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Segment No. 24-54-01

STATE OF WASHINGTON

DEPARTMENT OF ECOLOGY

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MEMORANDUM
December 24, 1986

To: Roger Ray, Eastern Regional Office

From: Don Reif, Water Quality Investigations Section

Subject: Kaiser Aluminum & Chemicals Corporation Class II Inspection, May 6-7, 1986

ABSTRACT

A Class II inspection was conducted at Kaiser Aluminum & Chemicals Corporation, Spokane, on May 6 and 7, 1986. The plant produces aluminum coil, sheet, and plate. Both domestic and industrial wastewater treatment facilities are located on the site. The survey analyzed plant operation and treatment efficiencies, reviewed laboratory procedures and sampling methods, conducted acute toxicity bioassays, and reviewed issues concerning new National Pollutant Discharge Elimination System (NPDES) permit issuance. Plant operation and treatment efficiencies appeared good overall. However, the daily average total chrome exceeded the permit allowance. Also, high levels of aluminum were found in the industrial effluent. Trout mortality was 100 percent in the industrial effluent, but not observed in the final lagoon outfall. Recommendations were made concerning further toxicity testing, new permit limits, and laboratory procedures.

INTRODUCTION

Kaiser Aluminum & Chemicals Corporation (KACC), Trentwood, is an aluminum rolling mill and metal finishing plant in east Spokane (Figures 1a and 1b). The 41-year-old plant operates continuously, all year around, employing about 1,500 people. Major endproducts are aluminum coil, sheet, and plate.

KACC uses about 450,000 gpd of on-site well water. Of this, 200,000 gpd is for domestic uses. The rest is for industrial process needs. Also, Spokane River water is used for cooling. Intake flows ranged from 10.0 to 40.0 MGD, and averaged 21.5 MGD in 1985 (from discharge monitoring reports).

KACC is regulated by NPDES permit #WA-000089-2, issued in 1975. A new permit is now being developed. It will be based on water quality and Best Available Technology (BAT).

A Class II inspection was held at KACC on May 6 & 7, 1986. The survey was conducted by John Bernhardt, Marc Heffner, and Don Reif of the Washington Department of Ecology, Water Quality Investigations Section. John Schaeffer, KACC environmental engineer, aided the effort. Also participating were Roger Ray and Jim Prudente, Ecology Eastern Regional Office.

The inspection objectives were:

- provide data on issues about the new permit, such as limits on specific pollutants, and a best management practices (BMP) plan.
- characterize plant operation and treatment efficiency.
- review lab procedures and sampling methods.
- conduct acute toxicity screening bioassays.

Site Description

Located at the Trentwood complex are both domestic and industrial wastewater treatment plants. The domestic wastewater treatment plant (DWTP) consists of a primary clarifier, rock trickling filter, secondary clarifier, and chlorine disinfection. Sludge is digested and dried on-site (Figure 2). The industrial wastewater treatment (IWT) facility processes oil, phosphorus, and chromium waste streams, as follows (Figure 3).

- o Emulsified oil waste is broken down by acid-heat treatment. The water portion flows to a neutralization tank for further treatment.
- o Hexavalent chrome waste is reduced to the trivalent form by acid-sulfur dioxide reduction. This reduced waste is also sent to the neutralization tank. It is mixed with the oil waste and untreated phosphate waste.
- o Lime and polymer are then added to the mixture. Calcium hydroxide complexes with the chromium and phosphate ions to form settleable floc. This sludge is dewatered and hauled to a local landfill.
- o DWTP and IWT effluents discharge to a 4 MGD lagoon. The used cooling water is added also. The lagoon discharges directly to the Spokane River. Several oil skimmers on the lagoon collect

oil residuals such as from spills, contact cooling water, and storm water.

METHODS

Sampling locations and parameters analyzed are summarized in Table 1 (see appendix). Twenty-four hour composite samples were collected by both Ecology and KACC. Grab samples were collected periodically at the same locations. Both KACC and Ecology composite samples were split for comparative analyses. Ecology samples were placed on ice and shipped to Ecology's Manchester Laboratory for analyses of conventional parameters. Priority pollutant organics samples were analyzed by Analytical Resources, Inc.

Acute 96-hour effluent bioassays with juvenile rainbow trout (*Salmo gairdneri*) were conducted using State of Washington test methods. Grab samples were collected from the industrial and lagoon effluents and Spokane River at the KACC intake.

Bioassays also were run on the IWT sludge, following procedures in Ecology's "Static Acute Fish Toxicity Test" (WDOE 80-12). The test is a toxicity range-finding tool. Rainbow trout were placed in two sets of test chambers, containing either 100 or 1000 mg/L concentrations of KACC industrial sludge, for 96 hours. Three replicates of 10 fish per dilution, plus a control, were monitored for mortality during the test.

KACC analysis included in-house and contract lab work. All NPDES permit parameters were analyzed at their on-site laboratory. A laboratory review for these procedures was conducted with Peter O'Brien, Bonnie Guindon, and Kathy Maynard from the KACC lab. Other tests (metals, organics, etc.) were analyzed by Amtest Laboratory of Seattle.

RESULTS

The composite and grab-sampling data collected during the inspection are given in Tables 2 & 3. These data provide an overview of the survey results and serve as reference for the following discussions.

Flow

KACC maintains flow meters to measure IWT and DWT effluents and final lagoon outfall. Instantaneous flows were measured at these sites, but no estimate of the meters' accuracy was made. Flows are listed in Table 9.

