57-1010

95-e02

DEPARTMENT OF ECOLOGY

January 24, 1995

TO: Roger Ray and Don Nichols
Water Quality Program, Eastern Regional Office

FROM: Norm Glenn
EILS Program, Watershed Assessment Section

SUBJECT: Corrections to Ecology Report No. 94-100, "Spokane River Basin Class II Inspection at the Spokane Industrial Park Wastewater Treatment Plant"

The subject report was issued in June 1994. Distribution was made through the state library. Representatives of the Industrial Park have requested that several appropriate corrections to the report be documented. Since it would be extremely onerous to retrieve and reissue all 70 copies, documentation will be by way of this memorandum.

The corrections are to comparisons made between inspection results and discharge limits for two effluent parameters - total suspended solids (TSS) and total residual chlorine. The report incorrectly notes in three places that there were violations of limits:

- Page 1, under **Abstract--**
  - third sentence should state, "The plant met permit requirements for five-day biochemical demand (BOD_5), TSS, total residual chlorine, fecal coliform, ammonia, pH, nickel, zinc, and 1,1,1-trichloroethane."
  - fourth sentence should be removed.
  - seventh sentence should be removed.

- Page 5, under **Results and Discussion**, third paragraph --
  - third sentence should state, "The plant met permit requirements for five-day biochemical demand (BOD_5), TSS, total residual chlorine, fecal coliform, ammonia, pH, nickel, zinc, and 1,1,1-trichloroethane."
  - fourth sentence should be removed.
  - fifth sentence should be removed.

- Page 8, **Table 3--**
  - has been corrected and is included as an attachment to this memorandum.

NLG:blt
Attachment

cc: Will Kendra
Tapas Das

Table 3. Comparison of Inspection Results to NPDES Permit Limits, Spokane Industrial Park – Spokane River Basin Class II Inspections, 3/93

Effluent Parameter	NPDES Permit Final Limits		Interim Discharge Limits		Inspection Results			
					Ecology Composite	SIP Composite	Ecology Grab Sample	
	Monthly Average	Weekly Average	Monthly Average (lbs/day)	Weekly Average (lbs/day)	Lab ID#:138253	138254	Eff-1 138251	Eff-2 138255
BOD5, mg/L	65	125	188	281	57++	65		
TSS, mg/L	95	190	188	281	110++	172		
Fecal Coliform, #/100 mL	200	400	200	400			<3	<3
Total Residual Chlorine, mg/L	0.05	0.2	***	***			1.5	0.15
Ammonia, mg/L	8.5	17	—	—	3.41	3.33		
pH, S.U.	6.0≤pH≤9.0						7.5	7.7
	Monthly Average	Daily Maximum	Monthly Average	Daily Maximum				
Copper*, µg/L (lbs/day)	20	30	3.1	4.2	--**	205 (1.47++)		
Lead*, µg/L (lbs/day)	3	8	1.3	1.7	--**	22.1 (0.16++)		
Nickel*, µg/L	3,000	5,000	--	--	--**	50 P		
Zinc*, µg/L (lbs/day)	60	100	6.3	8.3	--**	55 J (0.39++)		
1,1,1-Trichloroethane, µg/L	100	--					<0.40	--**
Flow, MGD	0.75	1.0				0.86+		

* Total recoverable metal.

P The analyte was detected above the instrument detection limit but below the established minimum quantitation limit.

J Indicates an estimated value when result is less than specified detection limit.

--** Ecology's sample was lost due to an accident.

\+ Flow obtained from plant's totalizer reading.

++ Derived loading using concentration and flow.

*** As listed in Order # DE92WQ-E312, First Amendment: "total residual chlorine shall be maintained at a level which is sufficient to attain the fecal coliform limits specified in Section S1.A of NPDES permit #WA-000095-7. Chlorine concentrations in excess of that necessary to reliably achieve these limits shall be avoided."

DEPARTMENT OF ECOLOGY

July 26, 1994

TO: Ken Merrill and Carl Nuechterlein
Eastern Regional Office

THROUGH: Will Kendra WK
EILS Program, Watershed Assessments Section

FROM: Tapas Das TKD
Watershed Assessments Section

SUBJECT: Spokane River Basin Class II Inspection at the Spokane Industrial Park Wastewater Treatment Plant

Attached are four copies of the above entitled report.

