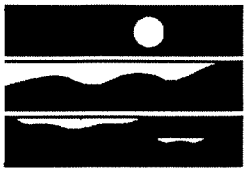
A Department of Ecology Report



Spokane River Basin Class II Inspection at the Kaiser Aluminum Corporation at Trentwood 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 Kaiser Aluminum and Chemical Corporation (Kaiser) WWTP. The plant was operating well at the time of inspection. The industrial wastewater (002) and sanitary wastewater (003) discharges to the facility wastewater lagoon met all permit requirements. Discharge from the lagoon (001) to the Spokane River also met permit requirements for total suspended solids (TSS), oil and grease, aluminum, chromium, zinc, cyanide, and pH. Aluminum, cadmium, copper, lead, and zinc exceeded water quality criteria in both lagoon effluent and in the receiving water upstream from the discharge point, but since river water is the primary source of plant process water supply, the discharger's NPDES permit limitations are applied on a basis of net loading. A concurrent metals study progressing in the Spokane River Basin should be consulted concerning potential effluent metals toxicity in the receiving water. Other recommendations are included in this report.

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: Kaiser Aluminum and Chemical Corporation at Trentwood, Inland Empire Paper Company, 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 inspections were Tapas Das and Rebecca Inman of the Environmental Investigations and Laboratory Services Program's Watershed Assessments Section. Patrick Hallinan and Kenneth Merrill of Ecology's Eastern Regional Office were present to observe the inspections. The data obtained from these inspections will subsequently support the Spokane River total maximum daily total (TMDL) study. A concurrent metals study is also progressing in the basin (Pelletier, in prep.).

by Tapas Das
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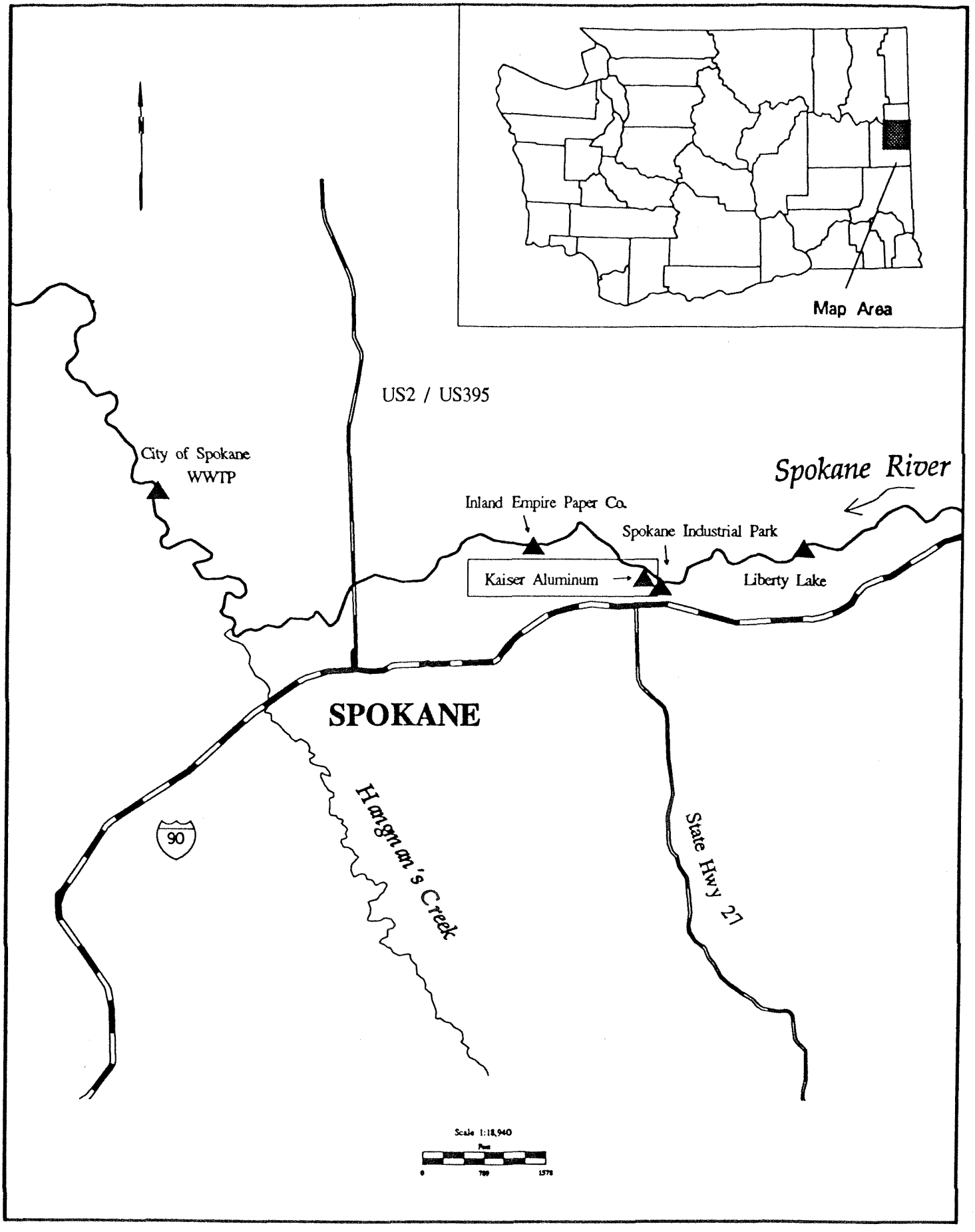

