WASHINGTON STATE
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KAISER ALUMINUM (MEAD) CLASS II INSPECTION

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KAISER ALUMINUM (MEAD) CLASS II INSPECTION

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ABSTRACT

A Class II Inspection was conducted May 18-20, 1993, at the Kaiser Aluminum and Chemical Corporation (Kaiser) aluminum smelter in Mead, Washington. The inspection investigated the Kaiser sanitary sewage trickling filter plant (SSTP), cooling water settling basin, and a peripheral wastewater treatment plant. SSTP influent and effluent concentrations were all within NPDES permit limits. SSTP BOD_5 removal efficiency was less than the 65% required by permit. Smelter effluent results were generally less than NPDES permit limits except for the 24-hour composite TSS result, which exceeded the monthly average limit. Effluent organic and metal concentrations were generally within state and EPA water quality criteria with the exception of aluminum, which exceeded the 1988 EPA criteria. Bioassays found slight acute and chronic toxicity. Areas for improvement of SSTP operation and maintenance are noted.

Deadman Creek water sample results suggest some contamination by smelter discharge. Due to public use of the receiving water, effluent fecal coliform monitoring is advised. Sediment samples collected near the outfall found BNAs and copper exceeded Ontario Provincial Sediment Quality Guidelines lowest effects levels. The coke calciner mill's sanitary treatment plant was not operating during the inspection, but typically receives a small influent load. Alternative treatment strategies should be considered. Influent TNVS, COD, and conductivity concentrations suggest contamination of the non-contact cooling water. Investigation for leaks in the cooling system is advised. Water quality in the other coke calciner discharges was acceptable.

SUMMARY

Smelter Wastewater Treatment System

Power Failure

A power failure the night of the composite sampling period caused a bypass of the sanitary treatment plant trickling filters. The failure also stopped the sanitary plant influent compositor and the settling basin effluent flow meter. Evaluation of the sanitary treatment plant efficiency may have been partially compromised.

Sanitary Treatment Plant

Flow Measurement

Comparisons of Ecology flow calculations to Kaiser's sanitary plant effluent flowmeter found the meter underreported flows. Kaiser's sanitary plant influent flowmeter was not operating during the inspection, but has subsequently been replaced.

Plant Operation

In addition to problems with flow measurement, the sanitary treatment plant had several operation and maintenance difficulties.

General Chemistry

Influent concentrations were low compared to typical domestic wastewater treatment plants. Treatment efficiency for BOD_5, TOC, COD, and nutrients across the SSTP was low. Low removal efficiency likely reflects weak influent strength as well as the trickling filter bypass.

Split Samples

Influent SSTP split comparisons were not possible due to Kaiser's compositor failure. Kaiser influent sampler intake positioning needed improvement. SSTP effluent split comparisons were generally acceptable. The Kaiser laboratory is accredited.

NPDES Permit Comparisons

SSTP influent and effluent results were all within NPDES permit 30-day and 7-day average limits with one exception. Effluent BOD_5 reduction across the SSTP was less than the 65% monthly average reduction required by the permit.

Detected Organics and Priority Pollutants

Concentrations of VOAs, BNAs, and metals were detected in the SSTP effluent. The copper concentration exceeded Washington state freshwater chronic water quality criteria for receiving waters. The SSTP effluent is diluted with cooling water and passes through a settling basin prior to discharge.

<u>Smelter Cooling Wastewater</u>

Flow Measurement

Comparison of Ecology flow calculations to Kaiser's settling basin flowmeter found the meter to be accurate.

Settling Basin Operation

The settling basin appeared to be functioning normally, although high flow events may increase TSS concentrations.

General Chemistry

Solids, oxygen demand, and nutrient parameter concentrations in the effluent were generally low. The composite sample TSS result for the settling pond influent was higher than expected, and suggests possible contamination of the non-contact cooling water.

Split Samples

Settling basin split comparisons found Kaiser sampling and analysis to be acceptable.

NPDES Permit Comparisons

Smelter total effluent discharge concentrations were within NPDES permit monthly average and maximum limits with the exception of a 24-hour TSS composite result. Smelter effluent 24-hour composite TSS concentration exceeded the permit's monthly average limit by 20%. A high fecal coliform density (550 colonies/100ml) was found in one effluent sample. Swimmers/ waders were observed near the outfall and the receiving water is classified for use as drinking water.

Detected Organics and Priority Pollutants

Volatile organic, BNA, and Pesticides/PCB results did not exceed EPA water quality criteria for receiving waters. PAHs were also found in low concentrations. Metals did not exceed EPA or state water quality criteria with the exception of aluminum, which exceeded both the EPA acute and chronic water quality criteria.

Bioassays

Daphnia pulex experienced acute toxicity (NOEC: 50% effluent and LC_{50}: 75.8% effluent) and *Ceriodaphnia dubia* experienced chronic toxicity (NOEC: 50% effluent). This toxicity may be associated with aluminum and fluoride concentrations.

Receiving Water and Sediments

Deadman Creek Water Samples

The data indicate incomplete mixing of the effluent/receiving water near the outfall. Several parameters detected near the outfall were at slightly higher concentrations than upstream samples and implicate the outfall as the source. Far downstream results displayed the highest concentrations for several parameters and likely reflect other sources of contamination. Fluoride concentration increases from 0.09 mg/L upstream of the outfall to 0.11 mg/L 150 ft. downstream. The near outfall Fluoride concentration (1.4 mg/L) was less than public drinking water criteria, but exceeded the threshold identified by a NOAA study as adversely effecting the behavior of returning salmon. Total aluminum concentration exceeded the EPA freshwater chronic water quality criteria for receiving waters at all stations and the acute criteria at several stations.

Deadman Creek Sediment Samples

Concentrations of metals and several BNA compounds found in the sediment suggest that Kaiser discharge is the source. Several PAHs and copper exceeded the Ontario Provincial Sediment Quality Guidelines lowest effects level at the outfall. The downstream sediment PAH and copper concentrations were well within the guidelines, as was the upstream sediment copper concentration.

Coke Calciner Mill Treatment System

The coke calciner mill sanitary treatment plant was not operating due to a failure of the aerator tank. The plant served a maximum of 10 employees per shift and the influent flow was augmented by cooling water to increase hydraulic loading. Influent was generally weak, although high COD, conductivity, and TNVS suggest some cooling water contamination. Ecology measurements of flow at the sanitary plant's Parshall flume gave an estimate of 0.034 MGD.

The influent to the receiving pond/marsh was very weak and received relatively little treatment in the pond/marsh prior to infiltration to groundwater. All detected organics and metals were within the EPA chronic and acute water quality criteria for receiving waters.

RECOMMENDATIONS

Sanitary Plant Wastewater

- Recalibration of the sanitary plant effluent flow meter.
- Remedy the sanitary plant operation and maintenance difficulties noted in the discussion.
- Reposition the influent composite sampler.
- Assure that all composite samples are properly cooled.
- Determine extent of analytical lab discharges to sanitary sewage system.

Smelter Cooling Wastewater

- Investigate possible surges to the settling basin.
- Determine extent of unmonitored discharges to stormwater drainage system.
- Evaluate the need for an effluent fecal coliform limit.
- Establish effluent aluminum limits.

Receiving Water and Sediments

- Monitor dissolved aluminum in the receiving water.

Coke Calciner Mill Treatment System

- Alternatives to operating the sanitary sewage system should be considered. Plant flows should be addressed in a permit if operation continues.
- Inspect cooling water system for leaks.

INTRODUCTION

A Class II Inspection was conducted at Kaiser Aluminum and Chemical Corporation's Mead (Kaiser) aluminum smelter on May 18-20, 1993. Guy Hoyle-Dodson and Marc Heffner, environmental engineers for the Washington State Department of Ecology (Ecology) Toxics Investigations Section, conducted the inspection. Ted Mix, permit coordinator for Ecology's Industrial Section assisted during the inspection. Eric Oie, also of Ecology's Industrial Section, provided initial background information. Michael J. Sawatzky, Kaiser Aluminum (Mead) staff environmental engineer, represented Kaiser Aluminum onsite. Joel Lorentz, Kaiser instrumentation specialist, provided data from Kaiser data loggers.

Wastewater generated at the Kaiser facility is primarily non-contact cooling water and stormwater runoff. A small amount of sanitary sewage generated onsite is treated at a trickling filter plant and mixed with smelter wastewater. The combined wastewater is routed through a settling basin and discharged to Deadman Creek. The plant discharge and sanitary plant effluent are regulated under NPDES permit No. WA 000087-6 issued April 13, 1990. An addendum was introduced in 1992 by Ecology Administrative Order No. DE 92-WQIO35 to include effluent and sediment biomonitoring. The permit's expiration date is April 13, 1995.

Kaiser Aluminum also operates a small wastewater treatment plant associated with the company's nearby coke calciner mill. The wastewater facility treats a small volume of sanitary sewage and a much larger volume of non-contact cooling water. Discharge is to a pond/marsh that infiltrates into the ground over the Spokane-Rathdrum Aquifer, which is a designated sole source aquifer. This discharge is unregulated at the present time, but is expected to be regulated under the state waste discharge permit system (173-216 WAC) in the near future.

The Department of Ecology initiated the inspection to assess permit compliance and to aid in Ecology's ongoing compliance strategy. The inspection was unannounced to aid compliance evaluation. Specific objectives of the inspection included:

1. assess NPDES permit compliance;
2. assess wastewater toxicity with priority pollutant scans and effluent bioassays;
3. assess sediment toxicity with priority pollutant scans and effluent bioassays;
4. evaluate treatment plant performance; and
5. evaluate permittee's self-monitoring by conducting split samples.

SETTING

The Kaiser aluminum smelter is located southwest of the town of Mead in Spokane County, just north of the Spokane, Washington, city limits (*Figure 1*). The smelter produces aluminum metal by the Hall-Heroult reduction process. The facility contains eight pot lines with 1,135 center worked, pre-baked reduction cells. Anodes are manufactured onsite from coal tar pitch and calcined coke produced at the company's coke calciner mill located several miles to the southeast. Eighty percent of the smelted metal is shipped in a molten state to a nearby rolling mill. The remaining 20% is cast onsite. Production approaches 225,000 tons per year.

The smelter generates wastewater from three sources: sanitary sewage from the smelter's workforce, non-contact cooling water, and storm water runoff. Sanitary flows include wastewater from restrooms, showers, and analytic laboratories. Cooling water originates from wells and is used primarily in heat exchangers. Stormwater runoff results mainly from precipitation, although a small amount may occur from the wetting of road surfaces for dust control. During the summer months significant seasonal runoff occurs when interior courtyards between pot rooms are sprayed to provide convection cooling of the workroom environment.

Aluminum Smelter Wastewater Treatment System

The smelter's wastewater treatment system consists of a sanitary treatment unit and a settling basin (*Figure 2*). Treated sanitary plant effluent is mixed with the cooling water and stormwater flow prior to the settling basin. The final discharge typically consists of less than 6% sanitary wastewater.

The sanitary sewage treatment plant (SSTP) consists of headworks, primary clarifier, two-stage trickling filter, secondary clarifier, chlorine contact chamber, and anaerobic digester. Influent flows are measured at a Parshall flume by ultrasonic flowmeter. Recirculation return from the primary trickling filter and supernatant from the anaerobic digester enters downstream of the flume.

Flow is routed through a primary clarifier to the first stage trickling filter. The trickling filter system consists of rock beds operated in series. Effluent from the final stage trickling filter is passed to a secondary clarifier.

Secondary clarifier effluent enters the chlorine contact chamber. An ultrasonic flow meter at an 8-inch square weir records effluent flow into the chamber. Chlorine injection can be controlled by a continuous chlorine concentration analyzer, but the system is difficult to maintain and manual chlorine adjustment is typical. Effluent is discharged to the cooling water conduit.

Clarifier sludge is routed to the anaerobic digester and periodically discharged to a tanker truck. Treated sludge is hauled to a publicly operated sewage treatment plant.

Cooling water and stormwater runoff are combined prior to the sanitary effluent discharge. The individual contributions from the two sources are not metered. The stormwater collection system may contain drains from laboratory sinks and other unmonitored sources. Cooling water, stormwater, and sanitary effluent drain into a settling basin located approximately 1,000 feet north of the plant. Effluent from the basin passes through a rectangular weir where temperature, pH, and flow are measured and recorded on a data logger. The wastestream finally flows approximately 9,000 feet to its discharge point into Deadman Creek.

Discharge, via a 30-inch pipeline, is permitted to cascade about 15 feet down a sloping discharge structure into Deadman Creek (*Figure 3*). The flow enters a shallow pool/ backwater before mixing with the creek. Sedimentation was observed in this area. Discharge is continuous and constitutes a significant portion of the Deadman Creek flow, particularly in the summer. During the inspection individuals were observed using the discharge structure and the pool/backwater as a swimming/wading area.