The plant met permit requirements for five-day biochemical oxygen demand (BOD_5), fecal coliform, ammonia, pH, nickel, zinc, and 1,1,1-trichloroethane. The effluent concentration exceeded the daily maximum limit for total residual chlorine. Copper and lead concentrations exceeded final permit limits, but met interim limits. The copper concentration was roughly 40-50 times higher than water quality criteria. Effluent total suspended solids (TSS) loading exceeded the monthly average permit limit.

I transferred to the Air Quality Program at Ecology HQ on June 27. If you have any questions regarding this report, please contact Norm Glenn at SCAN 407-6683.

BT
Attachments

A Department of Ecology Report

WASHINGTON STATE DEPARTMENT OF ECOLOGY

Spokane River Basin Class II Inspection at the Spokane Industrial Park Wastewater Treatment Plant

Abstract

Announced Basin Class II inspections were conducted at two municipal wastewater treatment plants (WWTPs) and three industrial WWTPs in the Spokane River Basin during March 22-24, 1993. A separate inspection report was written for each discharger in the basin; this report is based on the inspection conducted at the Spokane Industrial Park WWTP. The plant met permit requirements for five-day biochemical oxygen demand (BOD_5), fecal coliform, ammonia, pH, nickel, zinc, and 1,1,1-trichloroethane. The effluent concentration exceeded the daily maximum limit for total residual chlorine. Copper and lead concentrations exceeded final permit limits, but met interim limits. The copper concentration was roughly 40-50 times higher than water quality criteria. Effluent total suspended solids (TSS) loading exceeded the monthly average permit limit. It is recommended that Pelletier's Spokane River metals study be consulted to assess any impact of metals to the receiving water.

Introduction

Announced Basin Class II inspections were conducted at three industrial wastewater treatment plants (WWTPs) and two municipal WWTPs in the Spokane River Basin on March 22-24, 1993. Entities operating the plants are as follows: Inland Empire Paper Company, Kaiser Aluminum, Spokane Industrial Park, City of Spokane, and Liberty Lake Sewer District. These Basin Class II inspections are done in support of an emerging concept within the Department of Ecology to conduct activities on a coordinated geographic basis. This concept is referred to as the Basin (Watershed) Approach to environmental management. Figure 1 is a map showing the locations of the five WWTPs.

Conducting the inspection were Rebecca Inman and Tapas Das of the Environmental Investigations and Laboratory Services Program's Watershed Assessments Section. Donald Nichols of Ecology's Eastern Regional Office (ERO) was present to observe the inspection. The data obtained from these inspections will subsequently support the Spokane River total maximum daily load (TMDL) study. A concurrent metals study is also progressing in the basin (Pelletier, in prep.).

A separate Class II inspection report was written for each discharger. This report is based on the inspection conducted at the Spokane Industrial Park WWTP. Al Willner, plant superintendent, and Sarah Hubbard-Gray, environmental manager of the park, provided assistance during the inspection.