NPDES Permit Compliance

The analytical results for the current NPDES permit parameters are listed in Table 4. Each parameter was measured from a specific location, as noted in the table. Findings include:

- all domestic plant parameters were well within allowable limits.
- industrial effluent parameters were within permit limits except for total chromium, which exceeded the daily average criterion.
- pH of the lagoon outfall exceeded the permitted limit on one of three samples.

With these exceptions, the plant showed good compliance with the existing permit.

Metals

Results of metals analysis are shown in Table 5. Many parameters were either below detectable concentrations or at relatively low levels. The highest concentrations of most metals were in the industrial effluent.

Aluminum was the most prevalent metal. Although not included in the current permit, aluminum will be a limited parameter in KACC's new permit (Roger Ray, personal communication). Proposed limits (SAIC, 1986) are 14.2 and 28.4 lbs/day, for 30-day average and daily maximums, respectively, as measured in IWT effluent. Industrial effluent loading during this inspection was 68.4 lbs/day. This is nearly five times the proposed monthly average criterion.

Chromium exceeded the daily average loading limits as noted previously. Zinc was low from IWT, but higher in the lagoon outfall than in the river. The reason for this is unknown; one possible source, though, is via contact cooling water.

Sludge Metals

A sample of dewatered industrial waste sludge was analyzed for metals by the extraction procedure toxicity test (EP Tox) (WDOE 83-13). Results of the eight parameter analysis are listed in Table 6.

Chromium, at 3.5 mg/l, approached the criterion concentration for designation as a dangerous waste (5.0 mg/l). Recommendations concerning the chromium content of this sludge are as follows (from Brett Betts, Ecology; personal communication):

- chromium content should be monitored closely.
- the local health department should be notified of the chromium content, as chrome could be of particular interest to them.
- a relatively high percent of the total chromium content (30 percent) appears to be soluble. If the treatment process could be altered to decrease the soluble fraction, disposal problems may be avoided.

IWT Sludge Bioassay

No toxicity was observed in IWT sludge. Survival was 100 percent for all test organisms and the control.

Volatile and Acid, Base, Neutral Organics

Organic parameters detected in IWT effluent and/or lagoon outfall are listed in Table 7. Although a number of compounds were identified, all were found at relatively low concentrations. Ambient criteria are listed for several of the parameters. From this information, it appears that no individual compound was present in significant amounts in either waste stream.

Effluent Bioassays

Bioassay results are listed in Table 8. The lagoon outfall did not cause any fish mortalities. However, a 65 percent industrial effluent sample caused 100 percent trout mortality in the first two hours of the 96-hour test. Additional tests were run on this effluent after the pH was adjusted from 10.3 to 8.2. Again, mortality was complete. Since pH did not appear to be the major cause of death, bioassays with 30 percent and 10 percent effluent were run. Acute toxicity was greatly reduced at these concentrations (13 and 0% mortality, respectively). This is consistent with no toxicity observed in the lagoon outfall, which was diluted approximately 35:1, or to 2.9 percent effluent, by Spokane River cooling water.

A 17 percent mortality occurred with 100 percent Spokane River water. This result may be due to experimental variables unrelated to toxicity, or perhaps from the concentration of zinc. The Spokane River has higher-than-normal background zinc concentrations, to which native trout have adapted, but which may adversely affect hatchery fish (Bailey & Saltes, 1983).

The rapid and complete trout mortality in KACC IWT effluent may best be explained as aluminum toxicity. A concentration of 5.0 mg/L has proven lethal to trout in 5 minutes of exposure (Resources Agency of California, 1963). Aluminum was present in the IWT effluent at 7.5 times this amount. Conversely, the aluminum concentration in lagoon effluent was 100 times less, and no toxicity was observed.

Further toxicity testing is recommended, for the following reasons. First, a toxic component has been documented. Second, Spokane River flows frequently provide less than 100:1 dilution with KACC effluent, especially during the summer and fall months. Available dilution of less than 100:1 is, by itself, sufficient cause to proceed with definitive toxicity testing (EPA, 1985). In fact, the seven consecutive day low flow predicted to occur every ten years (7Q10) is 113 cfs or 73 MGD at Liberty Bridge (Rod Williams, USGS, personal communication). This may provide less than a 3:1 dilution.

Because of the potential for toxic impact, a definitive data generation procedure is recommended, as defined by EPA (EPA 1985). This process should involve the following considerations. First, 24-hour composite samples should be gathered on at least three consecutive days, from both IWT and lagoon effluents. Second, a suite of at least three organisms, from two or more trophic levels, should be tested for both acute and chronic toxicity effects. Serial dilutions should be conducted to determine the No Observable Effects Level (NOEL). Sample chemistry should be included. Third, the NOEL should be compared to the Instream Waste Concentration (IWC). NOEL is the theoretical concentration of effluent in the Spokane River after complete mixing.

The IWC must be less than or equal to the NOEL. If so, the sampling program may be reduced to one 24-hour composite bioassay, every 6 months. This analysis may include only the two most sensitive species, as determined from prior testing. Conversely, if the IWC is found to be greater than the NOEL, a toxicity reduction evaluation should be implemented to assure protection of the aquatic environment (EPA, 1985).

Temperature

Temperature is an important factor for protection of aquatic life in the Spokane River. Trout, especially, may be adversely impacted by warm temperatures. Stress and growth reduction may occur: a 50 percent mortality is possible if water temperatures exceed 24°C (Bailey and Saltes, 1982).