Coke Calciner Mill Wastewater Treatment System

Kaiser's coke calciner mill generates its own sanitary sewage and cooling water wastestreams. Sanitary sewage volumes are small, with service for less than 10 employees. Non-contact cooling water is produced in much greater volumes. The majority of cooling water is discharged untreated to a small receiving pond/marsh. Sanitary sewage and some cooling water are routed to a small sanitary sewage treatment plant.

The sanitary treatment plant consists of headworks, primary settling tank, combined aerator and secondary clarifier, anaerobic digester, and chlorination chamber (*Figure 4*). The plant design is unique, dating from the early 1940s. Low sanitary sewage flows requires the addition of cooling water to provide more hydraulic loading. Wastewater flows are not regularly measured. During the inspection the aerator had been removed for repairs. Effluent from the plant is combined with additional cooling water and discharged to the pond/marsh. Treated sludge is hauled by truck to a public sewage treatment plant.

The pond/marsh, originally a holding pond, has acquired a heavy growth of plants and acts as a wetland. The pond is drained by a small stream that flows to the east and infiltrates to the ground. An additional stream of non-contact cooling water flows into this channel just downstream of the pond.

PROCEDURE

Ecology collected both grab and composite samples from Kaiser's sanitary treatment plant and from the settling basin. Composite samples were collected from sanitary treatment plant influent, sanitary treatment plant effluent, settling basin influent, and settling basin effluent (*Figure 2 & Appendix A*). Additional composite samples were taken at the coke calciner mill's wastewater treatment system (*Figure 4 & Appendix A*). These samples included sanitary sewage plant's influent and the discharge to the pond. All composite samples were collected using Ecology ISCO composite samplers with equal volumes of the sample collected every 30 minutes over a 24-hour period.

Pairs of grab samples were collected at the same locations as the composite samples. Additional grabs were taken of the smelter's intake and the coke calciner mill's intake. A grab composite was taken from the coke calciner mill's final ground recharge channel. Sludge from the anaerobic digester was inaccessible for sampling due to the location and size of discharge valves. It may be possible to collect a sample when tanker trucks are being filled, but during the inspection hauling did not take place. Sediment samples were taken at three locations around the outfall. Water samples taken at five locations from Deadman Creek, three around the outfall and one each several miles upstream and downstream. Sampling locations are described in more detail in appendix A.

Kaiser Aluminum personnel collected composite samples from the sanitary sewage influent and effluent, and from the settling basin effluent. Kaiser's sampling locations were generally the same as Ecology's sampling locations. A lightning strike cut power to the Kaiser influent compositor during the sampling period and stopped sample collection approximately 17 hours into the sampling period. The same power outage may have also left the Kaiser settling basin effluent composite sampler without power for a short period during the sampling period. The Kaiser sanitary sewage effluent composite sampler did not appear to be affected.

Ecology and Kaiser composite samples were split for analysis by both Ecology and Kaiser laboratories. Parameters analyzed, samples collected, and schedules appear in Appendix B.

Samples designated for Ecology analysis were delivered to personnel from Ecology's Manchester Laboratory. Chain of custody procedures were observed throughout the inspection. Analytical procedures and laboratories performing the analyses are summarized in Appendix C.

QUALITY ASSURANCE/QUALITY CONTROL

Sampling quality assurance included priority pollutant cleaning of sampling equipment (*Appendix D*). Sampling in the field followed all protocols for holding times, preservation, and chain-of-custody set forth in the Manchester Lab Laboratory Users Manual (Ecology, 1991).

Laboratory QA/QC including applicable holding times, procedural blanks, spike and duplicate spike sample analyses, and control samples were generally within acceptable limits.

Qualifiers are included in the data table where appropriate. Specific QA/QC concerns are included in Appendix D.

RESULTS AND DISCUSSION

Smelter Wastewater Treatment System

Power Failure

An electrical storm cut power to sections of the Kaiser plant during part of the inspection composite sampling period. The outage began at approximately 12:30 a.m., May 19, 1993, and power was restored to most areas of the plant within one hour. Power to portions of the sanitary treatment plant and to the settling basin flowmeter was not restored until about 8:00 AM May 20, 1993. The outage shut down the plant's trickling filter transfer pumps resulting in a bypass of the plant's trickling filters. During this time the wastewater from the primary clarifier flowed directly into the secondary clarifier. The sanitary plant influent flow meter, and influent composite sampler did not function during the outage.

Sanitary Plant Wastewater

Flow Measurement

An Ecology instantaneous measurement was made for comparison with effluent flow readings by the SSTP ultrasonic flow meter. The Kaiser metered instantaneous flow rate was 0.071 MGD. The Ecology rate was calculated as 0.093 MGD. The relative percent difference between the two meters was about 27%. Checking the calibration of the SSTP effluent meter is recommended. The Kaiser flow totalizer recorded a sanitary plant flow of 0.104 MGD during the composite sampling period.

Kaiser measures SSTP influent flows with an ultrasonic meter at a 6-inch Parshall flume. The influent flow meter was not operating at the time of the inspection. A new influent flow meter has been installed since the inspection.

Plant Operation

Plant maintenance and operation at the sanitary plant appeared lax. Areas of concern include:

(1) The comminutor was inoperable allowing rags and other solids to pass through the headworks and potentially clog downstream units.

(2) The influent flow meter was inoperable and Kaiser's placement of the influent compositor strainer in the Parshall flume impaired accurate measurements.

(3) The primary clarifier scum skimmer valve was clogged and flow over the perimeter weir appeared cloudy.

(4) Algae growth on the primary and secondary clarifier walls appeared excessive.

(5) The 1st stage trickling filter's rotating sprayarm did not turn at lower flows allowing a continuous stream of wastewater to be sprayed at one location on the rock strata. It is reported by the permit manager that repairs to the sprayarm have been made since the inspection.

(6) A concentration proportional chlorine injection system was installed but was not used during the inspection. Instead, the chlorine injection rate was set manually, based on daily effluent chlorine residual concentration measurements. The operator stated that this was necessary because the analyzer probe had been clogging-up and would shut off injection.

(7) The chlorine contact chamber also contained floating and attached growth and appeared to need cleaning.

Correcting the items noted should improve plant performance.

General Chemistry

Ecology results are shown in Table 1. BOD_5, TOC, and COD influent concentrations were a third to half the strength of weak domestic sewage (Metcalf & Eddy, 1991). Other parameters including influent TSS and ammonia nitrogen were low compared to typical domestic sewage. Weak influent concentrations likely affect treatment plant efficiency by reducing the rate of flux of organic materials into the trickling filter attached growth.

The influent TSS concentration in the Ecology composite sample may have been biased low due to partial clogging of the compositor strainer with solids (*Table 1*). Grab sample results showed TSS concentrations, although varying widely throughout the day, to be generally higher.

Influent BOD_5 and TSS concentrations were reduced across the sanitary plant by 57% and 83%, respectively (*Table 2*). Although effluent BOD_5 (16 mg/L) and TSS (10 mg/L) concentrations were fairly low, BOD_5 removal efficiency was not comparable to that of typical trickling filters (Metcalf & Eddy, 1991). Nitrification by the SSTP appeared marginal. The removal efficiencies were likely affected by the bypass of the trickling filters and the weak influent concentrations.

Split Samples

Ecology analysis of Kaiser and Ecology SSTP samples produced somewhat different results. The Kaiser sanitary plant influent sample was disrupted by the power outage and did not match the volumes, number of aliquots, or sample times of the Ecology influent samples. Both Kaiser sanitary plant samples were above the desired 4°C holding temperatures. The refrigeration units should be checked and adjusted as necessary. Rags and other solids may have interfered with the influent sampling. A better influent sampling location should be sought.

In May 1993 Kaiser was lab accredited for all permit parameters except fecal coliform and aluminum. The Kaiser laboratory analysis results were generally similar to the Ecology lab results. There was some variation between labs for TSS and BOD_5 results, but a Wilcoxon nonparametric statistical analysis indicated the differences were not significant.

NPDES Permit Comparisons

The SSTP effluent BOD_5 concentration (16 mg/L) and TSS concentration (10 mg/L) were well within both the permit 7-day and 30-day average concentration limits (*Table 4*). NPDES permit comparisons to inspection data were compromised due to the trickling filter bypass during the power outage, but for concentrations within the permit limits it is reasonable to conclude that normal plant operation would have produced even lower effluent concentrations. Removal efficiency of BOD_5 was less than the 65% monthly average removal efficient required by the NPDES permit (*Table 2*). Weak influent concentrations and the power outage were possible contributors to this low removal efficiency. TSS removal efficiency was 83%, well above permit requirements. Effluent fecal coliform, total residual chlorine concentration, and pH were also well within monthly average permit limits.

Detected Organics and Priority Pollutants

Table 5 summarizes concentrations of organics detected with priority pollutant scans, and also summarizes priority pollutant metals. Appendix E contains results of all targeted organic compounds. Appendix F contains metals results. Tentatively identified compounds are presented in Appendix G.

Concentrations of VOAs, BNAs, and metals were detected in the SSTP effluent (*Table 5*). One VOA and ten BNAs were detected in the sanitary plant effluent, at concentrations as high as 7.6 μg/L-estimated. None exceeded water quality criteria for receiving waters. Copper was the only metal exceeding freshwater quality criteria (Ecology, 1992; EPA, 1986). The sanitary plant effluent concentrations are highly diluted by plant cooling water and undergo further treatment in the smelter sedimentation basin prior to final discharge.

Smelter Cooling Wastewater

Flow Measurements

Kaiser measures sedimentation pond effluent flow with an ultrasonic flowmeter. An Ecology instantaneous measurement at the weir and Kaiser's effluent flow metering device produced identical flow rates of 3.93 MGD. The Kaiser effluent totalizer flow was approximately 2.56 MGD.

Settling Basin Operation

The settling basin appeared to be generally functioning normally, although a brief high flow period at the settling basin inlet produced a TSS concentration at least eight times that of other influent grab TSS concentrations (Table 1). High flow events may contribute to excessive TSS concentrations.

General Chemistry

BOD_5 concentration in the settling pond effluent was below analytic detection limits (<4 mg/L) (*Table 1*). The cooling water influent composite TSS concentration was greater than the concentration found in the SSTP effluent or the cooling water intake (*Table 1*). Precipitation was 0.04 inches during the three day inspection, so stormwater runoff is not a likely source. The difference between grab sample influent TSS concentrations and the composite sample concentration indicate surges of contaminated cooling water or unmonitored flushing down the stormwater collection system. The possibility of surges high in TSS should be investigated. The potential for unmonitored flushing is of particular concern. TSS concentration was reduced by more than 72% through the sedimentation basin based on composite sample results. (*Table 2*).

Split Samples

Ecology and Kaiser settling basin effluent samples were similar (*Table 1 & 3*). Ecology and Kaiser laboratories produced similar results for BOD_5, TSS, fluoride, cyanide, and aluminum analyses.

NPDES Permit Comparisons

Settling basin effluent concentrations of oil and grease, free cyanide, fluoride and pH were all within NPDES permit monthly averages and daily maximums (*Table 4*). Aluminum was also a permit parameter, but a specific limit will not be set until the completion of a dilution study of wastewater discharge to Deadman Creek. The smelter effluent TSS discharge was 150 lbs/day; less than the permit's daily maximum limit, but greater than its monthly average limit (*Table 4*). The effluent composite TSS concentration was greater than the grab sample concentrations.

Fecal coliform densities in the settling basin effluent were 32 and 550 colonies/100ml. Because of Deadman Creek's class A rating (drinking water), reports that the creek serves some as a domestic water supply, and the observed recreational uses (swimming) fecal coliform monitoring is highly recommended to determine if a permit limit is necessary.

Detected Organics and Priority Pollutants

The smelter effluent methylene chloride concentration (1.3 μg/L), a common laboratory contaminate and the only VOA or BNA compound detected in the cooling water, was well within water quality criteria for receiving waters (Table 5). Metal concentrations in the smelter effluent were generally within water quality criteria with the exception of aluminum (1160 μg/L) (Table 5). The aluminum concentration exceeded both the acute and chronic water quality for receiving waters by a factor of 1.6 and 13, respectively (EPA, 1988). Two polynuclear aromatic hydrocarbons were detected at low detection levels, Fluoranthene (0.3 μg/L) and Benzo(b)Fluoranthene (0.02 μg/L) (Table 6). Benzo(a)Pyrene, the only PAH cited in the permit, was not detected.

Bioassays

Two of the four organisms tested demonstrated sensitivity to settling basin effluent (*Table 7*). Acute tests included rainbow trout and *Daphnia pulex*. The rainbow trout 96-hour test exhibited no significant toxicity with 96.7% survival in 100% effluent. The *Daphnia pulex* 48-hour survival test demonstrated some toxicity with a mortality of 60% in 100% effluent and an NOEC of 50% effluent.

Chronic tests included fathead minnow and *Ceriodaphnia dubia*. Fathead minnow 7-day survival and growth test found no significant toxicity (*Table 7*). The *Ceriodaphnia dubia* survival and reproduction test found a slight chronic effect in reproduction with an NOEC of 50% effluent.