by Tapas Das
June 1994

Waterbody No. 57-1010

Ecology Report No. 94-100

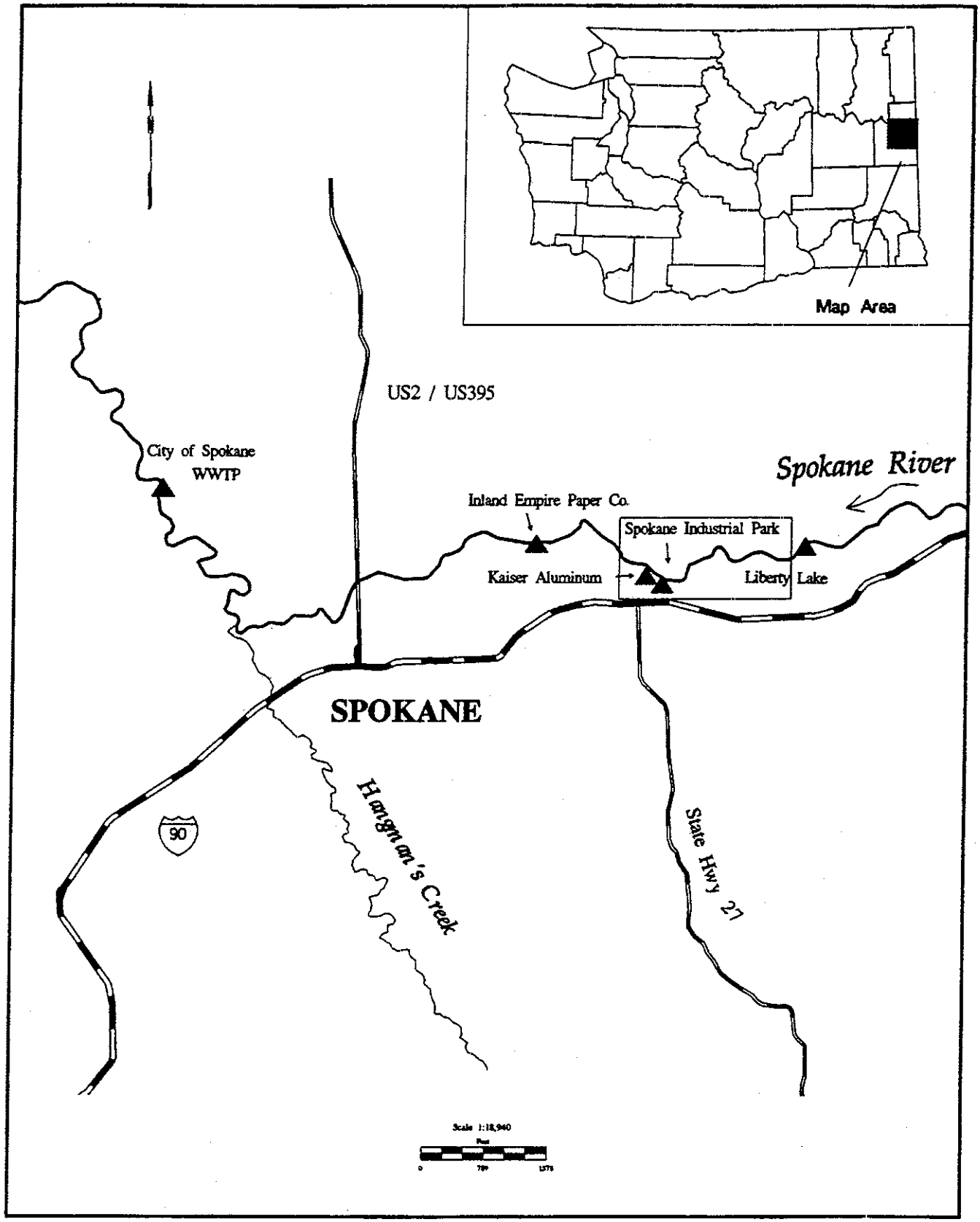

Figure 1. Location of Spokane Industrial Park WWTP – Spokane River Basin, 3/93

Objectives

1. verify compliance with NPDES permit limits; and
2. provide effluent data (including metals) to support the Spokane River TMDL assessment.

The Spokane Industrial Park (SIP) is owned and operated by Pentzer Development Corporation, a subsidiary of Washington Water Power Company. There are several tenants in the park who use the park's WWTP facility. Among them, three SIP tenants discharge pretreated wastewater regulated by state waste discharge permit. These industries include Columbia Lighting, Johnson Mathey, and Keytronics, Inc. The permittee is authorized to discharge treated wastewater to the Spokane River under NPDES Permit No. WA-000095-7, which will expire on April 20, 1997. An Administrative Order issued on August 30, 1993, provided revised interim loading limits for some permitted parameters. The permit contains an additional limit on total phosphorus which is in effect during the period from June through October (Ecology, 1992). It should be noted that all of SIP's wastewater flow was permanently diverted to the City of Spokane's WWTP on December 17, 1993. The facility is currently in the process of being decommissioned (Nichols, 1994).

The wastewater treatment system consists of the following: a comminutor, an oxidation ditch, a secondary clarifier, and a chlorine contact chamber (Figure 2). Influent flow is measured by an ultrasonic flow meter installed at the headworks. There is no flow measuring device on the effluent stream. A small sludge drying bed is available but only used occasionally.

