Liberty Lake in 2001. Liberty Lake serves approximately 3,397 users over a service area of 5,000 acres.

Liberty Lake constructed the wastewater treatment facility in 1982. The collection system, comprised of over 50 miles of mostly PVC piping, is separate from stormwater facilities located with the service area. The majority of flow to Liberty Lake's treatment facility is domestic, both from residential and light commercial, such as retail and offices. They receive a small portion of influent flow from industrial type facilities.

Liberty Lake's treatment facility is an extended aeration biological nutrient removal treatment system comprised of headworks, equalization basin, biological nutrient removal treatment, clarification, chemical coagulation, tertiary membrane ultrafiltration, disinfection, and solids handling. The last major upgrades for the treatment facility designed to meet the DO TMDL, completed late in 2017, included the chemical coagulation and membrane ultrafiltration systems. Treated effluent discharges to the Spokane River at river mile 92.3.

Table 14 summarizes the PCB data submitted by Liberty Lake in their Variance application. Table 14 only reflects the data collected after the next level of treatment was installed at the facility at the end of 2017 (February 2018 to October 2019). Although almost the same number of samples were taken in this period, concurrent sampling only occurred for three of those samples. All data summarized in Table 14 reflects 3x blank censoring.

Table 14. Liberty Lake Sewer and Water District PCB levels in influent and effluent from 2018 to 2019.

Statistic	Influent (pg/L)	Effluent (pg/L)
Minimum	1569	0
Average	3,384	93
Median	3,339	95
95th percentile	4,791	200
99th percentile	4,906	234
Maximum	4,935	242
Number of Samples	10	9

Technology Evaluation for Municipal Facilities

PCBs are hydrophobic with low water solubility and they generally adhere to suspended solids, organic matter, and oils present in domestic and industrial wastewater. The municipal wastewater treatment facilities are designed to treat or remove both solids and organics. This results in PCB removal efficiencies of greater than 95%. Spokane County and Liberty Lake have installed and operate advanced treatment facilities. The City of Spokane is currently installing systems that include physical and chemical treatment processes, which when combined, provide the greatest pollutant reduction available for PCBs. Currently, there are no demonstrated technologies implemented at full scale for municipal wastewater treatment systems that can achieve the current water quality criteria for PCBs (7 ppq).

Inland Empire Paper

Inland Empire Paper Background and Treatment System Description

Inland Empire Paper manufactures newsprint and specialty paper products from the groundwood-thermo-mechanical pulp (TMP) processing of raw wood chips and the de-ink processing of recycled newspapers, magazine, and office paper. The current production capacity of Inland Empire Paper's paper machine is about 525 tons per day, with the finished product typically containing 70% TMP pulp and 30% recycle content.

Inland Empire Paper's wastewater treatment system includes a series of different technology that include:

- Dissolved air floatation unit that removes suspended solids and inks from the deinking of pulp
- Heat exchangers that cool effluent from the thermo-mechanical pulping system

- Course screening
- A speece cone that oxygenates wastewater prior to primary clarification
- 100’ primary clarifier
- 75’ clarifier used for surge control
- Conustrenner that reclaims primary clarifier effluent for use in the pulp mill
- Two 1.2 million gallon equalization tanks
- Three moving bed biofilm reactors (MBBR)
- Orbal aeration basin
- 120’ secondary clarifier
- A tertiary ultra-filtration membrane system

Inland Empire Paper finished the installation of the ultra-filtration membranes in January 2020, which completed the necessary technology expected to meet their waste load allocations for total phosphorus, ammonia, and carbonaceous biochemical oxygen demand (CBOD), as defined by the Spokane River Dissolved Oxygen TMDL. The optimization of this system is expected to be completed by the end of 2020.

Inland Empire Paper’s treatment system removes PCBs through a number of physical processes (particle and membrane filtration) in combination with biological treatment. Once optimized, the treatment system will represent a combination of technologies that will be representative of the greatest pollutant reduction available for PCBs. There is no additional demonstrated technologies implemented at full scale that can achieve the human health water quality criterion for PCBs.

Inland Empire Paper Effluent Characterization

Under the requirements of their NPDES permit, Inland Empire Paper samples its wastewater effluent on a quarterly basis for PCBs using EPA method 1668. Influent has not been sampled and analyzed for PCBs. Table 15 provides a summary of these results from November 2011 through October 2018. All data summarized in Table 15 reflects 3x blank censoring. Appendix A contains the results for individual sampling events.

Table 15. Inland Empire Paper PCB levels in effluent.

Statistic	Effluent (pg/L)	Effluent (mg/day)
Minimum	694	19.2
Average	3,296	85.0

Statistic	Effluent (pg/L)	Effluent (mg/day)
Median	2,492	62.5
95th percentile	7,659	217.4
99th percentile	13,162	347.2
Maximum	15,052	387.8
Number of Samples	30	30

Inland Empire Paper also conducted a PCB source identification study as part of requirements in their NPDES permit. Over three consecutive weeks Inland Empire Paper sampled concurrently for PCBs in internal process waste streams, non-contact cooling water, and effluent. Sampling began on October 27, 2014 and ended on November 14, 2014. Ecology used this information to determine the efficiency of their treatment system in removing PCBs. However, Ecology excluded one week of samples from their analysis because wastewater solids were removed from the samples prior to analysis. This likely resulted in underestimates of actual loadings. The percent removal efficiency calculated for the remaining two sampling weeks were 94.9% and 98.1%. A summary of the source identification analysis is provided in Appendix B.

During the pilot testing of their tertiary membrane treatment system, Inland Empire Paper also collected samples to determine the efficiency of the membranes in removing PCBs. Inland Empire Paper used two sampling events between June and July of 2017 to calculate an additional percent removal efficiency across the membrane system. The additional percent removal efficiencies measured across the membrane treatment system were 26.1% and 48%. The percent removals from the source identification study and membrane pilot system are shown in Table 16. Ecology will review data collect by Inland Empire Paper during the rulemaking process and may revise the HAC based on additional data collected prior to issuance of the CR-103.

Table 16. Inland Empire Paper PCB percent removal efficiency.

Study	% Removal calculated from sampling event 1[a]	% Removal calculated from sampling event 2[a]
Source Identification Study (existing treatment system)	94.9	98.1
Membrane Pilot System (Additional % removal after existing treatment)	26.1	48.0

[a] Sampling events for each study were taken in different years

Kaiser

Kaiser Background and Treatment System Description

Kaiser owns and operates an aluminum rolling mill and metal finishing plant in Spokane Valley. The facility produces aluminum sheet, plate, and coil through the melting of aluminum, casting of ingots, and rolling with neat oils and emulsions.

Kaiser's wastewater treatment system includes a 4 million gallon, 1.5 acre wastewater treatment lagoon. The lagoon receives wastewater from onsite sanitary wastewater and industrial wastewater treatment plants, contact and non-contact cooling water, and stormwater. Effluent from the lagoon is treated using a trace oil filtration system prior to discharge to the Spokane River.

Kaiser's treatment system removes PCBs by the physical processes of particle aggregation and filtration. Ecology believes that additional feasible pollutant control technology can be identified for Kaiser's effluent. These technologies may include improved particle filtration, membrane filtration, adsorption, advanced oxidation processes, and possible biological treatment.

Kaiser Effluent Characterization

Kaiser samples its wastewater twice per month in accordance with requirements of their NPDES permit. Table 17 provides a summary of these results from January 3, 2108 through May 8, 2019. All data summarized in Table 17 reflects 3x blank censoring. Appendix C contains the results for individual sampling events.

Table 17. Kaiser's PCB levels in effluent.

Statistic	Effluent (pg/L)	Effluent (mg/day)
Minimum	1,504	50.1
Average	2,401	70.7
Median	2,447	68.3
95th percentile	3,133	94.6
99th percentile	3,470	102.0
Maximum	3,644	104.1
Number of Samples	35	35

Overview of Treatment Technologies

Ecology conducted an evaluation of additional treatment technologies and other alternative actions to meet effluent limits based on the underlying water quality criteria. A description of why these options are not technically, economically, or otherwise feasible as required in WAC 173-201A-420(3)(c), is included. In addition, RCW 90.48.010 requires the use of all known available and reasonable methods by industries and others to prevent and control the pollution of the waters of the state of Washington. This section addresses the treatment technologies considered in the variance.

There are no technology-based effluent limits or effluent limitation guidelines for PCBs. Therefore, NPDES permit limits for PCBs are evaluated based on the water quality criteria. Because PCB levels in the Spokane River exceed the water concentration needed to meet the PCB criteria, the five dischargers would be required to achieve an effluent concentration equal to the 7 ppq human health criterion before the effluent is discharged to the receiving water.

Based on this review, Ecology determined that no available full-scale technology exists to meet the current human health criterion. The review did identify numerous proven technologies for removal of PCBs from wastewater, and other emerging technologies for advanced oxidation of organics. However, none of these has demonstrated a capability to meet a 7 ppq limit at full-scale operation.

Alternative actions, beyond treatment technologies, considered to achieve an effluent limit based on the water quality criteria are discussed in the following section.

Treatment technologies for PCBs can be grouped into four major categories: physical removal, chemical degradation, biological degradation, and thermal degradation.

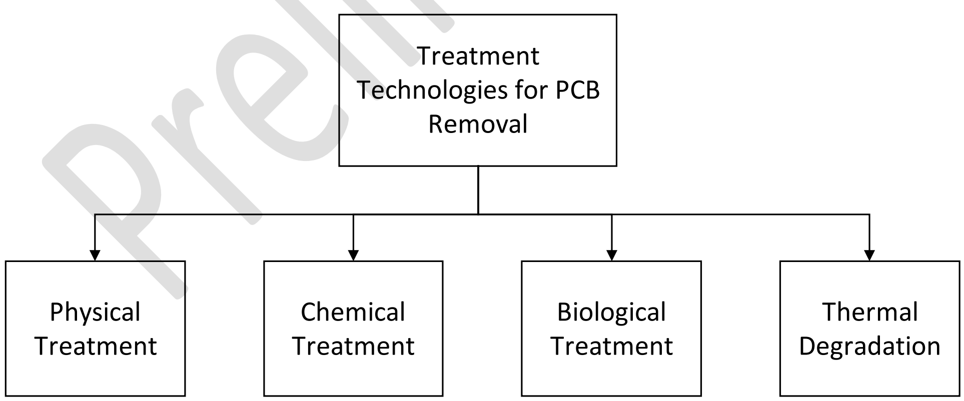

Figure 4. Different types of treatment technologies for PCB removal.

Physical Processes

Physical treatment processes rely on physical mechanisms to remove pollutants from wastewater. Generally, these processes include oil and grease removal, particle aggregation, particle filtration, and membrane filtration. Adsorption is a separate physical process used to remove contaminants from wastewater. Adsorption occurs when a thin layer of molecules adheres to the surfaces of a solid material. Adsorption media can include flocculants, aluminum oxide or iron hydroxide, synthetic materials, and activated carbon.

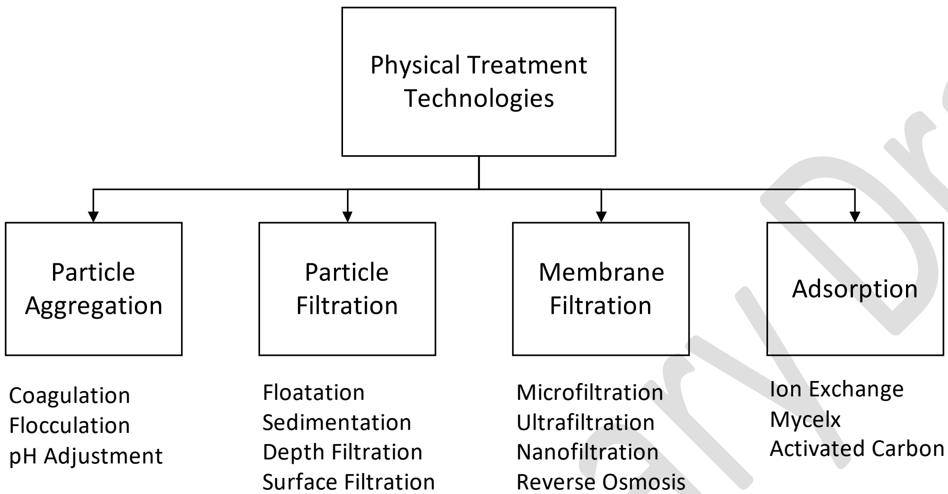

Figure 5. Types of physical treatment technologies for PCB removal.

PCBs tend to be hydrophobic, with low water solubility. This property makes PCBs preferentially adhere to suspended solids, organic matter, and oils present in domestic and industrial wastewater. Therefore, most physical treatment processes that remove solids and oil and grease will generally also remove PCBs. Oil and grease can be removed by skimming, filtration, and adsorption. The chemical structure of PCBs makes them soluble in oil. Therefore, removing oil and grease will also remove PCBs. The company MYCELX markets technology that uses adsorption media to remove oil and grease from wastewater.

Particle aggregation is the process where suspended particles and colloids in wastewater agglomerate, or stick, together. Coagulants and flocculants, with or without pH adjustment, are used to aid this process. A subsequent filtration technology can then be used to efficiently remove the solids.

Particle filtration includes all physical processes to remove suspended solids, including dissolved air floatation, sedimentation, clarification, depth filtration (filtration through media), and surface filtration (filtration through a fine mesh).

Membrane filtration technology uses a semipermeable membrane and a pressure differential to remove large particles, molecules, and ions from fluids. The pore size of the membrane determines the degree of separation that ranges from microfiltration (pore sizes of 0.01 to 5 microns), ultrafiltration (pore sizes of 0.01 to 0.1 microns), and reverse osmosis (pore sizes of 0.0001 – 0.001 microns).

Adsorption with activated carbon is commonly used to remove contaminates from water and wastewater. Due to its high surface area to volume ratio, activated carbon efficiently adsorbs a wide range of organic chemicals. However, suspended solids, colloidal materials, and oil and grease can all interfere with the adsorption process. Two types of carbon are used in wastewater treatment, granular and powdered. Powdered activated carbon (PAC) is typically added into the wastewater and subsequently removed by a filtration process. Granular activated carbon (GAC) is used in depth filtration.

Chemical Processes

Chemical processes used for PCB treatment result in the breaking of the chemical bonds of the PCB molecules. It is desired to completely mineralize the PCB molecule, as incomplete destruction may result in undesirable byproducts.

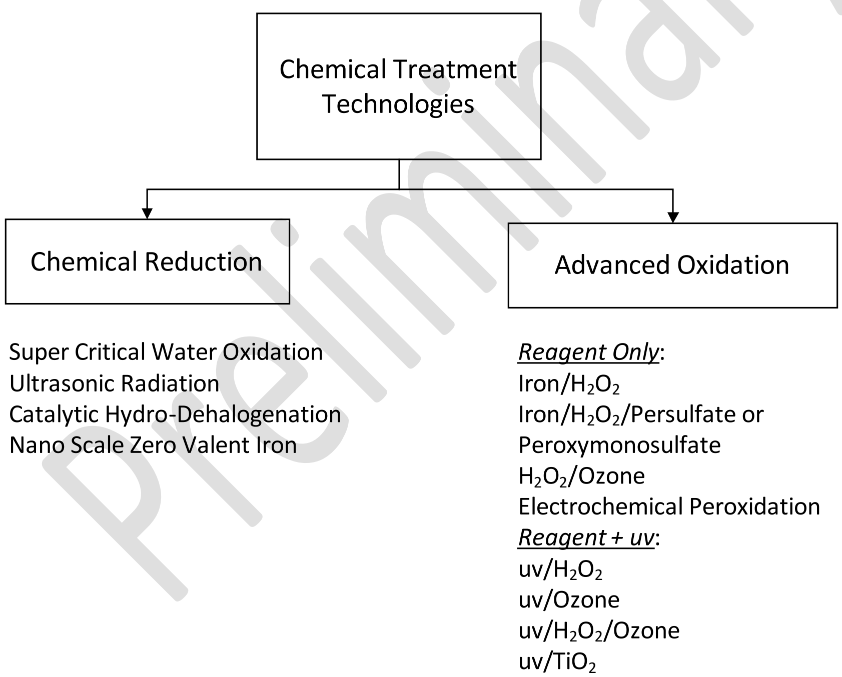

Figure 6. Types of chemical treatment technologies for PCB removal.