Generally, the maximum temperature in the upper Spokane is 23°C (Bailey and Saltes, 1982). Unfortunately, maximum river temperature and low flow tend to occur simultaneously, when KACC effluent will have its greatest impact. When the Spokane River exceeds 20°C, no discharge may increase river temperature by more than 0.3 degree (Ecology, 1984).

Calculations were made using 7Q10 flows and a KACC Spokane River intake of 26 MGD. Under these conditions, river temperature will increase from 23 to 23.3°C when lagoon effluent is 23.8°C. A new permit limit of 24°C is therefore recommended for the final outfall. Calcuations are shown in the appendix.

Phosphorus

Total phosphorus monitoring should be included in the new permit. A wasteload allocation is currently being developed for the upper Spokane River. This information is necessary for all point source discharges. Samples should be collected from the intake and the lagoon outfall, and flows measured. This may require the installation of additional flow meters. The net KACC phosphorus load can then be properly measured.

Laboratory Review

A review of lab procedures showed that, in many instances, updated techniques should be implemented. The two most obvious areas were BOD_5 and solids analysis. Comments are as follows:

BOD

If chlorinated DWTP effluent is tested, samples should be dechlorinated with sodium thiosulfate and re-seeded before analysis. An adequate microbe population should then be present.

The sodium thiosulfate solution should be standardized for each set of BODs, and stored in brown bottles. PAO may be substituted for thiosulfate.

A new batch of dilution water should be made for each set of BODs, and then discarded. Sample pH must be between 6.5 and 8.5. Meter calibration with pH buffers 7 and 10 are more appropriate for typical KACC effluents than pH 4 and 7. For details, see Standard Methods (APHA-AWWA-WPCF, 1985).

TSS

A comparison of Ecology versus KACC analysis showed TSS values consistently less from the KACC lab. Several discrepancies in technique, as noted below, may help.

The TSS test should be run using a Standard Methods approved filter. Several allowable filters are listed in Standard Methods.

The full TSS sample aliquot must be applied to the filter, with none remaining in the graduated cylinder. All sample should have passed through the filter within 5 minutes, or the test should be repeated with a new filter and smaller sample volume. Also, the use of a larger filter than a Gooch crucible may be more convenient as well as accurate because of larger sample volumes. In addition, dried samples should be re-dried and re-weighed quarterly, as a quality control check.

CONCLUSIONS

1. Both KACC wastewater treatment systems were operating well at the time of the inspection.

2. The IWT was out of compliance for daily average total chromium. Lagoon outfall pH exceeded the permit limit on one of three samples.

3. IWT effluent was highly toxic to rainbow trout, but no toxicity was observed in the lagoon outfall. Recommendations for further effluent testing were made.

4. Aluminum was high in IWT effluent and is a likely cause of the observed acute toxicity.

5. Chromium in IWT sludge was near the concentration for designation as a dangerous waste. Recommendations were given.

6. No organics were found at levels that appeared to be of concern in either IWT or lagoon effluents.

7. The KACC laboratory should upgrade protocols to include the latest recommendations of Standard Methods. These were discussed in the laboratory review section.

DR:cp

Attachments

REFERENCES

APHA-AWWA-WPCF, 1985. Standard Methods for the Examination of Water and Wastewater, 16th Edition.

Bailey, G.C. and J. Saltes, 1982. Fishery Assessment of the Upper Spokane River, State of Washington Water Resources Center, WSU, Report #46, June 1982.

Bailey, G.C. and J. Saltes, 1983. The Development of Some Metals Criteria for the Protection of Spokane River Rainbow Trout, Dept. of Civil and Environmental Engineering, WSU, September 1983.

EPA, 1980. Ambient Water Quality Criteria for Zinc, EPA 440/5-80-079, October 1980.

EPA, 1985. Technical Support Document for Water Quality-based Toxics Control. September 1985.