Procedures

Sampling locations are shown in Figure 2. A summary of the analytical methods and laboratories conducting the analyses is given in Appendix A. Standard operating procedure (SOPs) which are routinely employed when conducting Basin Class II inspections and when preserving and analyzing the samples are contained in the Ecology document Quality Assurance Project Plan for Basin Class II Inspections (Glenn, in prep.). The following procedures were exceptions to those SOPs (asterisks denotes changes made at the request of the client):

1) Composite samples of influent wastewater were obtained from the permittee's sampler;
*2) several standard influent and effluent parameters were not analyzed for;
*3) eight selected priority pollutant metals were analyzed by the total recoverable method;
4) no rinsate blank was collected even though composited samples of priority pollutant metals were collected; no transfer blank was collected even though a grab sample of volatile organic compounds (VOCs) was collected;
*5) no duplicates were collected for effluent parameters;
6) ortho-phosphate samples were filtered in the field rather than at the Manchester Lab;
7) an instantaneous flow verification could not be done because the flow measuring device wasn't accessible; and
8) SIP WWTP has a limited lab facility, which has been measuring only pH and chlorine (Van Donsel, 1994), and all other samples are analyzed by a contract lab (Willner, 1993); therefore, the exercise of splitting samples to compare sampling and analytical procedures was not conducted.

