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CLASS II INSPECTION OF WEYERHAEUSER, LONGVIEW PULP AND PAPER MILL

April 16-18, 1990

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ABSTRACT

Ecology conducted a Class II Inspection at the Weyerhaeuser, Longview Pulp and Paper Mill on April 16-18, 1990. Sediments were collected from the outfall area on April 10, 1990. The mill was operating within permit parameters at the time of the inspection. Hexavalent chromium was found in the effluent at levels exceeding acute and chronic Water Quality Criteria. No effluent toxicity was indicated in rainbow trout, fathead minnow or Microtox® bioassays. NOECs and LOECs of 30% and 100%, respectively, for both survival and reproduction were reported for *Daphnia magna*. Sediments showed very little contamination and no toxicity was indicated by Microtox® or *Hyalella azteca*. No deficiencies were observed in the laboratory review. BOD_5 agreement between laboratories was excellent, although TSS agreement was not good. Analysis of Radakovitch landfill leachate and R-W Paper plant runoff into Longview Ditch 3 did not indicate any problems in these areas.

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INTRODUCTION

A Class II Inspection of the on-site wastewater treatment plant (WTP) at Weyerhaeuser's pulp and paper mill in Longview, Washington, was conducted on April 16-18, 1990. As part of the inspection, sediment samples were collected on April 10, 1990, from areas near the mill outfall. The inspection was conducted by Jeanne Andreasson, Marc Heffner, and Keith Seiders of the Department of Ecology (Ecology) Compliance Monitoring Section. Stewart Lombard from Ecology's Quality Assurance Section evaluated the mill's laboratory procedures. The inspection was originally requested by Frank Meriwether, formerly of Ecology's Industrial Section. Jim Yount, Senior Process Engineer, represented Weyerhaeuser and provided assistance. The mill's WTP is a secondary treatment (activated sludge) facility which discharges continually into the Columbia River at an approximate rate of 53 MGD. Weyerhaeuser, Longview was discharging under NPDES Permit No.000012-4. This permit expired October 7, 1990.

Objectives of the Inspection

1. Assess plant compliance with NPDES permit effluent limits at outfall 001/002, outfall 005, and the on-site chlorine plant.

2. Characterize priority and non-priority pollutants in industrial in-plant waters and treated mill effluent.

3. Determine the removal efficiency achieved with secondary treatment of industrial streams.

4. Characterize priority and non-priority pollutants in sediments near the 001/002 outfall.

5. Evaluate any toxicity in the 001/002 effluent and the sediments using several bioassays.

6. Review lab procedures at the mill to determine adherence to accepted protocols.

7. Characterize any priority pollutants in the Radakovitch landfill leachate.

8. Characterize any priority pollutants in the R-W Paper plant drainage into Longview Ditch #3.

9. Advance the state-of-the-art of compliance inspections by contributing to the ongoing developmental efforts with centrifugation.

LOCATION AND DESCRIPTION

Weyerhaeuser's Longview Pulp and Paper mill is located at the intersection of Industrial Way and Washington Way in Longview, Washington, and discharges into the Columbia River about two miles downstream of the Lewis and Clark Bridge (Figure 1). Off-the-machine production is approximately 3000 tons per day and includes paperboard, corrugating medium, newsprint, and fine paper. Unbleached kraft, bleached kraft, and thermomechanical paper making processes are used. The mill is authorized to receive and treat discharges from Interox America and Pfizer Specialty Minerals, Inc.

Process mill waste streams are treated with combinations of primary and secondary treatment. F and D sump flows, as well as the NORPAC, R-W Paper plant and Pfizer plant discharges receive both primary and secondary treatment. A+C sump flows and the Interox America plant discharge receive secondary treatment only. Permit compliance for biochemical oxygen demand (BOD_5) and total suspended solids (TSS) is based on the flow from secondary treatment and is measured just above the juncture of the secondary effluent with the outfall collection box (see outfall 001/002 on Figure 2).

B sump flow (non-contact cooling water) and the filter plant backwash enter the outfall collection box without treatment. The discharge from the on-site chlorine plant must meet permit requirements for total chlorine residual (TCR), copper, lead, nickel, and TSS before combining with the flow from B sump.

Effluent from the collection box is discharged through adjacent 54 and 48-inch pipes which extend 700 ft and 1200 ft, respectively, into the Columbia River. Probes in the pipes continuously monitor effluent pH and temperature for permit compliance just prior to discharge to the river. (Note that TSS and BOD_5 are measured on the secondary effluent, while pH and temperature are measured on the total effluent.)

The primary and secondary clarifier sludges are dewatered prior to disposal. Some primary sludge is composted on site. The remainder is combined with dewatered secondary sludge and disposed of at the Radakovitch landfill. The landfill leachate is trucked back to the mill where it is recycled into the WTP at D sump (Figure 2).

Sanitary waste is treated by an on-site sewage plant and must meet permit limits for BOD_5, TSS, pH, fecal coliform numbers, and chlorine residual. Treated sewage is discharged to the Columbia River at outfall 005.

Run-off from the R-W Paper plant parking lot does not enter the WTP system but flows instead directly into Longview Ditch #3. The Longview Ditch System is included on the "short list" of waterbodies designated by Section 304(l) of the Federal Clean Water Act of 1987, due to metals (lead, zinc, cadmium, and copper) and cyanide contamination. The "short list" contains waterbodies which are not expected to meet all applicable standards for certain toxic pollutants, due substantially to point source discharges, after current technology-based control requirements have been met.

METHODS

A complete listing of sampling stations, dates and parameters is presented in Table 1. Sample locations are noted on Figures 2 (plant) and 3 (sediments).

Ecology collected 24-hour composite samples of effluent and in-plant streams with ISCO automatic samplers set to collect approximately 330 milliliters every 30 minutes. The ISCOs were also used to collect two concurrent 4-hour composite samples for dioxin/furan analysis (330 milliliters every 6 minutes). Sample collection jugs were continually iced to cool samples as they were collected. The sampling equipment (glass collection jugs, tubing, strainers and stainless steel beakers) was specially cleaned using the following protocol:

1. Wash with laboratory detergent
2. Rinse several times with tap water
3. Rinse with 10% HNO_3
4. Rinse three times with distilled/deionized water
5. Rinse with high purity methylene chloride
6. Rinse with high purity acetone
7. Allow to dry and seal with aluminum foil

Ecology collected 001/002 effluent composite and grab samples from a sampling access hole in the secondary effluent pipe just above the junction of the pipe and the outfall collection box. Grab samples were obtained by pumping the effluent through the ISCO sampler directly into sample containers. An additional three-part 001/002 grab-composite was obtained over a 24-hour period for bioassay analyses. Weyerhaeuser collected their routine daily 001/002 composite at the same site. The effluent composites were split for analysis by each lab.

A total effluent composite, which consisted of 001/002 effluent plus B-sump discharge, filter plant backwash water and chlorine plant discharge, was collected at the pH and temperature probe access holes in the outfall pipes (grab samples were obtained from nearby taps in the pipes). Sample containers were half-filled with sample from one pipe, then topped off with sample from the other pipe.

At the time of the inspection, activated sludge from the secondary clarifiers was being recycled into the lower outer discharge channel of the primary clarifier. In order to obtain a sample representative of primary effluent, samples were collected near the discharge from the primary clarifier before it overflowed the saw-toothed weir into the lower outer channel. Grab samples were obtained by holding sample containers in the weir overflow.

A+C sump discharge was sampled from a rubber hose coming off a tap on the A+C line above where the sump discharge entered the secondary treatment system. The hose was allowed to fill and overflow a large stainless steel beaker (set above a manhole) from which the 24-hour composite and 4-hour composite (discussed below) samples were collected. Grab sample containers were filled directly from the hose.

Concurrent 4-hour automatic composites of A+C sump effluent and primary influent were collected specifically for dioxin/furan analysis. Primary influent was collected at the influent Parshall flume. Grab samples of each were collected at the end of the 4-hour compositing period for adsorbable organic halides (AOX) analysis.

Chlorine plant discharge samples were collected at the chlorine plant sump. Grab samples were pumped through the ISCO sampler directly into sample containers.

Grab samples of the Radakovitch landfill leachate were collected from the truck as it discharged the leachate into D sump. R-W Paper plant run-off grab samples were taken at the culvert where the run-off entered the Longview Ditch system.

Sewage treatment plant effluent grab samples were collected to determine compliance with permit parameters at outfall 005. Two samples were collected an hour apart to determine short term variability. Flow measurements were made at the V-notch weir.

Composite sediment samples and grab water samples were collected in and around the outfall area in the Columbia River (Figure 3). Sediment samples were collected using a 0.1 m^2 van Veen grab sampler following Puget Sound Protocols (Tetra Tech, 1986). Sediment sample S-1 and the corresponding water sample W-1 were collected near the end of the diffuser section on the 54" outfall pipe. Samples S-2 and W-2 were collected at the downstream edge of the dilution zone, approximately 300 feet from the diffuser and 300 feet from shore. Background samples (S-3 and W-3) were collected approximately 4500 feet upriver and 300 feet from shore.

Samples for analysis by Ecology were placed on ice and shipped to the Ecology/EPA Laboratory in Manchester. The analytical methods employed for the Ecology samples are listed in Table 2, along with the laboratory performing the analysis.

Effluent particulate matter was collected using two Alfa Laval bowl type continuous centrifuges (model WSB/MAB 103) following procedures described by Andreasson (1991). A small peristaltic pump was used to pump effluent from the 001/002 effluent location to the centrifuges. The centrifuges were cleaned prior to sampling following procedures described by Seiders (1989). Grab composite samples of primary and return activated sludge (RAS) were collected in conjunction with the centrifuge samples to investigate their possible use as surrogates for effluent particulate matter.