Figure 1. Locations of Five WWTPs - Spokane River Basin Class II Inspection, 3/93

A separate Class II inspection report was written for each discharger. This report is based on the inspection conducted at Kaiser's WWTP. Patrick Blau, staff environmental engineer, provided assistance during the inspection.

Objectives

1) Verify compliance with NPDES permit limits;
2) provide effluent data (including metals) to support the Spokane River TMDL assessment; and
3) evaluate permittee's sampling and testing procedures by conducting sample splits.

Kaiser's aluminum rolling mill and metal finishing plant operates continuously and currently employs about 1,200 people. The primary products include aluminum coil, sheet, and plate. Aluminum is melted and cast into ingots as part of the manufacturing process. Three hot rolling mills are used to form coil, sheet, and plate followed by four cold rolling mills to achieve further reduction in thickness. Finishing operations include levelling, slitting, heat treating, coil coating, and cleaning.

Primary sources of wastewater to the WWTP are effluent from industrial wastewater treatment (IWT) and sanitary wastewater treatment (SWT) facilities, and contact and non-contact cooling water. The IWT, SWT, and south and north plant cooling water discharge locations are referred to as outfalls 002, 003, 004 and 005, respectively. The Spokane River water (Plant Intake) is the primary source of plant process water supply. Kaiser is planning to use groundwater in lieu of some river water. Cooling water is the largest contributor to the total discharge. All treated wastewaters are discharged to the Spokane River through outfall 001. The IWT facility removes oil, aluminum, chromium, zinc, and phosphorus by acid-heat treatment. This is followed by the addition of calcium hydroxide (lime) and polymer to the wastewater. A layout of all the Kaiser WWTP facilities, including a detailed description of the IWT facility, is given in the Class II inspection report by Glenn and Nell (1991). A detailed description of the SWT facility is provided in this report.

Figure 2 is a schematic diagram of the SWT facility at the time of inspection. The SWT facility is designed to reduce BOD, TSS, and fecal coliform. It consists of a primary clarifier, rock trickling filter, secondary clarifier, and chlorine contact basin. Effluent then passes through a Parshall flume before discharge to a lagoon. Waste sludge is digested and then hauled to the City of Spokane WWTP for further processing and disposal (Blau, 1993).