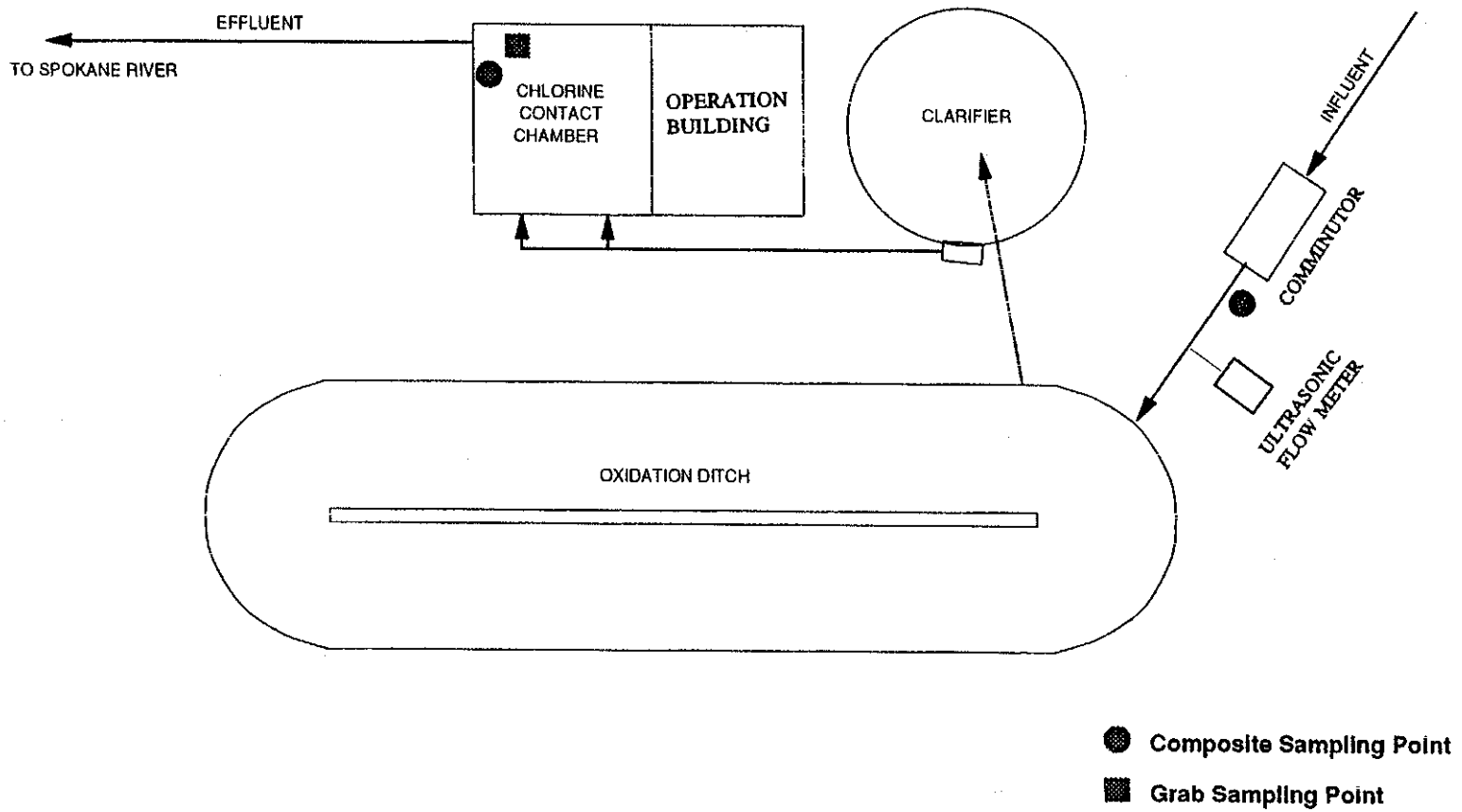

Figure 2. Plant Schematic and Sampling Sites - Spokane Industrial Park WWTP, 3/93.

Results and Discussion

General chemistry results are summarized in Table 1. The permittee's influent and effluent composite results should be interpreted with caution since composite sample temperatures exceeded 4°C. BOD_5, TSS, and NH_3 data indicated that the plant was receiving a very weak influent (Metcalf and Eddy, 1991). As can be expected with a low strength waste, percent removals were low: for BOD_5 and TSS they were 78 and 68%, respectively. There were negligible changes in ammonia and total Kjeldahl nitrogen concentrations, suggesting that no nitrification was taking place. Some phosphorus was removed (39%) by the plant, even though seasonal permit limits were not in effect (Ecology, 1992).

Priority pollutant metals results are presented in Table 2. The water quality criteria for metals were calculated using a receiving water hardness of 28.5 mg/L as $CaCO_3$ (Pelletier, in prep.). Cadmium, copper, lead, mercury, nickel, and zinc were detected in effluent. The mercury concentration was higher than the chronic water quality criterion; while cadmium, lead, zinc, and copper concentrations exceeded both acute and chronic criteria (EPA, 1986). The copper concentration exceeded acute and chronic criteria by roughly 40-50 times. The metals concentrations in effluent were high enough to cause some concern about acute and chronic toxicities in the receiving water. The potential impact of these metals on the receiving water will be evaluated by Pelletier (in prep.).

A comparison of effluent parameters to NPDES permit limits is presented in Table 3. The plant's influent totalizer readings for a 24-hour time period (March 22-23) indicated a flow of 0.86 MGD; this flow was used to calculate effluent mass loadings for comparison to permit limits. Effluent met permit requirements for BOD_5, fecal coliform, ammonia, pH, nickel, zinc, and 1,1,1-trichloroethane. Effluent TSS met the daily maximum permit limit, however, it exceeded the monthly average limit. One total residual chlorine concentration (Lab ID#: 138251) exceeded the daily maximum limit, while the other (Lab ID#: 138255) was greater than the monthly average permit limit. Copper and lead concentrations exceeded final permit limits, but met interim limits.

A complete listing of effluent volatile organic compound (VOC) results is included in Appendix B. Among VOCs, three compounds were positively identified in the range of 0.3-41 μg/L. Acetone was found at the highest concentration (41 J μg/L); however, there is no EPA water quality criterion for acetone. Chloroform and toluene did not exceed water quality criteria (EPA, 1986).

Conclusions and Recommendations

1. At the time of inspection, the plant met effluent permit limitations for BOD_5, fecal coliform, ammonia, pH, nickel, zinc, and 1,1,1-trichloroethane. Effluent TSS met the daily maximum permit limit, but exceeded the monthly average limit. Copper and lead concentrations were much higher than the monthly average and daily maximum limits, but met interim limits. The total residual chlorine concentration exceeded the daily maximum permit limit.

2. The mercury concentration in effluent was higher than the chronic water quality criterion; while cadmium, lead, zinc, and copper concentrations exceeded both acute and chronic criteria. The copper concentration exceeded acute and chronic criteria by roughly 40-50 times. It is recommended that Pelletier's Spokane River metals study be consulted to assess potential biological impacts of metals to the receiving water.