Data Quality Assurance

Sampling

A determination of wastewater sampling equipment contamination was made using field transfer blanks. Base neutral acid extractables (BNAs), pesticide/polychlorinated biphenyls (PCBs), cyanide, AOX, and metals transfer blanks were prepared by pumping a 1 liter rinse of deionized organic free water (obtained from the Ecology Manchester Laboratory prior to the inspection) through a clean compositor, discarding the rinse and then pumping six liters of the water through, and transferring the water to appropriate sample containers. Volatile organics (VOA) blanks were prepared by transferring deionized organic free water directly into sample containers.

No cyanide, VOAs or pesticide/PCBs were detected in the transfer blank. Low levels of two phthalate BNAs di-n-butyl and bis(2-ethylhexyl) were found (Appendix C). AOX was measured at high levels (5.2 mg/L) in the field transfer blank and residual organic cleaning solvents in the compositor and sampling equipment are suspected of being the cause. Since all AOX samples were obtained as grab samples, the AOX blank should have been prepared by direct transfer of organic free water to the sample container rather than by pumping water through the compositor.

Total recoverable copper, zinc, and mercury were detected at 3.9, 18 and 0.04 μg/l, respectively, in the transfer blank, however, copper and zinc were measured at comparable levels (4.5 and 2.3 μg/l Cu and 9.9 and 10 μg/l Zn) in the laboratory method blank (total recoverable) as well indicating that the copper and zinc contamination probably occurred at the laboratory. Copper was also detected at 2 μg/l in the total metals laboratory method blank.

Analysis (General)

Laboratory quality assurance and quality control (QA/QC) methods which were followed during the analyses of general chemistry parameters and priority pollutants are described by Kirchmer (1988), and Huntamer and Smith (1988). Recommended holding times were met for all analyses.

An independent QA/QC evaluation of the dioxin/furan analysis was conducted by Alta Analytical Laboratory Inc. of California. They concluded that: the initial and continuing calibrations were within the EPA Method 8290 limits; all column performance check standards were present and acceptable; all isotopic abundance ratios and internal standard recoveries were within their respective limits; calculations of amounts and detection limits were correct; and the results were valid as reported by Triangle Laboratories.

Matrix Spike/Matrix Spike Duplicate Analysis

Matrix spike and matrix spike duplicate (MS/MSD) results for water and sediment organics and metals are given in Appendix A. Organic results are not qualified based on MS/MSD results as recommended by Kirchmer, 1988. Some metals results are qualified based on spike recoveries as discussed below.

Organics

Volatile organic MS/MSD results indicate the possibility of not detecting the presence of vinyl acetate in either water or sediments, and methylene chloride and acetone in sediments. Nine BNA spikes were poorly recovered or not recovered at all from water samples (4-chloroaniline, 1-methylnaphthalene, 3-nitroaniline, 4-nitrophenol, 4-nitroaniline, N-nitrosodiphenylamine, carbazole, retene and 3,3'-dichlorobenzidine). Eight BNA spikes were unsatisfactorily recovered from sediment samples (benzyl alcohol, benzoic acid, 1-methylnaphthalene, hexachlorocyclopentadiene, N-nitrosodiphenylamine, carbazole, retene and 3,3'-dichlorobenzidine). Pesticide/ PCB recoveries indicated no systematic problems in either water or sediment sample analysis.

Dioxin/furan testing did not include MS/MSD analysis.

Guaiacol/catechol/phenolic (GCP) and resin/fatty acid (RFA) recoveries indicated no systematic problems in water sample analysis, however, sediment GCP results indicate the possibility of not detecting tetrachlorocatechol and sediment RFA results indicate the possibility of not detecting palustric acid, abietic acid, and neoabietic acid.

Metals

Metals spike recoveries for arsenic and hexavalent chromium in water samples were low, resulting in the data being flagged by the laboratory as estimates (J qualifier). Silver was not recovered from digested matrix spikes although it was recovered from a post-digestion spike at 94%. The silver data for water samples has been flagged as unusable (R qualifier).

Although the spike recoveries were somewhat low for two sediment metals (antimony and lead), the laboratory considered these results as well as all other sediment metals results acceptable without qualification.

Surrogate and/or Internal Standard Recoveries

Volatile organic surrogate recoveries were within the Contract Laboratory Program (CLP) limits for all water samples (Appendix A). Sediment surrogate volatile recoveries were high and outside the CLP limit for two of four surrogates on all samples. The high recoveries would indicate that the concentrations of volatiles detected in the sediments may be overestimated.

BNA surrogates were generally well recovered. D14-Terphenyl recovery was low and outside CLP limits on the primary effluent sample indicating that some BNAs in this sample may be present at somewhat higher levels than reported. Conversely, the 2-Fluorophenol recovery was high and outside the CLP limit on the A+C sump sample as well as the MS/MSD samples for the outfall 001/002 indicating that some BNAs in these samples may be lower than reported. All other water and sediment BNA surrogate recoveries were within the CLP limits.

Recovery of the CLP pesticide/PCB surrogate, dibutylchlorendate, was within the advisory limits for all water and sediment samples with the exceptions of the Weyerhaeuser composite effluent sample which had an interfering substance and the transfer blank which was very slightly above the upper limit. The other surrogate routinely used by Manchester, octachloronaphthalene, is not a CLP surrogate. Recoveries are reported for informational purposes and varied widely among samples (from 10% to 140%).

Dioxin internal standard recoveries and isotopic abundance ratios were all within their respective limits.

The non-priority pollutant organics (GCPs and RFAs) surrogate recoveries appear to be quite reasonable.

Generally speaking, no surrogate recoveries for organics were less than 10% indicating a low probability of not detecting a compound.

Bioassays

The rainbow trout, Microtox®, *Daphnia magna*, fathead minnow, and *Hyalella azteca* bioassays were completed using laboratory controls and reference toxicants where appropriate. Rainbow trout and *Daphnia* laboratory controls had a survival of 100%, fathead minnow control survival was 86.7% and *Hyalella* control survival was 90.7%. In addition, no toxicity (reduction in bacterial luminescence) was observed for the laboratory control in the Microtox® test. The reference toxicants yielded responses normally observed for fathead minnow, *Hyalella* and Microtox® (Stinson, 1990, Stinson, 1990a, Stinson, 1990b and Stinson, 1990c.)

RESULTS AND DISCUSSION

Comparison of Inspection Results to NPDES Permit Requirements

Outfall 001/002

The WTP was operating within the permit requirements for daily average and daily maximum BOD_5 and TSS loads. Naphthalene, 4-nitrophenol, 2-nitrophenol and pentachlorophenol were all undetected at levels below those required in the permit. The pH was within the required range.

Outfall 005

The sewage treatment plant was operating within the permit requirements for daily average and daily maximum BOD_5 and TSS concentration and load. The chlorine residual and pH were within the required range. Fecal coliform bacteria was not detected in the sample taken. Flow measurements made at the V-notch weir indicated that the flow was being accurately measured.

Chlorine Plant Discharge

Analysis of the chlorine plant discharge showed it to be meeting permit requirements. Total residual chlorine was measured at 0.18 mg/L (5.3 lb/day). TSS was undetected at 1 mg/L (29 lb/day) and copper (total) was estimated at a blank corrected value of 0.3 μg/l (0.009 lb/day). Mercury (not a permit parameter) was detected at an estimated concentration of 0.048 μg/l (0.0014 lb/day). Note that mercury was also measured in the transfer blank at 0.04 μg/l.

Table 4 summarizes NPDES permit limits for outfalls 001/002, 005, and the chlorine plant, and compares them to Ecology's inspection results.

Characterization of Priority and Non-priority Pollutants in Effluent and In-plant Streams

Priority Pollutant Organics

Chloroform was found in the effluent at 1/3 the lowest observable effect concentration (LOEC) for acute toxicity stated in EPA's Water Quality Criteria gold book (EPA, 1986). Bromodichloromethane and 2,4,6-trichlorophenol were also detected in the effluent, but at very low levels (Table 5). The complete results of the VOA, BNA, and pesticide/PCB analyses are contained in Appendices B-D.

2,3,7,8 tetrachlorodibenzo-*p*-dioxin (also known as dioxin or TCDD) is being proposed as a permit parameter with the proposed point of compliance being the combined bleach plant effluent. Since the plant does not have a suitable sampling point for combined bleach plant effluent, samples were collected at the A+C sump (containing the acid bleach effluent) and the primary influent (containing the alkaline bleach effluent from D sump).

TCDD was measured in the 4-hour A+C sump composite sample at 0.03 parts per trillion (ppt) which corresponds to a loading of 1.7 mg/day at an A+C sump flow rate of 15.2 MGD.

TCDD was not detected in the primary influent sample. However, increased noise in the analytical signal necessitated increasing the estimated detection limit (also referred to as the estimated maximum possible concentration or EMPC) from 0.005 to 0.02 ppt for TCDD in the primary influent. At a primary influent flow rate of 31.3 MGD, and an EMPC of 0.02 ppt, TCDD loadings in the influent below 2.4 mg/day would not be detectable. Table 6 shows the complete dioxin/furan results for the primary influent and the A+C sump.

Non-Priority Pollutant Organics

Other organic analyses conducted were AOX, phenolics (4-AAP method), guaiacols/catechols/ phenolics and resin/fatty acid analysis on effluent and in-plant streams. AOX loading at outfall 001/002 was 5,115 lb/day based on an AOX concentration of 13.85 mg/L (average of two grabs) and a flow rate of 44.3 MGD. Detected compounds are listed in Table 7 and complete results are given in Appendices F and G.