All wastewater produced at Kaiser is discharged to the lagoon before passing through a rectangular weir and outfall to the river. The combined wastewater in the lagoon is treated only for oil removal. The separation and removal of oil is accomplished mainly with oil booms and a mechanical skimmer. The permittee is authorized to discharge its cumulative treated wastewater to the Spokane River under NPDES Permit No. WA-000089-2, which expired on November 23, 1993, but has been administratively extended. The permit contains effluent limitations for outfalls 001, 002 and 003, respectively. The permit also contains an additional seasonal limitation on total phosphorus which is in effect from June through October (Ecology, 1988).

Procedures

Sampling locations are shown in Figure 2. A summary of the analytical methods and laboratories conducting the analyses is given in Table 1. Standard operating procedures (SOPs) which are routinely employed when conducting Basin Class II Inspections and when preserving and analyzing

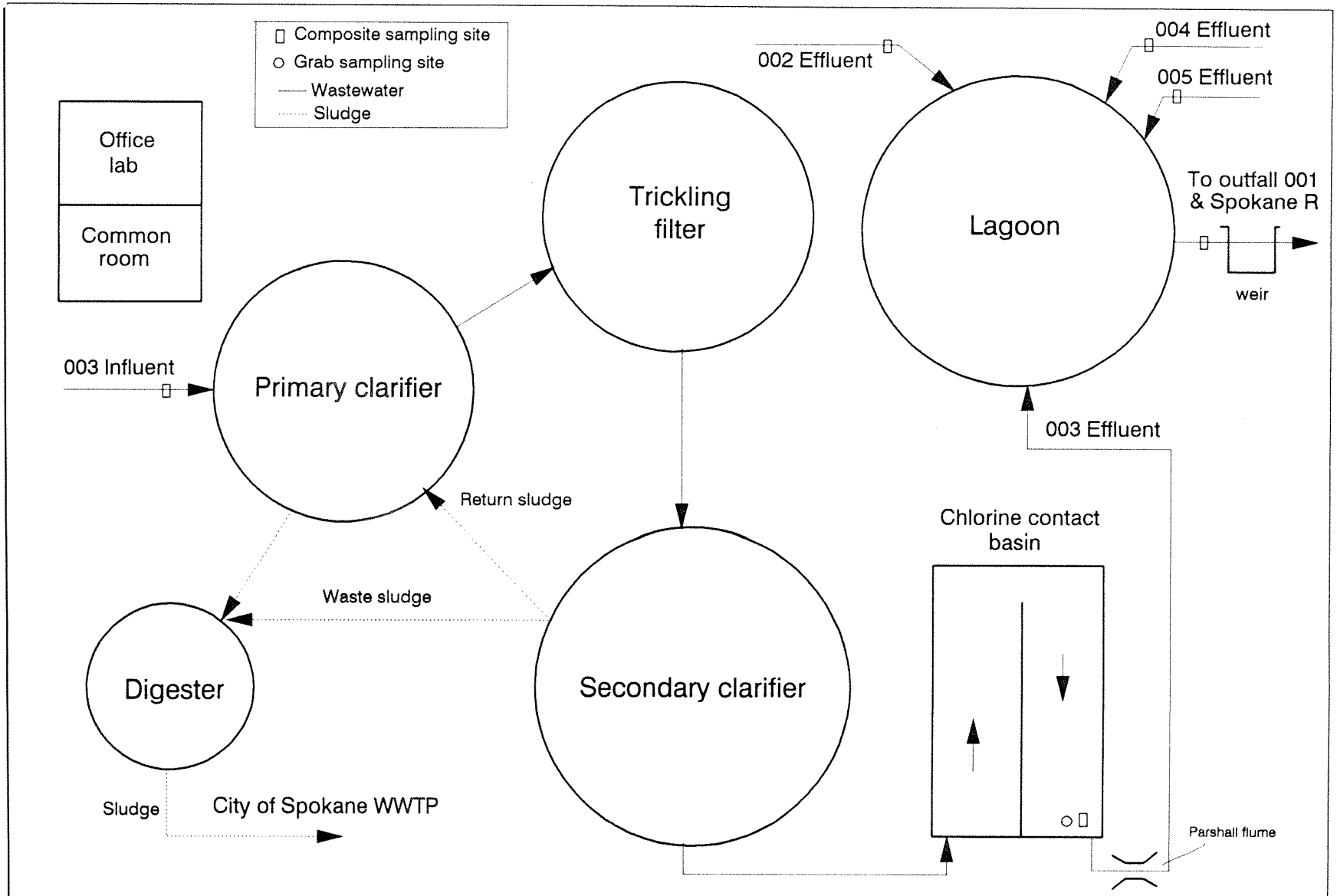

Figure 2. Schematic Diagram of Kaiser Aluminum & Chemical Company SWT Plant Showing All Sampling Sites, 3/93

Table 1. Analytical Methods and Laboratories, Kaiser Aluminum 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
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
Cyanide total	EPA, 1983: 335.2 Mod.	Ecology; Manchester, WA
METALS		
Al;Cr;Cu;Ni;Zn	EPA, 1983: 200.7	Ecology; Manchester, WA
Hg	EPA, 1983: 245.5	Ecology; Manchester, WA
Cd	EPA, 1983: EP1-213.2	Ecology; Manchester, WA
Pb	EPA, 1983: EP1-239.2	Ecology; Manchester, WA

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 QAPP changes made at the request of the client):

1) composite samples of SWT, cooling water, plant intake (Spokane River water), and effluent from the lagoon were obtained from the permittee's samplers;
*2) seven selected priority pollutant metals and aluminum were analyzed by the total method (APHA, 1989);
3) no rinsate blank was collected even though composited samples of priority pollutant metals were collected;
4) two sets of effluent grab samples were not collected, although a single fecal coliform grab was collected;
*5) no duplicates were collected for any effluent parameter;
6) ortho-phosphate samples were filtered in the field rather than at the Manchester Lab; and one ortho-phosphate value was higher than the total phosphate value (sample ID# 138246) and this result should be used with some caution (Thomson, 1993);