Chemical data found effluent aluminum and fluoride concentrations at levels which may cause sensitivity in test organisms. Aluminum concentration exceeded water quality criteria for receiving waters. Fluoride concentration exceeded the 0.5 mg/L threshold for fluoride sensitivity by returning salmon observed in a 1984 study and cited in a Columbia River report on salmonid avoidance (NOAA, 1985). It is possible that these compounds were the origin of the toxicity.

Receiving Water and Sediments

Deadman Creek Water Samples

Conductivity, hardness, fluoride, and fecal coliform concentrations in the upstream sample (Creek-3) were all lower than concentrations found in the outfall sample (Creek-2) (*Table 8*). An additional fluoride sample taken several miles upstream from the outfall showed the same concentration as the Creek-3 sample. This suggests the discharge is the source of the fluoride. A comparable low fluoride concentration found in the upstream spring sample suggests that the spring is not influenced by the discharge. The Creek-3 sample aluminum concentration exceeded the EPA acute and chronic water quality criteria for receiving waters.

Just below the outfall (Creek-2) concentrations for several parameters were higher than those of upstream and downstream creek samples (*Table 8*) indicating incomplete effluent/receiving water mixing. The Creek-2 fluoride concentration (1.4 mg/L) was below the 2.2 mg/L standard that the EPA recommends not be exceeded in public water supply sources for a locale with an annual average maximum air temperature range of 55-58°F (WQC, 1972). Creek-2 fecal coliform concentration increased 43% from the upstream sample concentration. A high fecal coliform concentration in one effluent grab sample (550 colonies/100ml) implicates the effluent as the coliform source. The fecal coliform concentration was 69 colonies/100ml at Creek-2 and 40 colonies/100ml 150 ft. downstream. These concentrations were within the State of Washington's Water Quality Standards for Surface Waters of Class A water bodies (173-201 WAC). The outfall water sample total aluminum concentration exceeded the chronic water quality criteria for receiving waters, but was lower than all other creek sample concentrations (*Table 8*). The concentration was also much lower than the smelter effluent sample concentration and is somewhat anomalous.

The 150 ft. downstream sample (Creek-1) fluoride concentration fell to 0.11 mg/L from the outfall concentration, but was still higher than the upstream (Creek-3) fluoride concentration (*Table 8*). The downstream water sample aluminum concentration was 1170 μg/L, the highest concentration of all the creek samples.

The furthest downstream sample (Creek-4) displayed the highest concentrations for conductivity, fluoride, and fecal coliform (*Table 8*). This station was located several miles downstream, and the higher concentrations may reflect other sources of contamination.

Deadman Creek Sediment Samples

Sediment composition was different in the three samples (*Table 9*). Sediment TOC concentrations were 857 mg/Kg-dry wt. upstream, 7730 mg/Kg-dry wt. near the outfall, and 4250 mg/Kg-dry wt. downstream.

Fluoride concentrations at the near outfall (280 mg/Kg-dry wt.) and downstream (200 mg/Kg-dry wt.) were 2-3 time the upstream concentration (*Table 9*). No criteria is available for sediment fluoride concentrations.

The near outfall sediment sample contained nineteen detected BNAs (*Table 5*). The highest concentration was Fluoranthene at 2300 μg/Kg-dry wt. Ten compounds were detected in the downstream sediment, generally at lower concentrations than near the outfall. The Ontario Provincial Sediment Quality Guidelines (OME, 1992) provides a lowest effects and a severe effects level for several polycyclic aromatic hydrocarbons. No organic compounds exceeded the severe effects level. Ten organic compounds found by the outfall exceeded the lowest effects level (*Table 10*). The guidelines represent the most complete toxicological study to date of sediment quality and provide reasonable criteria for the effects of sediment contamination on freshwater biota. Washington State criteria for freshwater sediments are presently under development and may incorporate some of the Ontario guidelines.

The outfall and downstream sediment samples had greater concentrations than the upstream sample for almost all metals (*Table 9*). Outfall sediment aluminum concentration (9900 μg/Kg-dry wt.) exceeded the upstream concentration by more than 45%. Comparison of sediment metals and TOC concentrations to the Ontario sediment guidelines (OME, 1992) found only copper in the outfall sediment (18.2 mg/Kg-dry wt.) to exceed the lowest effect level criteria (*Table 10*). The downstream sediment metal concentration was well below guidelines.

Sediment Microtox bioassay results produced an EC_{50} of 100% sediment extract (*Table 11*). *Hyallela azteca* freshwater sediment bioassay results indicate a high average percent survival in the outfall sample and in the downstream sample. The upstream sample displayed slight toxicity with an average percent survival of 72%.

Coke Calciner Mill Data

Treatment Plant

Two days prior to the inspection, bearings for the aerator in the sewage treatment plant failed. Kaiser was forced to pull the motor for repairs and the treatment plant was not operating for the duration of the inspection. Treatment plant operation could not be assessed. Only influent to the sewage treatment plant was sampled. Other samples were taken at the receiving pond/marsh and from cooling water.

Flow measurements are not regularly taken by Kaiser at the coke calciner mill's sewage treatment plant. During the inspection Ecology instantaneous measurements at the 3-inch Parshall flume gave a flow rate of 0.034 MGD. The operator reported a high percentage of this is non-contact cooling water, which is added to increase hydraulic loading. Removing the cooling water from the sanitary flow and putting the old septic system back in service was discussed during the inspection as an alternative to operating the sanitary plant. Holding the sanitary waste for transfer to the smelter sanitary plant should also be considered.

Plant influent concentrations were generally weak. Influent BOD_5 and TOC were low or undetected, but COD was relatively high (45.8 mg/L) (*Table 1*). Sewage treatment plant influent had relatively high concentrations of total non-volatile solids (1790 mg/L) and zinc (90.1 μg/L), and a high conductivity (4190 umhos/cm) (*Table 1*). Intake water supply sample's conductivity (322 umhos/cm) and highly diluted sanitary sewage wastewater suggest that the non-contact cooling water was the source of contamination. Inspection of the cooling water system for leaks is advised.

Treatment plant effluent joins additional cooling water and is discharged to the receiving pond/marsh. Pond influent conductivity and zinc concentrations were lower than concentrations found in the treatment plant influent (*Table 1*). This suggests that contaminated non-contact cooling water is restricted to the sanitary sewage plant.

Downstream pond discharge has only slightly lower concentrations of most parameters than the pond influent, suggesting minimal treatment through the pond (*Table 1*).

Volatile organics, BNAs, and Pesticides/PCBs were not detected in any sample. Detected concentrations of metals in pond influent, downstream pond discharge, and intake were all less than chronic and acute water quality criteria for receiving waters (*Table 5*).

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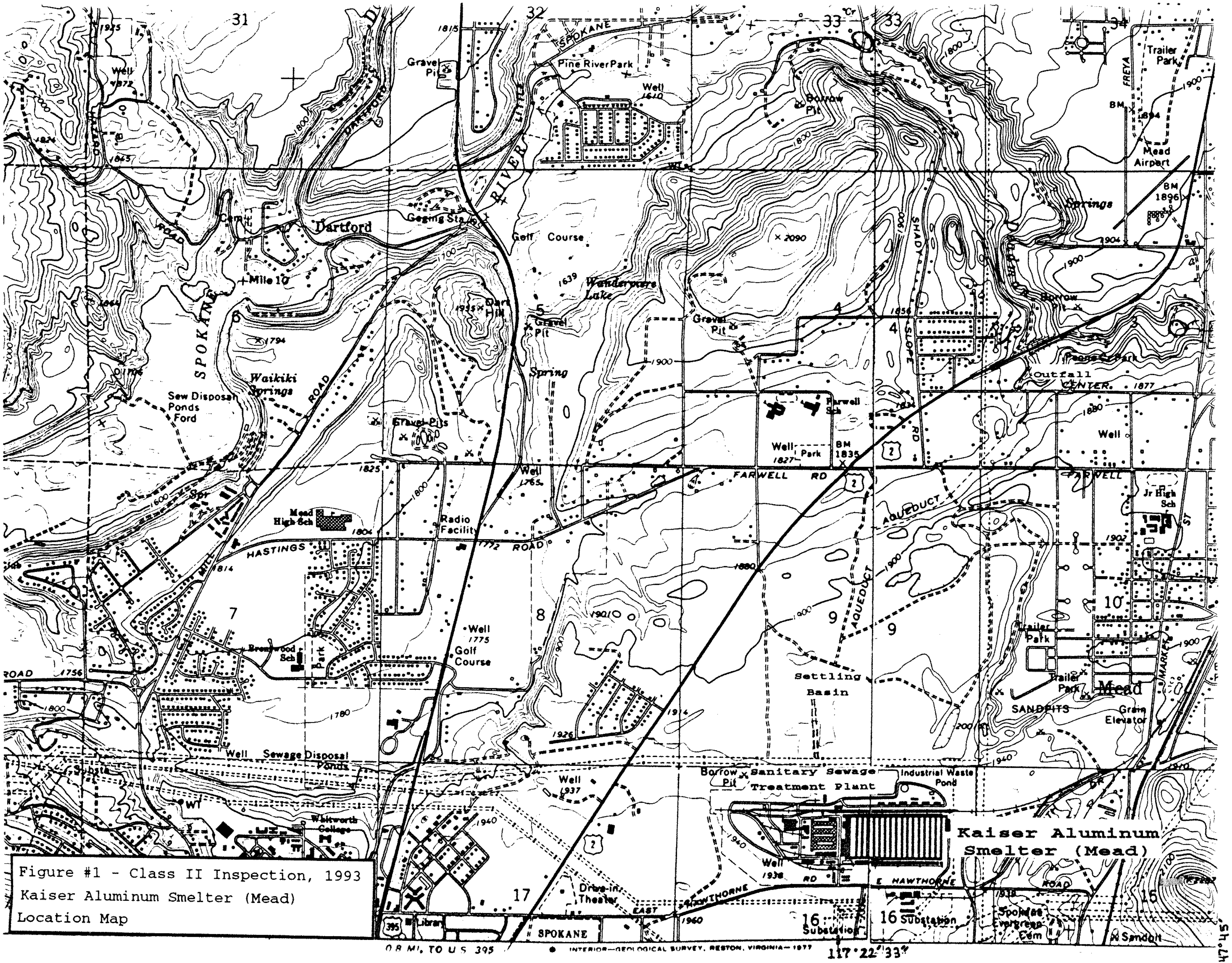

Figure #1 - Class II Inspection, 1993
Kaiser Aluminum Smelter (Mead)
Location Map

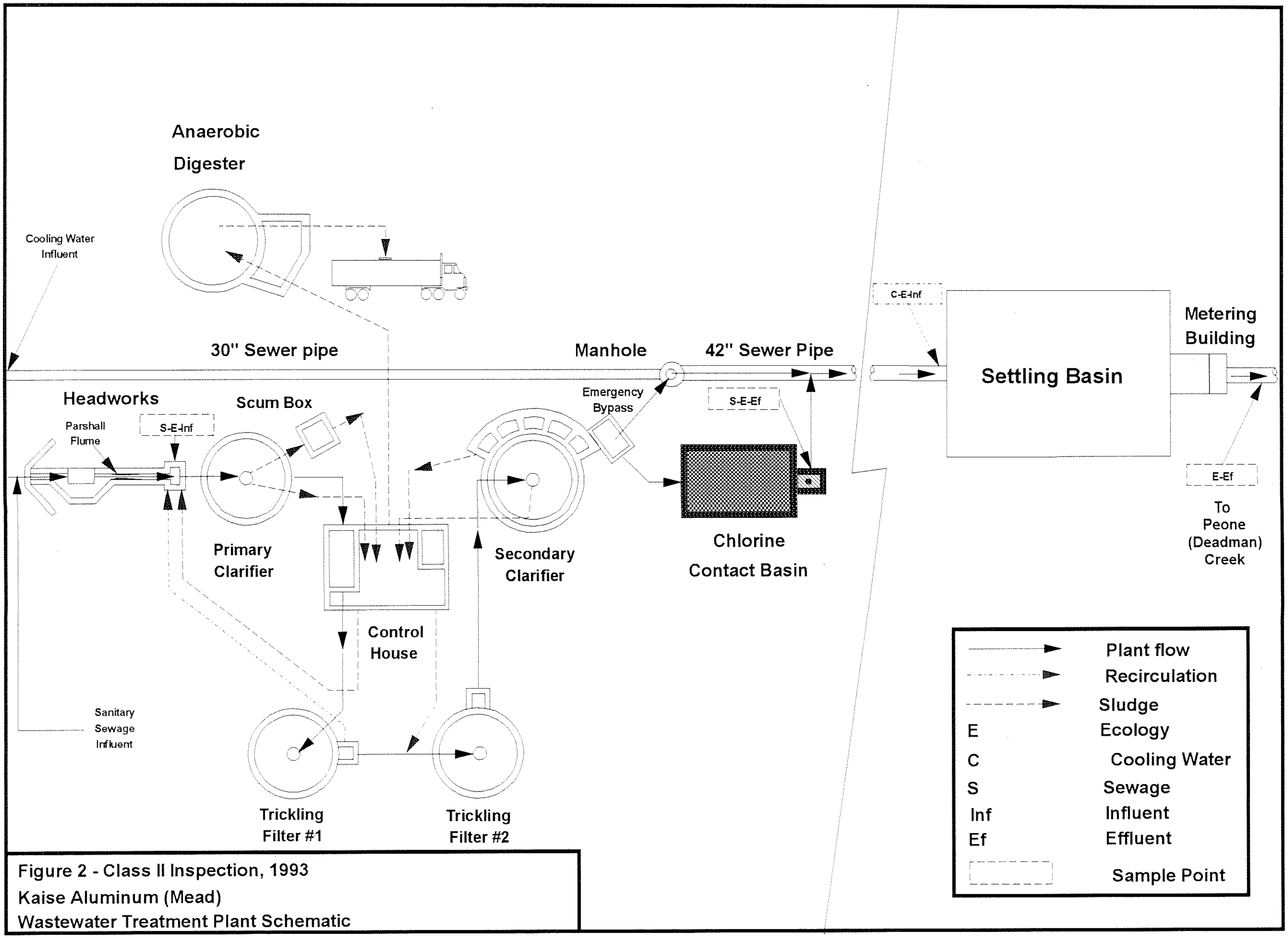

Figure 2 - Class II Inspection, 1993
Kaise Aluminum (Mead)
Wastewater Treatment Plant Schematic