Priority Pollutant Metals

Hexavalent chromium exceeded both acute and chronic Water Quality Criteria in all effluent samples (EPA 1986 and Table 8). The Ecology composite 001/002 effluent zinc sample (blank corrected) exceeded chronic criteria. The Weyerhaeuser composite 001/002 zinc analysis exceeded both acute and chronic criteria, but is not in agreement with other effluent zinc analyses and may be suspect. Given the dilution of the effluent by the Columbia River, hexavalent chromium and zinc would not be expected to have a receiving water impact. Due to the analytical method used at the laboratory, many of the metals had quantitation limits above the Water Quality Criteria, and are of little use in determining if criteria were being met. The silver analysis was considered invalid due to poor matrix spike recoveries.

Removal Efficiency of Secondary Treatment

In Table 9, a combined "secondary influent" concentration is calculated for all pertinent parameters by attributing 65.3% of the flow to the primary effluent and 34.7% of the flow to A+C sump. Since the recycled flow of activated sludge to the primary influent was small (0.29 MGD recycle vs 31.3 MGD primary influent), it was not considered in the calculations. Significant BOD_5 removal (96%) was achieved with secondary treatment. TSS removal, based on Ecology's 001/002 composite result (28 mg/l), was 57%, however, TSS composite 001/002 effluent results varied from 10 mg/l to 51 mg/l (corresponding to removal efficiencies between 84% and 21% respectively) depending on sampler and laboratory. AOX was reduced by 54%. This agrees well with the figure of 50% expected AOX reduction for activated sludge secondary treatment cited by Yee (1990). Phenolics (4-AAP method) were significantly reduced with secondary treatment (99%).

Priority pollutant organics found in the combined "secondary influent" were reduced to non-detectable levels for all but two compounds. Chloroform, which was present at a toxic levels in the secondary influent, was reduced by 87% to non-toxic levels in the secondary effluent. 2,4,6-Trichlorophenol was found at 9 μg/L in the influent and remained at virtually the same level (8 μg/L) following secondary treatment.

Guaiacols/catechols/phenolics were reduced in all cases, with 19 of 25 being reduced by more than 85%. Resin/fatty acids were generally reduced; however, only 3 of 14 were reduced by at least 85%. Two resin/fatty acids (palmitoleic acid and hexadecanoic acid) were detected at higher concentrations in the secondary effluent than in the "secondary influent".

Chromium and copper were reduced by 63% and 54%, respectively, with secondary treatment. Hexavalent chromium and zinc were not significantly reduced.

Effluent Bioassays

No acute effluent toxicity was indicated in either the rainbow trout bioassay with 100% survival in 65% effluent, or the fathead minnow survival test with a no observed effects concentration (NOEC) of 100%. The chronic portion of the fathead minnow test also indicated no toxicity with an NOEC of 100% for mean weight.

No toxicity was shown by the Microtox® (EC_{50} > 100%).

The *Daphnia magna* bioassay indicated some acute and chronic toxicity with NOECs and LOECs (lowest observed effect concentration) of 30% and 100% respectively for both survival and reproduction (Table 10).

Sediment Chemistry

Only three priority pollutant organics were detected in the sediment samples and at very low levels. Carbon disulfide, chloroform, and isophorone were found at levels <5 ppb. No guaiacols/catechols/phenolics were found at measurable levels. Three resin/fatty acids (isopimaric, dehydroabietic, and abietic acid) were found at <40 µg/kg (Table 11). The sediment samples collected consisted mainly of sand. Grain size analysis of the sediments and total organic carbon content are included in Table 11b.

Sediment Bioassays

Hyalella and Microtox® bioassays indicated no toxicity in any of the sediment samples. Data are included in Appendix I.

Laboratory Review and Split Sample Comparison

Stewart Lombard from Ecology's Quality Assurance Section evaluated the laboratory and procedures and found no deficiencies. His evaluation is included in Appendix J. The WTP laboratory results (including results from Longview and the Weyerhaeuser Technology Center) for general chemistry, including permit parameters, are presented, along with Ecology's results in Table 12a. There was perfect agreement among laboratories on BOD_5 analysis. TSS analyses varied considerably among the laboratories with a range of 10 - 51 mg/L. The sample collected by the Weyerhaeuser compositor appeared to have a higher TSS content. The reason for this is not clear since both samplers were set up at the same 001/002 location.

Priority pollutant organics (VOAs and BNAs) detected in the wastewater and/or sediments by at least one laboratory are listed in Table 12b along with the analytical results. Voa agreement is generally good although acetone (a common laboratory solvent) was measured in the 001/002 outfall sample by Weyerhaeuser but not by Ecology. The BNA analyses showed greater variability. Weyerhaeuser detected higher levels of several phenolic compounds, benzyl alcohol and benzoic acid in some samples. The Weyerhaeuser laboratory wastewater dioxin results were not received. No sediment dioxin was detected by either laboratory.

Guaiacols/catechols/phenolics and resin/fatty acids analyzed in wastewater and/or sediments by both laboratories are listed in Table 12c. Quantitation levels are quite different between laboratories, but agreement is acceptable for guaiacols/catechols/phenolics with a few exceptions (4,5-dichlorocatechol and tetrachlorocatechol). Ecology was able to detect more resin/fatty acids at the lower concentrations present in the 001/002 effluent, while Weyerhaeuser generally measured higher concentrations of resin/fatty acids than Ecology in the primary effluent sample.

Agreement was generally good for metals analyses (Table 12d) although differences in detection levels prevent some comparisons.

There was good agreement in bioassay results and these are shown on Table 12e.

Radakovitch Landfill Leachate

Low levels of two organic priority pollutants were found in the Radakovitch leachate. Chloroform was estimated at 7 parts per billion (ppb) and bis(2-ethylhexyl)phthalate was estimated at 4 ppb. Arsenic was estimated at 2.3 ppb (zinc was estimated at 5.1 ppb, however, blank correction reduces zinc to below detection). Also measured was total cyanide at 16 ppb and weak and dissociable cyanide at 4 ppb.

R-W Plant Drainage

Metals analysis of the R-W Paper plant parking lot drainage into Longview Ditch 3 showed the presence of small amounts of arsenic (estimated at 2.5 ppb), and mercury (estimated at .03 ppb but also found in the transfer blank at a comparable level). Copper and zinc, two metals mentioned as exceeding standards on the 304(l) short list were also detected. Blank corrected concentrations are 3.6 ppb copper and 40.2 ppb zinc. Assuming a hardness of 65 mg/l, these concentrations meet Water Quality Criteria.

Centrifuge Study

Whole effluent and effluent fraction (dissolved and particulate) results for priority pollutant organics and metals are presented in Table 13. Seven additional volatile organics and four additional metals were detected in the particulates probably due to the low detection levels achieved by measuring the concentrated contaminants in the particulates. Several additional BNAs were detected in the dissolved fraction of the effluent.

A comparison of the particulate fraction collected by the centrifuge with two surrogates (i.e., other readily available particulate material from the treatment process which may approximate the effluent particulates in chemical make-up and contaminant concentration, in this case dewatered sludge and RAS) is presented in Table 14. Eight volatiles were detected in the effluent particulates compared to three in the RAS and two in the sludge. Only chloroform was measured in all three samples. Two BNAs were measured in the effluent particulates and RAS and three BNAs were found in the sludge. With the exception of isophorone which was found in both the particulates and RAS, there is no relationship between the particulate and surrogate BNAs. A stonger correlation exists for the metals detected. Five of the seven metals found in the particulates were also measured in the RAS and four were found in the sludge. As can be seen from the particulate/surrogate (P/S) ratio, the relationship between the effluent particulates and the RAS metals is fairly constant (P/S varies from 0.12 to 0.24).

Complete analytical scans are included in Appendix K. The Weyerhaeuser results will be included as part of an Ecology report on the Centrifuge study due out in mid 1991.

CONCLUSIONS AND RECOMMENDATIONS

Permit requirements at outfall 001/002, outfall 005, and the chlorine plant discharge were being met at the time of the inspection.

Hexavalent chromium was found in the effluent at levels exceeding Water Quality Criteria. Dioxin was detected in the A+C sump discharge.

Removal efficiency of secondary treatment with respect to organics was quite good, often approaching 100%. AOX reduction was 54%. Metals did not appear to be removed as efficiently.

No acute effluent toxicity was indicated by rainbow trout or fathead minnow. Microtox® also indicated no toxicity. NOECs and LOECs of 30% and 100%, respectively, for both survival and reproduction were observed for *Daphnia magna*.

Sediment analytical results were unremarkable and bioassays indicated no toxicity in any of the sediments.

The laboratory review conducted by the Ecology Quality Assurance Section indicated no deficiencies. Agreement between Ecology and Weyerhaeuser on split samples for BOD_5 was excellent. 001/002 effluent TSS agreement was not good and further split sample analysis is recommended.

Analysis of the Radakovitch Landfill leachate did not indicate any problems.

Analysis of the R-W Paper plant drainage into Longview Ditch 3 showed the presence of small amounts of arsenic, and possibly mercury. Blank correction reduced the concentrations of copper and zinc (two of the metals responsible for the 304(l) short listing of the ditch) to below Water Quality Criteria assuming a water hardness of 65 mg/L (EPA 1986).

Although particulate matter samples were gathered and the resulting data analyzed, it is too early in Ecology's piloting of centrifugation to draw any definitive conclusions from the data.

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------ Weyerhaeuser Longview Results of Effluent Microtox® Bioassays, Memorandum to J. Andreasson, Washington State Department of Ecology, 1990c, EILS, June 28, 1990.

Tetra Tech. Recommended Protocols for Measuring Selected Environmental Variables in Puget Sound, 1986, Prepared for Puget Sound Estuary Program.

Yee, Chung. Proposed Effluent Limitations for Dioxin and AOX, Washington Department of Ecology (Industrial Section), 1990.