Supercritical water oxidation (SCWO) uses water at its supercritical point (high temperature and pressure) to destroy organic contaminates. Oxygen and organic compounds readily solubilize in supercritical water, allowing complete oxidation to occur in a relatively short period. This process requires the addition of an oxidant, usually oxygen or hydrogen peroxide.

In water at ordinary temperatures and pressures, high power ultrasonic radiation results in cavitation and formation of tiny bubbles. When these bubbles collapse, high temperatures and pressures develop in microscopic regions. These conditions result in the thermal destruction of organics. Additionally, free radicals form and react with organics resulting in further degradation.

PCBs can be de-halogenated (the removal of chlorine atoms) using catalyzed chemical reactions under varying temperatures, pressures, reagents, and catalysts. Complete de-halogenation results in biphenyl, a less toxic and biodegradable compound. De-halogenation can also occur using bimetal systems where corrosion of a zero-valent metal with water generates hydrogen at room temperature and pressure. The hydrogen absorbs onto the surface of the metal catalyst to form a metal hydride. The metal hydride then acts as the target substrate of dehalogenation.

Nano scale zero value iron (nZVI) particles have a diameter of less than 100 nm, typically in a core-shell structure. The outside ion of nZVI particles can react with water and oxygen to form an outer hydroxide layer in aqueous environments. As a result, this outer oxide layer allows electron transfer from the metal through the oxide conduction band or localized band. Furthermore, the outer oxide layer could serve as an adsorbent for PCBs.

The chemical processes described above have been demonstrated at the bench scale and pilot scale systems. These systems face limitations in implementation at full scale due to energy requirements, catalyst loadings, and operating constraints and conditions.

An advanced oxidation process (AOP) refers to a group of processes that produce free radicals that degrade organic pollutants. A free radical contains an unpaired valence electron, resulting in a highly reactive species. Generally, free radicals reactions are nonselective and occur rapidly. Some of these reactions (e.g., Fenton's) have been known and used since the 1890's.

AOPs use an oxidant (ozone, hydrogen peroxide, persulfate, peroxymonosulfate) and a catalyst (iron, titanium dioxide, ultraviolet light) to form free radicals. Fenton's reaction uses hydrogen peroxide and iron as a catalyst. Persulfate or peroxymonosulfate can also be used which generate sulfate based free radicals. Both reactions depend on the solubility of iron in water, and proceed faster at elevated pH.

Ozone (O_3) can be used in combination with hydrogen peroxide to generate hydroxyl radicals. Hydroxyl radical exposure increases with increasing temperature, pH and organic matter, and decreases with increasing alkalinity (alkalinity can scavenge hydroxyl radicals).

The use of ultraviolet (UV) light also acts as a catalyst for the reaction of the oxidants used in AOPs. In UV processes, the oxidant is applied ahead of UV so that oxidant-treated water is irradiated. The hydroxyl radicals formed can also react with organic and inorganic scavenging compounds. Organic matter, alkalinity, and nitrite play an important role for the UV systems because they "scavenge" hydroxyl radicals, reducing system effectiveness in the oxidation of the target contaminants. Excess peroxide can also act as a scavenger, limiting system effectiveness.

AOP are a group of known and demonstrated technologies used at full scale for water and wastewater treatment to oxidize recalcitrant organics (endocrine disrupting chemicals, herbicides, hydrocarbons, and pesticides). However, removal efficiencies for PCBs have not been demonstrated at concentrations approaching the water quality criteria. Ecology believes effluent specific bench/pilot scale information will be needed to determine the feasibility of these technologies for each discharger.

Biological processes

PCBs are removed in biological treatment processes by adsorption to biological solids, removal of suspended solids, and to some extent reduction and biodegradation. These processes include conventional and advanced nutrient removal biological treatment systems. In pilot studies, the CLEARAS Water Recovery (an algae based biological-based treatment system for nutrient removal) showed good PCB removal.

The biological activated carbon process occurs in combination with biological growth on granular activated carbon. Activated carbon has limited removal efficiency on PCBs adsorbed on suspended and colloidal solids. Bench scale studies have shown improved PCB removal from biological activated carbon versus granular activated carbon for particulate containing waters.

Thermal processes

This technology would not apply to wastewater, due to its high-energy requirement. For contaminated solids and oils, high temperature incineration is routinely applied as a remediation technology. Combustion temperatures typically range from 870°C (1560°F) to 1200°C (2190°F). EPA has approved high efficiency incinerators to destroy PCBs with concentrations above 50 ppm. Incinerators must meet a minimum of a 2-second residence time at 1200°C (2190°F) and 3% of excess oxygen or a 1.5-second residence time at 1600°C (2910°F) and 2% of excess oxygen in the stack gases.

Alternatives Actions to Meet the Human Health PCB Criteria

In addition to an evaluation of treatment, WAC 173-201A-420 (3)(c) also requires an evaluation of alternative actions that were considered to meet effluent limits based on the underlying water quality criteria, and a description of why these options are not technically, economically, or otherwise feasible. Each of the dischargers provided a series of alternative actions in their variance application submitted to Ecology.

The alternative actions explore options, beyond treatment technology, that could potentially reduce or eliminate discharging PCBs to the Spokane River. These options include evaluations of either partially or wholly removing effluent discharges from the Spokane River, as well as ways to remove or reduce PCBs from entering the influent streams or into the environment. In addition to the information submitted in the variance applications, Ecology also reviewed facility plans provided by the dischargers during the upgrade process to meet the DO TMDL. Actions deemed implementable for one or more dischargers were migrated into the pollutant minimization plans, as presented later in the Pollutant Minimization Plan section.

This section provides a description of each of the alternative actions that may be applicable to each discharger. Alternative actions proposed by one or multiple dischargers were considered for all dischargers by Ecology. However, alternatives identified for the three municipalities have limited applicability for the industrial dischargers based on design, thus creating a delineation in alternatives between municipal and industrial dischargers.

For the three municipal dischargers, the alternative actions were considered with the acknowledgment that their primary function of treating wastewater would remain unchanged. The review of alternative actions also considered the existing infrastructure within each system, including collection and treatment systems, with the understanding that existing infrastructure would be retained to the greatest extent possible and that add-ons to reduce PCBs will be considered. For the City of Spokane, this includes their sanitary, stormwater, and combined sanitary stormwater collection systems, some of which were constructed more than 70 years ago. Spokane County and Liberty Lake have newer collection systems, mostly comprised of PVC or other newer piping materials and which are separate from their stormwater systems. As such, Spokane County and Liberty Lake experience much less inflow and infiltration (I/I) into their collection systems than does the City of Spokane. Specific actions to reduce or control PCBs from I/I or stormwater were not proposed as alternative actions, but all three of the municipal dischargers are currently working on, and propose to continue working on, source control activities, as described further in the Pollutant Minimization Plan section.

Although the municipalities can and do set pretreatment limits and establish ordinances to protect their treatment works, they have very little control over the amount of flow and concentration of pollutants in their influent. As previously discussed in the Overview of Technologies section, there are no demonstrated technologies to meet water quality criteria for PCBs. Additionally, each of the municipal facilities has installed or is in the process of installing and optimizing the combination of technologies capable of providing the greatest pollutant reduction available for PCBs. As such, most of the alternative actions provided by the municipal dischargers revolve around removing their discharges from the Spokane River, either partially or entirely.

Options included in the alternatives analysis for removal of part or all of effluent discharges into the Spokane River include the following:

- Beneficial reuse, through issuance of a reclaimed water permit
- Discharge to ground via land treatment
- Discharge into a different surface water body
- Discharge to ground through infiltration or injection
- Evaporation, either natural, enhanced, thermal or gasification

It should be noted that partial discharge removal will help reduce loading of PCBs to the river, but does not change the concentration, or percent removal, of PCBs in the influent or effluent. Partial removal of effluent may be considered either as a portion of the daily flow discharged, a seasonal removal window, or even on an as-needed basis, dependent on the use or alternative discharge availability.

Regionalized treatment was recognized by the municipal dischargers as an alternative action. In October 2009, Ecology published a final report to the legislature on wastewater regionalization (Publication 09-10-066[10]). As described in the final report, regionalization refers to independent local governments sharing the responsibility of providing wastewater services, either by sharing physical infrastructure or through sharing administrative and operational tasks. However, because all three municipal facilities have already invested in and installed treatment technologies that provide the greatest pollutant reduction available for PCBs, regionalization would not improve upon the existing treatment capabilities or result in a greater reduction of PCBs to the Spokane River. As such, regionalization is not considered an option for achieving the water quality criteria for PCBs.

[10] https://fortress.wa.gov/ecy/publications/SummaryPages/0910066.html

Beneficial Reuse (Reclaimed Water)

Reclaimed water is a highly treated water resource derived in any part from wastewater with a domestic component. The process of reclaiming water speeds up the natural water cycle so it can be safely used again.

The production and uses of reclaimed water are regulated under RCW 90.46 and the reclaimed water rule, chapter 173-219 WAC. Reclaimed water must at all times meet the technology-based water quality limits, specific use-based standards, and reliability requirements defined in the rule so that it can be safely used for a variety of beneficial purposes. The rule defines three classes of reclaimed water, with Class A and Class B water currently being produced for beneficial use in 29 facilities across Washington State.

Reclaimed water facilities must meet specific technology-based requirements depending on the class of reclaimed water the facility intends to produce. The degree of treatment required varies according to the intended specific use(s). Class A reclaimed water requires at a minimum oxidized secondary treatment, coagulation, filtration, and a high level of disinfection. Class B reclaimed water only requires biological oxidation followed by enhanced disinfection. Since Class A reclaimed water is more highly treated, it can be used for more purposes than Class B reclaimed water.

To assure reliable treatment for the protection of human health and the environment, the reclaimed water rule requires redundant facilities for every unit treatment process, automated alarms, and provisions for managing any water that does not receive adequate and reliable treatment.

Some of the beneficial uses that were identified by the municipal dischargers included irrigation of urban green spaces, industrial water use, wetland creation or enhancement, aquifer recharge, and irrigation of agricultural or other lands. While it may be feasible for Liberty Lake to pursue options to remove their entire discharge from the river, the volumes discharged daily by Spokane County and the City of Spokane are very high and thus, it is unlikely that either would be able to completely remove their discharges from the Spokane River without impairing downstream water rights.

In order to use reclaimed water for a beneficial purpose, a facility must obtain a reclaimed water permit. Ecology and the Washington Department of Health work cooperatively to review and permit reclaimed water projects. In order to plan, design, and be permitted as a reclaimed water facility, each of the dischargers would have to go through the process as outlined in

Ecology's Reclaimed Water Facilities Manual,[11] otherwise known as the Purple Book (Ecology Publication 15-10-024). This process includes at minimum:

- Pre-planning meeting
- Feasibility Analysis with Preliminary Water Rights Impairment Analysis
- Water Rights Impairment Analysis
- Engineering Design Report
- Reclaimed Water Permit Application

As part of the planning process, potential impacts to existing water rights must be considered in the feasibility analysis criteria. The reclaimed water use act (RCW 90.46.130) states "facilities that reclaim water under this chapter shall not impair any existing water right downstream from any freshwater discharge points of such facilities unless compensation or mitigation for such impairment is agreed to by the holder of the affected water right." Project proponents will need to work closely with Ecology's Water Resources Program staff to develop the Impairment Analysis.

Discharge to Ground via Land Treatment

According to Ecology's Criteria for Sewage Works Design Manual,[12] otherwise known as the Orange Book, land treatment systems apply wastewater either below the land surface or by surface spreading to provide effluent treatment prior to its contact with the saturated ground water zone (Ecology Publication 98-37). Land treatment differs from land application of reclaimed water in that, land treatment systems utilize surface soils, cover crops, and/or soils in the vadose zone to provide additional treatment.

Land application of reclaimed water does not rely on soil treatment or crop uptake to meet ground water standards. Land treatment, including land application of reclaimed water, must meet the numerical criteria and other requirements for the protection of groundwater in accordance with the water quality standards for ground waters of the state set forth in chapter 173-200 WAC.

If a facility chooses not to pursue the reclaimed water permitting process that would allow for beneficial use of the effluent, land treatment might be an available option. Land treatment will have limitations on types of crops irrigated with the effluent. The option will also require greater buffers between a land treatment site and other land uses. Alternatively, land

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[11] https://fortress.wa.gov/ecy/publications/SummaryPages/1510024.html

[12] https://fortress.wa.gov/ecy/publications/SummaryPages/9837.html

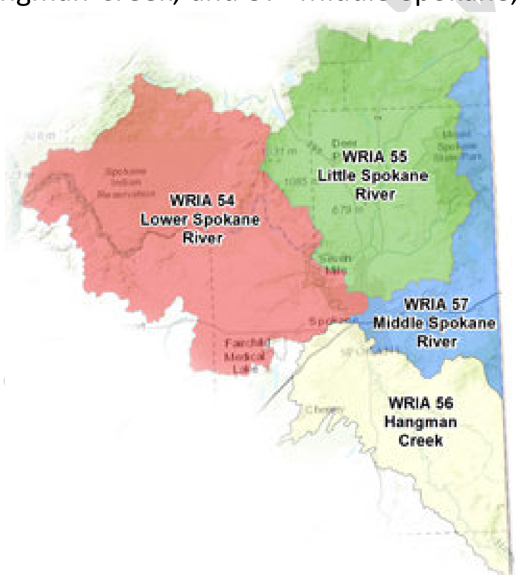
treatment does not require consideration of water rights impairment as is required for pursuing a reclaimed water option.

Land treatment also requires that irrigation of effluent meet agronomic rates during the growing season appropriate for the climate and specific crop. For this reason, permittees should only consider land treatment as an alternate for partial (seasonal) removal of discharge to the Spokane River. The non-growing season would still result in facilities discharging to the river, or require large impoundments for storage or other alternate uses described in this section.

The amount of land required for land treatment would depend of the quality of the wastewater effluent, localized climate conditions, soil type(s), and type of irrigated crops. In addition to land, a discharger would also have to install a distribution system to the land treatment site. All of the municipal dischargers considered land treatment during the DO TMDL planning and design phases. They determined it was not feasible given the amount of land that might be required, management of crops, and/or only being able to use land treatment of effluent for portions of the year. Accordingly, land treatment is not an option for the municipal dischargers.

Discharge to Other Water Bodies

The Spokane watershed includes Water Resource Inventory Areas (WRIAs) 55- Little Spokane, 56-Hangman Creek, and 57- Middle Spokane, which all flow into WRIA 54- Lower Spokane (Figure



4).

Figure 7: Spokane Watershed.

These combined WRIAs extend north and south beyond Spokane County boundaries, with the next nearest watershed, WRIA 62 for the Pend Oreille River Watershed, located over 30 miles away from the Spokane River. As such, any moving surface water body within WRIAs 55, 56, and 57 would likely drain back to the Spokane River and not meet the goal of removing PCBs from the watershed.