Table 1. General Chemistry Results, Spokane Industrial Park WWTP – Spokane River Basin Class II Inspections, 3/93
(Permittee's Composite Results Should be Interpreted with Caution Since Composite Sample Temperatures Exceeded 4°C)

Parameter	Station: / Type: / Date: / Time: / Lab ID#1382:	Inf–SIP comp 3/22–23 1430–1430 –52	Eff–E comp 3/22–23 1450–1450 –53	Eff–SIP comp 3/22–23 1450–1450 –54	Eff–1 grab 3/22 1445 –51	Eff–2 grab 3/24 0835 –55	Blank rinsate 3/24 1830 –56
Turbidity (NTU)				23			
Conductivity (µmhos/cm)				472			
Alkalinity (mg/L)				158			
Hardness (mg/L CaCO3)				161			
TS (mg/L)		467 J	368	660			
TNVS (mg/L)		277	218	417			
TSS (mg/L)		50	16	24			
TNVSS (mg/L)		10	5	10			
BOD5 (mg/L)		37	8	9			
TOC (mg/L)			9.7	10.3			
NH3–N (mg/L)		3.23	3.41	3.33			
NO2+NO3–N (mg/L)		1.68	2.14	2.20			
Total Phosphorus (mg/L)		3.47	2.11	2.16			
Ortho–Phosphorus (mg/L)		2.74	1.34	1.38			0.02
TKN (mg/L)		7.85	7.01	6.81			
Oil & Grease (mg/L)					3	3	
F–Coliform MF (#/100 mL)					<3	<3	
FIELD OBSERVATIONS							
Flow (MGD)			0.86*				
Temperature (°C)		11.1+	3.1+	6.6+	10.3	10.3	
pH (S.U.)					7.5	7.7	
Conductivity (µmhos/cm)		550	460	500	480	585	
Chlorine							
Free (mg/L)					0.50	0.08	
Total (mg/L)					1.50	0.15	

Eff – Effluent, Inf – Influent, E – Ecology sample, SIP – Spokane Industrial Park WWTP sample

J – Indicates an estimated value when result is less than specified detection limit.

\+ Iced composite sample.

* Flow was obtained from plant's totalizer for a 24–hour time period (3/22–23).

Table 2. Results of Metals Analyses, Spokane Industrial Park WWTP – Spokane River Basin Class II Inspections, 3/93

Station:	Inf–SIP	Eff–SIP		
Type:	comp	comp	Water Quality Criteria (µg/L)	
Date:	3/22–23	3/22–23	Freshwater	
Time:	1430–1430	1450–1450		
Lab ID#:	138252	138254	Acute	Chronic
Metals tot rec (µg/L)				
Cadmium	1.42 J	1.47 J	1*	0.4*
Chromium	<5	<5	16	11
Copper	111	205	5*	4*
Lead	6.90	22.1	17*	0.6*
Mercury	0.12 J	0.21 J	2.4	0.012
Nickel	28 P	50 P	490*	55*
Silver	<3	<3	0.5*	0.12
Zinc	105 J	55 J	40*	37*

Eff – Effluent, Inf – Influent, SIP – Spokane Industrial Park sample

J – Indicates an estimated value when result is less than specified detection limit.

P – The analyte was detected above the instrument detection limit but below the established minimum quantitation limit.

* Receiving water hardness dependent criteria at non–critical river flow conditions (based on 28.5 mg/L as CaCO3)(EPA)

Shaded area denotes metal detected

Table 3. Comparison of Inspection Results to NPDES Permit Limits, Spokane Industrial Park – Spokane River Basin Class II Inspections, 3/93

Effluent Parameter	NPDES Permit Final Limits		NPDES Interim Permit Limits		Inspection Results			
					Ecology Composite	SIP Composite	Ecology Grab Sample	
	Monthly Average	Weekly Average	Monthly Average (lbs/day)	Weekly Average (lbs/day)	Lab ID#:138253	138254	Eff–1 138251	Eff–2 138255
BOD5, mg/L	65	125	188	281	57++	65		
TSS, mg/L	95	190	188	281	110++	172		
Fecal Coliform, #/100 mL	200	400	200	400			<3	<3
Total Residual Chlorine, mg/L	0.05	0.2	––	––			1.5	0.15
Ammonia, mg/L	5.5	17	––	––	3.41	3.33		
pH, S.U.	6.0≤pH≤9.0						7.5	7.7
	Monthly Average	Daily Maximum	Monthly Average	Daily Maximum				
Copper*, µg/L (lbs/day)	20	30	3.1	4.2	––**	205 (1.47++)		
Lead*, µg/L (lbs/day)	3	8	1.3	1.7	––**	22.1 (0.16++)		
Nickel*, µg/L	3,000	5,000	––	––	––**	50 P		
Zinc*, µg/L (lbs/day)	60	100	6.3	8.3	––**	55 J (0.39++)		
1,1,1–Trichloroethane, µg/L	100	––					<0.40	––**
Flow, MGD	0.75	1.0				0.86+		