FIGURES

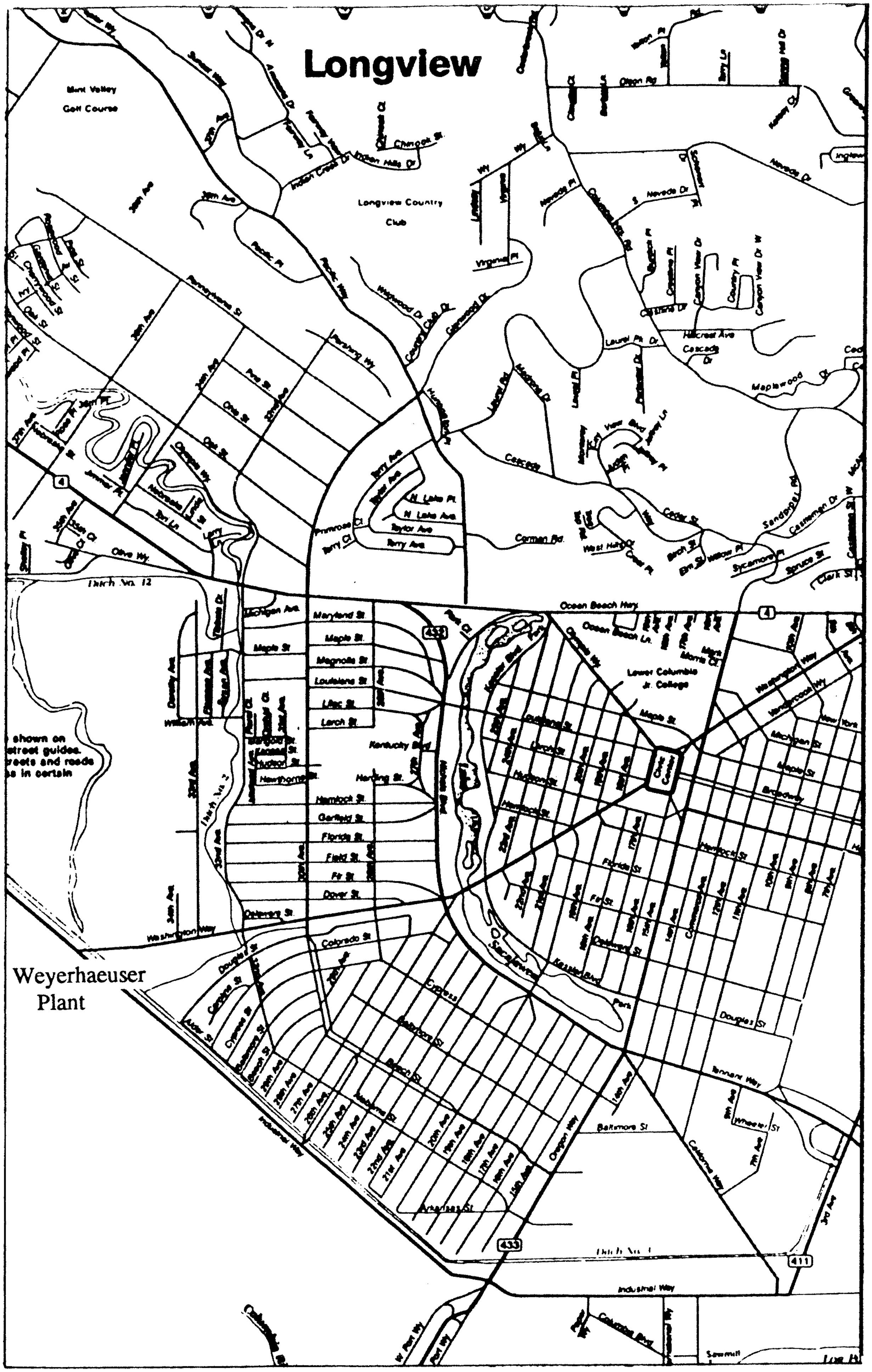
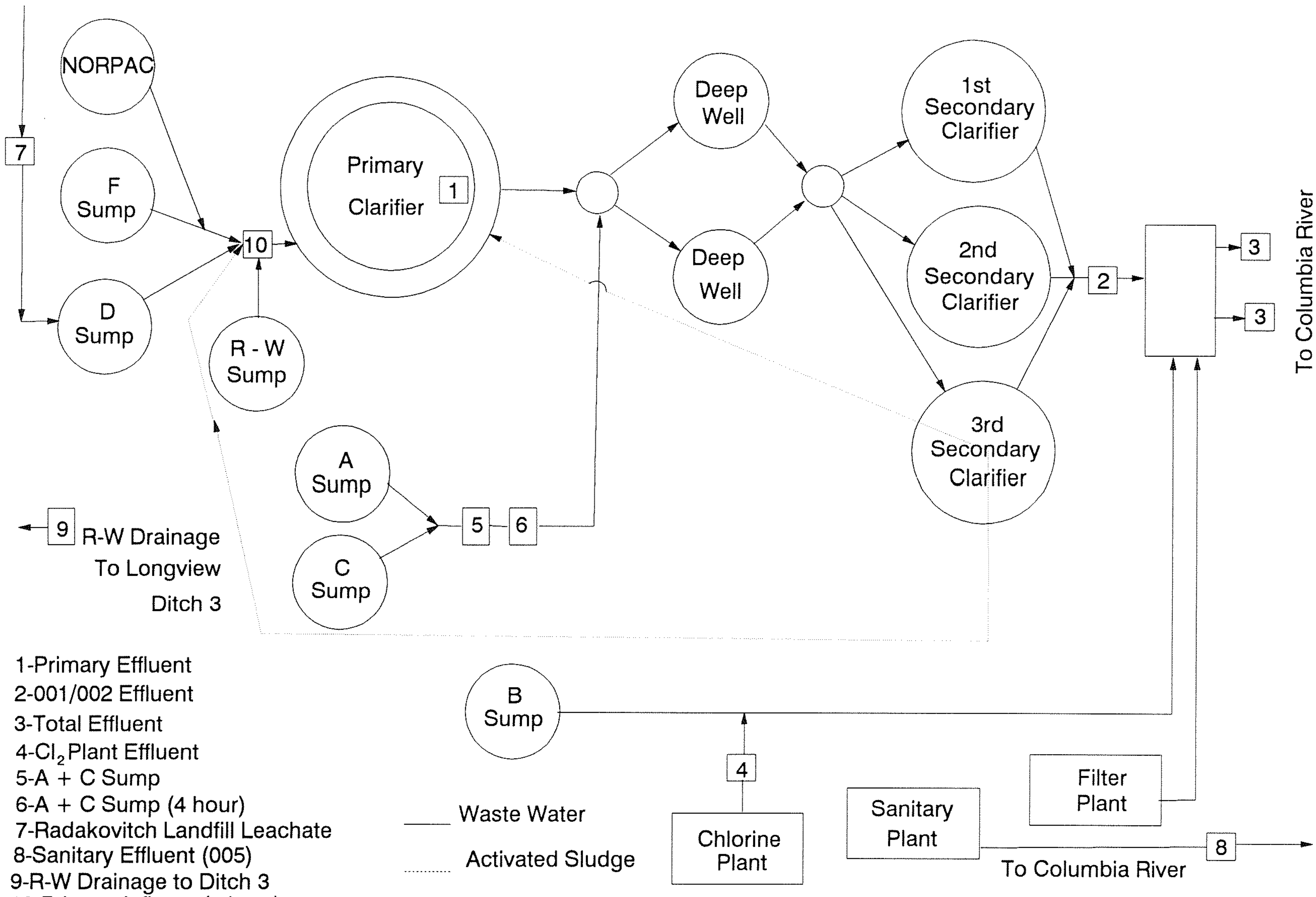


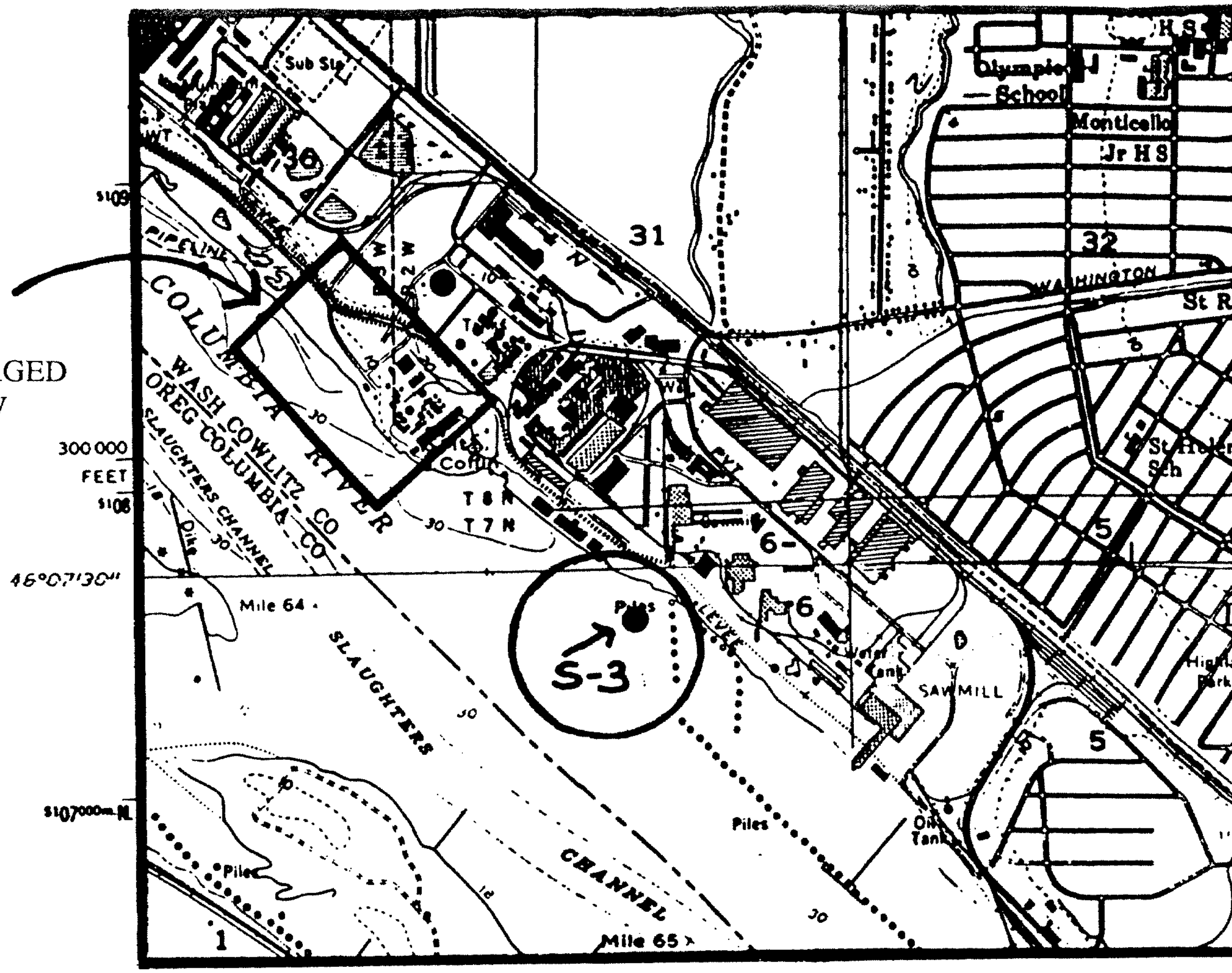
Figure 1. Vicinity Map - Weyerhaeuser, Longview - April 1990.