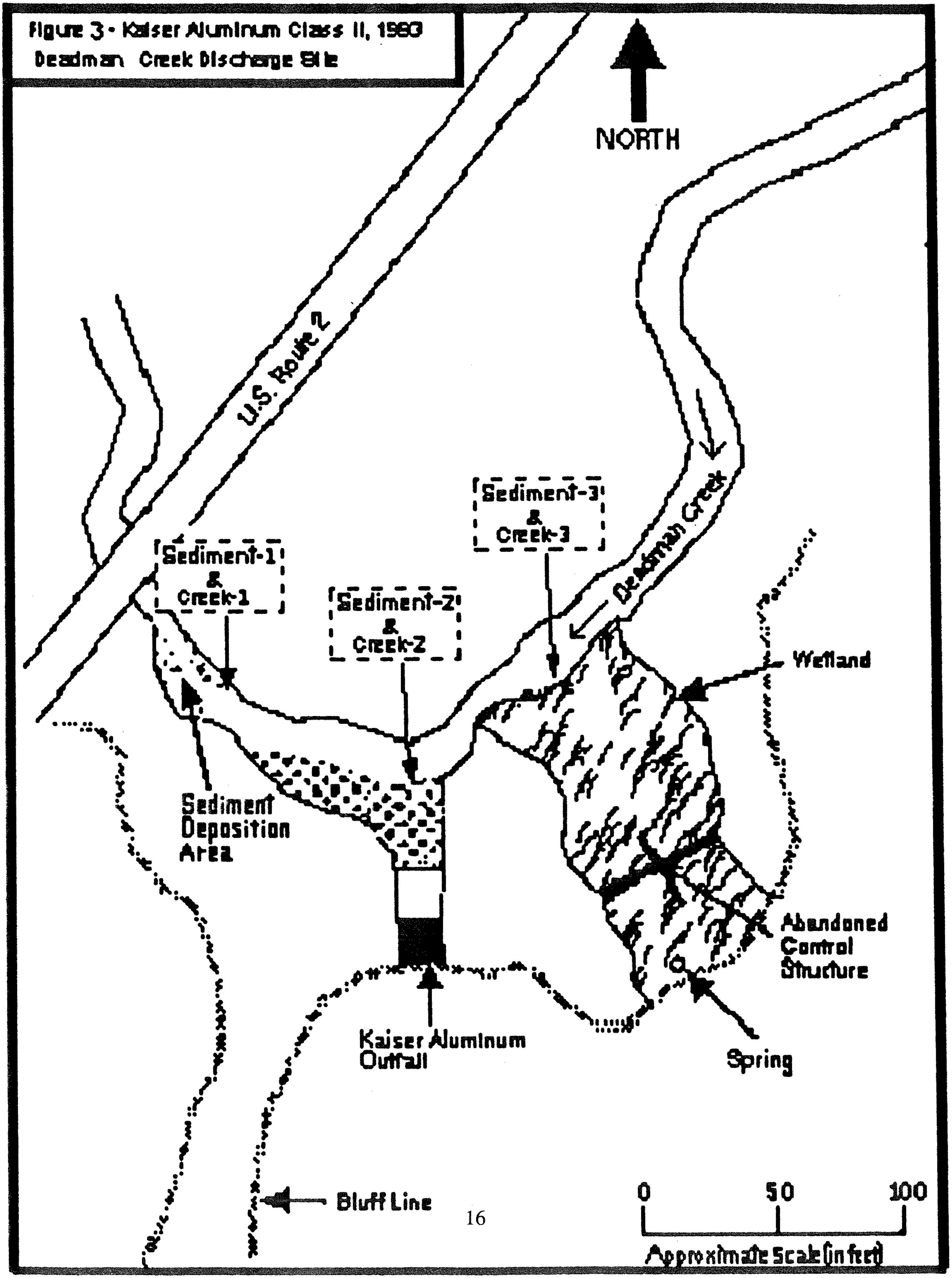

Figure 3 - Kaiser Aluminum Class II, 1980 Deadman Creek Discharge Site

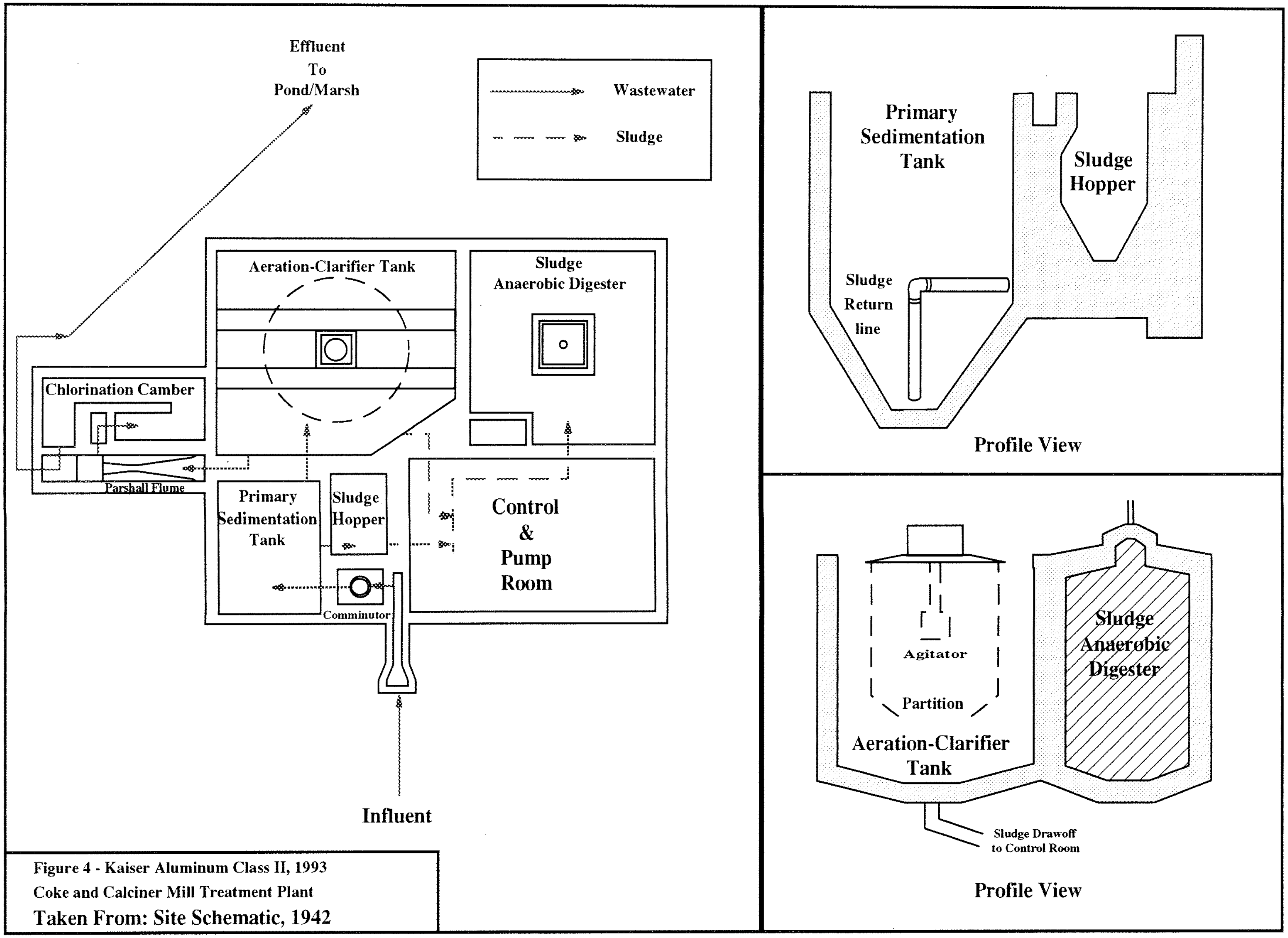

Figure 4 - Kaiser Aluminum Class II, 1993
Coke and Calciner Mill Treatment Plant
Taken From: Site Schematic, 1942

Table 1 – Ecology General Chemistry Results – Kaiser Aluminum (Mead), 1993

Parameter Location:	S-Inf-1	S-Inf-2	S-Inf-E	S-Inf-K	S-EF-1	S-Ef-2	S-Ef-E	S-Ef-K	C-Inf-1	C-Inf-2	C-Inf-E	Ef-1	Ef-2	Highflow
Type:	grab	grab	E-comp	K-comp	grab	grab	E-comp	K-comp	grab	grab	E-comp	grab	grab	grab
Date:	5/19	5/19	5/19-20	5/19-20	5/19	5/19	5/19-20	5/19-20	5/19	5/19	5/19-20	5/19	5/19	5/18
Time:	1046	1441	@	@	1026	1447	@	@	1135	1542	@	1111	1527	1100
Lab Log #:	218280	218281	218282	218283	218284	218285	218286	218287	218288	218289	218290	218291	218292	218310
GENERAL CHEMISTRY														
Conductivity (umhos/cm)			381				360	364			317			
Alkalinity (mg/L CaCO3)			163				134	134			117			
Hardness (mg/L CaCO3)			142				140	142			137			
Fluoride (total mg/L)			0.75				0.74	0.75			3.8			
Fluoride (soil mg/Kg)														
Grain Size (%)														
Gravel: (4-10 Sieve Size)														
Sand: (20-230 Sieve Size)														
Silt: (4-8 Phi Size)														
Clay: (9-10 Phi Size)														
SOLIDS														
TS (mg/L)			287				267							
TNVS (mg/L)			167				137							
TSS (mg/L)	176	71	60	132 *	7	11	10	22	3	2	25	2	2	24
TNVSS (mg/L)			17				4							
% Solids (%-wet wt.)														
% Volatile Solids (%-dry wt.)														
OXYGEN DEMAND PARAMETERS														
BOD5 (mg/L)			37	61 *			16	15						
COD (mg/L)			145				36.2	43.6						
TOC (water mg/L)	32.2	29.1	20.8		12.9	12.6	12				2.9			
TOC (soil mg/Kg-dry wt)														
NUTRIENTS														
NH3-N (mg/L)			5.23				3.47	3.66						
NO2+NO3-N (mg/L)			0.588				2.98	3.14						
Total-P (mg/L)			1.63				1.02	0.984						
MISCELLANEOUS														
Oil and Grease (mg/L)	9	25.4			2	2.7			0.8 U	0.8 U		0.5 U	0.9 U	
Oil and Grease (mg/Kg-dry wt.)														
F-Coliform MF (#/100mL)					1	21						32	550	
Cyanide total (ug/L)														
Cyanide (wk & dis ug/L)	0.002 UJ	0.002 UJ	0.002 U				0.002 U	0.002 U			0.002 U	0.002 U	0.002 U	
Cyanide (wk & dis mg/kg dry wt)														
FIELD OBSERVATIONS														
Temperature (C)	18.7	23.7		18.3 *	20.4	21.4			17.8	17.5		17.9	18.2	
Temp-cooled (℃)*+			7.7				5.8	9.4			5.3			
pH	8.18	7.71	7.94	8.34 *	7.61	7.67	7.61	7.8	8.26	8.14	7.74	7.26	7.3	
Conductivity (umhos/cm)	447	379	376	485 *	346	411	375	380	323	303	314	300	306	
Chlorine (mg/L)					1.0	1.0							< 0.1	

