Chemicals and Byproducts of Kraft Pulp Milling

A Plain-Language Guide to Pollutants and Emissions

Citizens for Safe Water and Air - Port Townsend

PORT TOWNSEND, WA

This research has been compiled to the best of our ability from named public sources. If you believe any fact presented here is incorrect or incomplete, please contact safewaterandair@gmail.com so it can be reviewed and corrected.

1. How to Read This Document

This document describes the kraft white liquor unbleached pulp mill process in plain language: what chemicals go in, what happens at each step, and what pollutants come out. It covers air emissions, water discharge, physical pollution, and legacy contamination.

Two types of statements appear throughout each step below. Statements marked as confirmed for Port Townsend Paper Company (PTPC) are drawn from its own public regulatory record: its permits, enforcement documents, and government agency reports. Statements describing the general kraft unbleached mill process may or may not apply exactly as described to PTPC; the public record does not confirm or deny those specific details for this facility.

Two definitions apply throughout. An input pollutant is a substance brought onto the site and used deliberately in the production process. An output pollutant is a substance that leaves the facility, to the air, to the water, or as waste.

2. What PTPC Is

PTPC operates a kraft pulp and paper mill on the shore of Port Townsend Bay, an arm of Puget Sound in Washington State. The mill has operated on this site for nearly a century. It produces unbleached pulp, kraft paper, and containerboard, the corrugated brown cardboard used in shipping boxes.

It operates two production lines: one that processes raw wood chips using the kraft chemical process, and one that repulps old corrugated cardboard for recycling into new containerboard. The mill produces approximately 1,000 tons of product per day and discharges an average of 9.6 million gallons of treated wastewater into Port Townsend Bay every day, approximately 3.5 billion gallons per year. It employs roughly 300 workers. It is owned by Atlas Holdings of Greenwich, Connecticut, which acquired it in October 2022.

3. Why Unbleached Matters for Pollution

The word unbleached is significant. Many kraft pulp mills use chlorine compounds to bleach their pulp white, and that bleaching process generates a class of highly toxic compounds called chlorinated dioxins and furans as byproducts. PTPC does not bleach its pulp. As a result, it does not generate the chlorinated dioxins associated with the bleaching process. This is confirmed by the permit fact sheet.

However, the absence of bleaching does not mean the absence of carcinogens in the discharge. As this document describes, the mill generates a range of toxic and carcinogenic byproducts through the pulping and combustion process itself, and carries legacy contaminants from historic site use. Several of these are confirmed in the treated wastewater that reaches Port Townsend Bay.

4. The Production Process, Step by Step

What follows is a description of the kraft white liquor unbleached pulp mill production process. Each step identifies what goes in, input pollutants, and what comes out, output pollutants. Steps confirmed from PTPC's own public regulatory record are noted as such. All other steps describe the standard industry process and may or may not apply exactly as described to this facility.

Step 1: Wood Chip Delivery and Storage

Logs are delivered to the mill, debarked, and chipped into small uniform pieces roughly the size of a poker chip. The chips are stored in large outdoor piles until needed. At PTPC, raw wood chips are one of the two primary raw material inputs alongside old corrugated cardboard (OCC). The mill processes both.

Input pollutant: wood chips are not themselves toxic, but the storage piles generate runoff containing wood sugars, tannins, natural astringent compounds found in wood, and resin acids, naturally occurring compounds in wood that are acutely toxic to fish at very low concentrations. Rain falling on chip piles can carry these compounds toward surface water. Output pollutant (potential): chip pile runoff containing resin acids and wood extractives if not contained.

Confirmed permit requirement: the 2025 permit requires sediment monitoring near the wood chip receiving dock, confirming that wood chip handling generates sediment contamination in Port Townsend Bay significant enough to warrant ongoing monitoring. Confirmed for PTPC: National Pollutant Discharge Elimination System (NPDES) Permit WA0000922 (2025) confirms kraft pulp production from wood chips and old corrugated cardboard (OCC) repulping. Approximately 1,000 tons per day confirmed by Fox13 News, September 2025, and Washington State Department of Ecology.