Figure 2. Plant Schematic Showing Sampling Locations - Weyerhaeuser, Longview - April 1990



1-Primary Effluent
2-001/002 Effluent
3-Total Effluent
4-Cl_2 Plant Effluent
5-A + C Sump
6-A + C Sump (4 hour)
7-Radakovitch Landfill Leachate
8-Sanitary Effluent (005)
9-R-W Drainage to Ditch 3
10-Primary Influent (4 hour)

AREA
ENLARGED
BELOW



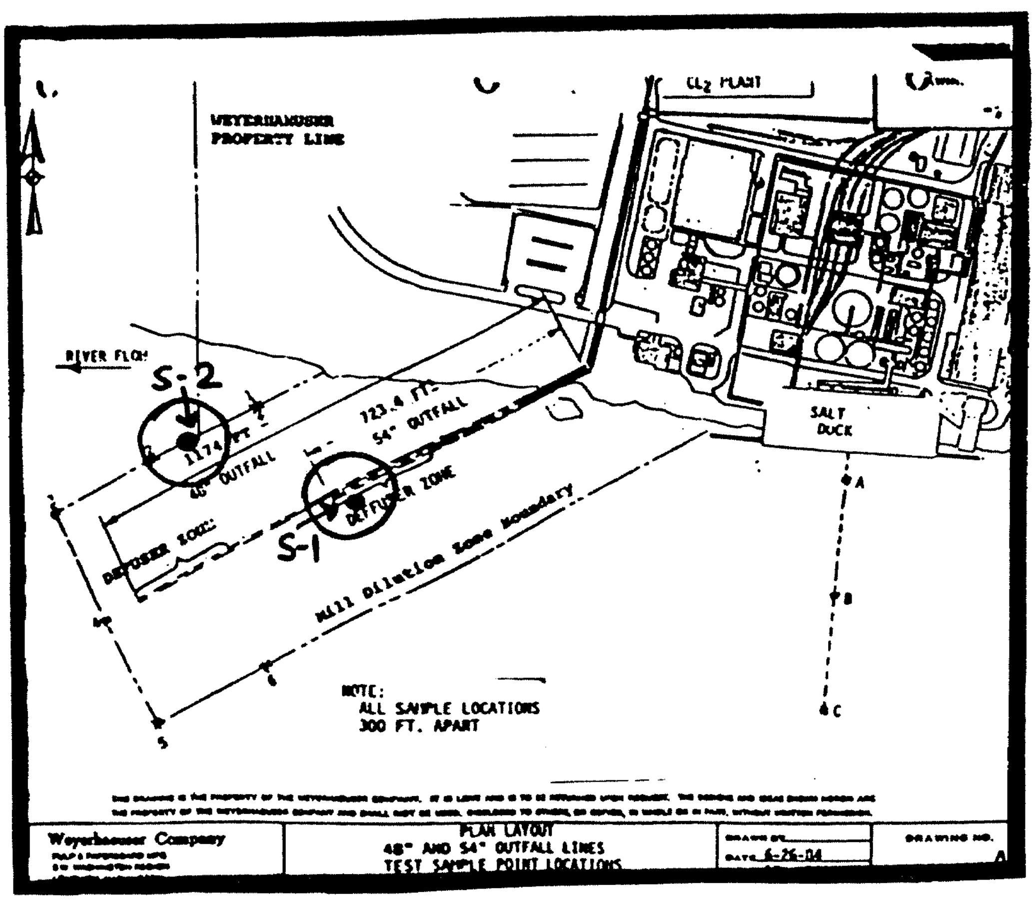


Figure 3. Sediment Sampling Locations - Weyerhaeuser, Longview - April 1990.

TABLES

Table 1. Sampling schedule and parameters analyzed - Weyerhaeuser, Longview - April 1990.

Station:	Primary influent (4 hour)		Primary effluent				A+C sump		A+C sump (4 hour)		Outfall 001/002 (permit effluent)					Chlorine plant		Total effluent				Transfer blank
Type:	4 hr comp	grab	comp	grab	grab	grab	comp	grab	4 hr comp	grab	E-comp+	grab	grab	grab	W-comp+	comp	grab	comp	grab	grab	grab	grab
Date:	4/18	4/16	4/17-18	4/16	4/17	4/17	4/17-18	4/17	4/18	4/18	4/17-18	4/16	4/17	4/17	4/17-18	4/17-18	4/17	4/17-18	4/16	4/17	4/18	4/16
Time:	10:30-2:30	PM		PM	AM	PM		AM	10:30-2:30	AM		PM	AM	PM			AM		PM	AM	PM	PM
GENERAL CHEMISTRY																						
Turbidity			E				E				E											
Conductivity			E		E	E	E				E		E	E	E	E	E	E		E		
Alkalinity			E				E				E											
Acidity			E				E				E											
Hardness			E				E				E				E	E		E				
Cyanide																						
total			E				E				E				E			E				E
weak & dissociable			E				E				E				E			E				E
Solids																						
TS			E				E				E					E		E				
TNVS			E				E				E					E		E				
TSS			E		E	E	E				E/W		E	E	E/W	E	E	E		E		
TNVSS			E				E				E					E						
BOD5			E				E				E/W				E/W			E				
COD			E		E	E	E	E			E		E	E	E	E	E	E		E		
Nutrients																						
NH3-N			E								E				E			E				
NO3+NO2-N			E								E				E			E				
T-Phosphate			E								E				E			E				
Fecal coliform																					E	
% Kleb																					E	
% Solids																						
% Volatile solids																						
Grain Size																						
ORGANICS AND METALS																						
Phenols			E				E				E				E							E
TOC											E											
AOX		E			E	E		E		E			E	E			E			E		E
Resin/fatty acids			E				E				E							E				
Guaiacols/catechols/phenolics			E				E				E							E				
Dioxins/furans	E								E													
Priority pollutants																						
BNA's			E				E				E				E			E				E
Pest/PCB			E				E				E							E				E
VOA					E	E		E					E	E						E		E
Metals + Cr(VI)			E				E				EE*				E	EE**		E				E
Cr(VI) only				E								E							E			
BIOASSAYS																						
Rainbow trout											E											
Microtox											E											
Daphnia magna											E											
Fathead minnow											E											
Hyallela																						
FIELD OBSERVATIONS																						
Temperature			E		E	E	E	E			E		E	E		E	E	E		E		
pH			E		E	E	E	E			E		E	E		E	E	E		E		
Conductivity			E		E	E	E	E			E		E	E		E	E	E		E		
Chlorine													E	E			E					

* (1) total recoverable, and (1) total dissolved metals.
** (1) total recoverable metals, and (1) total metals for Cu, Pb, Ni, Hg.
\+ E-comp indicates Ecology composite sampler, W-comp indicates Weyerhaeuser composite sampler
E Ecology analysis
W Weyerhaeuser analysis (permit parameters)

Table 1. Sampling schedule and parameters analyzed – Weyerhaeuser, Longview – April 1990 (continued).

Station:	Sanitary plant (outfall 005)			R–W plant drainage to Longview ditch #3	Radakovitch leachate	Columbia River water (W) and sediments (S)					
						W–1	W–2	W–3	S–1	S–2	S–3
Type:	grab	grab	grab	grab	grab	grab	grab	grab	grab–comp	grab–comp	grab–comp
Date:	4/17	4/17	4/18	4/16	4/16	4/10	4/10	4/10	4/10	4/10	4/10
Time:	PM	PM	PM	PM	PM						
GENERAL CHEMISTRY						(outfall)	(nr outfall)	(bkground)	(outfall)	(nr outfall)	(bkground)
Turbidity											
Conductivity	E	E			E	E	E	E			
Alkalinity	E	E				E	E	E			
Acidity											
Hardness	E	E		E	E	E	E	E			
Cyanide											
total					E				E	E	E
weak & dissociable					E				E	E	E
Solids											
TS				E							
TNVS				E							
TSS	E	E		E							
TNVSS				E							
BOD5	E	E									
COD	E	E		E	E						
Nutrients											
NH3–N	E	E		E	E						
NO3+NO2–N	E	E		E	E						
T–Phosphate	E	E		E	E						
Fecal coliform			E								
% Kleb											
% Solids									E	E	E
% Volatile solids									E	E	E
Grain Size									E	E	E
ORGANICS AND METALS											
Phenols					E				E	E	E
TOC									E	E	E
AOX											
Resin/fatty acids									E	E	E
Guaiacols/catechols/phenolics									E	E	E
Dioxins/furans									E	E	E
Priority pollutants											
BNA's					E				E	E	E
Pest/PCB					E				E	E	E
VOA					E				E	E	E
Metals + Cr(VI)				E	E				E	E	E
Cr(VI) only											
BIOASSAYS											
Rainbow trout											
Microtox									E	E	E
Daphnia magna											
Fathead minnow											
Hyallela									E	E	E
FIELD OBSERVATIONS											
Temperature	E	E			E						
pH	E	E			E						
Conductivity	E	E			E						
Chlorine	E	E									

Table 2 - Analytical methods and laboratories - Weyerhaeuser, Longview - April 1990.