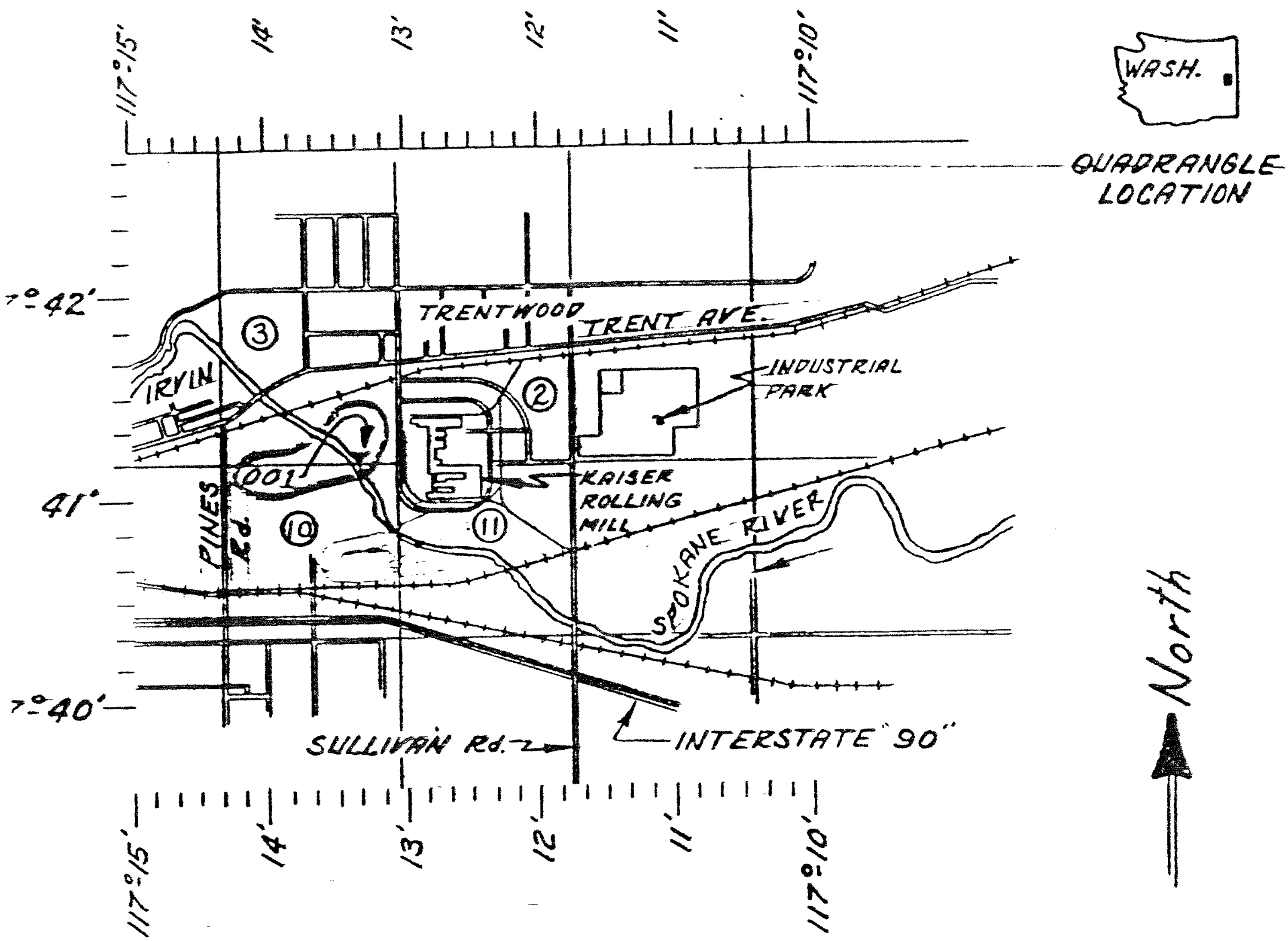
Noyes Data Corporation, 1980. Priority Toxic Pollutants: Health Aspects and Allowable Limits. Park Ridge, NJ.

Resources Agency of California, State Water Quality Control Board. 1963. Water Quality Criteria, 2nd Edition.

SAIC, 1986. Development of Permit Limitations for Kaiser Aluminum & Chemical Corporation, 1986.

Washington, State of, 1984. Water Pollution Laws and Regulations, Dept. of Ecology, May 1984.