7) one BOD_5 result (138245) was reported as simply less than 50 mg/L; this result should be used with caution; and
8) an instantaneous flow verification could not be done because the flow measuring devices weren't accessible.

Results and Discussion

General chemistry results are presented in Table 2. Effluent composite results should be interpreted with caution since all composite samples field temperatures exceeded 4°C. The sanitary influent waste stream (003-Inf) had low BOD_5, TSS, and NH_3 - indicating that the plant was receiving a weaker influent (Metcalf and Eddy, 1991). The effluent ammonia concentration was marginally less than the influent concentration; on the other hand, the effluent nitrite+nitrate concentration was slightly higher than the influent concentration -- suggesting that some nitrification took place in the plant. Among other noteworthy results are IWT effluent (002-E) conductivity, hardness, TS, and TNVS. Conductivity and hardness levels were very high due to the addition of lime to the wastewater for neutralizing pH. The addition of polymer helped to form floc, which contributed to higher TS and TNVS levels in the wastewater.

A listing of priority pollutant metals, which were analyzed by the total method, is given in Table 3. The water quality criteria for metals were calculated using the receiving water hardness of 28.5 mg/L as $CaCO_3$ (Pelletier, in prep.). Aluminum, cadmium, copper, lead, and zinc were detected in river water (Plant Intake) and lagoon effluent (001). The background concentrations of copper, lead, and zinc in river water actually exceeded acute and chronic criteria, while aluminum and cadmium concentrations were higher than chronic criteria. Among metals detected in the lagoon effluent (Lab ID# 138242), aluminum, cadmium, and lead concentrations exceeded chronic water quality criteria; while copper and zinc concentrations exceeded both acute and chronic criteria (EPA, 1986). Copper and lead concentrations in lagoon effluent were lower than levels found in the river 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 4. The plant's totalizer readings for a 24-hour time period (March 22-23) indicated flows of 22.94 MGD, 0.13 MGD, and 0.21 MGD at outfalls 001, 002 and 003, respectively. These flows were used to calculate