The redirection of Spokane River discharges to other waterbodies would lead to exceedances of the PCB water quality standard in other waterbodies and impairments of designated uses. This action would lead to another set of challenges in other water bodies and not accomplish the water quality goal of supporting designated uses in state waters.

Discharge to Ground via Infiltration or Injection

Wastewater could be disposed of by direct or indirect discharge to ground water. Infiltration is the process by which water above ground enters the soil. The amount of water then infiltrates at rates depending on the soil type(s) and underlying hydraulic conductivity. Injection is the direct discharge of effluent into groundwater via underground injections wells. Both are subject to the ground water quality standards previously referenced for the land treatment alternative. Depending on the soil type(s) and hydrology, groundwater interaction with nearby surface waters, and the depth of the wells, discharging wastewater to the ground has the potential to adversely impact both groundwater and surface water quality.

Most of the drinking water for the Spokane region comes from the Spokane Valley-Rathdrum Prairie (SVRP) Aquifer. Designated as a "sole source aquifer" in 1978 by EPA, the SVRP aquifer underlies approximately 370 square miles in two states and has one of the fastest flow rates in the United States; flowing as much as 60 feet per day in some areas.

Because the SVRP aquifer interacts directly and quickly with the Spokane River, it is highly susceptible to contamination. As such, discharging wastewater to groundwater could adversely impact the SVRP aquifer, and the river in areas where there are gaining reaches. Another consideration for discharging wastewater into the ground for once through, noncontact cooling waters sourced from the SVRP aquifer, would be to ensure that injection in gaining reaches does not affect downstream river temperatures, given that sections of the Spokane River are listed on the 303(d) list for temperature.

Evaporation

Evaporation of the effluent involves the vaporization of effluent from a liquid into a gaseous form as water is heated. Natural evaporation relies on the changes in the environment, such as increases in ambient air temperature, to provide the means for vaporization. Evaporation as a means of effluent disposal, however, requires that the amount of effluent vaporized into the atmosphere be greater than or equal to the amount discharged from a treatment plant. The drawback to the natural evaporation process is that the climate surrounding Spokane only has favorable conditions for evaporation during part of the year and little to no evaporation will occur during the colder weather months. Extra storage volume is also required to allow freeboard for precipitation. Engineered enhanced evaporative conditions such as heating and floating aerators or sprayers, may allow for greater evaporation, but as demonstrated in Table 18, the amount of land required for this alternative makes this option infeasible

Impoundments are required to provide the necessary surface area and storage volume required to accommodate the hydraulic balance of wastewater discharge, precipitation and local evaporation rates. Pan evaporation rates are a measurement that combines the temperature, humidity, rainfall, drought dispersion, solar radiation, and wind. According to the Western Region Climate Center, the pan evaporation rate annual total for the Spokane region is 48 inches; all of which occurs from April through September. The average annual precipitation for the Spokane area is 20 inches. The net evaporation is equal to the pan evaporation minus precipitation, or approximately 28 inches a year.

Table 18 depicts the minimum amount of area, in acres, required for each of the facilities to be able to remove their entire discharge from the river and use evaporative lagoons exclusively for disposal of effluent based on the average daily discharge volume reported for each facility in 2019 and net evaporation rate of 28 inches (2.33 feet) per year.

Table 18. Average discharge for municipal dischargers on the Spokane River and the minimum amount of evaporate area required to remove the entire discharge from the river.

Facility	Average Daily Discharge (MGD)	Average Daily Discharge (acre-feet)	Annual Average Discharge (acre-feet)	Minimum Evaporative Area Required (acres)
Liberty Lake	0.79	2.42	883	756
Spokane County	8.00	24.55	8,960	7,680
City of Spokane	30.78	94.46	34,478	29,552

The minimum evaporative area requirements shown in Table 18 show a snapshot of generally how much land area would be needed to remove discharge from the river using evaporation. The amount of area needed could be 10 to 50% more, based on required seasonal storage to accommodate peak flows and wetter, colder conditions. The total area needed to construct the impoundments would require at least another 10 to 15% or more depending on site location(s).

Thermal evaporation of wastewater and wastewater solids is often referred to as gasification. This technology is typically applied to industrial waste streams and may be applied to domestic wastewater solids. This alternative is not commonly applied to domestic wastewater due to the costs of energy and equipment required to heat the volume of effluent produced to the boiling point of water where liquid would become vapor. Therefore, thermal evaporation was not considered a viable means of eliminating discharges from municipal treatment facilities into the Spokane River. Application of this technology to wastewater may result in discharge of pollutants to air, which may not only require additional permitting, but could also result in air-borne deposition of pollutants into the Spokane River.

Inland Empire Paper Alternative Actions

In their variance application, Inland Empire Paper considered the elimination of paper recycling as an alternative action to meet effluent limits based on the underlying water quality criteria. The applicant believes the elimination of paper recycling may result in greater environmental harm due to an elimination of recycling programs. Elimination of the recycling program has the potential to provide a disincentive for the proper handling of waste materials, diverting additional paper products to landfills, increasing greenhouse gas emissions through additional methane production, potential groundwater contamination, and diversion to municipal solid waste incinerators with associated air emission and solid waste pathways to the environment.

Kaiser Alternative Actions

In their variance application, Kaiser examined how effluent flow rates correlated with the mass of PCB discharged. At lower effluent flows, the mass of PCBs discharged also decreased. This is likely a result of a combination of increased filtration performance and an overall decrease in PCB influent loadings. However, the data did not demonstrate an ability to reduce flows alone to meet the underlying water quality criteria.

Highest Attainable Condition (HAC)

The highest attainable condition (HAC) is a quantifiable expression of the best condition that can be achieved during the term of the variance. The proposed variance includes multiple individual dischargers where the HAC for each is based on the highest attainable interim effluent quality. Each discharger variance application included data and supporting narrative that was used by Ecology's in the development of the individual HACs.

For any variance term longer than 5 years, the HAC must be reevaluated at least every five years and submitted to EPA. If the reevaluation identifies a more stringent HAC, the more stringent HAC must be adopted. The dischargers are required to maintain or improve the HAC over the entire term of the variance. Once identified, the individual HACs are translated into compliance limits in the NPDES permits.

Within the Clean Water Act regulations (40 CFR §131.14), there are three discharger specific pathways outlined, as shown in Table 19.

Table 19. HAC Pathways and Requirements (40 CFR 131.14)

HAC Pathway	HAC Requirements
Path 1: The highest attainable interim criterion	Requires estimation of the highest attainable ambient water quality
Path 2: The interim effluent condition that reflects the greatest pollutant reduction achievable	Requires knowledge of the best quality effluent that is achievable (variance ends with best quality effluent is achieved)
Path 3: If no additional feasible pollutant control technology can be identified, the interim criterion or interim effluent condition that reflects the greatest pollutant reduction achievable with the pollutant control technologies installed at the time the State adopts the WQS variance, and the adoption and implementation of a Pollutant Minimization plan	Requires installation of feasible control technologies. Technology must be installed or guaranteed at the time the variance is granted. Requires PMP. Continued implementation of PMP allows the duration of variance to extend beyond the time of the technology installation.

One discharger (Kaiser) identified Pathway 2 in their application while the other four dischargers are using Pathway 3. Kaiser has not yet installed the best available pollutant control technologies that provide the greatest pollutant reduction achievable, and therefore does not meet the requirements for Pathway 3. Liberty Lake and Spokane County currently have the pollutant control technologies in place that provides the greatest pollutant reduction achievable, while the City of Spokane and Inland Empire Paper are currently installing and optimizing the most feasible control technologies. Kaiser applied for a variance term of 13 years to attain the greatest pollutant reduction achievable. The other four dischargers requested the maximum variance period of 20 years.

Methods to Calculate the Highest Attainable Condition

General Methods

The HAC for each discharger is set using the quantifiable method of a minimum percent removal efficiency. A minimum sample size of 10 or more paired samples was set to use this method. Percent removal efficiency is calculated as the influent minus the effluent divided by the influent, multiplied by 100. The percent removal efficiencies collected from each discharger should not be below each respective HAC set in the variance. In other words, using a minimum percent removal efficiency requires facilities to operate their systems at or above the efficiency set for the HAC.

Due to the limited ability to deviate from a value based on a minimum percent removal efficiency, the 1st percentile of each discharger's dataset is to be used to determine the greatest pollutant reduction achievable. Statistical analyses should be used to determine the 1st percentile of the data, with methods varying depending on the homogeneity and normality of the dataset.

Inland Empire Paper Method

The Inland Empire Paper HAC was calculated differently from the other dischargers due to limited data and uncertainty in the proportion of recycled materials that contain PCBs in the waste stream. Furthermore, Inland Empire Paper's limited data was calculated from a source identification pilot study that was not designed to calculate percent removal efficiencies. This pilot study also did not evaluate the full-scale treatment system. The percent of recycled materials can have a significant influence on PCBs in effluent. With a limited data set, we decided to apply an uncertainty factor to the two paired data points provided by Inland Empire Paper. Ecology used guidance for addressing uncertainty in effluent characterization from Chapter 3 of EPA's Technical Support Document For Water Quality-based Toxics Control (EPA 1991). This statistical approach combines knowledge of effluent variability with the uncertainty due to a limited number of data to estimate a maximum expected pollutant concentration.

The EPA uncertainty method is to be applied to Inland Empire Paper percent removal efficiencies when the paired sample size is less than 10. When Inland Empire Paper has collected 10 or more percent removal efficiency samples, the general methods for calculating HACs above will apply (i.e. 1st percentile of the data set).

Other Methods for Estimating HACs

When no or very limited data sets exist, HACs should be calculated by comparing treatment technologies, literature review comparisons, pilot scale testing results, or consistencies observed between similar types of dischargers (for example, municipal vs industrial). These factors alone and in combination were used to make initial HAC estimates for some of the dischargers. HACs using this method will be reevaluated when more data is collected.

Municipal Dischargers

Ecology reviewed influent and effluent PCB data provided by the municipal dischargers with their applications and as submitted in accordance with required sampling in their permit. The review of municipal dischargers was focused on Spokane County's data for their treatment facility. Spokane County was the only facility to have technologies with the greatest available pollutant reduction control online and optimized. While Liberty Lake completed construction at the end of 2017, they are still in the process of optimizing their new next level of treatment resulting in variability in their data set. There was not data for the City of Spokane, who has not completed installation of the next level of treatment but expects to have installation complete by March 2021.

Ecology considered various options for developing a quantifiable HAC, including effluent concentrations, effluent mass loading, and percent removal of PCBs using either concentrations or mass loading. In reviewing the data, Ecology also took into consideration the capabilities and limitations of using Method 1668. While Method 1668 is the most effective at measuring PCBs at low concentrations found in effluent, it is also susceptible to interference from background contamination as described in the Measuring PCBs in the Environment section. In some cases, the levels of blank contamination can be greater than the sample media, which makes consideration of concentration-based HACs (i.e., in units of pg/L) more challenging. Because concentrations are used to calculate the mass-loading of PCBs in the effluent, the same concerns exist. Additionally, variations in the flow quantity would also create challenges for a mass-loading based HAC (i.e., in units of mg/day), particularly for the City of Spokane where surges in influent loading can occur due to their combined sewer systems, as well as their agreement with Spokane County and Airway Heights to treat their excess flows.

Ecology determined that using a percent removal based HAC using concentration data allowed for the best representation of treatment capabilities while taking into consideration the background interferences known to be inherent with Method 1668. A percent removal-based HAC also aids in establishing a HAC where there is very little data (Liberty Lake) or no data (City of Spokane) available for actual concentrations or mass loads.

Ecology analyzed Spokane County's data from 2012 to 2019 and found that the amount of PCBs removed ranged from 97.7 % to 99.9%, using 3x censored data. Ecology used statistical analysis to review the distribution of percent removal efficiencies for Spokane County's data. Data transformations and regression analysis was used to determine the 1st percentile of the data. This information was used to set Spokane County's HAC at 97.6%.

Literature review and pilot scale testing have shown that the Liberty Lake facility and the City of Spokane facility are expected to be comparable to the percent removal (concentration based) capabilities shown at Spokane County. The percent removals are also very consistent between the municipal dischargers, regardless of the influent concentrations and mass loading.

Ecology also reviewed the limited data set for Liberty Lake's facility that was collected after completing its next level treatment installation at the end of 2017. While data was insufficient to conduct statistical evaluations, the percent removal data (3x censored) ranged from 97.7% to 99.9% and is comparable to Spokane County's 8 years of quarterly monitoring of PCBs. Because there is less data available from Liberty Lake, there is also less certainty in what constitutes the highest attainable condition. This is also true for the City of Spokane because the next level of treatment has not been installed and no data is available for making an evaluation. As such, the initially proposed HACs, based on a minimum percent removal efficiency, for Liberty Lake and the City of Spokane is slightly lower than the Spokane County's HAC. Ecology anticipates that during the 5-year review, more data from Liberty Lake and the City of Spokane will be available to determine a more stringent HAC. Table 20 below presents the proposed municipal discharger HACs.

Table 20. HACs for Municipal Dischargers

Municipal Discharger	Highest Attainable Condition (Percent Removal Efficiency)
Liberty Lake	97.0%
Spokane County	97.6%
City of Spokane	95.0%

Inland Empire Paper

Ecology considered setting a HAC for Inland Empire Paper using loading values from the routine monitoring data or the PCB percent removals from the limited sampling conducted from the studies previously mentioned. PCB loading in Inland Empire Paper's effluent will vary based on the amount of recycle content in the finished product. This variation in the characteristics of the recycled feedstock made it difficult to establish a HAC.

As an alternative, Ecology proposes to set a HAC based on the percent removal of PCBs through the treatment system. This presented a challenge due to the limited number of samples for percent removal obtained from both the wastewater treatment system and membrane systems (see Table 16). Ecology used guidance for addressing uncertainty in effluent characterization from Chapter 3 of EPA's Technical Support Document For Water Quality-based Toxics Control (EPA 1991). This statistical approach combines knowledge of effluent variability with the uncertainty due to a limited number of data to estimate a maximum expected pollutant concentration.

The EPA approach relies on an assumption of log-normally distributed data. However, removal efficiencies would likely not fit a lognormal distribution since the values have an upper bound of 100%. To perform the analysis, Ecology transformed the data by subtracting removals from 100%. Ecology estimated a minimum percent removal by combining the lowest removals from the source identification study and pilot study. Ecology calculated the maximum percent removal in the same manner. Table 21 lists the results of this analysis.

Table 21. Inland Empire Paper HAC calculation for percent removal efficiency.

Combined % Removal	100 - % Removal	EPA Multiplier from Table 3-2[a]	Maximum Expected Transformed Value	Resulting Minimum % Removal[b]
96.2	3.8	3.8	3.8 x 3.8 =14.4	100-14.4 = 85.6
99.0	1.0			

[a] Assumes coefficient of variation of 0.6 and number of samples equal to 2
[b] Re-transformed value (100-14.3)

This HAC estimate of a minimum PCB percent removal of 85.7% is based on the two-paired samples available at the time of the variance development. The HAC will be refined as Inland Empire Paper's treatment system comes online and additional data are collected.

Kaiser

Ecology will specify a HAC for Kaiser that reflects a schedule of actions to achieve the greatest pollutant reduction available for PCBs. This includes implementing a number of flow reduction projects for Kaiser, then installing the best available treatment technology based on the resulting effluent flows. A schedule of these actions is listed in Table 22 below.

Table 12. Kaiser schedule of flow reduction actions and treatment system evaluation.