APPENDIX

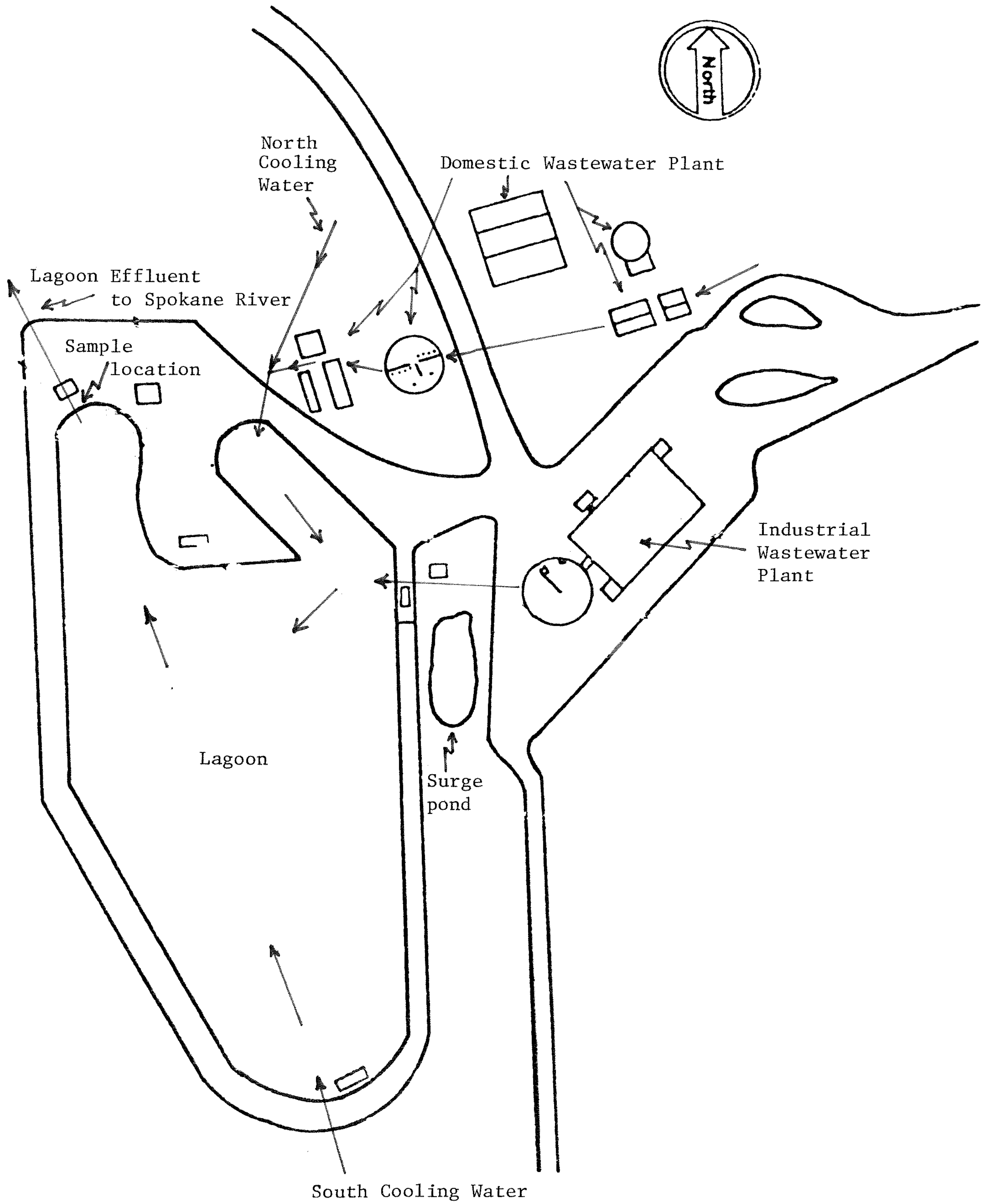


TRACED FROM UNITED STATES DEPARTMENT OF THE INTERIOR GEOLOGICAL SURVEY GREENACRES, WASH. & IDAHO.
N. 4730 - W 11700/15

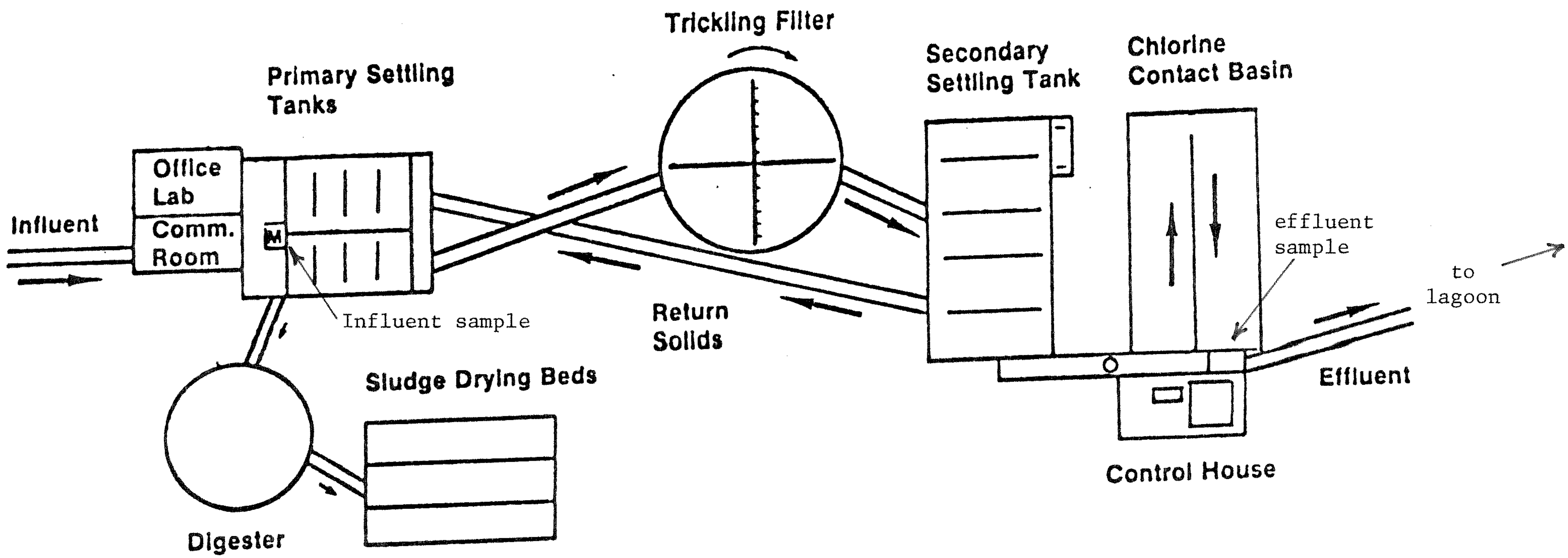
SCALE 1:62500

LOCATION MAP
OUTFALL 001
in SPOKANE RIVER
at TRENTWOOD
County of SPOKANE, State WA.
Application by KAISER ALUMINUM & CHEMICAL CORP. Date 10-1-71

Figure 1a.



Treatment Systems Layout
Figure 1b.



Domestic Wastewater Treatment Plant

Figure 2.