	EPA 1983	EPA 1986a	Other Methods	Laboratory
General chemistry				
Turbidty	180.1			Manchester
Conductance	120.1			Manchester
Alkalinity	310.1			Manchester
Acidity	305.1			Manchester
Hardness	130.2			Manchester
Cyanide-water & sediments				
total	335.3			Manchester
weak & dissociable	335.3			Manchester
TS	160.3			Manchester
TNVS	160.4			Manchester
TSS	160.2			Manchester
TNVSS	160.4			Manchester
BOD	405.1			Manchester
COD	410.1			Manchester
NH3-N	350.1			Manchester
N03+NO2-N	353.2			Manchester
T-Phosphate	365.2			Manchester
Fecal Coliform			SM-17 9222D	Manchester
% Kleb				Manchester
% Solids	160.3			Manchester
% Volatile solids	160.4			Manchester
Grain size			Tetra Tech 1986	Hart Crowser
Phenols-water & sediments	420.2			Manchester
TOC-water	415.1			Manchester
TOC-sediments			Tetra Tech 1986	Analytical Resources Inc.
Organics				
AOX		9020		Manchester
Resin/fatty acids			NCASI RAFA-85.10	Manchester
Guaiacols/catechols/phenolics			NCASI CP-86.01	Manchester
Dioxins/furans		8290		Triangle
BNA-water		3510/8270		Manchester
BNA-solids		3540/8270		Manchester
Pesticides/PCBs-water		3510/8080		Manchester
Pesticides/PCBs-solids		3540/8080		Manchester
VOA-water		8240		Manchester
VOA-solids		8240		Manchester
Bioassays				
Rainbow Trout			Ecology 1981	Biomed
Microtox-water			Beckman	Ecova
Microtox-sediments			Tetra Tech 1986	Parametrix
Daphnia Magna			EPA 1987	E.V.S. Consultants
Fathead Minnow			EPA 1989	Northwestern Aquatic
Hyallela			Nebeker, 1984	Northwestern Aquatic

EPA 1983, Methods for Chemical Analysis of Water and Wastes.

EPA 1986a, Test Methods for Evaluating Solid Waste.

SM-17 - Standard Methods for the Examination of Water and Wastewater, 17th ed.

Tetra Tech 1986, Recommended Protocols for Measuring Selected Environmental Variables in Puget Sound.

NCASI - National Council for Air and Stream Improvement, 1986.

Ecology 1981, Static Acute Fish Toxicity Test, Biological Testing Methods, 1981.

Beckman - Microtox System Operating Manual.

EPA 1987, "A Short-Term Chronic Toxicity Test using Daphnia magna".

EPA 1989, Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organism

Nebeker, 1984, "Biological Methods for Determining Toxicity of Contaminated Freshwater Sediments to Invertebrates".

Table 2 – Analytical methods and laboratories (continued).

	EPA 1983	EPA 1986a	Other Methods	Laboratory
Metals-water (total)				
Copper		3010/6010		Manchester
Nickel		3010/6010		Manchester
Lead		3010/6010		Manchester
Mercury		7470		Manchester
Hexavalent Chromium		7195		Manchester
Metals-water (total recoverable)				
Antimony		3005/6010		Manchester
Beryllium		3005/6010		Manchester
Cadmium		3005/6010		Manchester
Chromium		3005/6010		Manchester
Copper		3005/6010		Manchester
Lead		3005/6010		Manchester
Nickel		3005/6010		Manchester
Selenium		3005/6010		Manchester
Silver		3005/6010		Manchester
Thallium		3005/6010		Manchester
Zinc		3005/6010		Manchester
Arsenic		3005/7060		Manchester
Mercury		7470		Manchester
Metals-water (dissolved)				
Mercury		7470		Manchester
Hexavalent Chromium		7195		Manchester
Metals-sediment (total)				
Antimony		3005/7041		Manchester
Arsenic		3050/7060		Manchester
Beryllium		3050/6010		Manchester
Cadmium		3050/7131		Manchester
Chromium		3050/6010		Manchester
Copper		3050/6010		Manchester
Lead		3050/7421		Manchester
Mercury		7471		Manchester
Nickel		3050/6010		Manchester
Selenium		3050/7740		Manchester
Silver		3050/6010		Manchester
Thallium		3050/7841		Manchester
Zinc		3050/6010		Manchester

Table 3. General chemistry results - Weyerhaeuser, Longview - April 1990.

Station:	Primary influent (4 hour)	Primary effluent			A+C sump		A+C sump (4 hour)	Outfall 001/002 (permit effluent)				Chlorine plant		Total effluent			Transfer blank
Type:	grab	comp.	grab	grab	comp.	grab	grab	E-comp+	grab	grab	W-comp+	comp.	grab	comp.	grab	grab	grab
Date:	4/18	4/17-18	4/17	4/17	4/17-18	4/17	4/18	4/17-18	4/17	4/17	4/17-18	4/17-18	4/17	4/17-18	4/17	4/18	4/16
Time:	PM		AM	PM		AM	AM		AM	PM			AM		AM	PM	PM
Sample ID:	168254	168230	168231	168232	168243	168244	168246	168233	168234	168235	168237	168241	168242	168238	168239	168240	168249
GENERAL CHEMISTRY																	
Turbidity (NTU)		24			17			7									
Conductivity (umhos/cm)		2500	2610	2630	5390			2920	2880	2950	2920	261	213	1980	1590		
Alkalinity (mg/l as CaCO3)		420			1U			312									
Acidity (mg/l as CaCOs)		1U			346			1U									
Hardness (mg/l as CaCO3)		162			105			143			137	67		110			
Cyanide																	
total (ug/l)*		2			2			2			2			2			2U
weak & dissociable (ug/l)*		2			6			2			2			2			2U
Solids (mg/l)																	
TS		2200			3010			1900				186		1320			
TNVS		1420			2440			1600				42		1100			
TSS		88	66	57	20			28	56	57	51	1U	1U	44	26		
TNVSS		24			3			1U				1U		12			
BOD5 (mg/l)		360			175P			13			17			11			
COD (mg/l)		1130	1180	1100	908	990		352	341	357	344	4.5	4.0U	252	211		
Nutrients (mg/l)																	
NH3-N		0.07						4.18			4.07			2.61			
NO3+NO2-N		0.05						.01K			0.06			0.05			
T-Phosphate		1.68						2.69			2.38			1.77			
Fecal coliform (#/100ml)																1200	
% Kleb																81	
% Solids																	
% Volatile solids																	
ORGANICS																	
Phenols (ug/l)*		203			2320			10.6			10.6						2.11U
TOC (mg/l)*								140									
AOX (ug/l)	15700		15800	16700		64400	55400		15100	12600			100		10100		5200
FIELD OBSERVATIONS																	
Temp (C)		5.4	31.9	32.3	5.8	37.7		6.8	28.0	28.9		2.4	19.0	3.5	24.0		
pH (S.U.)		8.99	8.94	9.05	3.45	4.14		7.77	7.46	7.23		6.62	8.03	8.14	7.38		
Conductivity (umhos/cm)		2210	2180	2490	4810	4530		2530	2720	2790		217	207	178	1460		
Chlorine residual (mg/l)																	
Free									ND								
Total									ND				0.18				

* Sediment units are mg/kg dry weight.
\+ E-comp indicates Ecology composite sampler, W-comp indicates Weyerhaeuser composite sampler.
ND Not detected.
K or U Compound was analyzed for but not detected. The associated numerical value is the sample quantitation limit.
P Greater than.

Table 3. General chemistry results – Weyerhaeuser, Longview – April 1990 (continued).

Station:	Sanitary plant (outfall 005)			R–W plant drainage to Longview ditch #3	Radakovitch leachate	Columbia River water (W) and sediments (S)					
						W–1	W–2	W–3	S–1	S–2	S–3
Type:	grab	grab	grab	grab	grab	grab	grab	grab	grab–comp	grab–comp	grab–comp
Date:	4/17	4/17	4/18	4/16	4/18	4/10	4/10	4/10	4/10	4/10	4/10
Time:	15:32	16:30	PM	PM	PM						
Sample ID:	168251	168252	168253	168248	168247	158034 (outfall)	158036 (nr outfall)	158038 (bkground)	158035 (outfall)	158037 (nr outfall)	158039 (bkground)
GENERAL CHEMISTRY											
Turbidity (NTU)											
Conductivity (umhos/cm)	381	374			6510	156	154	159			
Alkalinity (mg/l as CaCO3)	88.1	87.4				56.6	54.3	59.7			
Acidity (mg/l as CaCOs)											
Hardness (mg/l as CaCO3)	77	76		125	783	66	63	67			
Cyanide											
total (ug/l)*					16				.134U	.136U	.136U
weak & dissociable (ug/l)*					4				.134U	.135U	.136U
Solids (mg/l)											
TS				250							
TNVS				187							
TSS	12	21		15							
TNVSS				12							
BOD5 (mg/l)	7	7									
COD (mg/l)	55.5	54.0		20.9	227						
Nutrients (mg/l)											
NH3–N	10.6	9.81		0.75	75.4						
NO3+NO2–N	0.23	0.21		0.13	0.65						
T–Phosphate	0.92	0.90		0.42	1.80						
Fecal coliform (#/100ml)			3U								
% Kleb											
% Solids									76	75	75
% Volatile solids									0.3	0.5	0.3
ORGANICS											
Phenols (ug/l)*					2.11				1U	1U	1U
TOC (mg/l)*									0.14	0.13	0.051
AOX (ug/l)											
FIELD OBSERVATIONS											
Temp (C)	16.9	17.1			16.1						
pH (S.U.)	7.39	7.00			8.36						
Conductivity (umhos/cm)	410	360			6170						
Chlorine (mg/l)											
Free	0.3	ND									
Total	1.0	1.0									

* Sediment units are mg/kg dry weight
\+ E–comp indicates Ecology composite sampler, W–comp indicates Weyerhaeuser composite sampler.
ND Not detected
K or U Compound was analyzed for but not detected, the associated numerical value is the sample quantitation limit.
P Greater than.