* Total recoverable metal.

P The analyte was detected above the instrument detection limit but below the established minimum quantitation limit.

J indicates an estimated value when result is less than specified detection limit.

––** Ecology's sample was lost due to an accident.

\+ Flow obtained from plant's totalizer reading.

++ Derived loading using concentration and flow.

3. The permittee's influent and effluent composited sample temperatures were higher than the recommended 4°C. The plant's sample coolers should be inspected and repaired as necessary to provide better sample cooling. The permittee's influent and effluent results should be used with some caution.

References

APHA-AWWA-WPCF, 1989. Standard Methods for the Examination of Water and Wastewater. 17th edition. American Public Health Association, American Water Works Association, and Water Pollution Control Federation. Washington, DC.

Ecology, 1992. National Pollutant Discharge Elimination System Waste Discharge Permit for the Spokane Industrial Park. Washington State Department of Ecology, Olympia, WA. Section-S1.B.1, pp. 4-5.

EPA, 1983. Methods for Chemical Analyses of Water and Waste. EPA-600/4-79-020 (Rev. March 1983), Washington, DC.

------, 1984. 40 CFR Part 136. October 26.

------, 1986. Quality Criteria for Water. EPA 440/5-86-001.

Glenn, N., in prep. Quality Assurance Project Plan for Basin Class II Inspections. Washington State Department of Ecology, Environmental Investigations and Laboratory Services Program, Olympia, WA.

Metcalf and Eddy, Inc., 1991. Wastewater Engineering: Collection, Treatment, & Disposal. 3rd edition, McGraw-Hill, Inc., New York, NY.

Nichols, D., 1994. Basin Class II Inspection - Spokane Industrial Park (Draft). Electronic Mail Memorandum to T. Das, Washington State Department of Ecology, Environmental Investigations and Laboratory Services Program, Olympia, WA. May 24.

Pelletier, G., in prep. Spokane River Metals Project. Washington State Department of Ecology, Environmental Investigations and Laboratory Services Program, Olympia WA.

Van Donsel, D., 1994. Personal Communication. Washington State Department of Ecology, Environmental Investigations and Laboratory Services Program, Quality Assurance Section, Manchester, WA. January 7.

Willner, A., 1993. Personal Communication. Plant Superintendent, Spokane Industrial Park, Spokane, WA. March 22.

Contacts

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(206) 407-6698

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For additional copies of this publication, please contact Ecology's Publications Distribution Office at (206) 407-7472, and refer to publication number 94-100.

Appendix B. Result of Effluent VOC Analysis, Spokane Industrial Park – Spokane River Basin Class II Inspections, 3/93