Item	Action	Schedule
Flow Reduction	Conversion of air compressors from water cooling to air cooling	completed
Flow Reduction	Conversion of certain water cooled direct current motor/generator sets to rectifying transformers that require no water for cooling	completed
Flow Reduction	Conversion of a cryogenic plant for nitrogen production from water cooling to air cooling	completed
Flow Reduction	Implement Phase 1 of underground injection of groundwater sourced non-contact cooling water, average daily infiltration rate of 0.85 million gallons per day (mgd)	completed
Flow Reduction	Complete Conversion to Groundwater Sourced Cooling, estimated average daily reduction in effluent flow of 0.5 mgd	3rd Qtr. 2020
Flow Reduction	Underground Injection Phase 2, Non-Contact Cooling, South Production Area, average daily infiltration rate of 0.5 mgd	3rd Qtr. 2020
Flow Reduction	Contact Cooling, Heat Treat Systems and South Production Area, estimated average daily reduction in effluent flow of 1.0 mgd	4th Qtr. 2023
Flow Reduction	Contact Cooling, South Area Facility Modernization Project	1st Qtr. 2025
Flow Reduction	Underground Injection Phase 3, Non-Contact Cooling, Casting Operations, estimated Phase 3 + Phase 4 average daily reduction in effluent flow up to 1.0 mgd	2nd Qtr. 2025
Flow Reduction	Underground Injection Phase 4, Miscellaneous Cooling Systems, estimated Phase 3 + Phase 4 average daily reduction in effluent flow up to 1.0 mgd	2rd Qtr. 2026
Flow Reduction	Contact Cooling, Casting Operations	1st Qtr. 2029
Technology Evaluation, Design, and Implementation	Identify technologies Describe process used to evaluate technologies	2/21/2020

Item	Action	Schedule
Technology Evaluation, Design, and Implementation	Identify final technology evaluation process Proposed schedule & scope for bench scale testing of candidate technologies	1/1/2021
Technology Evaluation, Design, and Implementation	Submission of results of bench scale testing Proposed schedule for pilot scale testing of candidate technologies	1/1/2025
Technology Evaluation, Design, and Implementation	Submission of results of pilot scale testing Proposed schedule for submission of approvable engineering report	1/1/2029
Technology Evaluation, Design, and Implementation	Submission of approvable engineering report and plans and specification for treatment system that provides technology that achieves the greatest pollutant reduction for PCBs	1/1/2030
Technology Evaluation, Design, and Implementation	Completion of construction of technology	1/1/2031

In developing Kaiser's HAC, Ecology considered setting a numeric interim effluent condition reflecting the greatest pollutant reduction achievable. Setting an effluent loading value or minimum percent removal efficiency through the treatment system will depend on a number of variables (reduction of effluent flows and influent loadings, and type of treatment system ultimately installed) which Ecology cannot predict with certainty at this time. Additionally, Ecology is not aware of any like facility with similar effluent characteristics, treatment system type, and relevant PCB data to allow a confident calculation of removal efficiencies.

However, Ecology can make generalized predictions based on the performance of Kaiser's existing treatment system, removal efficiencies from other municipal and industrial dischargers to the Spokane River, and pilot studies conducted as part of the groundwater remediation of PCBs at the Kaiser site. Table 23 below lists estimated removal efficiencies of these treatment alternatives.

Table 23. Estimated PCB Removals for Technologies

Treatment System Type	Notes	PCB Removals (%)
Secondary Biological	1, 2	86 – 98
Secondary Biological, Tertiary Membrane Filtration	1, 3	97.7 – 99.9
Walnut Shell Filtration (depth filtration)	4	70
Multimedia Filtration (depth filtration)	5	70

Treatment System Type	Notes	PCB Removals (%)
Membrane Filtration	6	83 – 87
Granular Activated Carbon	7	73 - 99
Powdered Activated Carbon	8	65 - 98
Advanced Oxidation	9	95 - 99

Notes for Table 23

1. Biological treatment processes may not be viable for Kaiser's effluent due to an apparent lack of sufficient biodegradable pollutants needed to support a biological treatment system. Oils used in the rolling and casting operations may present a potential source of biodegradable pollutants.
2. Percent removals from 2018 data from the City of Spokane and Inland Empire Paper Company's HAC.
3. Percent removals from October 2012 to June 2019 data from Spokane County.
4. Average percent removal from Kaiser's existing walnut shell filtration system as given in Kaiser's Variance Application.
5. Estimated percent removals based on note (4).
6. Estimated using existing Kaiser effluent TSS data as a surrogate for PCBs. Assumed a membrane filter system would remove TSS from existing levels down to ½ of the minimum reporting level.
7. Liyan et al, 2009; EPA 2005. Specific studies would be needed on Kaiser's effluent to verify the feasibility and removal efficiencies of this technology.
8. Rosinska and Dabrowska, 2015. Specific studies would be needed on Kaiser's effluent to verify the feasibility and removal efficiencies of this technology.
9. EPA 2005. Specific studies would be needed on Kaiser's effluent to verify the feasibility and removal efficiencies of this technology.

These removals represent a potential range of values expected for the greatest pollutant reduction achievable for Kaiser. In setting the HAC, Ecology selected a minimum percent removal value of 85% based on a membrane filtration process (initial steps include removal of TSS below reporting levels). However, Ecology realizes that other feasible filtration technologies may also meet this percent removal requirement, such as multiple stages of depth filtration. Ecology expects the PCB removal will increase as Kaiser further optimizes the operation of the walnut shell filtration system; and proceeds with the evaluation, design, and installation of the best available treatment technology for reducing PCBs. Additionally, Kaiser estimates a reduction of up to 3.85 mgd from flow reduction efforts. This will also result in a reduction of PCBs discharged to the Spokane River.

Pollutant Minimization Plan (PMP)

State Pollutant Minimization Plan

All variances require a pollutant minimization plan, WAC 173-201A-420(3)(e), and a pollutant minimization program, 40 CFR 131.14(b)(2)(ii). All variances require individual discharger pollutant minimization plans in WAC 173-201A-420(3) and require a state pollutant minimization actions, if federal factor three, in 40 CFR 131.10(g)(3), is used to justify the variance. The state minimization plan actions listed below describes actions Ecology will implement to minimize PCBs in the Spokane River watershed.

Cleanup of Contaminated Sites

The Model Toxics Control Act (MTCA) is Washington's environmental cleanup law. MTCA funds and directs the investigation, cleanup, and prevention of sites that are contaminated by hazardous substances. Cleanups protect people's health by removing toxic chemicals from the environment, like arsenic from playground soil or methane gas from a solid waste landfill. MTCA works to protect people's health and the environment, and to preserve natural resources for the future.

MTCA's main purpose is "to raise sufficient funds to clean up all hazardous waste sites and to prevent the creation of future hazards due to improper disposal of toxic wastes into the state's lands and waters." (RCW 70.105D.010). More than 7,000 contaminated sites in Washington have been cleaned up with MTCA funds and collection authority since it became law in 1989. That is more than half of the state's 13,000+ cleanup sites. MTCA's role is becoming even more essential because 200 to 300 new sites are reported each year. Ecology identified four contaminated sites with potential to directly contribute PCBs to the Spokane River (SRRTTF Comprehensive Plan). These four sites consist of Upriver Dam and Donkey Island, General Electric Co. Mission Avenue, City Parcel, and Kaiser Aluminum. Several other sites along the Spokane River are contaminated from past uses of PCBs. As required by MTCA, Ecology conducts periodic reviews of the completed cleanup sites – Upriver Dam and Donkey Island, General Electric, City Parcel – to ensure PCB clean up remedies are still effective. Ecology has entered into an amended Agreed Order with Kaiser to install and operate a full-scale pump and treat remediation system to remove PCBs from site groundwater. These actions should contribute to the reduction of PCBs in the Spokane River.

Washington's Nonpoint Pollution Program.

Ecology is the regulatory agency charged with protecting the quality of Washington State's water and addressing nonpoint source pollution. Ecology acts as the lead agency in restoring, maintaining and enhancing water quality collaboratively with citizens, stakeholder groups, tribes, local governments, state agencies, and federal agencies. Ecology's nonpoint source program uses a combination of technical assistance, financial assistance, and regulatory tools to help citizens understand and comply with state and federal water quality laws and regulations.

Ecology's objective is to identify and document nonpoint source pollution problems, and use a variety of tools to encourage voluntary compliance. When violations are found and unresolved through voluntary processes, Ecology will use its enforcement authority as a regulatory backstop in appropriate cases.

Ecology staff operating out of the Eastern Regional Office (ERO) in Spokane perform annual watershed evaluations to help identify water quality problems. These surveys help staff assess the health of streams, document where improvements have been made, and identify sites with non-point pollution issues. Staff then follow up with those landowners to offer technical and financial assistance to reduce identified pollution sources through the implementation of effective best management practices, such as riparian buffers and conservation tillage.

The primary focus of our eastern Washington watershed evaluations is polluted run-off from agricultural sources. Staff evaluate livestock grazing and agricultural tilling impacts to rivers and streams. For the last four years, ERO staff have focused their evaluations in the Hangman Creek watershed. In future years, it is anticipated that other watersheds will also undergo evaluations.

Although the use of most chlorinated pesticides and PCBs was banned in the U.S. in the 1970s and 1980s, effects from their earlier applications remain in the environment. Additionally, atmospheric deposition on soils is widespread. Soil erosion from fields is the primary mechanism that leads to pesticide and PCB loading to surface water in the agriculture context. The best way to ensure water quality is protected is to combine good upland best management practices (BMPs), such as conservation tillage and riparian buffers. Conservation tillage keeps sediment in place and minimizes erosion, while riparian buffers filter out pollutants and trap sediment that does erodes from upland areas.

The tools described above are some ways that Ecology's nonpoint program can assist in reducing PCBs in the Spokane River. The collective efforts of the nonpoint program will contribute to the reduction or elimination of some sources of PCBs.

Safer Products for Washington.

Chapter 70.365[13] RCW creates a process for Ecology, in consultation with Washington Department of Health (WDOH), to regulate classes of chemicals in consumer products. The law requires Ecology to designate priority chemicals, identify products that contain these chemicals, determine regulatory actions, and adopt rules to implement regulatory actions. Chemical

[13]https://app.leg.wa.gov/RCW/default.aspx?cite=70.365&full=true

restrictions require that safer alternatives are feasible and available. The law outlines steps that involve stakeholder consultation, legislative reporting, and rulemaking.

Working with WDOH, Ecology is committed to identifying the most dangerous toxic chemicals and finding ways to reduce or eliminate them. Many of these priority chemicals are persistent, bioaccumulative, and toxic (PBTs). These chemicals are considered the "worst of the worst" and raise special challenges for society and the environment. PBTs can travel long distances and generally move easily between air, land, and water.

To combat these threats to human health and the environment, Ecology launched an initiative to reduce and phase out the use, release, and exposure of priority toxic chemicals in Washington. Ecology's strategy focuses on one chemical or group of chemicals at a time.

Washington PBT rule Chapter 173-333 Washington Administrative Code.

Washington's PBT Rule[14] establishes criteria for identifying priority PBTs, establishes a list of PBTs[15], and defines the process for preparing and implementing a chemical action plan for each PBT or group of PBTs. Chemical Action Plans (CAPs) are developed under this rule. CAPs are comprehensive plans that identify, characterize, and evaluate all uses and releases of a specific chemical of concern. Each CAP provides recommendations for actions to protect human health and the environment. CAPs do not ban or regulate chemicals, but the recommendations in the plans can lead to legislative or regulatory action. Ecology develops each CAP in collaboration with other agencies and experts, including representatives from businesses, local government, human health, and environmental advocates. Ecology has developed a CAP for PCBs[16] (Ecology Publication 15-07-002).

The CAP for PCBs includes a series of actions and recommendations to limit releases of PCBs and minimize practices that can lead to inputs of PCBs into waterbodies. Implementation of the recommendations of the CAP for PCBs in the Spokane River watershed has the potential to lead to policy or legislative actions that will ultimately reduce PCBs in the Spokane River.

Enterprise Service preferred Packaging.

Ecology has also committed to reducing PCBs from waste streams through the State's purchasing policy (DES-280-00). This policy:

- Establishes purchasing preference for products and packaging that do not contain PCBs
- Sets PCB restrictions in yellow road paint that the state purchases

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[14] https://apps.leg.wa.gov/wac/default.aspx?cite=173-333

[15] https://apps.leg.wa.gov/wac/default.aspx?cite=173-333-310

[16] https://fortress.wa.gov/ecy/publications/SummaryPages/1507002.html

PCBs are continually cycled through the environment and humans due to their persistence. This state policy, when implemented in the Spokane River watershed, has the potential to reduce PCBs in waste streams that eventually lead to the Spokane River. These actions can lead to the reduction or elimination of some sources of PCBs.

Discharger Specific Pollutant Minimization Plan

As outlined in WAC 173-201A-420, one of the requirements in applying for a variance is to submit a schedule for development and implementation of a pollutant minimization plan (PMP) for the subject pollutant. The PMPs provide a multi-pronged approach to require PCB reductions and are integral in demonstrating that variance recipients are making reasonable progress towards the water quality criteria for PCBs. The WAC also specifies that a variance adopted into rule must include identification of required actions and a schedule, including any measureable milestones, and that adaptive management be used to fine-tune and update actions, schedules, and milestones. The PMP must include PCB reduction activities throughout the term of the variance. Ecology will reevaluate the PMP as part of the mandatory interim variance reviews.

Ecology reviewed the following information to identify PMP actions that each discharger could take: the PMP information submitted by the dischargers for reducing PCB loading to the Spokane River; the Spokane River Regional Toxics Task Force Comprehensive Plan; and discharger specific facility plans. Ecology created a list of actions and a corresponding schedule that will require dischargers to conduct pollutant minimization activities throughout the term of the variance. Ecology categorized the proposed actions into the following five objectives by type of activity:

- PMP organization
- Source investigation and identification
- Mitigation and/or reduction of sources
- Regional coordination
- Reporting and adaptive management

Ecology has summarized the actions in Tables 24 and 25. Table 24 provides a list of actions that apply to all of the dischargers, while Table 25 includes discharger specific PMP items. The following provides a general description for each objective category of actions, including additional details about specific actions, milestones and/or goals.

The tables include schedules for each activity that outline their frequency. Ongoing activities are expected to continue throughout the duration of the variance period.

PMP Organization

The actions identified under the first objective, PMP Organization, are necessary to develop the "who, what, and when" for how the PMP actions are to be completed. Based on other elements included in Tables 24 and 25, the dischargers will have to identify in their initial PMPs the participating parties or individuals from their respective organizations that are responsible for completing the actions and providing updates, as needed. Each organization will also identify how they will track progress over the term of the variance. This task includes identifying any discrete actions or activities the dischargers will conduct for the PMP actions. Examples for discrete activities and actions are included for each PMP objective description below.

In addition to the general schedule provided, each discharger permit will require a submittal of individual discrete deliverables or activities in accordance with the schedule. The discharger may provide GANTT charts and/or a list of interim milestones that support the schedule outlined in Tables 24 and 25.

Source Investigation and Identification

The goal is to continue the ongoing work to reduce or eliminate PCBs from entering the waste streams, whether that is influent to a municipal treatment plant, source water for industrial users, or from raw materials or chemicals used in the industrial or treatment processes.

Each discharger is responsible for preparing and submitting a quality assurance project plan (QAPP) that outlines the procedures they will follow for the data collection required to continue investigating and identifying sources of PCBs during the variance period. While EPA Method 608.3 is required for compliance monitoring associated with permit limits for PCBs, EPA Method 1668 is required for source investigation, identification, and determining the effectiveness of PMP actions.

As dischargers continue to collect information regarding potential PCB sources, Ecology expects that each discharger will implement additional sampling to identify sources, which is captured in the "other PCB sampling" to be completed "as necessary."