E	Ecology Sample
K	Kaiser Aluminum sample
S	Sanitary Sewage plant sample
C	Cooling water sample
E-comp	Ecology composite samples
K-comp	Kaiser composite samples
Inf	Influent
Ef	Settling basin effluent sample
grab	Grab sample
comp	Composite sample
*+	Refrigerated sample
U	The analyte was not detected at or above the reported result.
UJ	The analyte was not detected at or above the reported estimated result.
@	Composite sample period: 07:00-07:00
Highflow	Settling basin influent sample during highflow
*	Sample incomplete due to power outage

Table 1 – Ecology General Chemistry Results (cont.) – Kaiser Aluminum (Mead), 1993

Parameter II Locatn:	Ef–E	Ef–K	Ef–GC	Intake	Above	Creek–3	Spring	Creek–2	Creek–1	Creek–4	Sed–3	Sed–2	Sed–1
Type:	E–comp	K–comp	grab–comp	grab	grab	grab	grab	grab	grab	grab	grab	grab	grab
Date:	5/19–20	5/19–20	5/19	5/19	5/19	5/20	5/19	5/20	5/20	5/20	5/20	5/20	5/20
Time:	@	@	1111&1527	1238	1000	0745	0750	0720	0620	1000	0745	0720	0620
Lab Log #	218293	218294	218295	218296	218312	218299	218311	219298	218297	218308	218302	218301	218300
GENERAL CHEMISTRY													
Conductivity (umhos/cm)	298	298	294			80.4		283	84.4	124			
Alkalinity (mg/L CaCO3)	117	115	122										
Hardness (mg/L CaCO3)	137	134	134	133		32.3		128	33.3	52			
Fluoride (total mg/L)	3.3	3.5		0.07	0.09	0.09	0.06	1.4	0.11	0.24			
Fluoride (soil mg/Kg)											84	280	200
Grain Size (%)													
Gravel: (4-10 Sieve Size)											4	44	4
Sand: (20-230 Sieve Size)											95	42	53
Silt: (4-8 Phi Size)											1	13	38
Clay: (9-10 Phi Size)											0	1	5
SOLIDS													
TS (mg/L)	195												
TNVS (mg/L)	111												
TSS (mg/L)	7	7	2	1 U		35		7	37	30			
TNVSS (mg/L)	5												
% Solids (%-wet wt.)											81	76	70
% Volatile Solids (%-dry wt.)											1	2	2
OXYGEN DEMAND PARAMETERS													
BOD5 (mg/L)	4 U												
COD (mg/L)	7.3	11											
TOC (water mg/L)	2.4	2.2											
TOC (soil mg/Kg–dry wt)											857	7480	4430
NUTRIENTS													
NH3-N (mg/L)	0.139	0.189											
NO2+NO3-N (mg/L)	1.35	1.43											
Total-P (mg/L)	0.057	0.042											
MISCELLANEOUS													
Oil and Grease (mg/L)													
Oil and Grease (mg/Kg-dry wt.)											383	202	316 U
F-Coliform MF (#/100mL)						39 BOF		69 BOF,S	40 BOF	100 BOF			
Cyanide total (ug/L)	0.002 U	0.002 U		0.002 U									
Cyanide (wk & dis ug/L)	0.002 U	0.002 U		0.002 U		0.002 U	0.002 U	0.002 U	0.002 UJ	0.002 U			
Cyanide (wk & dis mg/kg dry wt)											0.06 U	0.07 U	0.07 U
FIELD OBSERVATIONS													
Temperature (C)				13.1									
Temp-cooled (°C)*+	5.0	7.5											
pH	7.87	7.71		8.14									
Conductivity (umhos/cm)	297	294		289									
Chlorine (mg/L)													

E	Ecology sample
K	Kaiser sample
S	Smelter sanitary sewage plant
C	Smelter cooling water
*+	Refrigerated sample
Sed-1	Ecology downstream sediment sample
Sed-2	Ecology near outfall sediment sample
Sed-3	Ecology upstram sediment sample

Creek-1	150 ft. downstream from outfall Deadman Creek sample
Creek-2	Near outfall Deadman Creek sample
Creek-3	100 ft upstream from outfall Deadman Creek sample
Creek-4	far downstream from outfall Deadman Creek sample
Intake	Smelter intake sample
Above	Sample taken several miles upstream of the outfall.
Spring	Spring above discharge into Deadman Creek
BOF	Bottle over full
S	Spreader: other colonies growing

U	The analyte was not detected at or above the reported result.
Ef	Settling basin effluent sample
grab	Grab sample
comp	Composite sample
grab-comp	A grab composite: AM&PM
E-comp	Ecology composite samples
K-comp	Kaiser composite samples
@	Composite sample period: 07:00-07:00

Table 1 – Ecology General Chemistry Results (cont.) – Kaiser Aluminum (Mead), 1993

Parameter II				
Locatn:	S2–Pool	S2–Inf–E	S2–Ef–GC	S2–In
Type:	E–comp	E–comp	grab/comp	grab
Date:	5/19–20	5/19–20	5/20	5/20
Time:	@	@	1230&1626	1238
Lab Log #:	218304	218305	218307	218313
GENERAL CHEMISTRY				
Conductivity (umhos/cm)	631	4190	354	322
Alkalinity (mg/L CaCO3)	142	145	144	
Hardness (mg/L CaCO3)	210	796	78	
Fluoride (total mg/L)				0.06
Fluoride (soil mg/Kg)				
Grain Size (%)				
Gravel: (4–10 Sieve Size)				
Sand: (20–230 Sieve Size)				
Silt: (4–8 Phi Size)				
Clay: (9–10 Phi Size)				
SOLIDS				
TS (mg/L)	416	2930	313 J	
TNVS (mg/L)	261	1790	88 J	
TSS (mg/L)	7	27	11	1 U
TNVSS (mg/L)	2	7	4	
% Solids (%–wet wt.)				
% Volatile Solids (%–dry wt.)				
OXYGEN DEMAND PARAMETERS				
BOD5 (mg/L)	4 U	4 U	4 U	
COD (mg/L)		45.8	7.3	
TOC (water mg/L)	1.8	2.2	1.4	
TOC (soil mg/Kg–dry wt)				
NUTRIENTS				
NH3–N (mg/L)	0.01 U	0.096	0.01 U	
NO2+NO3–N (mg/L)	1.92	1.94	1.82	
Total–P (mg/L)	0.024	0.072	0.011	
MISCELLANEOUS				
Oil and Grease (mg/L)				
Oil and Grease (mg/Kg–dry wt.)				
F–Coliform MF (#/100mL)				
Cyanide total (ug/L)				
Cyanide (wk & dis ug/L)	0.002 U	0.002 U		
Cyanide (wk & dis mg/kg dry wt)				
FIELD OBSERVATIONS				
Temperature (C)			30.2	15.9
Temp–cooled (°C)*+	7.6	7.5		
pH	8.27	7.92	8.72	7.03
Conductivity (umhos/cm)	637	4340	372	329
Chlorine (mg/L)				

E	Ecology sample	Pool	Coke calciner mill receiving pool
K	Kaiser sample	S2–In	Coke calciner mill water intake
S	Smelter sanitary sewage plant	Inf	Influent sample
C	Smelter cooling water	grab–comp	A grab composite: AM&PM
S2	Coke Calciner mill sanitary sewage plant	grab	Grab sample
@	Composite sample period: 07:00–07:00	comp	Composite sample

Table 2 – General Chemistry Results Percent Reduction– Kaiser Aluminum (Mead), 1993

Parameter		Smelter Wastewater							Coke Calciner Mill					
Location:	Intake	S–Inf–E	S–Ef–E	Percent Reduced Across Sewage Plant	C–Inf–E	Percent Load In Cooling Water Due To Sanitary Effluent	Ef–E	Percent Reduced Across Settling Pond	S2–In	S2–Inf–E	S2–Pool	Percent Reduced Across S2 Treatment Plant**	S2–Ef–GC	Percent Reduced Across S2 Outfall Pond***
Type:	grab	E–comp	E–comp		E–comp		E–comp		grab	E–comp	E–comp		grab/comp	
Date:	5/19	5/19–20	5/19–20		5/19–20		5/19–20		5/20	5/19–20	5/19–20		5/20	
Time:	1238	@	@		@		@		1238	@	@		1230&1626	
Lab Log #:	218296	218282	218286		218290		218293		218313	218305	218304		218307	
GENERAL CHEMISTRY														
Alkalinity (mg/L CaCO3)		163	134	18%	117	5%	117	0%		145	142	2%	144	–1%
Fluoride (total mg/L)	0.07	0.75	0.74	1%	3.8	1%	3.3	13%						
SOLIDS														
TSS (mg/L)	1 U	60	10	83%	25	2%	7	72%	1 U	27	7	74%	11	–57%
OXYGEN DEMAND PARAMETERS														
BOD5 (mg/L)		37	16	57%			4 U			4 U	4 U	0%	4 U	0%
COD (mg/L)		145	36.2	75%			7.3			45.8			7.3	
TOC (water mg/L)		20.8	12	42%	2.9	17%	2.4	17%		2.2	1.8	18%	1.4	22%
NUTRIENTS														
NH3–N (mg/L)		5.23	3.47	34%			0.139			0.096	0.01 U	90%	0.01 U	0%
NO2+NO3–N (mg/L)		0.588	2.98	–407%			1.35			1.94	1.92	1%	1.82	5%
Total–P (mg/L)		1.63	1.02	37%			0.057			0.072	0.024	67%	0.011	54%

E	Ecology Sample.
K	Kaiser Aluminum sample.
S	Smelter sewage plant sample.
S2	Coke calciner mill sewage plant sample.
C	Cooling water sample – after addition of treated sewage.
E–comp	Ecology composite samples.
grab	Grab sample.
grab–comp	A grab composite: AM&PM.

Inf	Influent sample.
Ef	Effluent sample.
Pool	Coke calciner mill receiving pool.
S2–In	Coke calcifer mill water intake.
Intake	Smelter intake.
GC	Composite grab made downstram from coke calciner mill receiving pool.
@	Composite sample period: 07:00–07:00.

U	The analyte was not detected at or above the reported result.
*	Remaining percent is cooling water load.
**	Coke calciner mill sewage treatment plant was not completely operational. Also additional cooling water is mixed with treated sewage before discharge to pond.
***	Sample taken from stream that drains discharge pool. Includes additional cooling water from the coke calciner mill added just after pond discharge.

Table 3 – Split Sample Result Comparison – Kaiser Aluminum (Mead), 1993

	Location:	S–Inf–E	S–Inf–K	S–Ef–E	S–Ef–K	Ef–1	Ef–2	Ef–E	Ef–K
	Type:	E–comp	K–comp	E–comp	K–comp	grab	grab	E–comp	K–comp
	Date:	5/19–20	5/19–20	5/19–20	5/19–20	5/19	5/19	5/19–20	5/19–20
	Time:	@	@	@	@	1111	1527	@	@
	Lab Log #:	218282	218283	218286	218287	218291	218292	218293	218294
Parameter	**Laboratory**								
TSS (mg/L)	Ecology	60	132	10	22			7	7
	Kaiser Aluminum	70	156	16	9.3			7.2	8.8
BOD5 (mg/L)	Ecology	37	61	16	15				
	Kaiser Aluminum	43.6	44.2	22.6	18.3				
Oil & Grease (mg/L)	Ecology					0.5 U	0.9 U		
	Kaiser Aluminum					0.34	0.44		
Flouride (mg/L)	Ecology							3.3	3.5
	Kaiser Aluminum							2.72	3.68
Cyanide total (mg/L)	Ecology							0.002 U	0.002 U
	Kaiser Aluminum							<0.004	<0.004
Alumninum (mg/L)	Ecology							1.16	1.17
	Kaiser Aluminum							1.00	0.94

@	24 hour composite. Collection period: 0700–0700.
S	Sanitary sewage treatment plant sample
Inf	Influent samples.
Ef	Effluent sample
Comp	Ecology composite sample
grab	grab sample
E	Ecology sample
K	Kaiser Aluminum sample
U	The analyte was not detected at or above the reported value.