	Field Station:	Eff-1
	Type:	grab
	Date:	3/22
	Time:	1445
Parameters (µg/L)	Lab ID#:	138251
Chloromethane		0.4 U
Methane, Dichlorodifluoro-		2 UJ
Bromomethane		0.4 U
Vinyl chloride		0.4 U
Chloroethane		0.4 U
Trichlorofluoromethane		0.4 UJ
Methylene Chloride		0.8 U
Acetone		41 J
Carbon Disulfide		0.4 U
1,1- Dichloroethene		0.4 U
trans-1,2-Dichloroethene		0.4 U
Cis-1,2-Dichloroethene		0.4 U
2,2-Dichloropropane		0.4 U
Bromochloromethane		0.4 U
Chloroform		0.3 J
1,2-Dichloroethane		0.4 U
2-Butanone		4 UJ
1,1,1-Trichloroethane		0.4 U
Carbon Tetrachloride		0.4 U
1,1-Dichloropropane		0.4 U
Bromodichloromethane		0.4 U
1,2- Dichloropropane		0.4 UJ
Dibromomethane		0.4 U
trans-1,3-Dichloropropene		0.4 U
Ethene, trichloro-		0.4 U
Dibromochloromethane		0.4 U
1,2-Dibromomethane (EDB)		0.4 U
1,1,2-Trichloroethane		0.4 U
1,3-Dichloropropane		0.4 U
Benzene		0.4 U
cis-1,3-Dichloropropene		0.4 U
Bromoform		0.4 U
2-Hexanone		0.4 U
4-Methyl-2-Pentanone (MIBK)		0.4 U
Tetrachloroethane		0.4 U
Ethane, 1,1,2,2-Tetrachloro-		0.4 U
Ethane 1,1,1,2-tetrachloro-		0.4 U
Toluene		16
Chlorobenzene		0.4 U
Ethylbenzene		0.4 U
Benzene, Ethenyl- (Styrene)		0.4 U
Bromobenzene		0.4 U
1,2,3-Trichloropropane		0.4 U
2-Chlorotoluene		0.4 U
4-Chlorotoluene		0.4 U
Total Xylenes		0.4 U
1,2,4-Trimethylbenzene		0.4 U
Tert-Butylbenzene		0.4 U
1,3,5-Trimethylbenzene		0.4 U
Sec-Butylbenzene		0.4 U
p-Isopropyltoluene		0.4 U
Butylbenzene		0.4 U
1,2-Dibromo-3-chloropropane		2 U
1,2,3-Trichlorobenzene		0.4 U
Isopropylbenzene		0.4 U
Benzene, Propyl-		0.4 U
1,3-Dichlorobenzene		0.4 U
1,4-Dichlorobenzene		0.4 U
1,2-Dichlorobenzene		0.4 U
1,2,4-Trichlorobenzene		0.4 U
Naphthalene		0.4 U
Hexachlorobutadiene		0.4 U

U – The analyte was not detected at or above the reported result.
J – Indicates an estimated value when result is less than specified detection limit

Appendix A. Analytical Methods and Laboratories, Spokane Industrial Park WWTP – Spokane River Basin Class II Inspections, 3/93

Parameter	Method	Lab used
Turbidity	EPA, 1983: 180.1	Ecology; Manchester, WA
Conductivity	EPA, 1983: 120.1	Ecology; Manchester, WA
Alkalinity	EPA, 1983: 310.1	Ecology; Manchester, WA
Hardness	EPA, 1983: 130.2	Ecology; Manchester, WA
SOLIDS4		
TS	EPA, 1983: 160.3	Ecology; Manchester, WA
TNVS	EPA, 1983: 106.4	Ecology; Manchester, WA
TSS	EPA, 1983: 160.2	Ecology; Manchester, WA
TNVSS	EPA, 1983: 106.4	Ecology; Manchester, WA
BOD5	EPA, 1983: 405.1	Ecology; Manchester, WA
TOC	EPA, 1983: 415.2	Ecology; Manchester, WA
NUTRIENTS		
NH3-N	EPA, 1983: 350.1	Ecology; Manchester, WA
NO2+NO3-N	EPA, 1983: 353.2	Ecology; Manchester, WA
T-phosphorus	EPA, 1983: 365.1	Ecology; Manchester, WA
O-phosphate	EPA, 1983: 365.3	Ecology; Manchester, WA
Total Kjeldahl nitrogen	EPA, 1983: 351.3	Analytical Resources Inc.; Seattle, WA
Fecal coliform (MF)	APHA, 1989:9222D	Ecology; Manchester, WA
Oil and grease	EPA, 1983: 413.1	Ecology; Manchester, WA
VOCs	EPA, 1984: 624	Ecology; Manchester, WA
METALS		
Cr;Cu;Ni;Zn	EPA, 1983: 200.7	Ecology; Manchester, WA
Hg	EPA, 1983: 245.5	Ecology; Manchester, WA
Ag	EPA, 1983: EP1-272.2	Ecology; Manchester, WA
Cd	EPA, 1983: EP1-213.2	Ecology; Manchester, WA
Pb	EPA, 1983: EP1-239.2	Ecology; Manchester, WA