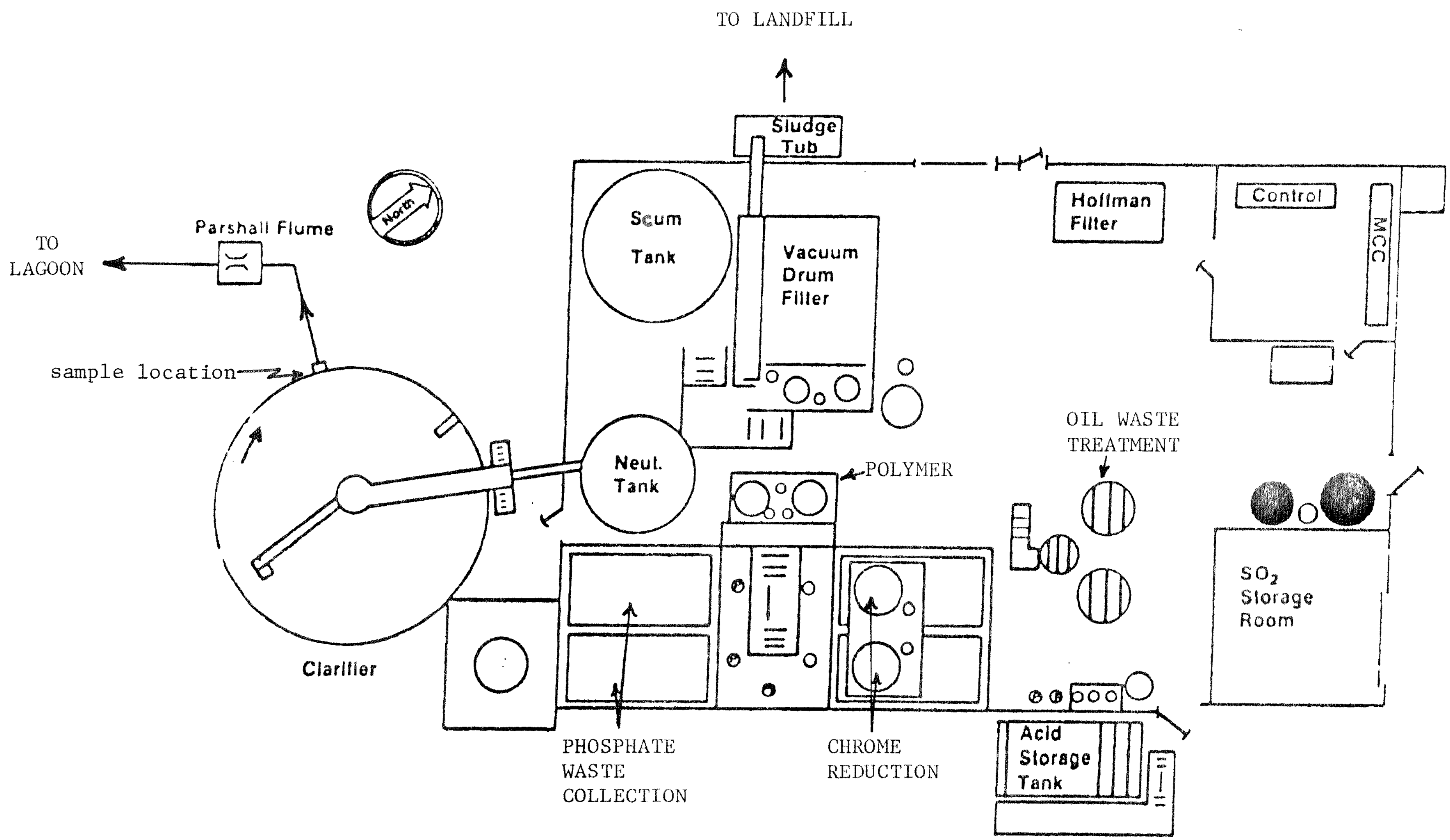


FIGURE 3.
KACC Industrial Wastewater Treatment System

Table 1. Sampling schedule for Class II inspection; Kaiser Aluminum & Chemicals Corporation, Spokane, wastewater treatment facilities, May 6-7, 1986.

Sample	Station Number	Date	Time	Field Analyses: pH	Conductivity	Temperature (°C)	Chromium (+6)	Flow	Cl_2 Residual	Laboratory Analyses: pH	Turbidity	Conductivity	Alkalinity	Hardness, Total	Sulfate	BOD_5, Total	Solids (4)	TSS	% Solids	Nutrients (5)	$O-PO_4-P$	Total-P	COD	Cyanide, Total	Cyanide, Free	Phenols	Oil & Grease	Chromium (+6)	Metals, Total	Metals, Tot. Rec.	Metals, Diss.	EP Tox Metals	Bioassay	Fecal Coliform	Priority Pollutants: Metals	ABN	PCB	VOA
Grab Samples																																						
Domestic Influent	1	5/6	1215	X	X	X																												X				
		5/6	1630																															X				
		5/7	1010	X	X	X																												X				
Domestic Effluent	2	5/6	1218	X	X	X																																
			1615	X	X	X																																
			1750						X																													
			1800					X																														
		5/7	1020	X	X	X			X																													
Industrial Effluent	3	5/6	1206	X	X	X																																
			1705	X	X	X												X			X	X				X	X	X	X	X	X							X
			1730				X																															
			1810					X																														
		5/7	1100	X	X	X												X			X	X				X	X	X	X	X	X		X					X
Lagoon Outfall	4	5/6	1220	X	X	X																																
			1640	X	X	X												X			X	X				X	X	X	X	X	X			X				
			1705					X										X			X	X				X	X	X	X	X	X							X
			1740				X																															
			1800					X																														
		5/7	1145	X	X	X																											X	X				X
Industrial Sludge	5	5/9	1100																X										X			X	X					
Spokane River	6	5/7	1000	X	X	X					X			X							X	X							X	X	X		X					
Composite Samples																																						
Domestic Influent	1	5/6	1000																																			
		5/7	0945	X	X	X				X	X	X	X			X	X			X			X															
Domestic Effluent	2	5/6	1030																																			
		5/7	1000	X	X	X				X	X	X	X			X	X			X			X															
Industrial Effluent	3	5/6	1130																																			
		5/7	1045	X	X	X				X	X	X	X	X	X			X		X			X	X	X	X		X		X	X				X	X	X	
Lagoon Outfall	4	5/6	1045																																			
		5/7	1030	X	X	X				X	X	X	X	X	X			X		X			X	X	X	X		X		X	X				X	X	X	

Table 2. Ecology results - domestic wastewater treatment plant analyses; Kaiser Aluminum & Chemicals Corporation Class II inspection, May 6-7, 1986.