Table 4 – Effluent NPDES Limits/Inspection Results – Kaiser Aluminum (Mead), 1993

	NPDES Permit Limits			Inspection Data				NPDES Permit Limits			Inspection Data				
				Sanitary Plant Effluent							Smelter Effluent				
	Sanitary Treatment Plant Discharge			Ecology Composite	STP Composite	Ecology Grab		Smelter Discharge			Ecology Composite	STP Composite	Ecology Grab		
Parameter			Location:	S-Ef-E	S-Ef-K	S-EF-1	S-Ef-2			Location:	Ef-E	Ef-K	Ef-1	Ef-2	EF-GC
			Type:	E-comp	K-comp	grab	grab			Type:	E-comp	K-comp	grab	grab	grab-comp
			Date:	5/19-20	5/19-20	5/19	5/19			Date:	5/19-20	5/19-20	5/19	5/19	5/19
	30-Day Average	7-Day Average	Time:	@	@	1026	1447	Monthly Average	Daily Maximum	Time:	@	@	1111	1527	1111&1527
			Log #:	218286	218287	218284	218285			Log #:	218293	218294	218291	218292	218295
BOD5															
(mg/L)	25	45		16	15						4 U				
(lbs/D)	40	70		14 †	13 †										
(% removal)	>= 65			57	75										
TSS															
(mg/L)	30	45		10	22	7	11				7	7	2	2	
(lbs/D)	50	70		9 †	19 †	6 †	9 †	120	681		150 ‡	150 ‡	43 ‡	43 ‡	
(% removal)	>= 65			83	83										
Fecal coliform															
(colonies/100 mL)	200	400				1	21						32	550	
pH (S.U.)	$6.0 < pH < 9.0$			7.61	7.8	7.61	7.67	$6.5 < pH < 8.5$			7.87	7.71	7.26	7.30	
Total Residual Chlorine															
(mg/L)	0.1 to 2.0					1.0	1.0	0.007	0.018					<= 0.1	
Flouride (Total)															
(mg/L)								4			3.3	3.5			
(lbs/D)								106	765		71	75			
Aluminum															
(mg/L)								?	?		1.16	1.17			
Free Cyanide (wk & dis)															
(mg/L)								0.003	0.008		0.002 U	0.002 U			
Oil & Grease															
(mg/L)						2.0	2.7		10				0.5 U	0.9 U	
Salmonid Bioassay															
(% Survival-100% Effluent)								80							96.7

S	Sewage treatment plant smaple	E-comp	Ecology composite
E	Ecology sample	K-comp	Kaiser composite
K	Kaiser sample	@	Composite sample period: 07:00-07:00
Ef	Effluent sample	U	The analyte was not detected at or above the reported result.

† Calculated from sanitary sewage plant effluent flow rate (0.1038 MGD)- summation of Kaiser hourly totals from 07:00 05/19/93 to 07:00 05/20/93.

‡ Calculated from settling basin effluent flow rates (2.56 MGD)- 24-hour extrapolation from summation of Kaiser hourly totals for the first 16 hours of the composite sampling period, 05/19/93.

? Aluminum limits are to be established after critical receiving water conditions have been determined. Ecology is awaiting the submission of study results. Until that time Kaiser will be required to monitor aluminum concentrations, without effluent limitations.

Table 5 – Detected VOA, BNA, Pesticide/PCB and Metals Scan Results – Kaiser Aluminum (Mead), 1993.

Parameter I	Location:	S–Inf–1	S–Inf–2	S–EF–1	S–Ef–2	Ef–1	EPA Water Quality Criteria Summary	
	Type:	grab	grab	grab	grab	grab	Acute Fresh	Chronic Fresh
	Date:	5/19	5/19	5/19	5/19	5/19		
	Time:	1046	1441	1026	1447	1111		
	Lab Log#:	218280	218281	218284	218285	218291		
VOA Compounds		(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
Methylene Chloride						1.3 J	11000 *(a)	
Acetone			17 J		13 J			
Carbon Disulfide					2.5			
Toluene				3.1	4.5		17500 *	
1,4-Dichlorobenzene		11	9.8		1		1120 *(h)	763 *(h)

Parameter I	Location:	S–Inf–E	S–Ef–E	EPA Water Quality Criteria Summary	
	Type:	E–comp	E–comp	Acute Fresh	Chronic Fresh
	Date:	5/19–20	5/19–20		
	Time:	@	@		
	Lab Log#:	218282	218286		
BNA Compounds		(µg/L)	(µg/L)	(µg/L)	(µg/L)
Phenol			1.2 J	10200 *	2560 *
1,4-Dichlorobenzene		5.2	1.6 J	1120 *(h)	763 *(h)
Benzyl Alcohol			2.3 J		
4-Methylphenol			1.7 J		
Isophorone			0.7 J	117000 *	
Benzoic Acid			7.6 J		
Naphthalene		0.4 J		2300 *	620 *
2-Methylnaphalene					
Acenaphthene				1700 *	520 *
Dibenzofuran					
Diethyl Phthalate		3.6	2.5	940 *(i)	3 *(i)
Fluorene					
Phenanthrene			0.3 J		
Anthracene					
Carbazole					
Fluoranthene				3980 *	
Pyrene					
Butylbenzyl Phthalate		3.1	2.2	940 *(i)	3 *(i)
Benzo(a)Anthracene		1 J			
Bis(2-Ethylhexyl)Phthalate			1.7 J	940 *(i)	3 *(i)
Chrysene					
Benzo(b)Fluoranthene					
Benzo(k)Fluoranthene					
Benzo(a)Pyrene					
Indeno(1,2,3-cd)Pyrene					
Dibenzo(a,h)Anthracene					
Benzo(g,h,i)Perylene					

Parameter I	Location:	S–Inf–E	S–Ef–E	C–Inf–E	Ef–E	Ef–K	Creek–1	Creek–2	Creek–3	Creek–4	Intake	EPA & WAC Water Quality Criteria Summary	
	Type:	E–comp	E–comp	E–comp	E–comp	K–comp	grab	grab	grab	grab	grab	Acute Fresh –c	Chronic Fresh –d
	Date:	5/19–20	5/19–20	5/19–20	5/19–20	5/19–20	5/20	5/20	5/20	5/20	5/19		
	Time:	@	@	@	@	@	0620	0720	0745	1000	1238		
	Lab Log#:	218282	218286	218290	218293	218294	218297	219298	218299	218308	218296		
Metals		(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
Hardness = 130													
Arsenic		2.5 P	3.1 P	4.0 P	3.2 P	2.2 P	2.6 P	2.4 P	2.6 P	2.0 P	2.7 P	360.0	190.0
Beryllium												130 *	5.30 *
Cadmium		0.24 P	0.17 P	0.34 P	0.25 P	0.31 P						4.56 +	1.21 +
Chromium													
Hexavalent												16.0	11.0
Trivalent												2153 +	257 +
Copper		38	18 P	27 P	14 P	14 P	3.5 P	5.4 P			19 P	19.6 +	12.8 +
Lead		2.6 P	1.4 P	2.9 P	1.3 P		1.3 P		1.9 P	1.3 P		78 +	3.05 +
Mercury			0.096 P									2.40	0.012
Nickel				15 P								1682 +	187 +
Zinc		48.3	35 P	58.3		41.9	5.4 P	5.5 P	9.2 P	5.5 P	12 P	130 +	118 +
Aluminum					1160	1170	1180	416	914	870	28 P	750	87

S	Sanitary Sewage treatment plant sample.
C	Cooling water sample.
Inf	Influent sample.
Ef	Effluent sample.
E-comp	Ecology composite sample
@	Composite sampling period: 07:00–07:00
E	Ecology sample
K	Kaiser sample

J	The analyte was positively identified. The associated numerical result is an estimate.
N	For metals analytes the spike sample recovery is not within control limits.
P	The analyte was detected above the instrument detection limit, but below the established minimum quantitation limit.
+	Hardness dependent criteria (130 mg/L used).
*	Insufficient data to develop criteria. Value presented is the LOEC–Lowest Observable Effects Concentration.
☐	Effluent results exceed criteria.

Creek–1	150 ft downstream Deadman Creek sample
Creek–2	20 ft below outfall Deadman Creek sample
Creek–3	100 ft downstream Deadman Creek sample
Creek–4	Far downstream Deadman Creek sample
Intake	Smelter intake sample.
c	A 1-hour average concentration not to be exceeded more than once every three years on the average
d	A 4-day average concentration not to be exceeded more than once every three years on the average.

a	Total Halomethanes
h	Total Dichlorobenzenes
i	Total Phthalate Esters

Table 5 (cont.) – Detected VOA, BNA, Pesticide/PCB and Metals Scan Results – Kaiser Aluminum (Mead), 1993.

Parameter II	**Location**	**Sed–1**	**Sed–2**	**Sed–3**
	Type:	**grab**	**grab**	**grab**
	Date:	**5/20**	**5/20**	**5/20**
	Time:	**0620**	**0720**	**0745**
	Lab Log #:	**218300**	**218301**	**218302**
BNA Compounds		(µg/Kg–dry wt.)	(µg/Kg–dry wt.)	No BNA compounds were detected
Phenol				
1,4-Dichlorobenzene				
Benzyl Alcohol				
4-Methylphenol				
Isophorone				
Benzoic Acid				
Naphthalene			20 J	
2-Methylnaphalene			28 J	
Acenaphthene			130 J	
Dibenzofuran		73	32 J	
Diethyl Phthalate				
Fluorene			140 J	
Phenanthrene		53 J	1500	
Anthracene			140	
Carbazole			240	
Fluoranthene		120 J	2300	
Pyrene		93 J	1700	
Butylbenzyl Phthalate				
Benzo(a)Anthracene		74 J	1000	
Bis(2-Ethylhexyl)Phthalate			74 J	
Chrysene		91 J	1300	
Benzo(b)Fluoranthene		150		
Benzo(k)Fluoranthene			2000	
Benzo(a)Pyrene		93 J	1200	
Indeno(1,2,3-cd)Pyrene		79 J	700	
Dibenzo(a,h)Anthracene			190	
Benzo(g,h,i)Perylene		59 J	490	

Parameter II	**Location**	**S2–Pool**	**S2–Ef–GC**	**S2–In**	**EPA & WAC Water Quality Criteria Summary**		**Sed–1**	**Sed–2**	**Sed–3**
	Type:	**E–comp**	**grab/comp**	**grab**	**Acute**	**Chronic**	**grab**	**grab**	**grab**
	Date:	**5/19–20**	**5/20**	**5/20**	**Fresh –c**	**Fresh –d**	**5/20**	**5/20**	**5/20**
	Time:	**@**	**1230&1626**	**1238**			**0620**	**0720**	**0745**
	Lab Log #	**218304**	**218307**	**218313**			**218300**	**218301**	**218302**
Metals		(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(mg/Kg–dry wt.)	(mg/Kg–dry wt.)	(mg/Kg–dry wt.)
Hardness =	130								
Arsenic		2.6 P	2.6 P	2.0 P	360.0	190.0	5.04	5.75	3.78
Beryllium					130 *	5.3 *	0.41 P	0.52 P	0.25 P
Cadmium					4.56 +	1.21 +	0.092 P	0.164	0.042 P
Chromium							9.38	9.26	6.06
Hexavalent					16.0	11.0			
Trivalent					2153 +	257 +			
Copper			3.9 P	3.3 P	19.6 +	12.8 +	7.95	18.2	3.35
Lead		1.0 P			78 +	3.05 +	9.47	10.3	4.67
Mercury					2.40	0.012	0.0066 P	0.013 P	
Nickel					1682 +	187 +	8.3 P	11.6	
Zinc		9.1 P		90.1	130 +	118 +	43.1 B		
Aluminum					750	87	9200	9900	5410

S2	Coke calciner mill sewage treatment system	S2-In	Coke calciner mill water intake sample.	c	A 1-hour average concentration not to be exceeded more than once every three years on the average.
Ef	Effluent sample.	N	For metals analytes the spike sample recovery is not within control limits.	d	A 4-day average concentration not to be exceeded more than once every three years on the average.
E-comp	Ecology composite sample	P	The analyte was detected above the instrument detection limit, but below the established minimum quantitation limit.	+	Hardness dependent criteria (130 mg/L used).
grab/comp	Grab-Composite sample	B	Analyte was found in the analytic method blank, indicating the sample may have been contaminated	Sed-1	Ecology downstream Deadman Creek sediment sample
grab	Grab sample	*	Insufficient data to develop criteria. Value presented is the LOEC–Lowest Observable Effects Concentration.	Sed-2	Ecology near outfall Deadman Creek sediment sample
E	Ecology sample			Sed-3	Ecology upstream Deadman Creek sediment sample
@	Composite sampling period: 07:00-07:00				
Pool	Coke calciner mill receiving pool.				

Table 6 – Detected Polynuclear Aromatic Hydrocarbon Scan Results – Kaiser Aluminum (Mead), 1993.

Parameter I	**Location:**	S–Ef–E	C–Inf–E	Ef–E
	Type:	E–comp	E–comp	E–comp
	Date:	5/19–20	5/19–20	5/19–20
	Time:	@	@	@
	Lab Log#:	218286	218290	218293
Polynuclear Aromatic Hydrocarbons		(µg/L)	(µg/L)	(µg/L)
Fluoranthene		0.4 JN	0.4	0.3 JN
Pyrene		0.2 JN		
Benzo(a)Anthracene		0.08 JN	0.01 JN	
Chrysene		0.1 JN		
Benzo(b)Fluoranthene		0.1 JN	0.02 JN	0.02 JN
Benzo(k)Fluoranthene		0.06 JN	0.01 JN	
Benzo(a)Pyrene		0.08 JN	0.01 JN	
Dibenz(a,h)Anthracene		0.07 JN		
Benzo(ghi)Perylene		0.09 JN		
Indeno(1,2,3–cd)Pyrene		0.1 JN		

S	Sanitary Sewage treatment plant sample.
C	Cooling water sample.
Inf	Influent sample.
Ef	Effluent sample.
E-comp	Ecology composite sample
@	Composite sampling period: 07:00–07:00
E	Ecology sample

N	For organic analytes there is evidence that the analyte is present in this sample.
J	The analyte was positively identified. The associated numerical result is an estimate.