Step 2: Cooking the Wood Chips, the Digester

Wood chips are loaded into a large pressure vessel called a digester and cooked at high temperature and pressure, approximately 338 degrees Fahrenheit (170 degrees Celsius in the original source document) and about 100 pounds per square inch (roughly three times the pressure inside a typical car tire), in a chemical solution called white liquor. This is where the name kraft white liquor mill comes from.

White liquor is a highly caustic, meaning severely corrosive, mixture of two industrial chemicals: sodium hydroxide (the active ingredient in drain cleaners) and sodium sulfide (a sulfur compound that reacts aggressively with organic material). Together they dissolve lignin, the natural binding compound in wood that holds the cellulose fibers together, freeing the fibers to become pulp. Input pollutant: sodium hydroxide and sodium sulfide are the primary process chemicals. Both are highly corrosive and acutely hazardous but are not carcinogenic.

A spill of white liquor is a serious acute hazard: contact causes severe chemical burns; ingestion or inhalation is life-threatening. It was a white liquor tank implosion that killed eleven workers at Nippon Dynawave in Longview, Washington on May 26, 2026.

Output pollutant (air): when the cooking is complete, the digester is opened and pressure is released rapidly in a process called blowing. This releases a burst of steam and gases including hydrogen sulfide (the compound responsible for the rotten egg odor associated with kraft mills), methyl mercaptan, dimethyl sulfide, and dimethyl disulfide. These four compounds are collectively known as Total Reduced Sulfur (TRS) compounds. They are the primary source of kraft mill odor and can cause acute respiratory effects at sufficient concentrations.

Output pollutant (water): the cooking process generates what is called spent liquor or weak black liquor, the dark brown liquid that remains after the fibers are separated. It contains dissolved lignin, wood extractives, resin acids, fatty acids, and the spent cooking chemicals.

Output pollutant (byproduct, confirmed in permit): turpentine. Kraft pulping of softwood species releases crude sulfate turpentine as a byproduct when the digester is blown. Turpentine is a volatile, flammable liquid solvent composed primarily of terpenes, naturally occurring organic compounds from pine resin. Average yield from pine species is 11 to 22 pounds per ton of pulp (5 to 10 kilograms per metric ton in the original source). It is toxic to aquatic organisms and flammable at temperatures above 95 degrees Fahrenheit (35 degrees Celsius in the original source document). The 2025 permit specifically requires PTPC to minimize spills of turpentine to the wastewater treatment plant, confirming its presence as a spill risk at this facility.

Confirmed for PTPC: white liquor composition confirmed in Washington State Department of Ecology National Pollutant Discharge Elimination System (NPDES) Permit Fact Sheet WA0000922 (2025). Total Reduced Sulfur (TRS) compound emissions confirmed by Agency for Toxic Substances and Disease Registry (ATSDR) Exposure Investigation (2024), which detected 14 sulfur compounds in air near the facility. Washington State Labor and Industries Press Release 26-07 (June 1, 2026) confirmed white liquor storage and the Longview disaster.

Step 3: Washing the Pulp, Brown Stock Washing

After cooking, the pulp and the spent black liquor are separated. The pulp, which is now brown, not white, because it has not been bleached, is washed with large volumes of water to remove as much of the residual black liquor as possible. This washing step is critical: black liquor that passes through to the wastewater system rather than being captured for recovery increases the pollution load substantially.

At well-designed mills, brown stock washing captures more than 99 percent of the black liquor for recovery. Failures in the washing process, spills, equipment malfunctions, or process upsets, can release black liquor directly into the wastewater stream. Output pollutant (water): wash water containing residual black liquor, dissolved lignin, resin acids, and organic compounds from the cooking process. Biochemical Oxygen Demand (BOD), the measure of how much oxygen bacteria consume breaking down organic waste in receiving water, rises substantially when black liquor enters the wastewater stream.

General kraft unbleached mill process. Whether and how PTPC performs this specific step is not documented in the public record reviewed for this document.