PMPs for the municipal dischargers require the following two additional elements:

- Take actions to control nonpoint sources of PCBs that enter the collection system through infiltration and inflow (I/I). These actions will attempt to identify and remove potential pathways for PCBs to enter the collection system from nonpoint sources.
- Identify actions needed to control sources from industrial discharges to the publicly owned treatment works (POTW).

- The PMP for Liberty Lake will require an updated local sewer ordinance. Liberty Lake will need to evaluate and implement BMPs in the ordinance that eliminate, to the extent possible, all identified sources of PCBs.
- As previously discussed, Ecology delegated the City of Spokane and Spokane County as the control authority to permit, monitor, and enforce conditions for industrial users discharging to their treatment systems; with oversight from Ecology. The City of Spokane and Spokane County will be required to update their pretreatment programs to identify how they will identify sources of PCBs from each industrial discharger and what steps each of those dischargers must implement to eliminate PCBs from their discharge.

Mitigation or Reduction of Sources

As dischargers identify sources of PCBs, they will be required to take actions to mitigate or reduce those sources. While most of these actions will be ongoing, each discharger must report on the mitigation and reduction efforts in their annual reports and during the periodic variance reviews.

Some of the mitigation and reduction efforts directly affect treatment system influent, process, and effluent PCB concentrations. Optimization of operation and maintenance (O&M) or screening for PCB containing materials can apply to all facilities. Other actions will be required of each discharger at a policy and management level, such as reviewing and updating procurement policies or participation in committee and work group efforts to reduce PCBs in commercial and consumer products.

Each discharger will be required to stay abreast of emerging treatment technologies for PCB removal by conducting periodic literature reviews. If a discharger finds an add-on or replacement treatment technology that has promise for a greater reduction in PCB removal than the technology already utilized at their facility, the discharger will be required to conduct bench scale or pilot studies to determine the feasibility of implementing the technology at full-scale.

Municipal Dischargers

In addition to the items above, the municipal facilities will be required to conduct periodic reviews of alternative actions previously identified in this report where the feasibility of implementation was unknown. For example, the municipal dischargers must revisit or continue evaluating opportunities such as land treatment, reclaimed water, correction of I/I and stormwater contributions, and/or their pretreatment programs, to reduce PCB loading either to their treatment facilities or the river through eliminating or partially removing their effluent discharges from the river.

Inland Empire Paper

Mitigation and reduction actions required for Inland Empire Paper include continued advocacy and involvement in efforts to reform the Toxics Substances Control Act (TSCA) that regulates the introduction of new or already existing chemicals in the environment, including PCBs. IEP will also be required to reduce or eliminate PCBs used in newsprint/packaging in inks and dyes by working with manufacturer's associations. The recycled content could be changed from old newspapers and magazines to materials that contain fewer PCBs such as office paper.

Kaiser

Federal Rules do not require a discharger to prepare a PMP under a Path 2 variance (40 CFR 131.14(b)(ii)(A). However, Washington's Water Quality Standards require the preparation of a PMP for all variances (WAC 173-201A-420(3)(e)). A detailed list of mitigation and reduction actions have been included in Table 25 for Kaiser that reflect the items included in the Agreed Administrative Order No. 16958, issued in January 2020. Kaiser has a slightly different PMP outline because they have not yet installed the most effective treatment technology for removing or treating PCBs. Specific dates relevant to their PMP schedule for many of their actions have already been identified in Agreed Administrative Order No. 16958.

Regional Coordination

The PMPs will contain a suite of actions that benefit from collaboration and regional coordination. The activities of the Task Force, for example, have included the creation of the Comprehensive Plan, which identifies a suite of actions that can be implemented to reduce PCB inputs to the Spokane River. The Task Force can fulfill a valuable role by supporting the implementation of these actions, collecting environmental data, collaborating on public education activities, and supporting actions that eliminate PCBs at the point of production.

Ecology intends to continue to require participation by the dischargers in the Task Force and monitor its success through periodic determinations of measurable progress. Dischargers will be required to support the data collection for the measurable progress evaluation, which is done on a 5-year cycle and determines whether progress is being made towards meeting applicable water quality standards for PCBs.

Reporting and Adaptive Management

Each discharger will have reporting obligations as part of their PMP, including preparing and submitting annual reports. Other annual reporting will include the data collected (using EPA Method 1668 as outlined in Source Investigation and Identification section above). The annual report should provide a summary of the data collection efforts and results, including an evaluation of congener trends in the PCB data related to source identification and source removal effectiveness. The annual report should also describe any actions taken to mitigate and/or reduce sources of PCBs.

As part of the annual reporting process, each discharger will also be responsible for integrating adaptive management strategies for the PMP. Adaptive management incorporates a cyclical process of planning, implementation, evaluation, and adjustment. As additional information is collected, gathered, and analyzed, dischargers must use it to refine their PMP with the goal of reducing PCBs from entering the Spokane River.

Ecology is required to conduct an interim review of a variance at least once every five years in accordance with WAC 173-201A-240. The review is required to determine if dischargers are meeting the conditions of the variance and to evaluate if the variance is still necessary. In order to complete this evaluation, Ecology will require each of the dischargers to prepare a PMP implementation review report prior to the mandatory interim review that occurs at least every five years. The reports will detail progress towards achieving the PCB human health criteria during the review period.

Table 24. Pollutant minimization plan actions that are applicable to all dischargers.

Objective	Action	Frequency	Schedule	Goals
PMP Organization	Establish team	Once	By end of Year 1	Identify cross functional team responsible for developing and implementing PMP Plan
PMP Organization	Identify procedures and methods for PMP effectiveness tracking	Once	By end of Year 1	Establish how progress and/or success of PMP action items will evaluated and measured
PMP Organization	Submit proposed schedule for performing and completing PMP actions	Once	By end of Year 1	Identify initial timeline for conducting actions outlined in PMP table
Source Investigation and Identification	Submit a Quality Assurance Project Plan (QAPP) for PMP PCB Sampling	Once	By end of Year 1 or as needed	Establish acceptable protocols for PCB sampling, analysis, and reporting
Source Investigation and Identification	Conduct influent and effluent sampling	Ongoing	Sampling as required by the NPDES permit	Measure concentrations and calculate loading of PCBs entering and exiting the treatment facilities for evaluation of HAC (using EPA Method 1668)
Source Investigation and Identification	Conduct other PCB sampling	As necessary	Every year or as needed	Characterize PCBs in waste streams, solids, products, etc.
Mitigation or Reduction of Sources	Serve on Ecology and other committees for addressing PCBs in commerce	Ongoing	Every year or as needed	Reduce PCBs in commercial and consumer products in use in the Spokane River watershed
Mitigation or Reduction of Sources	Implement measures to optimize O&M where practicable	Ongoing	Amend O&M to include a chapter on BMPs within Year 1. Verify O&M is up to date annually thereafter.	Reduce PCBs discharged in the final effluent through proper operation and maintenance of wastewater treatment systems
Mitigation or Reduction of Sources	Screen for PCB containing materials	Ongoing	Every year or as needed	Reduce contributions of PCBs to the final effluent from raw materials, chemicals, and additives used at facility

Objective	Action	Frequency	Schedule	Goals
Mitigation or Reduction of Sources	Conduct periodic review of procurement policies	Ongoing	Review every 4 years	Use and promote purchase of products that reduce introduction of new PCBs to the environment
Mitigation or Reduction of Sources	Evaluate and optimize the solids dewatering and storage processes	Ongoing	By end of Year 10	Minimize PCB return to the treatment system from solids dewatering/recovery processes
Regional Coordination	Actively participate in the Task Force and work collaboratively to implement the comprehensive plan; incorporate adaptive management to identify and reduce sources of PCBs	Ongoing	Monthly or as appropriate based on meeting schedule	Attendance in SRRTTF meetings and SRRTF work group meetings
Regional Coordination	Identify and collect additional information to assist Ecology in evaluating measurable progress towards achieving applicable water quality standards for PCB and the effectiveness of the variance.	As necessary	First report due by Year 4 and every 5 years thereafter (prior to each mandatory interim review)	Make periodic determinations of measurable progress in meeting applicable water quality criteria for PCBs
Regional Coordination	Work collaboratively through the SRRTTF to collect and analyze in-river water samples for PCBs using EPA Method 1668, to evaluate progress in reducing PCBs loading to the Spokane River. Alternatively, each individual discharger will collect in-river samples within 300 feet downstream of their outfall for the progress evaluation. In-river PCB concentrations shall be submitted in an annual report by January 30.	As necessary	First report due by Year 4 and every 5 years thereafter (prior to each mandatory interim review)	In-river data for trends in PCB concentrations and to demonstrate progress in reducing PCBs loading to the Spokane River.
Regional Coordination	Investigate Technical, Legal and Toxic Substances Control Act Policy Solutions	Ongoing	Every year or as needed	TSCA workgroup members continue to investigate the Technical, Legal and Policy Solutions document to determine what, if any, may be worth pursuing to reduce PCBs. This includes ranking the solution list and pursuing any feasible options to

Objective	Action	Frequency	Schedule	Goals
				reduce PCBs.
Regional Coordination	Work with the SRRTTF to host and attend workshops to address various PCB issues, such as analytical techniques, Spokane River ambient monitoring data, TSCA reform, etc.	Ongoing	Every year or as needed	Public and stakeholder education
Regional Coordination	Provide public education and outreach for the Spokane River community on PCBs in the Spokane River and reducing sources of PCBs	Ongoing	Every year or as needed	Public education
Reporting and Adaptive Management	Prepare and submit annual report	Annual	Every year	Document pollutant minimization efforts and progress through effectiveness tracking
Reporting and Adaptive Management	Report influent/effluent PCB testing data	Annual	Every year	Determine treatment removal efficiencies of PCBs for evaluation with HAC (using EPA Method 1668)
Reporting and Adaptive Management	Report results from additional testing of waste streams and raw materials	As necessary	By Year 4 and every 5 years thereafter	Reduce contributions of PCBs to the final effluent from raw materials, chemicals, and additives used at facility
Reporting and Adaptive Management	Evaluate and update schedule of PMP actions	Annual	By Year 4 and every 5 years thereafter (prior to each mandatory interim review)	Report changes in schedule to reflect adaptive management of PMP to reduce PCBs
Reporting and Adaptive Management	Prepare and submit a PMP Implementation Review prior to each mandatory interim review of the variance	Once per 5-year review cycle	By Year 4 and every 5 years thereafter (prior to each mandatory interim review)	Report progress made towards achieving water quality criteria for PCBs

Table 25. Discharger specific actions in pollutant minimization plans.

Discharger(s)	Objective	Action	Frequency	Schedule	Goals
Municipal facilities	Source Investigation and Identification	Evaluate infiltration and inflow (I/I) to collection systems	Ongoing	Years 1-5 and implementation Years 6-15	Identify and address potential sources of I/I in collection systems
Municipal facilities	Source Investigation and Identification	Administer industrial pretreatment programs	Ongoing	Years 1-20	Work with industrial facilities to identify and reduce or eliminate sources that contribute to influent loading of PCBs to municipal treatment facilities
Municipal facilities	Mitigation or Reduction of Sources	Conduct periodic literature review to identify emerging treatment technologies	Ongoing	First report due by Year 4 and every 5 years thereafter	Identify emerging technologies for PCB treatment for further bench scale/pilot system evaluation
Municipal facilities	Mitigation or Reduction of Sources	Submit Scope of Work for conducting bench scale/pilot studies on emerging PCB treatment technologies, as identified during periodic literature reviews	As necessary	Within 6 months of completing literature review, if applicable emerging technology is identified	Determine effectiveness and feasibility of emerging technologies for PCB treatment
Municipal facilities	Mitigation or Reduction of Sources	Conduct bench scale/pilot studies on emerging PCB treatment technologies, as identified in periodic literature reviews	As necessary	Within 18 months of approved Scope of Work	Determine effectiveness and feasibility of emerging technologies for PCB treatment
Municipal facilities	Mitigation or Reduction of Sources	Conduct periodic review of alternative actions and implement feasible actions to reduce PCBs loading to the environment	Ongoing	Years 1-20	Identify opportunities to reduce or eliminate PCB loading through alternative actions such as beneficial reuse of effluent (reclaimed water), correction of I/I and stormwater contributions, and management of pretreatment programs

Discharger(s)	Objective	Action	Frequency	Schedule	Goals
Municipal facilities	Reporting and Adaptive Management	Evaluate and update PMP based on source tracking and effectiveness monitoring	Annual	By Year 4 and every 5 years thereafter (prior to each mandatory interim review)	Update and adjust PMP based on annual assessment of effectiveness tracking
Inland Empire Paper	Mitigation or Reduction of Sources	Conduct periodic literature review to identify emerging treatment technologies	Ongoing	First report due by Year 4 and every 5 years thereafter	Identify emerging technologies for PCB treatment for further bench scale/pilot system evaluation
Inland Empire Paper	Mitigation or Reduction of Sources	Submit Scope of Work for conducting bench scale/pilot studies on emerging PCB treatment technologies, as identified during periodic literature reviews	Ongoing	Beginning by Year 2 and every 5 years thereafter, as needed	Determine effectiveness and feasibility of emerging technologies for PCB treatment
Inland Empire Paper	Mitigation or Reduction of Sources	Conduct bench scale/pilot studies on emerging PCB treatment technologies according to Ecology approved Scope of Work	Ongoing	Beginning by Year 3, and every 5 years thereafter, as needed	Determine effectiveness and feasibility of emerging technologies for PCB treatment
Inland Empire Paper	Mitigation or Reduction of Sources	Printing Inks Pilot (Packaging/Newsprint) – Continue work with manufacturers associations	-	Years 1-20	Reduce or eliminate PCBs used in newsprint/packaging in inks and dyes
Inland Empire Paper	Mitigation or Reduction of Sources	Continue work with EPA for revision of allowable PCB levels in products under TSCA	-	Years 1-20	Reduce or eliminate the gap between allowable TSCA levels in products and water quality criteria
Inland Empire Paper	Mitigation or Reduction of Sources	Continue to present concerns with the PCB allowances in TSCA to both in-state and out-of-state groups	-	Every year or as needed	Reduce or eliminate the gap between allowable TSCA levels in products and water quality criteria

Discharger(s)	Objective	Action	Frequency	Schedule	Goals
Inland Empire Paper	Mitigation or Reduction of Sources	Site Specific Best Management Practices (BMP) Plan to minimize contributions during site demolition and remodeling	-	By Year 1	Reduce or eliminate contributions of PCBs to the final effluent during site demolition and remodeling
Inland Empire Paper	Mitigation or Reduction of Sources	Conduct periodic review of alternative actions and implement feasible actions to reduce PCBs loading to the environment	Ongoing	Years 1-20	Identify opportunities to reduce or eliminate PCB loading through alternative actions
Kaiser	Source Investigation and Identification	Clean out north sewer	Ongoing	By Year 5, and as needed thereafter	Identify and reduce or eliminate PCBs within industrial sewer system
Kaiser	Mitigation or Reduction of Sources	Refurbish PCB containing electrical equipment	Ongoing	By Year 1 and as needed thereafter	Retro-filling transformers that contain detectable levels of PCB when analysis show that PCB levels are approaching a set threshold
Kaiser	Mitigation or Reduction of Sources	Conduct leak detection and prevention activities for electrical equipment	Ongoing	By Year 1, Annually thereafter	Routine transformer and electrical equipment inspections to identify and prevent leaks of PCB contaminated fluids or materials
Kaiser	Mitigation or Reduction of Sources	Site Specific Best Management Practices (BMP) Plan to minimize contributions during site demolition and remodeling	Ongoing	By Year 1	Reduce or eliminate contributions of PCBs to the final effluent during site demolition and remodeling
Kaiser	Mitigation or Reduction of Sources	Flow reduction projects as outlined in Table 2 - Kaiser Schedule of Flow Reduction Action and Treatment System Evaluation	Ongoing	Years 1-8	Reduce or eliminate PCB loading through a reduction of effluent flows and ultimate size of treatment system that achieves the greatest pollutant reduction for PCBs