Table 7 – Effluent Bioassay Results – Kaiser Aluminum (Mead), 1993.

NOTE: all tests were run on the effluent (Ef–GC sample) – lab log # 218295

Daphnia pulex – 48 hour survival test

(Daphnia pulex)

Sample	# Tested *	Percent Survival
Control	20	100
6.25 % Effluent	20	100
12.5 % Effluent	20	90
25 % Effluent	20	100
50 % Effluent	20	65
100 % Effluent	20	40

Survival
LC50 = 75.8% effluent
NOEC = 50 % effluent

* 4 replicates of 5 organisms

Ceriodaphnia dubia – 8 day survival and reproduction test

(Ceriodaphnia dubia)

Sample	# Tested	Percent Survival	Mean # Young per Original Female
Control	10	90	14.6
6.25 % Effluent	10	80	8.4
12.5 % Effluent	10	80	8.7
25 % Effluent	10	80	10.6
50 % Effluent	10	80	10
100 % Effluent	10	60	4.8

Survival
LC50 = >100% effluent
NOEC = 100% effluent
LOEC = >100% effluent

Reproduction
NOEC = 50% effluent

Fathead Minnow – 7 day survival and growth test

(Pimephales promelas)

Sample	# Tested *	Percent Survival	Average Growth per Fish (mg)
Control	40	95	0.59
6.25 % Effluent	40	100	0.62
12.5 % Effluent	40	93	0.55
25 % Effluent	40	90	0.67
50 % Effluent	40	77	0.50
100 % Effluent	40	83	0.50

Survival
LOEC = >100% effluent

Growth
NOEC = 100% effluent
LOEC > 100% effluent

* 4 replicates of 10 organisms

Rainbow Trout – 96 hour survival test

(Oncorhynchus mykiss)

Sample	# Tested	Percent Survival
Control	30	96.7
100% Effluent	30	96.7

NOEC = 100% effluent
LC50 = >100% effluent

NOEC – no observable effects concentration
LOEC – lowest observable effects concentration
LC50 – lethal concentration for 50% of the organisms
EC50 – effect concentration for 50% of the organisms

Table 8 – Smelter Effluent and Deadman Creek General Chemistry & Metals Results – Kaiser Aluminum (Mead), 1993

Parameter	Location:	Intake	Ef–1	Ef–2	Ef–E	Ef–K	Above	Creek–3	Spring	Creek–2	Creek–1	Creek–4		
	Type:	grab	grab	grab	E–comp	K–comp	grab	grab	grab	grab	grab	grab		
	Date:	5/19	5/19	5/19	5/19–20	5/19–20	5/19	5/20	5/19	5/20	5/20	5/20		
	Time:	1238	1111	1527	@	@	1000	0745	0750	0720	0620	1000		
	Lab Log #:	218296	218291	218292	218293	218294	218312	218299	218311	219298	218297	218308		
GENERAL CHEMISTRY														
Conductivity (umhos/cm)					298	298		80.4		283	84.4	124		
Alkalinity (mg/L CaCO3)					117	115								
Hardness (mg/L CaCO3)		133			137	134		32.3		128	33.3	52		
Fluoride (total mg/L)		0.07			3.3	3.5	0.09	0.09	0.06	1.4	0.11	0.24		
SOLIDS														
TS (mg/L)					195									
TNVS (mg/L)					111									
TSS (mg/L)		1 U	2	2	7	7		35		7	37	30		
TNVSS (mg/L)					5									
OXYGEN DEMAND PARAMETERS														
BOD5 (mg/L)					4 U									
COD (mg/L)					7.3	11								
TOC (water mg/L)					2.4	2.2								
NUTRIENTS														
NH3-N (mg/L)					0.139	0.189								
NO2+NO3-N (mg/L)					1.35	1.43								
Total-P (mg/L)					0.057	0.042								
MISCELLANEOUS														
Oil and Grease (mg/L)			0.5 U	0.9 U										
F-Coliform MF (#/100mL)			32	550				39 BOF		69 BOF,S	40 BOF	100 BOF		
Cyanide total (ug/L)		0.002 U			0.002 U	0.002 U								
Cyanide (wk & dis ug/L)		0.002 U	0.002 U	0.002 U	0.002 U	0.002 U		0.002 U	0.002 U	0.002 U	0.002 UJ	0.002 U		
													EPA & WPA Water Quality Criteria Summary	
METALS (Total)	Hardness =	33											Acute Fresh–c	Chronic Fresh–d
Antimony µg/L		30 U			30 U	30 U		30 U		30 U	30 U	30 U		
Arsenic (µg/L)		2.7 P			3.2 P	2.2 P		2.6 P		2.4 P	2.6 P	2.0 P	360.0	190.0
Beryllium (µg/L)		1 U			1 U	1 U		1 U		1 U	1 U	1 U	130 *	5.30 *
Cadmium (µg/L)		0.1 U			0.25 P	0.31 P		0.1 U		0.1 U	0.1 U	0.1 U	0.97 +	0.41 +
Chromium (µg/L)		5 U			5 U	5 U		5 U		5 U	5 U	5 U		
Hexavalent													16.0	11.0
Trivalent													700 +	83 +
Copper (µg/L)		19 P			14 P	14 P		3 U		5.4 P	3.5 P	3 U	5.4 +	4.0 +
Lead (µg/L)		1 U			1.3 P	1 U		1.9 P		1 U	1.3 P	1.3 P	14 +	0.53 +
Mercury (µg/L)		0.5 U			0.5 U	0.5 U		0.5 U		0.5 U	0.5 U	0.5 U	2.40	0.012
Nickle (µg/L)		10 U			10 U	10 U		10 U		10 U	10 U	10 U	527 +	59 +
Selenium (µg/L)		2 U			2 U	2 U		2 U		2 U	2 U	2 U	260	35
Silver (µg/L)		0.5 UJ			0.5 UJ	0.5 UJ		0.5 UJ		0.5 UJ	0.5 UJ	0.5 UJ	0.3 +	–
Thallium (µg/L)		2.5 U			2.5 U	2.5 U		2.5 U		2.5 U	2.5 U	2.5 U	1400 *	40 *
Zinc (µg/L)		12 P			30 U	41.9		9.2 P		5.5 P	5.4 P	5.5 P	41 +	37 +
Aluminum (µg/L)		28 P			1160	1170		914		416	1180	870	750	87
FIELD OBSERVATIONS														
Temperature (C)		13.1	17.9	18.2										
Temp-cooled (°C)*+					5.0	7.5								
pH		8.14	7.26	7.3	7.87	7.71								
Conductivity (umhos/cm)		289	300	306	297	294								
Chlorine (mg/L)				< 0.1										

E	Ecology Sample
K	Kaiser Aluminum sample
E-comp	Ecology composite samples
K-comp	Kaiser composite samples
Intake	Smelter intake water sample
@	Composite sample period: 07:00-07:00

Creek-1	150 ft. downstream Deadman Creek sample
Creek-2	20 ft. below Outfall Deadman Creek sample
Creek-3	100 ft. upstream Deadman Creek sample
Creek-4	Far downstream Deadman Creek sample
Above	Far upstream Deadman Creek sample
Spring	Spring above discharge into Deadman Creek

+	Hardness dependent criteria (33 mg/L used–creek hardness)
*	Insufficient data to develop criteria. Value presented is the LOEC–Lowest Observable Effects Concentration
c	A 1-hour average concentration not to be exceeded more than once every three years on the average.
d	A 4-day average concentration not to be exceeded more than once every three years on the average.

Table 9 – Ecology Sediment General Chemistry & Metals Results – Kaiser Aluminum (Mead), 1993

Parameter				
	Location:	Sed–3	Sed–2	Sed–1
	Type:	grab	grab	grab
	Date:	5/20	5/20	5/20
	Time:	0745	0720	0620
	Lab Log #:	218302	218301	218300
GENERAL CHEMISTRY				
Fluoride (soil mg/Kg)		84	280	200
Grain Size (%)				
Gravel: (4–10 Sieve Size)		4	44	4
Sand: (20–230 Sieve Size)		95	42	53
Silt: (4–8 Phi Size)		1	13	38
Clay: (9–10 Phi Size)		0	1	5
SOLIDS				
% Solids (%–wet wt.)		81	76	70
% Volatile Solids (%–dry wt.)		1	2	2
OXYGEN DEMAND PARAMETERS				
TOC (soil mg/Kg–dry wt)		857	7480	4430
MISCELLANEOUS				
Oil and Grease (mg/Kg–dry wt.)		383	202	316 U
Cyanide (wk & dis mg/kg dry wt)		0.06 U	0.07 U	0.07 U
Metals (Total)				
Antimony	(mg/Kg–dry wt.)	3 UN	3 UN	3 UN
Arsenic	(mg/Kg–dry wt.)	3.78	5.75	5.04 U
Beryllium	(mg/Kg–dry wt.)	0.25 P	0.52 P	0.41 P
Cadmium	(mg/Kg–dry wt.)	0.042 P	0.164	0.092 P
Chromium	(mg/Kg–dry wt.)	6.06	9.26	9.38
Copper	(mg/Kg–dry wt.)	3.35	18.2	7.95
Lead	(mg/Kg–dry wt.)	4.67	10.3	9.47
Mercury	(mg/Kg–dry wt.)	0.006 U	0.017 P	0.009 P
Nickel	(mg/Kg–dry wt.)	5.5 U	11.6	8.3 P
Selenium	(mg/Kg–dry wt.)	0.4 U	0.4 U	0.4 U
Silver	(mg/Kg–dry wt.)	0.1 U	0.1 U	0.1 U
Thallium	(mg/Kg–dry wt.)	0.5 U	0.5 U	0.5 UJ
Zinc	(mg/Kg–dry wt.)	28.5 U	67.5 U	43.1 B
Aluminum	(mg/Kg–dry wt.)	5410	9900	9200

Sed–1	Ecology downstream sediment sample
Sed–2	Ecology near outfall sediment sample
Sed–3	Ecology upstream sediment sample
grab	Grab sample
B	The analyte was also found in the analytical method blank indicating the sample may have been contaminated.
N	For metals analytes the spike sample recovery is not within control limits.
P	The analyte was detected above the instrument detection limit, but below the established minimum quantitation limit.
U	The analyte was not detected at or above the reported result.
UJ	The analyte was not detected at or above the reported estimated result.

Table 10 – Comparison to Ontario Provincial Sediment Quality Guidelines – Kaiser Aluminum (Mead), 1993.

Parameter				Ontaria Criteria	
Location:	Sed-1	Sed-2	Sed-3	Lowest Effect Level	Severe Effect Level
Type:	grab	grab	grab		
Date:	5/20	5/20	5/20		
Time:	0620	0720	0745		
Lab #:	218300	218301	218302		
METALS	(mg/Kg-dry wt)	(mg/Kg-dry wt)	(mg/Kg-dry wt)	(mg/Kg-dry wt)	(mg/Kg-dry wt)
Arsenic (Total)	5.04	5.75	3.78	6	33
Cadmium	0.092 P	0.164 P	0.042 P	0.6	10
Chromium (Total)	9.38	9.26	6.06	26	110
Copper	7.95	18.2	3.35	16	110
Lead	9.47	10.3	4.67	31	250
Mercury	0.007 P	0.013 P	0.005 U	0.2	2
Nickel	8.3 P	11.6	5.5 P	16	75
Zinc	43.1 B	67.5	28.5 B	120	820
POLYCYCLIC AROMATIC HYDROCARBONS	(μg/Kg-dry wt)	(μg/Kg-dry wt)		(μg/Kg-dry wt)	(μg/Kg-dry wt)
Fluorene		140 J		190	160,000
Phenanthrene	53 J	1500		560	950,000
Anthracene		140		220	370,000
Fluoranthene	120 J	2300		750	1,020,000
Pyrene	93 J	1700		490	850,000
Benzo(a)Anthracene	74 J	1000		320	1,480,000
Chrysene	91 J	1300		340	460,000
Benzo(k)Fluoranthene		2000		240	1,340,000
Benzo(a)Pyrene	93 J	1200		370	1,440,000
Indeno(1,2,3-cd)Pyrene	79 J	700		200	320,000
Dibenzo(a,h)Anthracene		190		60	130,000
Benzo(g,h,i)Perylene	59 J	490		170	320,000
NUTRIENTS	(% C – dry wt.)	(% C – dry wt.)	(% C – dry wt.)	(% C – dry wt.)	(% C – dry wt.)
TOC	0.43	0.773	0.086	1	10
ADDITIONAL PARAMETERS				Lower Practical Limit For Management Decision	
	(%)	(%)	(%)	(%)	
Oil & Grease	0.032	0.02	0.038	15	
	(mg/Kg – dry wt.)	(mg/Kg – dry wt.)	(mg/Kg – dry wt.)	(mg/Kg – dry wt.)	
Cyanide	0.07 U	0.07 U	0.07 U	0.1	

Sed-1 Downstream sediment sample
Sed-2 Outfall sediment sample
Sed-3 Upstream sediment sample
grab Grab sample'

B For metals analytes the spike sample recovery is not within control limits.
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.
U The analyte was not detected at or above the reported result.
☐ Results exceeding guidelines

Table 11 – Sediment Bioassay Results – Kaiser Aluminum (Mead), 1993.