				Field Analyses			Laboratory Analyses						Nutrients (mg/L)					Solids (mg/L)				
Sample	Sampler	Date	Time	pH (S.U.)	Conductivity (umhos/cm)	Temperature (°C)	Fecal Coliforms (#/100 mL)	pH (S.U.)	Turbidity (NTU)	Sp. Conductivity (umhos/cm)	COD (mg/L)	BOD_5 (mg/L)	NH_3-N	NO_2-N	NO_3-N	O-PO_4-P	Total-P	Total Solids	Total Non-vol. Solids	T. Susp. Solids	TNVSS	Alkalinity (mg/L as $CaCO_3$)
Composite Samples																						
Influent	Ecology	5/7		8.1	330	3.2		8.0	7	353	59	29	6.7	0.15	1.8	0.82	1.4	200	130	25	2	120
	Kaiser			7.9	335	12.7		8.3	15	418	290	>60	5.8	0.17	1.3	0.95	2.1	270	160	33	3	160
Effluent	Ecology	5/7		7.9	320	3.2		8.0	6	325	31	8	5.0	0.18	1.7	0.83	1.1	180	120	6	<1	110
	Kaiser			7.9	325	9.0		8.1	5	354	38	12	6.2	0.21	1.6	0.90	1.3	200	120	11	3	110
Ecology Grab Samples																						
Influent		5/6	1215	8.4	360	13.7																
		5/7	1010	7.7	370	13.4																
Effluent		5/6	1135				49															
			1218	7.8	315	13.4																
			1615	7.2	340	14.3	57															
		5/7	1020	7.5	310	11.9	7															

Table 3. Ecology results - industrial wastewater plant effluent and lagoon outfall; Kaiser Aluminum & Chemicals Corporation Class II inspection, May 6-7, 1986.

Parameter	ECOLOGY GRAB SAMPLES							COMPOSITE SAMPLES			
	Industrial Eff.			Lagoon Outfall			Spokane River	Industrial Effluent Ecology	Industrial Effluent Kaiser	Lagoon Outfall Ecology	Lagoon Outfall Kaiser
Date	5/6	5/6	5/7	5/6	5/6	5/7	5/7	5/7	5/7	5/7	5/7
Time	1206	1705	1100	1220	1690	1145					
Field Analysis											
pH (S.U.)	11.3	11.4	11.7	8.3	8.4	8.7		11.3		8.4	
Conductivity (umhos/cm)	>1000	>1000	>1000	80	95	85		>1000		88	
Temperature (^{o}C)	24.8	30.0	29.8	16.0	18.8	14.8		7.1		3.8	
Hexachrome (mg/L)		N.D.			N.D.						
Laboratory Analysis											
pH (S.U.)								11.8	10.8	8.4	8.1
Turbidity (NTU)							1	11	11	5	4
Spec. Cond. (umhos/cm)								1640	1620	78	78
COD (mg/L)								920	942	21	14
NH_3-N (mg/L)								0.26	1.3	0.06	0.02
NO_2-N (mg/L)								0.31	0.28	0.01	<0.01
NO_3-N (mg/L)								0.18	0.19	0.07	0.10
O-PO_4-P (mg/L)		0.01			0.04	0.05	<0.01	0.01	0.02	0.02	0.02
Total P (mg/L)		0.25			0.07	0.05	<0.01	0.13	0.16	0.07	0.09
Total Solids (mg/L)								1700		64	
TNVS (mg/L)								1400		40	
TSS (mg/L)								52	41	6	
TNVSS								38		3	
Sulfate (mg/L as SO_4)								700	780	10	9.3
Total Hardness (mg/L as $CaCO_3$)							34	20,000	970	42	44
Alkalinity (mg/L as $CaCO_3$)								450	430	30	27
Phenols (mg/L)		0.33	0.28			0.01	0.01	0.32		0.03	
Oil & Grease (mg/L)	10	16	13	3	3	3					
Cyanide, Total/Free (mg/L as CN)								0.020/0.015		0.005/0.005	
Fecal Coliform (#/100 mL)					11	47					

N.D. = Not detected.

Table 4. Comparison of Ecology inspection data to NPDES permit limits; Kaiser Aluminum and Chemicals Corporation Class II inspection, May 6-7, 1986.

Parameter	Measurment Station	NPDES Permit Limit Daily Average	NPDES Permit Limit Daily Maximum	Inspection Results
Flow (MGD)	Outfall		33	15.1
TSS (lbs/day)	Industrial plus domestic effls.	253.5	350	105
Oil and Grease				
(lbs/day)	Industrial effl.	106	132	24
(mg/L)	Outfall	10	15	3
$O\text{-}PO_4\text{-}P$ (lbs/day)	Industrial effl.	9.6	12	0.03
Chromium (+6), (lbs/day)	Industrial effl.	0.16	0.20	ND
Total Chromium (lbs/day)	Industrial effl.	0.8	1.0	/0.88/
BOD_5 (lbs/day)	Domestic effl.	72.5	124	15
Fecal Coliforms (#/100 mL)	Domestic effl.	200	400	38
pH	Outfall	6.5 - 8.5		8.3, 8.4, /8.7/

/ / = Exceeds daily average or maximum permit limits.

ND = Not detected.