Discharger(s)	Objective	Action	Frequency	Schedule	Goals
Kaiser	Mitigation or Reduction of Sources	Identify and evaluate treatment technologies	As necessary	Years 1-8	Find technologies capable of achieving greatest pollutant reduction achievable
Kaiser	Mitigation or Reduction of Sources	Conduct bench/pilot scale testing of candidate technologies	As necessary	By Year 8	Determine feasibility and efficiencies of the identified technologies
Kaiser	Mitigation or Reduction of Sources	Submit final engineering design documents for selected treatment technology	Once	By Year 9	Planning phase of treatment installation
Kaiser	Mitigation or Reduction of Sources	Install and optimize selected treatment technology	Once	By Year 10	Reduction or elimination of PCBs in effluent

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Appendices

Appendix A. Inland Empire Paper PCB Effluent Concentration Data

Units:	mgd	-	pg/L										
Date	Flow	blank	Mono	Di	Tri	Tetra	Penta	Hexa	Hepta	Octa	Nona	Deca	TOTAL
11/10/2011	6.2696	3x	38.8	404.6	458	284.9	97	17.5	0	0	0	0	1300.8
12/19/2011	6.952	3x	62.3	554.7	407.8	304.4	183.6	74.2	12.4	0	0	1.1	1600.5
2/8/2012	6.5599	3x	36.1	397.9	399.9	180.9	55.5	0	0	0	0	0	1070.3
4/11/2012	6.3422	3x	50	721.4	561.6	333.6	122.4	37.7	0	0	0	0	1826.7
5/31/2012	6.2805	3x	64.2	492.9	615.6	307.4	72	0	0	0	0	0	1552.1
7/11/2012	6.154	3x	68.6	569.4	639.7	441.4	162.6	23.1	0	0	0	0	1904.8
9/18/2012	6.3057	3x	172	1458.3	1765.9	978.3	389.2	209.6	62.1	4.8	0	0	5040.2
11/6/2012	7.0442	3x	138.4	1078.9	1646.4	730.2	96.2	6.6	0	0	0	0	3696.7
1/1/2013	7.0237	3x	110.3	1792.4	1842.3	873.7	575.6	340.3	108	15	4.1	0	5661.7
4/17/2013	5.867	3x	74.3	937.8	1792.4	1175.3	286.5	63.8	22.1	3	0	0	4355.2
8/15/2013	6.8063	3x	88.3	1956.2	7103.4	4843.4	879.7	131.8	39.1	10.1	0	0	15052
1/28/2014	7.0413	3x	50.7	557.3	896.8	434.8	64.2	17.7	2.4	0	0	0	2023.9
3/13/2014	5.8436	3x	50.1	806.7	1493.8	698.2	130.1	26.1	13.5	5.6	0	0	3224.1
5/12/2014	6.4685	3x	48.4	830.7	1365	659.1	110.8	18	8	0	0	0	3040
2/17/2015	6.896	3x	10.3	455.5	636.4	108.1	0	0	0	1.4	0	0	1211.7
4/24/2015	6.2043	3x	23.6	626	1122.4	562.2	79.1	3	0	1.1	0	0	2417.4
8/28/2015	7.0304	3x	80.2	780.5	1310.3	814.8	84	4.8	2.5	3.5	0	0	3080.6
12/28/2015	7.1334	3x	66.8	1060.2	1237.7	517.4	89.1	3.3	1.6	2.1	0	0	2978.2
1/11/2016	6.042	3x	76.9	1132.8	1303.9	549.4	93.6	2.2	0	0	0	0	3158.8
6/6/2016	6.8522	3x	96.5	1148.2	2016.7	1120	203.2	28.9	13.9	0	9.9	5.2	4642.5
8/29/2016	7.2361	3x	79.1	1219.6	2714.3	1952.4	477.8	111.5	29.2	2.3	3	0	6589.2
12/2/2016	6.9545	3x	5.8	554	1053	547.7	55	2.4	1.3	1	0.7	0	2220.9
3/14/2017	6.8401	3x	78.4	862.3	1044.8	488.2	84.1	6.2	3.5	0	0	0	2567.5
6/15/2017	6.2278	3x	23.8	474.7	437	305.2	68	15.5	0	0	0	0	1324.2
7/18/2017	6.6053	3x	75.9	431.3	335.2	225.6	75.1	24.9	1.9	0	0	0	1169.9
12/5/2017	7.62	3x	54.2	755.7	1056.8	663.6	162.7	41.6	4.2	0	0	0	2738.8
3/9/2018	7.12	3x	28.9	405.7	734.2	674.6	259.7	54	9.5	5.2	0	0	2171.8
5/9/2018	7.3	3x	0	95.4	313.6	205.9	59.9	15.3	2.7	0.9	0	0	693.7
7/26/2018	7.573	3x	40.3	442.4	895.8	533.2	93	12.6	1.4	0	0	0	2018.7
10/5/2018	7.6645	3x	87.1	1857.4	4261.2	1996.5	274.3	44.5	13.3	0.6	0	0	8534.9

Units:	mgd	-	mg/day	Percent of Total										
Date	Flow	blank	Load	Mono%	Di%	Tri%	Tetra%	Penta%	Hexa%	Hepta%	Octa%	Nona%	Deca%	Total %
11/10/2011	6.2696	3x	30.87	2.98	31.10	35.21	21.90	7.46	1.35	0.00	0.00	0.00	0.00	100.0
12/19/2011	6.952	3x	42.12	3.89	34.66	25.48	19.02	11.47	4.64	0.77	0.00	0.00	0.07	100.0
2/8/2012	6.5599	3x	26.58	3.37	37.18	37.36	16.90	5.19	0.00	0.00	0.00	0.00	0.00	100.0
4/11/2012	6.3422	3x	43.86	2.74	39.49	30.74	18.26	6.70	2.06	0.00	0.00	0.00	0.00	100.0
5/31/2012	6.2805	3x	36.90	4.14	31.76	39.66	19.81	4.64	0.00	0.00	0.00	0.00	0.00	100.0
7/11/2012	6.154	3x	44.37	3.60	29.89	33.58	23.17	8.54	1.21	0.00	0.00	0.00	0.00	100.0
9/18/2012	6.3057	3x	120.31	3.41	28.93	35.04	19.41	7.72	4.16	1.23	0.10	0.00	0.00	100.0
11/6/2012	7.0442	3x	98.57	3.74	29.19	44.54	19.75	2.60	0.18	0.00	0.00	0.00	0.00	100.0
1/1/2013	7.0237	3x	150.53	1.95	31.66	32.54	15.43	10.17	6.01	1.91	0.26	0.07	0.00	100.0
4/17/2013	5.867	3x	96.72	1.71	21.53	41.16	26.99	6.58	1.46	0.51	0.07	0.00	0.00	100.0
8/15/2013	6.8063	3x	387.81	0.59	13.00	47.19	32.18	5.84	0.88	0.26	0.07	0.00	0.00	100.0
1/28/2014	7.0413	3x	53.95	2.51	27.54	44.31	21.48	3.17	0.87	0.12	0.00	0.00	0.00	100.0
3/13/2014	5.8436	3x	71.32	1.55	25.02	46.33	21.66	4.04	0.81	0.42	0.17	0.00	0.00	100.0
5/12/2014	6.4685	3x	74.44	1.59	27.33	44.90	21.68	3.64	0.59	0.26	0.00	0.00	0.00	100.0
2/17/2015	6.896	3x	31.63	0.85	37.59	52.52	8.92	0.00	0.00	0.00	0.12	0.00	0.00	100.0
4/24/2015	6.2043	3x	56.77	0.98	25.90	46.43	23.26	3.27	0.12	0.00	0.05	0.00	0.00	100.0
8/28/2015	7.0304	3x	81.98	2.60	25.34	42.53	26.45	2.73	0.16	0.08	0.11	0.00	0.00	100.0
12/28/2015	7.1334	3x	80.42	2.24	35.60	41.56	17.37	2.99	0.11	0.05	0.07	0.00	0.00	100.0
1/11/2016	6.042	3x	72.25	2.43	35.86	41.28	17.39	2.96	0.07	0.00	0.00	0.00	0.00	100.0
6/6/2016	6.8522	3x	120.42	2.08	24.73	43.44	24.12	4.38	0.62	0.30	0.00	0.21	0.11	100.0
8/29/2016	7.2361	3x	180.49	1.20	18.51	41.19	29.63	7.25	1.69	0.44	0.03	0.05	0.00	100.0
12/2/2016	6.9545	3x	58.47	0.26	24.94	47.41	24.66	2.48	0.11	0.06	0.05	0.03	0.00	100.0
3/14/2017	6.8401	3x	66.48	3.05	33.59	40.69	19.01	3.28	0.24	0.14	0.00	0.00	0.00	100.0
6/15/2017	6.2278	3x	31.22	1.80	35.85	33.00	23.05	5.14	1.17	0.00	0.00	0.00	0.00	100.0
7/18/2017	6.6053	3x	29.25	6.49	36.87	28.65	19.28	6.42	2.13	0.16	0.00	0.00	0.00	100.0
12/5/2017	7.62	3x	79.00	1.98	27.59	38.59	24.23	5.94	1.52	0.15	0.00	0.00	0.00	100.0
3/9/2018	7.12	3x	58.53	1.33	18.68	33.81	31.06	11.96	2.49	0.44	0.24	0.00	0.00	100.0
5/9/2018	7.3	3x	19.17	0.00	13.75	45.21	29.68	8.63	2.21	0.39	0.13	0.00	0.00	100.0
7/26/2018	7.573	3x	57.87	2.00	21.92	44.38	26.41	4.61	0.62	0.07	0.00	0.00	0.00	100.0
10/5/2018	7.6645	3x	247.63	1.02	21.76	49.93	23.39	3.21	0.52	0.16	0.01	0.00	0.00	100.0

Appendix B. Inland Empire Paper Source ID Study Results

Summary

This document summarizes the analysis of PCB data collected by Inland Empire Paper Company as part of a study to determine PCB sources within their facility. Inland Empire Paper sampled process wastestreams, non-contact cooling water (NCCW), and effluent over three consecutive weeks. Sampling began on October 27, 2014 and ended on November 14, 2014. The facility produced an average of 558.5 and 558.9 machine dry tons of paper per day in October and November of 2014, respectively. Recycled fiber comprised an average of 22.8% of total production for both months.

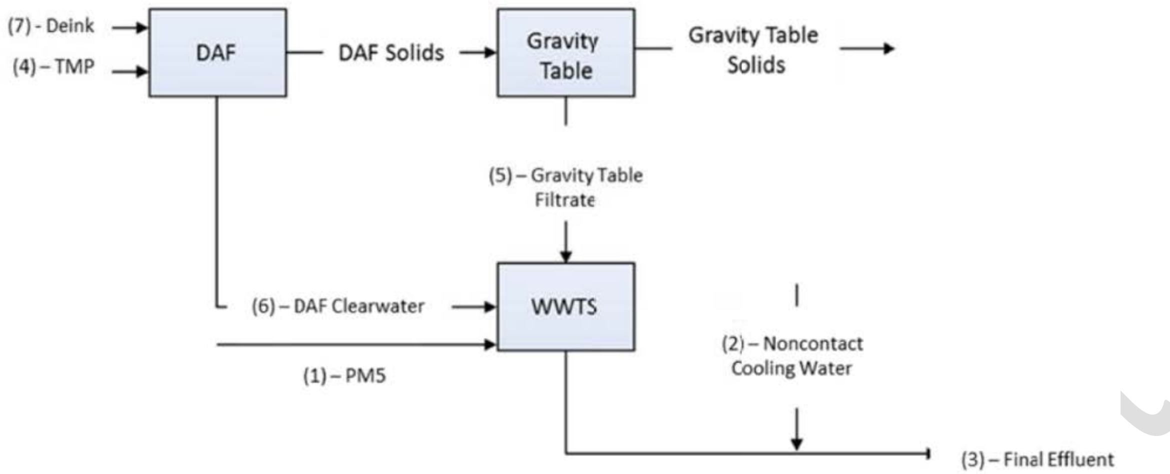
Ecology calculated the percent removal of PCBs through the facility's treatment system in consideration of setting a 'highest attainable condition' in response to Inland Empire Paper's request for a variance for PCBs in the Spokane River.

Data Collection

Inland Empire Paper sampled the following monitoring points that are part of the study:

Sample ID Number	Sample Description
1	PM5 Sewer
2	Non-Contact Cooling Water
3	Final Effluent
4	#5 TMP Line
5	Gravity Table Filtrate
6	DAF Clearwater
7	Deink Waste Stream
8	Transfer Blank

Sampling locations are designated by location number as shown above followed by the week sampled. For example, Location 1-1 is sample point 1 (PM5 Sewer) for week number 1. A layout of these sampling locations is shown below:



Inland Empire Paper Sampling Locations

Data Analysis - Flags

Ecology set all values flagged with a 'U' (not detected at the reporting limit) and 'K' (peak detected but did not meet quantification criteria, result reported represents the estimated maximum possible concentration) as zero. Ecology used all other flagged values as the reported concentration, including 'J' flags (concentration less than lowest calibration equivalent).

Data Analysis - Blank Correction

Ecology used laboratory method blanks to correct reported results at the 3 times level. Two laboratory method blanks were run for the collected samples with total PCB results reported as 84.5 and 43.9 pg/L.