Table 2. General Chemistry Results, Kaiser Aluminum WWTP - Spokane River Basin Class II Inspections, 3/93

	Location:	001	Plant Intake	003-Inf	003-Eff	004	005	002-E	002-KA	Blank
	Sampler:	Kaiser	Kaiser	Kaiser	Kaiser	Kaiser	Kaiser	Ecology	Kaiser	Ecology
	Type:	comp	comp	comp	comp	comp	comp	comp	comp	rinsate
	Date:	3/22-23	3/22-23	3/22-23	3/22-23	3/22-23	3/22-23	3/22-23	3/22-23	3/23
	Time:	1410-1410	1400-1400	1340-1340	1320-1320	1330-1330	1420-1420	1400-1400	1440-1440	1630
Parameter	Lab ID#1382:	-42	-43	-44	-45	-46	-47	-48	-49	-50
Turbidity (NTU)		3.3						45		
Conductivity (μmhos/cm)		91						4,360		
Alkalinity (mg/L)		24						103		
Hardness (mg/L CaCO3)		34.8				51.1	26.1	1,410	1,410	
TS (mg/L)				353	LAC			4,690		
TNVS (mg/L)				162	LAC			4,230		
TSS (mg/L)		11	13	64	5	7	14	7	9	
TNVSS (mg/L)				8	1			2		
BOD5 (mg/L)				37	<50					
NH3-N (mg/L)		0.07		5.79	3.91	<0.01	<0.01		14.7	
NO2+NO3-N (mg/L)		0.10		1.07	2.57	0.08	0.06		0.01	
Total Phosphate (mg/L)		0.03	0.02	1.48	1.26	0.02	0.02	0.15	0.18	
TKN (mg/L)		0.71			7.63	0.42	0.45	19.1	20.1	
Ortho-Phosphate (mg/L)		0.01	<0.01	1.0	0.96	0.13	<0.01	<0.01	<0.01	0.02
Oil & Grease (mg/L)		3+ J	3+ J			3+ J	3+ J		11+ J	
F-Coliform MF (#/100 mL)					6+					
Cyanide total (mg/L)		<0.002	<0.002			<0.002	<0.002	0.014		
FIELD OBSERVATIONS										
Flow (MGD)		22.94	22.94		0.21*	9.6*	13.0*	0.13*		
Temperature (°C)		10.6**	11.5**	11.7**	10.8**	8.9**	9.9**	9.7**	16.3**	
pH (S.U.)		7.4	7.4	7.0	7.7	7.0	7.4	7.2	7.1	
Conductivity (μmhos/cm)		110	70	340	325	70	70	5,100	6,200	
Chlorine										
Free (mg/L)					0.35					
Total (mg/L)					1.70					

E - Ecology sample, KA - Kaiser Aluminum WWTP sample

LAC - Lost; accident during analysis.

J - The analyte was positively identified; the associated numerical value is an estimate.

* Flow was obtained from plant's totalizer reading.

\+ Grab sample collected on 3/23.

001 - effluent discharge from the lagoon to the river.

002 - effluent from the industrial wastewater treatment to the lagoon.

003 - sanitary wastewater (effluent goes to the lagoon).

004 - cooling water from the south plant to the lagoon.

005 - cooling water from the north plant to the lagoon.

** Iced composite sample; however field temperatures remained higher than 4°C and all composite sample results should be used with caution.