Step 4: The Black Liquor Spill Problem

Black liquor, the spent cooking solution separated from the pulp, is one of the most significant pollution risks at a kraft mill. It is a dark, viscous liquid that contains dissolved lignin, spent cooking chemicals, wood extractives, and a high concentration of organic compounds. Its Biochemical Oxygen Demand (BOD) is extremely high, meaning that if it reaches a receiving waterway it depletes oxygen rapidly, creating conditions that suffocate fish and aquatic life.

In normal operations, black liquor is captured and sent to the chemical recovery system. When the system fails, through equipment malfunction, a spill, or a process upset, black liquor can enter the wastewater treatment system in quantities that overwhelm it, causing permit exceedances for Biochemical Oxygen Demand (BOD) and total suspended solids (particles of material floating in the water).

Confirmed spill history: in early January 2025, approximately 1,000 gallons of condensed water from the plant's steam system spilled into Port Townsend Bay. In April 2025, 114,630 gallons of untreated wastewater were discharged. Washington State Department of Ecology fined PTPC a total of $20,000 combined for both 2025 spills. Mill leadership appealed the penalty. Between November 2021 and March 2022, PTPC spilled approximately 800 gallons of untreated process wastewater and exceeded its permit limits 14 times, resulting in a $27,000 penalty.

Confirmed for PTPC: Washington State Department of Ecology enforcement record confirms that black liquor spill events on April 7 and April 10, 2026 caused six permit limit exceedances: Biochemical Oxygen Demand (BOD) on April 8 and 9, total suspended solids on April 9, 10, 12, and 14. Ecology found the facility failed to follow its own Spill Prevention, Control, and Countermeasure Plan.

Step 5: Concentrating the Black Liquor, Multiple-Effect Evaporators

Before black liquor can be burned in the recovery furnace, its water content must be reduced dramatically. It enters the evaporation system at roughly 15 to 20 percent dissolved solids and must reach approximately 65 to 70 percent dissolved solids before it can sustain combustion. This is achieved through a series of evaporators that use steam to boil off water progressively.

The evaporation process releases steam and gases that contain volatile organic compounds and Total Reduced Sulfur (TRS) compounds. These gases, called non-condensable gases (NCG), are an important source of kraft mill air emissions and odor. Modern mills collect these gases and route them to incineration rather than releasing them directly to the atmosphere. Output pollutant (air): non-condensable gases (NCG) including hydrogen sulfide, methyl mercaptan, dimethyl sulfide, and dimethyl disulfide released during evaporation if not fully collected.

General kraft unbleached mill process. Whether and how PTPC performs this specific step is not documented in the public record reviewed for this document.

Step 6: Burning the Black Liquor, the Recovery Furnace

The concentrated black liquor is sprayed into a large combustion vessel called the recovery furnace, where it burns. The recovery furnace serves two purposes simultaneously: it generates heat and steam that power the mill, and it converts the spent cooking chemicals back into a form that can be recycled into new white liquor. The combustion process produces a molten material at the bottom of the furnace called smelt, which is primarily sodium carbonate and sodium sulfide. When this smelt is dissolved in water it becomes green liquor, which is then processed back into white liquor for the next batch of cooking.

The recovery furnace is the largest single source of air emissions at a kraft mill. Its combustion stack releases particulate matter (fine particles that carry carcinogenic compounds), sulfur dioxide, nitrogen oxides, carbon monoxide, and a range of combustion byproducts including dioxins, furans, polycyclic aromatic hydrocarbons (complex chemical compounds produced when organic material burns incompletely), formaldehyde, and lead compounds. These are all confirmed in PTPC's air emissions records.

The smelt dissolving tank, where molten smelt meets water, is also an emission source, releasing particulates and sulfur compounds. A recovery furnace failure or smelt-water explosion is among the most catastrophic events possible at a kraft mill. Input pollutant: concentrated black liquor, sodium sulfate makeup chemical.