Results:

Results for total PCBs concentrations (pg/L):

Location	Description	Result	Blank_Total	Result_3x
Site 1-1	PM5 Sewer	44,156.7	84.5	44,156.7
Site 1-2	PM5 Sewer	15,123.0	84.5	15,123.0
Site 1-3	PM5 Sewer	96,155.5	43.9	96,155.5
Site 2-1	NCCW	60.8	84.5	17.7
Site 2-2	NCCW	86.4	84.5	39.0
Site 2-3	NCCW	69.3	43.9	13.5
Site 3-1	Final Effluent	2,909.2	84.5	2,909.2
Site 3-2	Final Effluent	3,496.8	84.5	3,494.7
Site 3-3	Finale Effluent	1,774.3	43.9	1,774.3
Site 4-1	#5 TMP Line	11,045.0	84.5	11,045.0

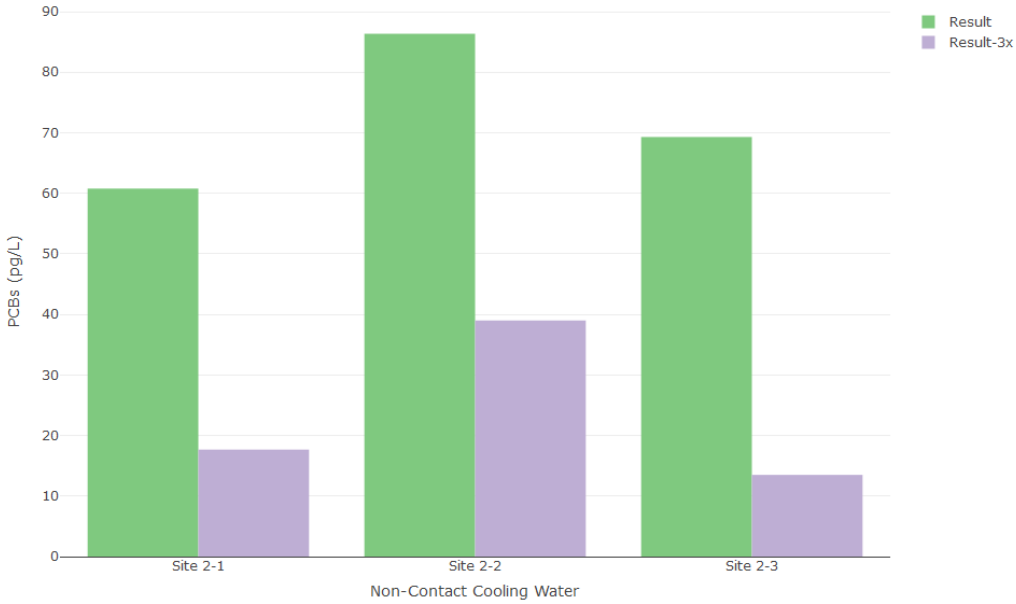
Location	Description	Result	Blank_Total	Result_3x
Site 4-2	#5 TMP Line	13,198.9	84.5	13,198.9
Site 4-3	#5 TMP Line	41,058.8	43.9	41,058.8
Site 5-1	Gravity Table Filtrate	33,846.6	84.5	33,846.6
Site 5-2	Gravity Table Filtrate	13,124.5	43.9	13,124.5
Site 5-3	Gravity Table Filtrate	11,763.3	43.9	11,763.3
Site 6-1	DAF Clearwater	158,815.6	84.5	158,815.6
Site 6-2	DAF Clearwater	46,329.7	43.9	46,329.7
Site 6-3	DAF Clearwater	267,222.4	43.9	267,222.4
Site 7-1	Deink Wastestream	53,108.3	84.5	53,108.3
Site 7-2	Deink Wastestream	2,318,613.2	43.9	2,318,613.2
Site 7-3	Deink Wastestream	59,458.1	43.9	59,458.1

Results for total PCB loadings (mg/day):

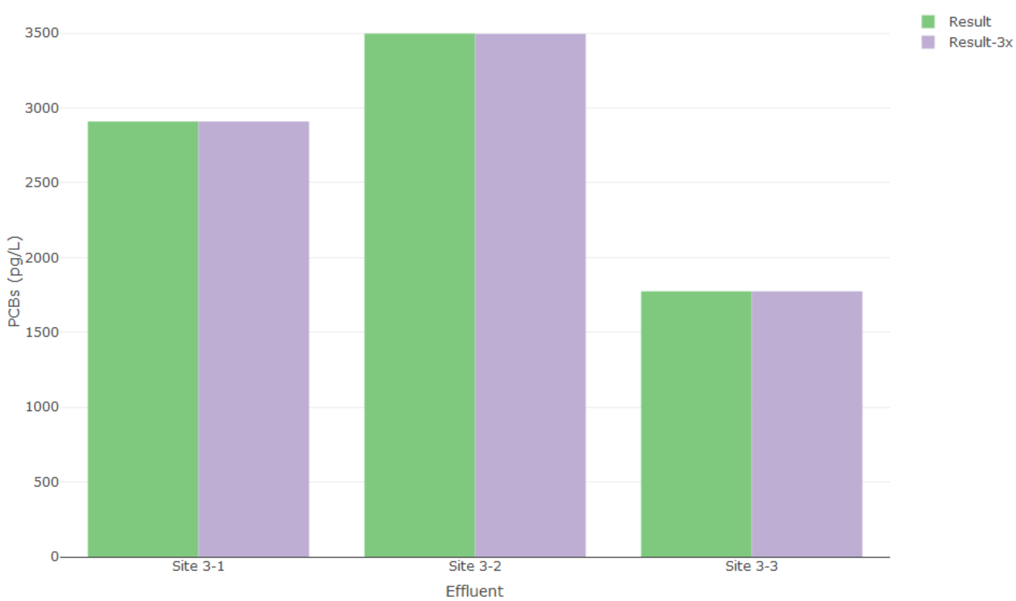
Location	Description	Flow-mgd	Load	Load_3x
Site 1-1	PM5 Sewer	3.3	553.6	553.6
Site 1-2	PM5 Sewer	3.5	197.8	197.8
Site 1-3	PM5 Sewer	3.5	1,257.9	1,257.9
Site 2-1	NCCW	2.4	0.6	0.2
Site 2-2	NCCW	2.0	0.7	0.3
Site 2-3	NCCW	2.4	0.6	0.1
Site 3-1	Final Effluent	7.2	79.3	79.3
Site 3-2	Final Effluent	7.2	95.3	95.2
Site 3-3	Finale Effluent	7.5	50.3	50.3
Site 4-1	#5 TMP Line	1.2	50.6	50.6
Site 4-2	#5 TMP Line	1.1	53.2	53.2
Site 4-3	#5 TMP Line	1.0	158.9	158.9
Site 5-1	Gravity Table Filtrate	0.3	38.7	38.7
Site 5-2	Gravity Table Filtrate	0.2	11.9	11.9
Site 5-3	Gravity Table Filtrate	0.3	12.8	12.8
Site 6-1	DAF Clearwater	1.6	952.3	952.3
Site 6-2	DAF Clearwater	1.3	227.3	227.3
Site 6-3	DAF Clearwater	1.3	1,340.1	1,340.1
Site 7-1	Deink Wastestream	0.3	55.0	55.0
Site 7-2	Deink Wastestream	0.0	417.1	417.1
Site 7-3	Deink Wastestream	0.2	42.8	42.8

Blank Correction Comparisons

Non-Contact Cooling Water (NCCW):



Effluent:

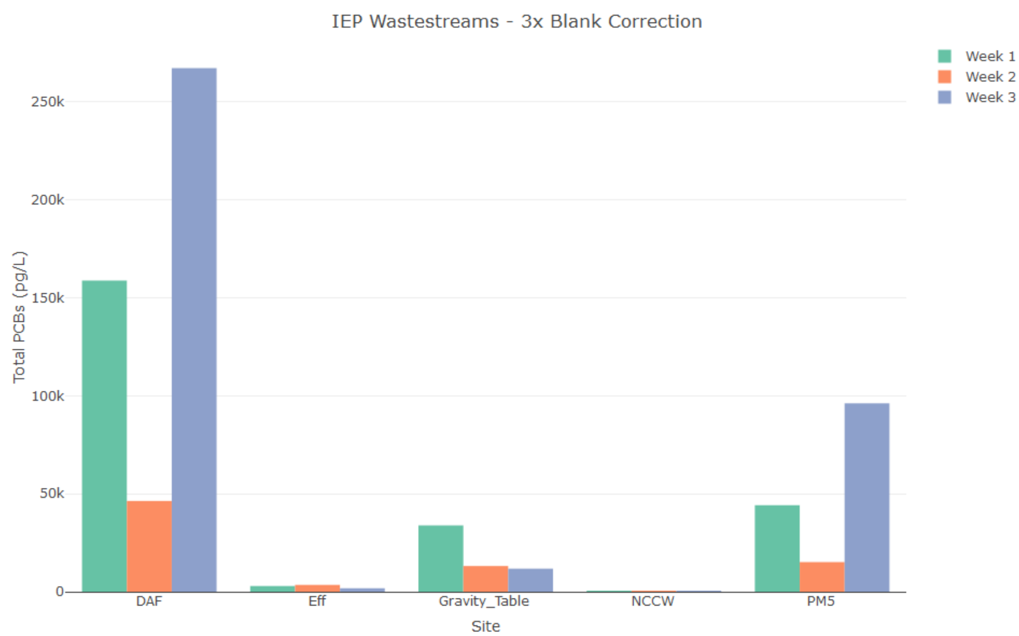


Percent Removal Calculation

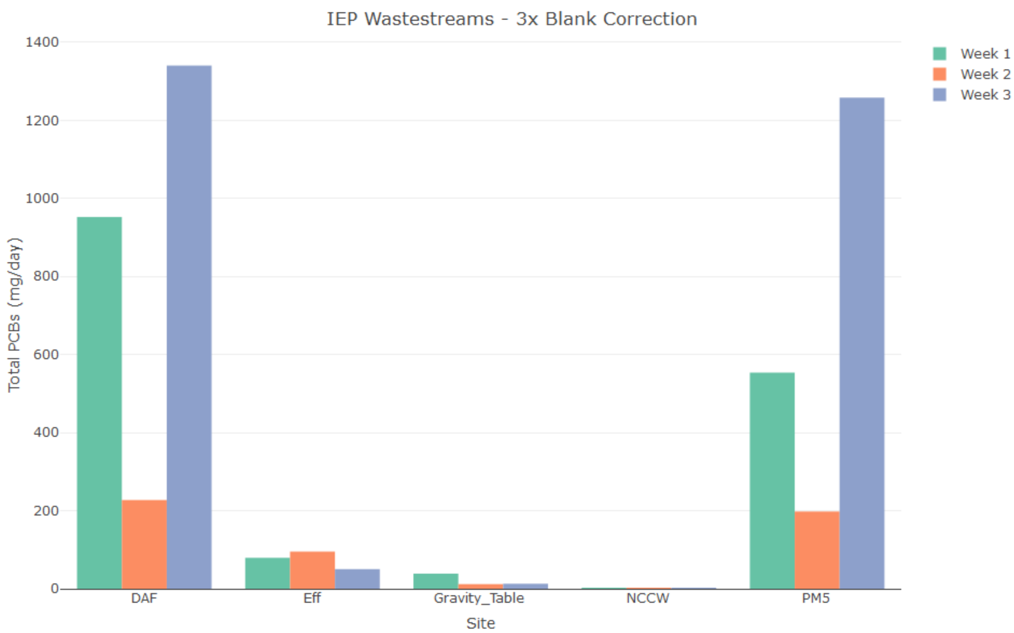
The sampling results include sufficient information to calculate a percent removal across the treatment system. Influents to the treatment system include locations (1) PM5 sewer, (5) Gravity Table Filtrate, and (6) DAF Clearwater. The effluent of the treatment system can be calculated by subtracting loads from (2) Noncontact Cooling Water (NCCW) from (3) Final Effluent.

The following figures show results corrected using 3 times the blank concentrations.

Inlet and Outlet Concentrations:



Inlet and Outlet Loadings:



Existing Treatment System - Percent Removals

For week 2 mass loading results, percent removals may be biased low due to solids removal during analytical testing. Therefore, these results should not be used in development of a highest attainable condition.

Week#	Result	Result_3x
Week1	94.9	94.9
Week2	78.3	78.3
Week3	98.1	98.1

Membrane Treatment System - Percent Removals

Inland Empire Paper also collected PCB samples during the pilot testing for their tertiary membrane treatment system. They sampled effluent before and after the membrane system, and calculated percent removals of 26% and 48%. Using these percent removals as very rough estimates, overall removal efficiencies could increase to a range of 96.2% to 99.0%.

Appendix C. Kaiser Monitoring Data

PCB Effluent Concentration Data

Units:	-	pg/L										
Date	Corr	Mono	Di	Tri	Tetra	Penta	Hexa	Hepta	Octa	Nona	Deca	Total
1/3/2018	3x	0.00	115.49	703.69	934.98	168.62	26.31	1.20	0.64	0.86	0.00	1,951.79
1/17/2018	3x	3.07	119.36	785.11	1,170.80	209.51	26.76	6.43	3.55	1.46	0.00	2,326.06
1/30/2018	3x	1.38	56.26	384.80	867.68	174.01	12.55	4.64	2.34	0.00	0.00	1,503.65
2/14/2018	3x	0.00	72.50	631.85	1,110.00	189.62	28.36	4.36	0.58	0.00	0.00	2,037.26
2/28/2018	3x	0.00	75.77	712.43	1,313.95	272.50	34.89	3.21	4.96	0.00	0.00	2,417.70
3/14/2018	3x	0.00	80.01	791.20	1,438.10	297.28	46.37	6.46	0.00	0.00	0.00	2,659.41
3/28/2018	3x	0.00	86.75	927.43	1,665.82	336.72	49.23	6.27	3.05	0.00	0.00	3,075.27
4/11/2018	3x	0.00	110.11	910.94	1,534.00	278.67	31.38	5.18	0.00	0.00	0.00	2,870.28
4/25/2018	3x	0.00	75.03	600.70	892.98	163.41	23.56	3.33	1.41	0.00	0.00	1,760.42
5/9/2018	3x	2.53	147.77	850.71	1,218.48	243.95	41.58	5.65	1.06	0.00	0.00	2,511.73
5/23/2018	3x	0.00	134.11	856.80	1,244.89	236.38	22.85	4.30	0.00	0.00	0.00	2,499.32
6/6/2018	3x	0.00	125.80	950.88	1,557.65	381.34	95.63	16.92	4.30	0.00	0.00	3,132.51
6/20/2018	3x	0.00	53.78	358.15	897.81	187.70	30.63	1.20	1.33	0.00	0.00	1,530.60
7/4/2018	3x	0.00	46.50	388.37	921.15	204.02	17.43	1.64	0.58	0.00	0.00	1,579.68
7/18/2018	3x	0.54	69.65	539.90	1,153.62	261.89	34.82	3.50	0.85	1.26	1.83	2,067.85
8/1/2018	3x	0.00	62.40	424.31	852.79	175.35	21.67	0.00	1.01	0.00	2.16	1,539.69
8/15/2018	3x	0.00	76.84	630.83	899.31	162.39	20.77	0.75	0.00	0.00	0.00	1,790.90
8/29/2018	3x	0.84	73.02	693.42	1,064.41	188.55	25.46	0.74	0.92	0.00	0.00	2,047.36
9/12/2018	3x	0.70	73.60	559.98	777.80	154.27	20.78	0.71	0.00	0.00	1.48	1,589.32
9/26/2018	3x	0.00	86.78	721.26	1,060.74	235.99	27.14	0.59	0.77	0.00	1.34	2,134.61
10/10/2018	3x	0.00	109.16	911.38	1,147.85	231.12	42.19	3.20	2.19	0.00	0.00	2,447.09
10/24/2018	3x	0.76	94.76	844.79	1,214.61	264.65	28.34	1.29	1.21	1.24	0.00	2,451.65
11/7/2018	3x	0.00	76.82	655.45	1,353.35	262.34	33.53	3.83	0.69	0.00	0.00	2,386.01
11/21/2018	3x	0.00	83.13	752.59	1,537.08	283.57	29.66	7.50	1.07	0.00	0.00	2,694.60
12/5/2018	3x	2.29	86.45	805.42	1,601.62	339.94	36.44	9.72	1.53	0.00	0.00	2,883.40
12/19/2018	3x	0.00	115.05	811.39	1,393.49	306.97	63.77	19.51	4.81	2.09	0.00	2,717.08
1/16/2019	3x	0.00	129.54	860.67	1,393.28	211.38	26.69	7.24	0.00	0.00	0.00	2,628.80
1/30/2019	3x	2.20	134.20	992.06	1,521.15	369.59	58.60	1.94	2.14	0.00	0.00	3,081.88
2/13/2019	3x	1.86	121.04	1,001.22	1,626.77	346.26	36.18	0.00	0.00	0.00	0.00	3,133.33
2/27/2019	3x	2.06	128.00	985.29	1,551.38	293.21	22.00	6.15	0.00	0.00	0.00	2,988.08
3/13/2019	3x	2.56	131.08	1,167.20	1,864.18	412.85	52.56	10.75	2.41	0.00	0.00	3,643.59
3/27/2019	3x	0.00	64.42	621.61	1,188.60	239.40	17.43	4.14	0.00	0.00	0.00	2,135.60
4/10/2019	3x	0.00	86.11	596.10	1,270.20	273.43	24.46	7.21	1.83	0.00	0.00	2,259.34
4/24/2019	3x	0.00	80.52	795.19	1,312.73	265.30	12.37	11.82	2.34	0.00	0.00	2,480.27
5/8/2019	3x	0.00	130.41	1,022.54	1,509.47	363.76	47.16	12.55	0.00	0.00	0.00	3,085.89