Table 4. NPDES permit limits* and inspection results – Weyerhaeuser, Longview – April 1990.

Outfall 001/002

Parameter	Daily average	Daily maximum	Inspection results	
BOD5, lbs/day+	26,900	51,100	4,801	
TSS, lbs/day+	46,900	88,300	10,341	
pH++	5.0 to 9.0 at all times		7.38	
Napthalene, ug/l+	---	10U	2U	
4-nitrophenol, ug/l+	---	50U	8U	
2-nitrophenol, ug/l+	---	20U	2U	
Pentachlorophenol, ug/l+	---	50U	8U	
Flow, MGD (from Weyco records)	---	---	44.3	
Temperature, F++	---	---	75	
Fecal coliform, #/100 ml++	---	---	1200	(81% Klebsiella)

Outfall 005

Parameter	Daily average	Daily maximum	Inspection results	
Flow, MGD	---	---	.174	
BOD5, mg/l	20	30	7 and 7	(2 grab samples)
lb/day	70	125	10.2 and 10.2	
TSS, mg/l	20	30	12 and 21	(2 grab samples)
lb/day	70	125	17.4 and 30.5	
Chlorine residual, mg/l	range 0.3 to 3.0		1.0 and 1.0	(2 grab samples)
Fecal coliform, #/100 ml	200	400	3U	
pH	6.0 to 8.5 at all times		7.4 and 7.0	(2 grab samples)

Chlorine plant discharge

Parameter	Daily average	Daily maximum	Inspection results	
Total residual chlorine, lb/day	6.6	10.8	5.3	
Copper, lb/day	4.1	10.0	0.009JB	(blank corrected)
Lead, lb/day	2.0	4.9	0.58U	
Nickel, lb/day	3.1	8.1	0.29U	
TSS, lb/day	189	503	29U	
Flow, MGD (from Weyco records)	---	---	3.5	

* Based on the permit which expired October 7, 1990.
+ Measured at 001/002.
++ Measured on total effluent.
U Indicates compound was analyzed for but not detected at the given quantitation limit.
J Indicates an estimated value when the result is less than the specified quantitation limit.
B Indicates method blank contamination.

Table 5. Wastewater priority pollutant organics detected – Weyerhaeuser, Longview – April 1990.

Station:	Primary effluent (ug/l)	Primary effluent (ug/l)	A+C sump (ug/l)	Outfall 001/002 (ug/l)	Outfall 001/002 (ug/l)	Total effluent (ug/l)	Water quality criteria (fresh)* chronic (ug/l)	Water quality criteria (fresh)* acute (ug/l)
VOAs								
Acetone	[230]	[120]	[2000]	50 U	50 U	20 U	--	--
Carbon disulfide	[3] J	10 U	50 U	50 U	50 U	20 U	--	--
Chloroform	[890]	[1000]	[8400]	[470]	[430]	[360]	28,900	1,240
2-Butanone	10 U	10 U	[1000]	50 U	50 U	20 U	--	--
Bromodichloromethane	10 U	[2] J	[41] J	50 U	50 U	[2] J	--	--
4-Methyl-2-Pentanone	10 U	10 U	[140]	50 U	50 U	20 U	--	--
Toluene	10 U	10 U	[5] J	50 U	50 U	20 U	17,500	--
Ethylbenzene	10 U	[1] J	50 U	50 U	50 U	20 U	32,000	--
Total Xylenes	[3] J	[5] J	50 U	50 U	50 U	20 U	--	--
BNAs								
Phenol	[20]		8 U	2 U		0.8 U	10,200	2,560
Benzoic Acid	[130]		40 U	8 U		4 U	--	--
Naphthalene	[9]		8 U	2 U		0.8 U	2,300	620
2,4,6-Trichlorophenol	[14]		8 U	[8]		[4]	--	970
Phenanthrene	[3]		8 U	2 U		0.8 U	--	--
Pyrene	[2]		8 U	2 U		0.8 U	--	--

* EPA, 1986.
U Indicates compound was analyzed for but not detected at the given quantitation limit.
J Indicates an estimated value when the result is less than the specified quantitation limit.
[ ] Indicates compounds detected.

Table 6. Dioxin/furan analysis of bleach plant effluents – Weyerhaeuser, Longview – April 1990.

Station:	Primary influent (4 hour) (alkaline bleach) Concentration (ppt)		Primary influent (4 hour) (alkaline bleach) Loading* (mg/day)	A+C sump (4 hour) (acid bleach) Concentration (ppt)		A+C sump (4 hour) (acid bleach) Loading** (mg/day)
2378-TCDD	0.02	EMPC		0.03		1.7
12378-PeCDD	0.005	U		0.02	EMPC	
123478-HxCDD	0.005	U		0.005	U	
123678-HxCDD	0.005	U		0.02		1.2
123789-HxCDD	0.005	U		0.02		1.2
1234678-HpCDD	0.06	EMPC		0.04		2.3
OCDD	1.2		142	0.28		16.1
2378-TCDF	0.20		23.7	0.98		56.4
12378-PeCDF	0.005	U		0.01	EMPC	
23478-PeCDF	0.005	U		0.01	EMPC	
123478-HxCDF	0.005	U		0.01	EMPC	
123678-HxCDF	0.005	U		0.003	U	
234678-HxCDF	0.005	U		0.03		1.7
123789-HxCDF	0.008	U		0.005	U	
1234678-HpCDF	0.005	U		0.04		2.3
1234789-HpCDF	0.008	U		0.008	U	
OCDF	0.02	U		0.1	EMPC	
Total TCDD	0.21		24.9	0.14		8.1
Total PeCDD	0.02		2.4	0.009		0.52
Total HxCDD	0.02		2.4	0.08		4.6
Total HpCDD	0.10	EMPC		0.04		2.3
Total TCDF	0.86		102	1.2		69.0
Total PeCDF	0.07		8.3	1.2		69.0
Total HxCDF	0.02	EMPC		0.2		11.5
Total HpCDF	0.005	U		0.05		2.9

ppt parts per trillion.
* Based on primary influent flow rate of 31.3 MGD.
** Based on A+C sump flow rate of 15.2 MGD.
U Indicates compound was analyzed for but not detected at the given detection limit.
EMPC Estimated maximum possible concentration OR estimated detection level.
[box] Indicates detected compounds

Table 7. Wastewater non-priority pollutant organics detected – Weyerhaeuser, Longview – April 1990.

Station:	Primary effluent (ug/l)	A+C sump (ug/l)	Outfall 001/002 (ug/l)	Total effluent (ug/l)
AOX	15,800	64,400	15,100	10,100
	16,700	55,400	12,600	
Phenolics (4-AAP)	203	2,320	10.6	NT
Guaiacols/catechols/phenolics				
Phenol	100	54	1 U	1 U
Ethanone, 1-phenyl-	13	12	0.7 U	0.6 U
2-Methylphenol	2	6	0.5 U	0.04 J
4-Methylphenol	5	0.4 U	0.4 J	0.2 J
a-Terpeneol	500	1600	0.3 U	0.3 U
2,4-Dimethylphenol	0.2 J	6	0.1 J	0.09 J
2-Cyclopenten-1-one, 2-methyl	0.4 U	220	0.5 U	0.4 U
Guaiacol (2-methoxyphenol)	160	4200	0.2 J	0.1 J
2,4-Dichlorophenol	3	6	0.8	0.5
2,4,6-Trichlorophenol	9	12	5	3
2,4,5-Trichlorophenol	2	0.4 U	0.5 U	0.4 U
4-Allylguaiacol (eugenol)	150	48	0.5 U	0.08 J
4,5-Dichloroguaiacol	12	18	0.9	0.5
4-Chlorocatechol	0.4 U	2	0.04 J	0.4 U
4-Propenylguaiacol	0.8	9	0.2 J	0.4 U
6-Chlorovanillin	8	10	0.4 J	0.3 J
4,5-Dichlorocatechol	0.4 U	25	1	0.7
4,5,6-Trichloroguaiacol	8	6	4	3
9,10-Dichlorosteric acid	32	13	4	3
5,6-Dichlorovanillin	10	7	0.6	0.5
Pentachlorophenol	0.4 U	0.6	0.5 U	0.4 U
3,4,5-Trichlorocatechol	0.4 U	120	6	3
Tetrachloroguaiacol	14	4	3	2
Trichlorosyringol	9	2	5	3
Tetrachlorocatechol	0.4 U	39	2	1
Resin/fatty acids				
Linoleic acid	84	4	33	28
Palmitoleic acid	71	0.9 U	120	120
Decanoic Acid, Hexa-	99	100	140	160
Oleic acid	240	0.9 U	39	290
Octadecanoic acid	21	10	12	13
Pimaric acid	140	0.9 U	34	38
Sandaracopimaric acid	37	0.9 U	6	7
Isopimaric acid	99	1	41	46
Palustric acid	88	0.9 U	10	9
Eicosatrienoic acid	32	0.9 U	1 U	0.9 U
Dehydroabietic acid	230	3	57	64
Abietic acid	200	0.9 U	69	77
Neoabietic Acid	39	0.9 U	2	3
9,10-Dichlorosteric acid	19	21	1 U	0.9 U

[box] Indicates detected compounds
NT Not tested
U Indicates compound was analyzed for but not detected at the given quantitation limit.
J Indicates an estimated value when result is less than specified quantitation limit.