Output pollutant (air): particulate matter (fine particles, some carrying carcinogens), sulfur dioxide, hydrogen sulfide, Total Reduced Sulfur (TRS) compounds, nitrogen oxides, carbon monoxide, dioxins and furans (trace combustion byproducts), formaldehyde (known to cause cancer in humans, the same classification given to tobacco smoke and asbestos), polycyclic aromatic hydrocarbons, lead compounds, hexavalent chromium (also known to cause cancer in humans), and acetaldehyde.

Confirmed for PTPC: recovery furnace confirmed in Air Operating Permit (AOP) and Toxics Release Inventory (TRI) records. The $56,250 air quality penalty issued December 2022 involved recovery furnace emissions: a clog in the emissions treatment system caused the hazardous air pollutant limit to be exceeded on July 6, 2022, undetected for 24 hours. The $342,000 Clean Air Act (CAA) settlement paid May 2019 involved a digester whose emissions were not fully routed to a control device. Carcinogenic air emissions confirmed by Agency for Toxic Substances and Disease Registry (ATSDR) Exposure Investigation (2024) and Toxics Release Inventory (TRI).

Step 7: Regenerating the Lime, the Lime Kiln

The chemical recovery cycle requires lime (calcium oxide) to convert green liquor back into white liquor. In the causticizing process, calcium oxide reacts with sodium carbonate in the green liquor to produce sodium hydroxide (one of the active ingredients in white liquor) and calcium carbonate as a byproduct. That calcium carbonate is then heated in a large rotating cylinder called a lime kiln to drive off carbon dioxide and regenerate the calcium oxide for the next cycle.

The lime kiln burns fuel, historically oil or natural gas, though some modern mills have converted to biofuels. It is one of the three major combustion sources at a kraft mill alongside the recovery furnace and the power boiler. Output pollutant (air): Total Reduced Sulfur (TRS) compounds, particulate matter, nitrogen oxides, carbon monoxide, sulfur dioxide, carbon dioxide. Washington State law, Washington Administrative Code (WAC) 173-405-040, sets specific limits on Total Reduced Sulfur (TRS) emissions

from lime kilns at kraft mills.

General kraft unbleached mill process. Whether and how PTPC performs this specific step is not documented in the public record reviewed for this document.

Step 8: Recycling Old Corrugated Cardboard

PTPC operates a second production line that repulps old corrugated cardboard (OCC), used shipping boxes, into fiber that can be incorporated into new containerboard. This process does not use white liquor cooking. Instead, old cardboard is mixed with water and mechanically broken down into its component fibers.

The repulping process introduces whatever contaminants were present in the recycled cardboard: inks, adhesives, coatings, and trace chemical residues from the materials the boxes previously contained. It also generates wastewater with high fiber content and Biochemical Oxygen Demand (BOD). Output pollutant (water): wastewater from repulping containing fiber, Biochemical Oxygen Demand (BOD) load, and trace contaminants from recycled materials.

Confirmed for PTPC: old corrugated cardboard (OCC) repulping confirmed in Washington State Department of Ecology National Pollutant Discharge Elimination System (NPDES) Permit Fact Sheet WA0000922 (2025) and the 2018 State Environmental Policy Act (SEPA) checklist for the old corrugated cardboard (OCC) pulper upgrade.

Step 9: Treating the Wastewater, Before It Reaches the Bay

All process wastewater from across the mill is collected and treated before discharge. The treatment system is designed primarily to reduce Biochemical Oxygen Demand (BOD), total suspended solids (floating particles), and pH before the water is discharged into Port Townsend Bay. Standard kraft mill wastewater treatment uses a combination of primary physical treatment (screens and settling tanks that remove large particles and suspended solids) and secondary biological treatment (large aeration basins where bacteria consume dissolved organic matter, reducing the biochemical oxygen demand of the water).

What this treatment does and does not do is critically important. It reduces Biochemical Oxygen Demand (BOD) by 85 to 98 percent in a well-designed activated sludge system, plus total suspended solids, fiber content, and some dissolved organic compounds.