Table 3. Results of Metals Analyses, Kaiser Aluminum WWTP - Spokane River Basin Class II Inspections, 3/93

Station:	004	005	002-E	Plant Intake	001	Water Quality Criteria++ (µg/L)	
Type:	comp	comp	comp	comp	comp	Freshwater	
Date:	3/22-23	3/22-23	3/22-23	3/22-23	3/22-23		
Time:	1330-1330	1420-1420	1500-1500	1400-1400	1410-1410		
Lab ID#1382:	-46	-47	-48	-43	-42	Acute	Chronic
Metals total (µg/L)							
Aluminum	105 P	180 P	673	174 P	187 P	750+	87+
Cadmium	0.73	0.88	0.12 P	0.89	0.94	1*	0.4*
Chromium	<5	<5	<16 J	<5	<5	16	11
Copper	6 P	8 P	<3	9.3 P	6.3 P	5*	4*
Lead	5.2 P	6.5 P	2.1 P	20	7.1 P	17*	0.6*
Mercury	<0.05 J	<0.05 J	<0.05 J	<0.05 J	<0.05 J	2.4	0.012
Nickel	<10	<10	22 P	<10	<10	490*	55*
Zinc	123	129	33 P	136	151	40*	37*

E - Ecology sample

J - The analyte was positively identified; the associated numerical result is an estimate.

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

* Receiving water hardness dependent criteria based on 28.5 mg/L as CaCO3 (EPA, 1986).

\+ EPA (1988).

++ Total recoverable method.

Shaded area metals are compared with the water quality criteria.

Table 4. Comparison of Inspection Results to NPDES Permit Limits – Kaiser Aluminum WWTP – Spokane River Basin Class II Inspections, 3/93

OUTFALL 001 – WASTEWATER LAGOON (WL) DISCHARGE TO SPOKANE RIVER

	NPDES Permit Limits		Inspection Data & Derived Loading		
Effluent Parameter	Daily Maximum* (Net, lbs/day)	Monthly Average** (Net, lbs/day)	Plant Intake Composite (mg/L)	WWTP Composite (mg/L)	Derived Net Loading (Net, lbs/day)
Oil and grease+	1,960	588	3 J	3 J	0.0
TSS	3,611	1,209	13	11	−380
Aluminum***	107.5	31	0.174 P	0.187 P	2.5
Zinc***	89.3	26.6	0.136	0.151	2.9
Chromium***	5.1	2.1	<0.005	<0.005	0.0
Cyanide	1.42	0.59	<0.002	<0.002	0.0
pH (S.U.)	6.0≤pH≤9.0		7.4	7.4	
Flow (MGD)	– – –	– – –	22.94	22.94	

OUTFALL 002 – INDUSTRIAL WASTEWATER TREATMENT (IWT) DISCHARGE TO WL

	NPDES Permit Limits		Inspection Data & Derived Loading		
Effluent Parameter	Daily Maximum* (lbs/day)	Monthly Average** (lbs/day)	Ecology Composite (mg/L)	Grab Samples (mg/L)	Derived Loading (lbs/day)
Oil and grease	84	50	– – –	3 J	3
TSS	171	82	7		8
Ortho-phosphate	12	9.6	<0.01		<0.01
Aluminum***	13.29	6.51	0.673		0.73
Zinc***	3.08	1.30	0.033 P		0.04
Chromium***	0.94	0.39	<0.016 J		<0.02
Cyanide	0.63	0.26	0.014		0.02
Flow (MGD)	– – –	– – –	0.13		

OUTFALL 003 – SANITARY WASTEWATER TREATMENT (SWT) DISCHARGE TO WL

	NPDES Permit Limits		Inspection Data & Derived Loading		
Effluent Parameter	Daily Maximum*	Monthly Average**	WWTP Composite	Grab Samples	Effluent Loading
BOD5					
(mg/L)	45	30	<50		
(lbs/day)	94	63			<88
TSS					
(mg/L)	45	30	5		
(lbs/day)	94	63			9
Fecal coliform					
(#/100 mL)	400	200		6	
Flow (MGD)	– – –	– – –	0.21		

J – The analyte was positively identified; the associated numerical result is an estimate.

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

\+ Grab sample.

* The daily maximum is a maximum value for any one day.

** The monthly averages for all parameters, except for fecal coliform, are based on the arithmetic mean of all values obtained during the specified period. The average for fecal coliform is based on the geometric mean of all values obtained during the specified period.