Table 5. Metals concentrations - Kaiser Aluminum & Chemicals Corporation Class II inspection, May 6-7, 1986 (all parameters in ug/L).

	Industrial Effluent			Lagoon Outfall			Spokane River		
Parameter	Total	Total Recov.	Dissolved	Total	Total Recov.	Dissolved	Total	Total Recov.	Dissolved
Aluminum	37,600*			360					
Zinc	14	8	<1	91	81	79	75	84	58
Chromium	484	433	14	12	10	7	<1	<1	<1
Nickel	26	29	21	<1	<1	<1	<1	<1	<1
Lead	<1	<1	<1	<1	<1	<1	<1	<1	<1
Arsenic	<1			<1					
Mercury	0.16			0.04					
Selenium	3			<1					
Silver	<0.2			<0.2					
Beryllium	<0.2			<0.2					
Copper	<1	5	<1	9	2	<1	2	23	<1
Cadmium	<0.2	0.4	<0.2	0.4	1.0	0.8	0.3	0.5	<0.2
Antimony	68			<1					
Thallium	15			2					

*KACC analysis, from sample split.

Table 6. Extraction procedure toxicity test results of industrial sludge - Kaiser Aluminum & Chemicals Corporation Class II inspection, May 6-7, 1986.

Parameter	Sludge Concentration (mg/L)	Dangerous Waste Criteria (mg/L)
Arsenic	0.003	5 - 500
Barium	<0.050	100 - 10,000
Cadmium	0.0033	1 - 100
Chromium	3.5	5 - 500
Lead	0.026	5 - 500
Mercury	0.00004	0.2 - 20
Selenium	<0.001	1 - 100
Silver	0.0002	5 - 500

Table 7. Volatile and acid/base neutral organics found at or above detectable levels - Kaiser Aluminum & Chemicals Corporation Class II inspection, May 6-7, 1986 (ug/L).

Compounds	Industrial Effluent	Lagoon Effluent	Criteria* Acute	Criteria* Chronic
Priority Pollutants				
1,1,1-trichloroethane	11	2u	5,300+	--
Benzene	4	2u	5,300	--
Toluene	3	2u	17,500	--
Methylene Chloride	5	4u	4,000+	--
Chloroform	3u	3	28,900	1,240
Phenol	15	2.2u	10,200	2,560
2,4-dimethylphenol	94	2.2u	2,120	--
Naphthalene	11 J	2.2u	2,300	620
Phenanthrene	2.2 J	2.2u	--	--
bis(2-ethylhexyl) phthalate	0.75 J	0.38u	--	--
Dangerous Substances				
Acetone	990 J,B	93 B	--	--
2-butanone	19	7u	--	--
Total Xylenes	5	34	--	--
4-methylphenol	250	2.2u	--	--
2-methylnaphthalene	2.6	2.2u	--	--
Others Found				
Mesitylene	90 J			
1-ethyl-d,4-dimethyl-benzene	135 J			
IH-indene; 2,3-dihydro-4-methyl-	38 J			
Isodurene	59 J			
2-bromo-thiophene	44 J			
IH-indole-5-ol	65 J			
3-ethylphenol	610 J			
N,N-dicotyl-ethanediamine	710 J			
Hexylene glycol	290 J			

u = Not detected at detection limit shown.
J = Estimate only.
B = Compound also found in blank as a contaminant.
* = EPA - Quality Criteria for Water, 1986, except where noted.
+ = Priority toxic pollutants; health impacts and allowable limits; Noyes Data Corp., 1980.

Table 8. Ninety-six-hour rainbow trout bioassay results; Kaiser Aluminum & Chemicals Corporation Class II inspection, May 6-7, 1986.

Water Sample	Percent Sample	Percent Survival	Initial pH	Diluent
Industrial Effluent	65	0	10.3	Manchester water
	65	0	8.2	" "
	30	87	9.5	" "
	10	100	9.2	" "
Lagoon Outfall	65	100	8.4	Manchester water
		100	8.0	Spokane River
Spokane River	100	83	8.0	None
Control	0	97	8.0	Manchester water

Table 9. Flow data, Kaiser Aluminum & Chemicals Corporation; May 6-7, 1986.*

Location	Flow (MGD)
Industrial effluent	0.218
Domestic effluent	0.218
Lagoon effluent	15.1

*From KACC records.

Table 10. Kaiser Aluminum & Chemicals Corporation effluent loading to Spokane River, May 6-7, 1986.

Parameter	Loading, lbs/day
Total solids	8,060
Total suspended solids	756
Total phosphorus	8.8
$O-PO_4-P$	2.5
NH_3-N	7.6
NO_3-N	8.8
Oil and grease	378
Total chrome	1.5
Total aluminum	45
COD	2,645

Blended effluent/Spokane River temperature calculation

$$Q_r \; T_r + Q_e \; T_e = Q_{r+e} \; T_{r+e}$$

therefore: $$T_e = \frac{Q_{e+r} \; T_{e+r} - Q_r \; T_r}{Q_e}$$

T_r = 23°C; maximum ambient river temperature
T_{e+r} = 23.3°C; maximum ambient plus allowable increase
Q_{e+r} = 73; 7Q10 low flow
Q_e = 26 MGD; usually highest daily flow
Q_r = 47 MGD river flow at KACC discharge

Substituting, T_e = 23.8°C

Therefore, the river reaches the maximum allowable temperature, due to KACC effluent, when lagoon effluent temperature is 23.8°C. Since this is essentially a worst-case scenario, a limit of 24°C should be adequate.