It does not meaningfully reduce three cancer-causing compounds: benzo(a)anthracene and chlordane, both classified as probably causing cancer in humans, and pentachlorophenol, classified as a known human carcinogen, the same certainty level as tobacco smoke and asbestos. These three substances survive secondary biological treatment largely intact and are present in the treated wastewater discharged into Port Townsend Bay. This is confirmed by the permit. The permit does not establish that treatment reduces their concentration.

Confirmed for PTPC: wastewater treatment and discharge confirmed in National Pollutant Discharge Elimination System (NPDES) Permit WA0000922 (2025). The presence of carcinogens in treated discharge is confirmed in the permit fact sheet. The characterization of what treatment does and does not remove is drawn from peer-reviewed literature (ScienceDirect, IntechOpen) and the permit fact

sheet itself, which notes no established treatment reduction for these compounds.

Step 10: Discharge Into Port Townsend Bay

After treatment, wastewater is discharged into Port Townsend Bay through a 1,200-foot outfall pipe at Glen Cove. The average discharge volume is 9.6 million gallons per day, approximately 3.5 billion gallons per year. This is the water that carries the confirmed pollutants described later in this document into the bay.

In the 2025 permit renewal process, PTPC requested permission to increase its discharge by approximately 7 percent and to increase total suspended solids by approximately 2 percent. The request was made at the same time carcinogen limits were being imposed in the permit for the first time. The outfall pipe at Glen Cove has been described as aging by journalist Scott Doggett of the Port Townsend Leader. When asked how old the pipe was and whether PTPC would replace it, Crown Paper Group declined to answer.

Port Townsend Bay is a semi-enclosed marine body with limited tidal exchange. Pollutants entering the bay tend to remain longer than they would in open water, concentrating in sediments, accumulating in organisms, and moving up the food chain. Confirmed for PTPC: discharge volume confirmed in National Pollutant Discharge Elimination System (NPDES) Permit WA0000922 (2025). Semi-enclosed bay characteristics confirmed in permit fact sheet dilution modeling.

5. Confirmed Output Pollutants: What Reaches Port Townsend Bay and the Surrounding Air

The following pollutants are confirmed in the public record for PTPC. Every entry cites its source. This section is organized by where the pollutant goes: water discharge to Port Townsend Bay, or air emissions to the surrounding community.

Water Discharge: Confirmed Pollutants in Treated Wastewater

Source for all water discharge entries: Washington State Department of Ecology National Pollutant Discharge Elimination System (NPDES) Permit Fact Sheet, Permit Number WA0000922, effective June 1, 2025 (240 pages), unless otherwise noted.

Note on this section: the source material reviewed for this rebuild preserved the section heading and citation above but did not preserve the itemized compound-by-compound data table (specific pollutant names, concentrations, and permit limits) that this heading refers to. Rather than estimate or reconstruct those figures, they are omitted here. Readers should consult National Pollutant Discharge Elimination System (NPDES) Permit WA0000922 (2025) directly for the complete water discharge pollutant table.

Air Emissions: Confirmed Pollutants Released to the Atmosphere

Sources: Agency for Toxic Substances and Disease Registry (ATSDR) Exposure Investigation published June 2024 (data from 2018); United States Environmental Protection Agency (EPA) Toxics Release Inventory (TRI); PTPC Air Operating Permit (AOP); Washington State Department of Ecology enforcement records.

Note on this section: as with the water discharge section above, the source material preserved this heading and its citations but not the underlying itemized pollutant-by-pollutant data table. That table is not reconstructed here. Readers should consult the cited Agency for Toxic Substances and Disease Registry (ATSDR) Exposure Investigation and Toxics Release Inventory (TRI) records directly for the complete air emissions pollutant data.

Input Pollutants: What the Mill Deliberately Brings On Site

Input pollutants are chemicals brought onto the facility and used deliberately in the production process. At a kraft white liquor unbleached mill, the primary process chemicals are not themselves carcinogenic; the carcinogens associated with this facility arise as byproducts of the process, not as raw materials. This distinction is important and confirmed in the permit fact sheet.