*** Analyzed by the total method as specified in the permit.

effluent mass loadings for comparison to permit limits. Wastewater lagoon discharge to the Spokane River (outfall 001) met permit requirements for oil and grease, TSS, aluminum, chromium, zinc, cyanide, and pH. The discharger's effluent limitations for outfall 001 were applied on a net basis as per their NPDES permit (Ecology, 1988). The IWT discharge to the lagoon (outfall 002) and the SWT discharge to the lagoon (outfall 003) met permit requirements for all parameters.

Table 5 compares results of analyses performed by Kaiser and Ecology on splits (or duplicates). Oil and grease, and TSS results were in acceptable agreement. However, three aluminum (673 versus 379, 187 P versus 227, and 180 versus 217) and two zinc (123 versus 84 and 151 versus 114) results revealed a disparity in lab results. The permittee's overall laboratory performance as revealed by sample splits was acceptable. Temperatures of all composited samples were above the recommended 4°C (APHA, 1989).

Conclusions and Recommendations

1) The plant was operating well during the inspection and lagoon effluent (001) met permit requirements for oil and grease, TSS, aluminum, chromium, zinc, cyanide, and pH. Effluent from IWT (002) and SWT (003) to the lagoon met permit requirements for all parameters.

2) Among metals detected in lagoon effluent (001), aluminum, cadmium, and lead concentrations exceeded chronic water quality criteria; while copper and zinc exceeded both acute and chronic criteria. Aluminum, cadmium, copper, lead, and zinc were also found at high levels in the receiving water (Plant Intake). Copper and lead concentrations in effluent were lower than levels found in the receiving water. Pelletier's (in prep.) Spokane River metals study should be consulted to address concerns about potential metals toxicity in the receiving water.

3) Both Ecology's and the discharger's effluent composite sample temperatures were higher than the recommended 4°C. The plant's sample coolers should be inspected and repaired/adjusted as necessary to provide adequate sample cooling.

References

APHA, 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.

Blau, P., 1993. Personal Communication, December 15. Staff Environmental Engineer, Kaiser Aluminum and Chemical Corporation. Trentwood WA.

Ecology, 1988. National Pollutant Discharge Elimination System Waste Discharge Permit for the Kaiser Aluminum and Chemical Corporation at Trentwood Works. Washington State Department of Ecology. Olympia WA.

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

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

Table 5. Comparison of Laboratory Results of Sample Splits, Kaiser Aluminum WWTP, Spokane River Basin Class II Inspections, 3/93

Station:	001		Plant-Intake		002-E		004		005	
Lab ID#:	138242		138243		138248		138246		138247	
Date:	3/22-23		3/22-23		3/22-23		3/22-23		3/22-23	
Sampler:	Kaiser		Kaiser		Ecology		Kaiser		Kaiser	
Laboratory:	Ecology	WWTP	Ecology	WWTP	Ecology	WWTP	Ecology	WWTP	Ecology	WWTP
Parameter										
Oil & grease (mg/L)	3 J	3.7	3 J	2.3	11 J	7.4	3 J	3.4	3 J	4.1
TSS (mg/L)	11	13.8	13	11	7	--	7	7	14	14.8
Al (μg/L)	187 P	227	174 P	154	673	379	105 P	105	180 P	217
Cr (μg/L)	<0.005	<0.002	<0.005	<0.002	<16 J	<0.002	<0.005	<0.002	<0.005	<0.002
Zn (μg/L)	151	114	136	125	33 P	44	123	84	129	104

J - The analyte was positively identified; the associated numerical result is an estimate.

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

------, 1988. Quality Criteria for Water. EPA 440/5-86-001, Addendum for Aluminum, August 23.

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.

Glenn N., and T. Nell, 1991. Kaiser Aluminum and Chemical Corporation - Trentwood, Class II Inspection. 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.

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

Thomson, D., 1993. Personal Communication, December 23. Ecology Manchester Laboratory, Manchester WA.

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