Table 8. Wastewater priority pollutant metals – Weyerhaeuser, Longview – April 1990.

Station:		Primary effluent		A+C sump	Outfall 001/002			Chlorine plant		Total effluent		Freshwater criteria*	
Sample type:		composite	grab	composite	E-comp+	grab	W-comp+	composite	composite	composite	grab	acute	chronic
Analysis type:		recoverable	total	recoverable	recoverable	total	recoverable	recoverable	total	recoverable	total		
		(ug/l)										(ug/l)	
Antimony		200 U		200 U	200 U		200 U	200 U		200 U		9,000 **	1,600 **
Arsenic		1.5 UJ		1.5 UJ	1.5 UJ		1.5 UJ	1.5 UJ		1.5 UJ		360	190
Beryllium		2 U		2 U	2 U		2 U	2 U		2 U		130	5.3
Cadmium		10 U		10 U	10 U		10 U	10 U		10 U		2.4 ++	0.81 ++
Chromium	(total)	5 U		679	86		94	5 U		64		1,220 ++	145 ++
	(hexavalent)	1.7 JB	2.2 JB	61.2 J		30.7	26.8 J	1.0 UJ		18.3 J	23.1	16	11
Copper	(blank corrected)	14.6 B		2.9 JB	4.9 JB		4.8 JB	2 U	0.3 JB	2.8 JB		11.8 ++	8.2 ++
Lead		60 U		60 U	60 U		60 U	60 U	20 U	60 U		47 ++	1.8 ++
Mercury		0.02 U		0.02 U	0.02 U		0.02 U	0.02 U	0.048 J	0.02 U		2.4	0.012
Nickel		40 U		40 U	40 U		40 U	40 U	10 U	40 U		1,329 ++	69 ++
Selenium		200 U		200 U	200 U		200 U	200 U		200 U		260	35
Silver		3 UR		3 UR	3 UR		3 UR	3 UR		3 UR		1.9 ++	0.12
Thallium		250 U		250 U	250 U		250 U	250 U		250 U		1,400 **	40 **
Zinc	(blank corrected)	79.4 B		27.1 B	59.6 B		674	6.1 JB		>0 JB		225 ++	47
Cyanide	(total)	2		2	2		2			2		22	5.2

\+ E–comp indicates Ecology composite sampler, W–comp indicates Weyerhaeuser composite sampler.
* EPA, 1986.
++ Hardness dependant criteria based on 65 mg/l hardness as CaCO3 in Columbia River receiving water.
** Insufficient data to develop criteria. Value presented is the lowest observed effect level.
U Indicates metal was not detected at given quantitation limit.
J Indicates an estimated value when the result is less than the specified quantitation limit.
B Indicates method blank contamination
R Indicates unusable data due to poor MS/MSD recoveries.
[box] Indicates EFFLUENT metals above acute and/or chronic criteria
[shaded] Indicates EFFLUENT quantitation limits above chronic criteria or unusable data.

COPPER, MERCURY AND ZINC WERE MEASURED IN THE FIELD TRANSFER BLANK AT 3.9, 0.04 AND 18 ug/l RESPECTIVELY.

Table 9. Secondary treatment removal efficiencies - Weyerhaeuser, Longview - April 1990.

		Primary effluent (65.3% of flow)*		+	A+C sump (34.7% of flow)*		=	Secondary influent (calculated)		Secondary effluent (001/002)		% Removal influent-effluent / influent
General chemistry		(mg/l)			(mg/l)			(mg/l)		(mg/l)		
TSS		88			20			64		28		57
BOD5		360			175	P		296	P	13		96
COD		1130			908			1053		352		67
Priority pollutant organics		(ug/l)			(ug/l)			(ug/l)		(ug/l)		
Acetone		230			2000			844		ND		100
Carbon Disulfide		3	J		ND			2		ND		100
Chloroform		890			8400			3496		470		87
2-Butanone		ND			1000			347		ND		100
Bromodichloromethane		ND			41	J		14		ND		100
4-Methyl-2-Pentanone		ND			140			49		ND		100
Toluene		ND			5	J		2		ND		100
Total Xylenes		3	J		ND			2		ND		100
Phenol		20			ND			13		ND		100
Benzoic Acid		130			ND			85		ND		100
Naphthalene		9			ND			6		ND		100
2,4,6-Trichlorophenol		14			ND			9		8		12
Phenanthrene		3			ND			2		ND		100
Pyrene		2			ND			1		ND		100
Priority pollutant metals		(ug/l)			(ug/l)			(ug/l)		(ug/l)		
Chromium		ND			679			236		86		63
Chromium	(hexavalent)	2.2	JB		61.2	J		23	JB	30.7		<0
Copper	(blank corrected)	14.6	B		2.9	JB		11	JB	4.9	JB	54
Zinc	(blank corrected)	79.4	B		27.1	B		61	B	59.6	B	3
Cyanide	(total)	2			2			2		2		0

* Based on a primary effluent flow rate of 29 MGD and A+C sump flow rate of 15.4 MGD.
ND Not detected.
J Indicates an estimated value when the result is less than the specified quantitation limit.
P Greater than.
B Indicates method blank contamination.

Table 9. Secondary treatment removal efficiencies (continued)

	Primary effluent (65.3% of flow)*	+	A+C sump (34.7% of flow)*	=	Secondary influent (calculated)	Secondary effluent (001/002)		% Removal influent–effluent / influent
Non-priority pollutant organics	(ug/l)		(ug/l)		(ug/l)	(ug/l)		
Phenols	203		2,320		938	10.6		99
AOX	15,800		64,400		32664	15,100		54
Guaiacols/catechols/phenolics	(ug/l)		(ug/l)		(ug/l)	(ug/l)		
Phenol	100		54		84	ND		100
Ethanone, 1-phenyl-	13		12		13	ND		100
2-Methylphenol	2		6		3	ND		100
4-Methylphenol	5		ND		3	0.4	J	88
a-Terpeneol	500		1600		882	ND		100
2,4-Dimethylphenol	0.2	J	6		2	0.1	J	95
2-Cyclopenten-1-one, 2-methy	ND		220		76	ND		100
Guaiacol (2-methoxyphenol)	160		4200		1562	0.2	J	100
2,4-Dichlorophenol	3		6		4	0.8		80
2,4,6-Trichlorophenol	9		12		10	5		50
2,4,5-Trichlorophenol	2		ND		1	ND		100
4-Allylguaiacol (eugenol)	150		48		115	ND		100
4,5-Dichloroguaiacol	12		18		14	0.9		94
4-Chlorocatechol	ND		2		1	0.04	J	94
4-Propenylguaiacol	0.8		9		4	0.2	J	95
6-Chlorovanillin	8		10		9	0.4	J	95
4,5-Dichlorocatechol	ND		25		9	1		88
4,5,6-Trichloroguaiacol	8		6		7	4		45
9,10-Dichlorosteric acid	32		13		25	4		84
5,6-Dichlorovanillin	10		7		9	0.6		93
Pentachlorophenol	ND		0.6		0	ND		100
3,4,5-Trichlorocatechol	ND		120		42	6		86
Tetrachloroguaiacol	14		4		11	3		72
Trichlorosyringol	9		2		7	5		24
Tetrachlorocatechol	ND		39		14	2		85
Resin/fatty acids	(ug/l)		(ug/l)		(ug/l)	(ug/l)		
Linoleic acid	84		4		56	33		41
Palmitoleic acid	71		ND		46	120		<0
Decanoic Acid, Hexa-	99		100		99	140		<0
Oleic acid	240		ND		157	39		75
Octadecanoic acid	21		10		17	12		30
Pimaric acid	140		ND		91	34		63
Sandaracopimaric acid	37		ND		24	6		75
Isopimaric acid	99		1		65	41		37
Palustric acid	88		ND		57	10		83
Eicosatrienoic acid	32		ND		21	ND		100
Dehydroabietic acid	230		3		151	57		62
Abietic acid	200		ND		131	69		47
Neoabietic Acid	39		ND		25	2		92
9,10-Dichlorosteric acid	19		21		20	ND		100

Table 10. Effluent bioassay results – Weyerhaeuser, Longview – April 1990.

Rainbow trout – *(Oncorhyncus mykiss)* – 96 hour acute

Sample	% Survival
65% effluent	100
Control	100

Microtox – *(Photobacterium phosphoreum)* – 15 minute

Sample	EC50
100% effluent	> 100%

Water flea – *(Daphnia magna)* – 7 day chronic

Sample	% Survival	Total reproduction
Effluent		
1.0%	100	142
3.0%	90	204
10.0%	100	124
30.0%	100	134
100.0%	60	86
Control	100	158
	NOEC = 30%	NOEC = 30%
	LOEC = 100%	LOEC = 100%

Fathead minnow – *(Pimephales promelas)* – 7 day chronic

Sample	Mean % survival	Mean weight (mg)
Effluent		
6.25%	90.0	.485
12.5%	90.0	.413
25%	93.3	.461
50%	81.7	.542
100%	68.3	.416
Control	86.7	.455
	NOEC = 100%	NOEC = 100%

EC50 Concentration effecting 50% of the organisms.
NOEC No observed effects concentration.
LOEC Lowest observed effects concentration.