6. What the Science Shows: Peer-Reviewed Research on Kraft Mill Effluent

The following findings come from peer-reviewed scientific research, studies published in named scientific journals and reviewed by independent scientists before publication. These studies examine the effects of kraft pulp mill wastewater on aquatic life and human health. They are not specific to PTPC except where noted. They represent the scientific consensus on what this category of wastewater does to marine environments.

Fish Reproduction and Endocrine Disruption

The most extensively documented biological effect of kraft mill wastewater is disruption of fish reproduction. More than 30 years of peer-reviewed research across North America, Scandinavia, and New Zealand have established that pulp and paper mill wastewater affects fish reproduction through endocrine disruption: interference with the hormonal systems that control reproduction, growth, and sexual development.

The landmark Jackfish Bay study, conducted over 30 years at a bleached kraft mill on Lake Superior in Canada, documented reduced sex steroid hormone levels, delayed sexual maturation, reduced gonadal sizes, altered circulating sex steroid hormones, and changes in liver and body condition in white sucker fish. These effects persisted for decades even after the installation of secondary wastewater treatment.

A 2008 review by Hewitt et al. published in Environmental Toxicology and Chemistry examined 20 years of studies in North America, Scandinavia, and New Zealand. It confirmed that both bleached and unbleached kraft mill effluent affect fish reproduction. Unbleached kraft mill effluent specifically caused reductions in circulating testosterone concentrations in rainbow trout at concentrations as low as 1 percent of river flow.

A study of longear sunfish in the Pearl River, United States, found that unbleached kraft and recycled pulp mill effluent suppressed female reproductive hormone levels when effluent made up 1 percent or more of river flow. The compounds responsible for endocrine disruption in kraft mill wastewater include resin acids, naturally occurring compounds released from wood during pulping, confirmed in the discharge from PTPC and acutely toxic to fish at concentrations below 1 milligram per liter.

Hydrogen Sulfide Health Effects: Pulp Mill Communities

The Agency for Toxic Substances and Disease Registry (ATSDR) Toxicological Profile for Hydrogen Sulfide documents its health effects in detail. Effects at increasing concentrations: detectable by smell at 0.13 to 0.15 parts per million; respiratory, eye, and throat irritation at 100 parts per million; paralysis of the olfactory nerve (the loss of the ability to smell the gas) at 150 parts per million; coma at 1,000 parts per million; death at higher concentrations from respiratory arrest within minutes.

A peer-reviewed study of a pulp mill community in South Karelia, Finland found that during days of strong sulfur compound emissions from the mill, 63 percent of nearby residents reported at least one symptom, compared to 26 percent during reference periods. Symptoms included headaches, eye irritation, nausea, and respiratory effects.

Polycyclic Aromatic Hydrocarbons: Bioaccumulation in Seafood

Polycyclic aromatic hydrocarbons accumulate in marine sediments and build up through the food chain. Bottom-dwelling marine animals including crabs, clams, and mussels accumulate these compounds at higher concentrations than fish, because they live in direct contact with contaminated sediment.

The 2014 Washington Department of Fish and Wildlife crab tissue study found polycyclic aromatic hydrocarbon contamination in Port Townsend Bay crabs at concentrations comparable to Seattle and Tacoma urban waters. Higher molecular weight polycyclic aromatic hydrocarbons, including benzo(a)anthracene, are more persistent, less readily broken down, and more carcinogenic than lower molecular weight compounds, and persist in marine sediment for years to decades.

7. Physical Pollution: Beyond Individual Chemicals

Not all pollution is chemical. The term pollutant in environmental law covers physical conditions that harm aquatic life and receiving water quality, not just specific chemical compounds. The following physical pollution parameters are part of PTPC's permitted discharge and are confirmed in the public record.

Thermal Discharge: Heat in the Water

Industrial processes generate substantial heat, and cooling water that has absorbed that heat is discharged into receiving water. Elevated water temperature reduces the amount of dissolved oxygen the water can hold and affects the metabolism, behavior, and reproduction of fish and aquatic organisms. Pacific salmon, present in the waters around Port Townsend, are particularly sensitive to water temperature changes. The permit includes temperature limits at the discharge point.