Kaiser PCB Effluent Loading Data

Units:	-	mgd	mg/day	% of Total										
Date	Corr	Flow	Load	Mono%	Di%	Tri%	Tetra%	Penta%	Hexa%	Hepta%	Octa%	Nona%	Deca%	%Total
1/3/2018	3x	8.76	64.72	0.00	5.92	36.05	47.90	8.64	1.35	0.06	0.03	0.04	0.00	100.00
1/17/2018	3x	9.57	84.26	0.13	5.13	33.75	50.33	9.01	1.15	0.28	0.15	0.06	0.00	100.00
1/30/2018	3x	8.873	50.50	0.09	3.74	25.59	57.70	11.57	0.83	0.31	0.16	0.00	0.00	100.00
2/14/2018	3x	8.508	65.61	0.00	3.56	31.01	54.48	9.31	1.39	0.21	0.03	0.00	0.00	100.00
2/28/2018	3x	8.448	77.32	0.00	3.13	29.47	54.35	11.27	1.44	0.13	0.21	0.00	0.00	100.00
3/14/2018	3x	8.68	87.38	0.00	3.01	29.75	54.08	11.18	1.74	0.24	0.00	0.00	0.00	100.00
3/28/2018	3x	8	93.13	0.00	2.82	30.16	54.17	10.95	1.60	0.20	0.10	0.00	0.00	100.00
4/11/2018	3x	8.518	92.55	0.00	3.84	31.74	53.44	9.71	1.09	0.18	0.00	0.00	0.00	100.00
4/25/2018	3x	8.412	56.06	0.00	4.26	34.12	50.73	9.28	1.34	0.19	0.08	0.00	0.00	100.00
5/9/2018	3x	9.116	86.67	0.10	5.88	33.87	48.51	9.71	1.66	0.22	0.04	0.00	0.00	100.00
5/23/2018	3x	9.516	90.03	0.00	5.37	34.28	49.81	9.46	0.91	0.17	0.00	0.00	0.00	100.00
6/6/2018	3x	8.777	104.08	0.00	4.02	30.36	49.73	12.17	3.05	0.54	0.14	0.00	0.00	100.00
6/20/2018	3x	8.693	50.37	0.00	3.51	23.40	58.66	12.26	2.00	0.08	0.09	0.00	0.00	100.00
7/4/2018	3x	8.786	52.54	0.00	2.94	24.59	58.31	12.92	1.10	0.10	0.04	0.00	0.00	100.00
7/18/2018	3x	9.123	71.41	0.03	3.37	26.11	55.79	12.66	1.68	0.17	0.04	0.06	0.09	100.00
8/1/2018	3x	8.872	51.71	0.00	4.05	27.56	55.39	11.39	1.41	0.00	0.07	0.00	0.14	100.00
8/15/2018	3x	8.465	57.39	0.00	4.29	35.22	50.22	9.07	1.16	0.04	0.00	0.00	0.00	100.00
8/29/2018	3x	8.643	66.98	0.04	3.57	33.87	51.99	9.21	1.24	0.04	0.04	0.00	0.00	100.00
9/12/2018	3x	8.33	50.12	0.04	4.63	35.23	48.94	9.71	1.31	0.04	0.00	0.00	0.09	100.00
9/26/2018	3x	8.457	68.34	0.00	4.07	33.79	49.69	11.06	1.27	0.03	0.04	0.00	0.06	100.00
10/10/2018	3x	8.009	74.19	0.00	4.46	37.24	46.91	9.44	1.72	0.13	0.09	0.00	0.00	100.00
10/24/2018	3x	6.889	63.93	0.03	3.87	34.46	49.54	10.79	1.16	0.05	0.05	0.05	0.00	100.00
11/7/2018	3x	6.98	63.04	0.00	3.22	27.47	56.72	10.99	1.41	0.16	0.03	0.00	0.00	100.00
11/21/2018	3x	6.55	66.81	0.00	3.09	27.93	57.04	10.52	1.10	0.28	0.04	0.00	0.00	100.00
12/5/2018	3x	6.56	71.60	0.08	3.00	27.93	55.55	11.79	1.26	0.34	0.05	0.00	0.00	100.00
12/19/2018	3x	6.87	70.66	0.00	4.23	29.86	51.29	11.30	2.35	0.72	0.18	0.08	0.00	100.00
1/16/2019	3x	6.24	62.09	0.00	4.93	32.74	53.00	8.04	1.02	0.28	0.00	0.00	0.00	100.00
1/30/2019	3x	6.26	73.03	0.07	4.35	32.19	49.36	11.99	1.90	0.06	0.07	0.00	0.00	100.00
2/13/2019	3x	6.93	82.20	0.06	3.86	31.95	51.92	11.05	1.15	0.00	0.00	0.00	0.00	100.00
2/27/2019	3x	6.76	76.46	0.07	4.28	32.97	51.92	9.81	0.74	0.21	0.00	0.00	0.00	100.00
3/13/2019	3x	7.11	98.06	0.07	3.60	32.03	51.16	11.33	1.44	0.30	0.07	0.00	0.00	100.00
3/27/2019	3x	6.81	55.05	0.00	3.02	29.11	55.66	11.21	0.82	0.19	0.00	0.00	0.00	100.00
4/10/2019	3x	6.94	59.35	0.00	3.81	26.38	56.22	12.10	1.08	0.32	0.08	0.00	0.00	100.00
4/24/2019	3x	6.35	59.62	0.00	3.25	32.06	52.93	10.70	0.50	0.48	0.09	0.00	0.00	100.00
5/8/2019	3x	6.66	77.80	0.00	4.23	33.14	48.92	11.79	1.53	0.41	0.00	0.00	0.00	100.00

Kaiser Total Suspended Solids (TSS) Data

Min TSS Level Reported - mg/L (ML):	0.6

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Data		
Sample Date	TSS (mg/L)	% Rem to 1/2 ML
1/2/2018	0.9	66.7%
1/4/2018	0.9	66.7%
1/9/2018	1.5	80.0%
1/11/2018	2.6	88.5%
1/16/2018	1.6	81.3%
1/18/2018	1.3	76.9%
1/23/2018	0.9	66.7%
1/25/2018	1.4	78.6%
1/30/2018	1.9	84.2%
2/1/2018	0.7	57.1%
2/6/2018	1.3	76.9%
2/8/2018	1.2	75.0%
2/13/2018	0.9	66.7%
2/15/2018	1.7	82.4%
2/20/2018	0.7	57.1%
2/22/2018	1.3	76.9%
2/28/2018	2.1	85.7%
3/6/2018	1.3	76.9%
3/8/2018	1.1	72.7%
3/13/2018	1.8	83.3%
3/15/2018	2.1	85.7%
3/20/2018	1.9	84.2%
3/22/2018	2.5	88.0%
3/27/2018	2	85.0%
3/29/2018	2.3	87.0%
4/3/2018	3.9	92.3%
4/5/2018	3.6	91.7%
4/10/2018	1.8	83.3%
4/12/2018	6	95.0%
4/17/2018	2.1	85.7%
4/19/2018	2.1	85.7%
4/24/2018	1.6	81.3%
4/26/2018	1.2	75.0%
5/1/2018	1.3	76.9%
5/3/2018	1.9	84.2%
5/8/2018	2.6	88.5%
5/10/2018	1.1	72.7%
5/15/2018	0.9	66.7%

Data		
Sample Date	TSS (mg/L)	% Rem to 1/2 ML
5/17/2018	1.6	81.3%
5/22/2018	2.5	88.0%
5/24/2018	2.1	85.7%
5/29/2018	2.7	88.9%
5/31/2018	1.6	81.3%
6/5/2018	1.4	78.6%
6/7/2018	1.8	83.3%
6/12/2018	1	70.0%
6/14/2018	1.1	72.7%
6/19/2018	1.9	84.2%
6/21/2018	2	85.0%
6/28/2018	1.6	81.3%
7/3/2018	1	70.0%
7/5/2018	1.6	81.3%
7/10/2018	2	85.0%
7/12/2018	2.2	86.4%
7/17/2018	1.3	76.9%
7/19/2018	1.1	72.7%
7/24/2018	1.8	83.3%
7/26/2018	2.9	89.7%
7/31/2018	1.8	83.3%
8/2/2018	1.8	83.3%
8/7/2018	1.4	78.6%
8/9/2018	1	70.0%
8/14/2018	0.9	66.7%
8/16/2018	2.1	85.7%
8/21/2018	2.4	87.5%
8/23/2018	1.3	76.9%
8/28/2018	1.1	72.7%
8/30/2018	1.6	81.3%
9/4/2018	1.7	82.4%
9/6/2018	1.8	83.3%
9/11/2018	0.6	50.0%
9/13/2018	0.9	66.7%
9/18/2018	0.7	57.1%
9/20/2018	1.6	81.3%
9/25/2018	1.3	76.9%
9/27/2018	1.6	81.3%

Data		
Sample Date	TSS (mg/L)	% Rem to 1/2 ML
10/5/2018	5	94.0%
10/7/2018	5	94.0%
10/12/2018	3	90.0%
10/14/2018	1.6	81.3%
10/19/2018	2.2	86.4%
10/21/2018	1.1	72.7%
10/23/2018	1.1	72.7%
10/25/2018	1.4	78.6%
10/30/2018	2.1	85.7%
11/1/2018	0.7	57.1%
11/6/2018	2.2	86.4%
11/8/2018	0.7	57.1%
11/13/2018	1.3	76.9%
11/15/2018	1.6	81.3%
11/20/2018	1.8	83.3%
11/22/2018	1.4	78.6%
11/27/2018	2.4	87.5%
11/29/2018	1.4	78.6%
12/4/2018	1.7	82.4%
12/6/2018	2	85.0%
12/11/2018	2.1	85.7%
12/13/2018	2.1	85.7%
12/18/2018	1.1	72.7%
12/20/2018	1.5	80.0%
12/25/2018	0.9	66.7%
12/27/2018	1.8	83.3%
1/1/2019	2.1	85.7%
1/3/2019	1.3	76.9%
1/8/2019	3.3	90.9%
1/15/2019	1.5	80.0%
1/17/2019	1.3	76.9%
1/22/2019	1.8	83.3%
1/24/2019	2.8	89.3%
1/29/2019	2	85.0%
1/31/2019	1.7	82.4%
2/5/2019	0.9	66.7%
2/7/2019	1.9	84.2%
2/12/2019	1.8	83.3%

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Data		
Sample Date	TSS (mg/L)	% Rem to 1/2 ML
2/14/2019	1.3	76.9%
2/19/2019	1.4	78.6%
2/21/2019	0.9	66.7%
2/26/2019	1.3	76.9%
2/28/2019	1.4	78.6%
3/5/2019	1.1	72.7%
3/7/2019	1.1	72.7%
3/12/2019	1.9	84.2%
3/14/2019	1.7	82.4%
3/19/2019	1.5	80.0%
3/21/2019	1.7	82.4%
3/26/2019	1.9	84.2%
3/28/2019	2.7	88.9%
4/2/2019	2	85.0%
4/4/2019	2	85.0%
4/9/2019	1.8	83.3%
4/11/2019	7.3	95.9%
4/16/2019	1.7	82.4%
4/18/2019	1.3	76.9%
4/23/2019	2.5	88.0%
4/25/2019	1.8	83.3%
4/30/2019	2.3	87.0%
5/3/2019	2.4	87.5%
5/8/2019	1.9	84.2%
5/10/2019	2.5	88.0%
5/15/2019	2.4	87.5%
5/17/2019	2.1	85.7%
5/22/2019	2	85.0%
5/24/2019	2.9	89.7%
5/29/2019	2.4	87.5%
5/31/2019	1.5	80.0%
6/4/2019	1.7	82.4%
6/6/2019	1.9	84.2%
6/11/2019	1.3	76.9%
6/13/2019	1	70.0%
6/18/2019	2.8	89.3%
6/20/2019	1.6	81.3%
6/25/2019	2.5	88.0%
6/27/2019	1.9	84.2%
7/2/2019	1.9	84.2%
7/4/2019	1.5	80.0%
7/9/2019	2.4	87.5%

Data		
Sample Date	TSS (mg/L)	% Rem to 1/2 ML
7/11/2019	2.1	85.7%
7/16/2019	1	70.0%
7/18/2019	1.7	82.4%
7/23/2019	4.8	93.8%
7/25/2019	13.6	97.8%
7/30/2019	1.5	80.0%
8/1/2019	1.7	82.4%
8/6/2019	2.6	88.5%
8/8/2019	1.4	78.6%
8/13/2019	1.2	75.0%
8/15/2019	3	90.0%
8/20/2019	1.3	76.9%
8/22/2019	1.5	80.0%
8/27/2019	3.2	90.6%
8/29/2019	1.7	82.4%
9/3/2019	1.6	81.3%
9/5/2019	2.8	89.3%
9/10/2019	3.2	90.6%
9/12/2019	3.2	90.6%
9/17/2019	3	90.0%
9/19/2019	2.6	88.5%
9/24/2019	2.2	86.4%
9/26/2019	1.3	76.9%
10/1/2019	1.7	82.4%
10/3/2019	3	90.0%
10/8/2019	4.1	92.7%
10/10/2019	3.2	90.6%
10/15/2019	2	85.0%
10/17/2019	1.9	84.2%
10/22/2019	3.1	90.3%
10/24/2019	2.7	88.9%
10/29/2019	2.8	89.3%
10/31/2019	2.2	86.4%
11/5/2019	2.7	88.9%
11/7/2019	4.5	93.3%
11/12/2019	1.9	84.2%
11/14/2019	2.8	89.3%
11/19/2019	3.5	91.4%
11/21/2019	3.2	90.6%
11/26/2019	4.9	93.9%
11/28/2019	1.9	84.2%
12/3/2019	2.4	87.5%

Data		
Sample Date	TSS (mg/L)	% Rem to 1/2 ML
12/5/2019	1.9	84.2%
12/10/2019	2.6	88.5%
12/12/2019	1.5	80.0%
12/17/2019	3.7	91.9%
12/19/2019	2	85.0%
12/24/2019	1.7	82.4%
12/26/2019	1.5	80.0%
12/31/2019	2.3	87.0%
1/2/2020	1.7	82.4%
1/7/2020	2.8	89.3%
1/9/2020	2.2	86.4%
1/14/2020	2	85.0%
1/16/2020	1.9	84.2%
1/21/2020	1.9	84.2%
1/23/2020	1.2	75.0%
1/28/2020	1.7	82.4%
1/30/2020	1.7	82.4%

Summary Stats	*Removal*
5th Percentile	0.66667
1th Percentile	0.57143
Mean	0.81876
Standard Error	0.00536
Median	0.83333
Mode	0.76923
Standard Deviation	0.07854
Sample Variance	0.00617
Kurtosis	2.06185
Skewness	-1.1943
Range	0.47794
Minimum	0.5
Maximum	0.97794
Sum	176.033
Count	215
Conf Level(95.0%)	0.01056

Concentration Inlet (assumed) unitless	% Removal across WSF	Concentration Outlet of WSF	% Removal to 1/2 ML*	Concentration Final Outlet	Total % Removal
1	60	0.4	57.1	0.1716	82.8%
1	70	0.3	57.1	0.1287	87.1%

* - 1st percentile of % Removals to 1/2 ML