Color: The Dark Tint of the Water

The treated wastewater carries dissolved lignin compounds that give it a characteristic dark brown or black tint. Colored water blocks sunlight from penetrating to aquatic plants and photosynthetic organisms on the bay floor. Color is not individually regulated in the current permit as a separate parameter.

Odor: A Measurable Community Impact

The odor produced by kraft pulping is a measurable community health and quality-of-life impact. Between 2016 and 2021, nearly 2,000 odor complaints were recorded by Washington State Department

of Ecology and PTPC. The Agency for Toxic Substances and Disease Registry (ATSDR) confirmed in 2024 that the sulfur compounds responsible for the odor can cause acute respiratory effects in nearby residents when multiple compounds spike simultaneously.

8. The On-Site Landfill: Solid Waste Pollution Pathway

PTPC operates an approximately 25-acre landfill on its southern tract of land, adjacent to the mill site. This is a solid waste pollution pathway entirely separate from the water and air permits. It is not regulated by either the National Pollutant Discharge Elimination System (NPDES) permit or the Air Operating Permit (AOP).

The landfill receives approximately 7,000 dry tons of boiler ash and lime grits annually, the solid residues from the recovery furnace and the lime kiln. The combination is highly alkaline, with a pH of 12 or higher, comparable to household bleach in alkalinity, which can affect the chemistry of surrounding soil and groundwater. The landfill is classified as an inert landfill for regulatory purposes, the only active ash landfill in Washington State with that classification. PTPC maintains groundwater monitoring wells at the site and holds $790,500 in a trust account for future landfill closure and post-closure costs.

Sources and Citations

All factual claims in this document are drawn from the following sources, verified during research for this document.

1. Washington State Department of Ecology: National Pollutant Discharge Elimination System (NPDES) Permit WA0000922 and Permit Fact Sheet, effective June 1, 2025 (240 pages).

2. Washington State Department of Ecology: Air Operating Permit (AOP) WA0000922.

3. United States Environmental Protection Agency (EPA) Toxics Release Inventory (TRI): Port Townsend Paper Company (PTPC) facility data.

4. Agency for Toxic Substances and Disease Registry (ATSDR): Port Townsend Paper Company (PTPC) Exposure Investigation, published June 2024.

5. Washington State Department of Ecology: Enforcement records including Notice of Violation Docket 24681, June 4, 2026; air quality penalty December 14, 2022.

6. United States Environmental Protection Agency (EPA): Clean Air Act (CAA) Consent Agreement, penalty $342,000, May 20, 2019.

7. Washington State Department of Ecology: April 2025 wastewater spill enforcement record.

8. Washington State Labor and Industries: Press Release 26-07, June 1, 2026.

9. Washington Department of Fish and Wildlife: 2014 Crab Tissue Study, Marine Area 7.

10. International Agency for Research on Cancer (IARC): Monograph Volume 117 (2016); Monograph Volume 79 (2001).

11. United States Environmental Protection Agency (EPA) Integrated Risk Information System.

12. World Health Organization (WHO): Dioxins and their effects on human health, fact sheet November 2023.

13. Quinn et al., Environmental Toxicology and Chemistry, 2003.

14. ScienceDirect review, Treatment of pulp and paper mill wastewater (2004).

15. Washington Administrative Code (WAC) 173-405-040.

16. City of Port Townsend and Port Townsend Paper Company (PTPC): Water Supply Agreement, December 30, 2021.

17. Smoky Mountain News, February 24, 2021.

18. Ussery et al., Frontiers in Endocrinology, 2021, PMC 8101260.

19. Hewitt et al., Environmental Toxicology and Chemistry, 2008.

20. Agency for Toxic Substances and Disease Registry (ATSDR): Toxicological Profile for Hydrogen Sulfide.

21. Haahtela et al., American Journal of Public Health, 1992.

22. LocalWiki Port Townsend; Port Townsend Leader, November 2018.

23. EIN Presswire, May 17, 2022.

24. Radio Pacific, September 19, 2025.