Microtox

Location	Sed–1	Sed–2	Sed–3
Type:	grab	grab	grab
Date:	5/20	5/20	5/20
Time:	0620	0721	0745
Lab Log #:	218300	218301	218302
EC50* (% extract)	100	100	100

* Microtox analysis resulted in negative gammas, which is usually interpreted as a lack of sample toxicity.

Hyalella Freshwater Sediment Acute Toxicity Test

(HYALELLA AZTECA)

Location	Control	Sed–1	Sed–2	Sed–3
Type:		grab	grab	grab
Date:		5/20	5/20	5/20
Time:		0620	0721	0745
Lab Log #:		218300	218301	218302
Average Percent Survival*	96	98	92	72**

* 5 replicates of 10 organisms

** Statistically significant ($p <= 0.05$) from the control

EC50	Effect concentration for 50% of the organisms
Sed–1	Deadman Creek downstream sediment sample
Sed–2	Deadman Creek outfall sediment sample
Sed–3	Deadman Creek upstream sediment sample
grab	Grab sample

APPENDICES

Appendix A - Sampling Stations Descriptions - Kaiser Aluminum (Mead), 1993

S-Inf-#	Grab sample of sanitary sewage plant influent collected at headwork's upstream of the Parshall flume - Collected in both A.M. and P.M..
S-Inf-E	Ecology 24-hour composite sample of sanitary sewage plant influent collected at the headwork's upstream of the Parshall flume.
S-Inf-K	Kaiser Aluminum 24-hour composite sample of sanitary sewage plant influent collected at the headworks in the Parshall flume.
S-Ef-#	Grab sample of sanitary sewage plant effluent collected from the overflow at the weir to the chlorine contact chamber - Collected in both A.M. and P.M..
S-Ef-E	Ecology 24-hour composite sample of chlorinated sanitary sewage plant effluent collected from the the weir overflow at the end of the chlorine contact chamber.
S-Ef-K	Kaiser Aluminum 24-hour composite sample of sanitary sewage plant effluent collected prior to the chlorine contact chamber.
C-Inf-#	Grab sample of cooling water influent into the settling basin - Collected in both A.M. and P.M.
C-Inf-E	Ecology 24-hour composite sample of cooling water influent collected from the flow into the settling pond.
Ef-#	Grab sample of effluent from settling basin collected from the weir overflow just prior to the ponds outlet pipe.
Ef-E	Ecology 24-hour composite sample of effluent from settling basin collected from the weir overflow just upstream of the outlet weir.
Ef-K	Kaiser Aluminum 24-hour composite sample collected from the settling basin effluent just upstream of the outlet weir.
Ef-GC	Bioassay composite grabs taken from the settling basin effluent just prior to the outlet pipe.
HighFlow	Grab sample taken from the settling basin influent during a period of high flow.
Above	Grab sample taken from Deadman Creek several miles above effluent discharge near where Bruce Road crosses the creek (Long: 117°- 20′ - 40″ W., Lat: 47°- 46′ - 55″ N.).

Number of grab samples

Appendix A (cont.) - Sampling Stations Descriptions - Kaiser Aluminum (Mead), 1993

Creek-1/Sed-1	Grab sample taken from Deadman creek 150 ft. downstream from effluent discharge (Long: 117°-21′-06″ W., Lat: 47°-46′-50″ N.).
Creek-2/Sed-2	Grab sample taken from Deadman Creek at the pool formed by the effluent discharge (Long: 117°- 21′-06″ W., Lat: 47°-46′-48″ N.).
Creek-3/Sed-3	Grab sample taken from Deadman Creek 100 ft. upstream from the effluent discharge. (Long: 117°-21′-05″ W., Lat: 47°-46′-48″ N.)
Creek-4	Grab sample taken from Deadman Creek several miles downstream from the effluent discharge near the creek's confluence with the Little Spokane River (Long: 117°-22′-05″ W., Lat: 47°-47′-35″ N.).
Spring	Grab collected from a spring discharging into Deadmen Creek approximately 100 ft. upstream of effluent discharge (Long: 117°-20′-05″ W., Lat: 47°-46′-48″ N.).
S2-Pool	Ecology composite sample taken at the coke calciner sanitary sewage plant effluent into the pond/marsh. - consists of sanitary sewage plant effluent and cooling water.
S2-Inf-E	Ecology composite sample taken from the influent into the coke calciner plant's sanitary sewage plant. - consists of sanitary sewage and cooling water.
S2-Ef-GC	Ecology grab-composite taken from the channel draining the coke calciner plant's pond/marsh effluent collection pool, approximately 500 ft. downstream from the pood/marsh discharge.
S2-In	Grab sample taken from a faucet in one of the coke calciner plant's restrooms, representing cooling water intake.
Intake	Grab sample take at the smelter's laboratory, representing the facilities intake water.

Appendix B – Sampling Schedule – Kaiser Aluminum (Mead), 1993

Parameter Location:	S–Inf–1	S–Inf–2	S–Inf–E	S–Inf–K	S–EF–1	S–Ef–2	S–Ef–E	S–Ef–K	C–Inf–1	C–Inf–2	C–Inf–E	Ef–1	Ef–2	Highflow
Type:	grab	grab	E–comp	K–comp	grab	grab	E–comp	K–comp	grab	grab	E–comp	grab	grab	grab
Date:	5/19	5/19	5/19–20	5/19–20	5/19	5/19	5/19–20	5/19–20	5/19	5/19	5/19–20	5/19	5/19	5/18
Time:	1046	1441	@	@	1026	1447	@	@	1135	1542	@	1111	1527	1100
Lab Log #:	218280	218281	218282	218283	218284	218285	218286	218287	218288	218289	218290	218291	218292	218310
GENERAL CHEMISTRY														
Conductivity			E				E	E			E			
Alkalinity			E				E	E			E			
Hardness			E				E	E			E			
Fluoride			E				E	E			E			
Fluoride (soil)														
Grain Size														
SOLIDS														
TS			E				E							
TNVS			E				E							
TSS	E	E	EK	EK	E	E	EK	EK	E	E	E	E	E	E
TNVSS			E				E							
% Solids														
% Volatile Solids														
OXYGEN DEMAND PARAMETERS														
BOD5			EK	EK			EK	EK						
COD			E				E	E						
TOC (water)	E	E	E		E	E	E	E			E			
TOC (soil/sed)														
NUTRIENTS														
NH3–N			E				E	E						
NO2+NO3–N			E				E	E						
Total–P			E				E	E						
MISCELLANEOUS														
Oil and Grease (water)	E	E			E	E			E	E		EK	EK	
Oil and Grease (soil/sed)														
F–Coliform MF					E	E						E	E	
Cyanide (total)														
Cyanide (wk & dis)	E	E	E				E	E			E	E	E	
Cyanide (wk & dis soil/sed)														
ORGANICS														
VOC (water)	E	E			E	E			E	E		E	E	
VOC (soil/sed)														
BNAs (water)			E				E							
BNAs (soil/sed)														
Pest/PCB (water)														
Pest/PCB (soil/sed)														
PAH (water)											E			
METALS														
PP Metals (water)			E				E				E			
PP Metals (soil/sed)														
Aluminum–ICP			E				E				E			E
BIOASSAYS														
Salmonid (acute 100%)														
Daphnia magna (acute)														
Ceriodaphnia (chronic)														
Fathead Minnow (chronic)														
Hyallela (solid acute)														
Microtox (solid acute)														
FIELD OBSERVATIONS														
Temperature	E	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	E	
Conductivity	E	E	E	E	E	E	E	E	E	E	E	E	E	
Chlorine					E	E						E	E	

E	Ecology analysis	@	Composite sample period: 07:00–07:00.
K	Kaiser analysis	Inf	Inluent
S	Smelter sanitary sewage plant	Ef	Effluent
C	Smelter cooling water	E–comp	Ecology composite samples
Intake	Smelter intake sample	K–comp	Kaiser composite samples
Highflow	Settling basin influent sample during highflow	grab–comp	Grab–composite sample
grab	Grab sample		
comp	Composite samples		

Appendix B – Sampling Schedule – Kaiser Aluminum (Mead), 1993

Parameter Locatn:	Ef–E	Ef–K	Ef–GC	Intake	Above	Creek–3	Spring	Creek–2	Creek–1	Creek–4	Sed–3	Sed–2	Sed–1	S2–Pool	S2–Inf–E	S2–Ef–GC	S2–In
Type:	E–comp	K–comp	grab–comp	grab	grab	grab	grab	grab	grab	grab	grab	grab	grab	E–comp	E–comp	grab	grab
Date:	5/19–20	5/19–20	5/19	5/19	5/19	5/19	5/19	5/19	5/19	5/19	5/20	5/20	5/20	5/19–20	5/19–20	5/19	5/19–20
Time:	@	@	1111&1527	1238	1000	0745	0750	0720	0620	1000	0745	0720	0620	@	@	1230&1626	1238
Lab Log #:	218293	218294	218295	21829(	218312	218299	218311	219298	218297	218308	218302	218301	218300	218304	218305	218307	218313
GENERAL CHEMISTRY																	
Conductivity	E	E	E			E		E	E	E				E	E	E	
Alkalinity	E	E	E											E	E	E	
Hardness	E	E	E	E		E		E	E	E				E	E	E	E
Fluoride	EK	EK		E	E	E	E	E	E	E							E
Fluoride (soil)											E	E	E				
Grain Size											E	E	E				
SOLIDS																	
TS	E													E	E	E	
TNVS	E													E	E	E	
TSS	EK	EK	E	E		E		E	E	E				E	E	E	E
TNVSS	E													E	E	E	
% Solids											E	E	E				
% Volatile Solids											E	E	E				
OXYGEN DEMAND PARAMETERS																	
BOD5	E													E	E	E	
COD	E	E													E	E	
TOC (water)	E	E												E	E	E	
TOC (soil/sed)											E	E	E				
NUTRIENTS																	
NH3–N	E	E												E	E	E	
NO2+NO3–N	E	E												E	E	E	
Total–P	E	E												E	E	E	
MISCELLANEOUS																	
Oil and Grease (water)																E	
Oil and Grease (soil/sed)											E	E	E				
F–Coliform MF						E		E	E	E							
Cyanide (total)	E	E		E													
Cyanide (wk & dis)	EK	EK		E		E	E	E	E	E				E	E		
Cyanide (wk & dis soil/sed)											E	E	E				
ORGANICS																	
VOC (water)																	
VOC (soil/sed)																	
BNAs (water)	E															E	
BNAs (soil/sed)											E	E	E				
Pest/PCB (water)	E															E	
Pest/PCB (soil/sed)											E	E	E				
PAH (water)	E					E		E	E	E							
METALS																	
PP Metals (water)	E	E		E		E		E	E	E						E	E
PP Metals (soil/sed)											E	E	E				
Aluminum–ICP	EK	EK		E		E		E	E	E	E	E	E				
BIOASSAYS																	
Salmonid (acute 100%)			E														
Daphnia magna (acute)			E														
Ceriodaphnia (chronic)			E														
Fathead Minnow (chronic)			E														
Hyallela (solid acute)											E	E	E				
Microtox (solid acute)											E	E	E				
FIELD OBSERVATIONS																	
Temperature	E	E		E										E	E	E	E
pH	E	E		E										E	E	E	E
Conductivity	E	E		E										E	E	E	E
Chlorine	E	E															

E	Ecology analysis
K	Kaiser analysis
S	Smelter sanitary sewage plant
C	Smelter cooling water
S2	Coke calciner mill sanitary sewage plant
Ef	Effluent
grab	Grab sample
comp	Composite samples

Creek–1	150 ft. downstream from outfall Deadman Creek water sample
Creek–2	Near outfall Deadman Creek water sample
Creek–3	100 ft. up[stream from outfall Deadman Creek water sample
Creek–4	Far downstream from outfall Deadman Creek water sample
Intake	Smelter intake sample
Above	Several miles upstream from outfall Deadman Creek water sample.
Spring	Spring above discharge into Deadman Creek
grab–comp	Grab–composite sample

Sed– 1	Ecology downstream sediment sample
Sed– 2	Ecology near outfall sediment sample
Sed– 3	Ecology upstream sediment sample
S2–In	Coke calciner mill water intake
@	Composite sample period: 07:00–07:00.

Pool	Coke Calciner mill discharge pool

Appendix C – Laboratory Methods – Kaiser Aluminum (Mead), 1993

Parameter	MANCHESTER_METHODS	Lab Used
GENERAL CHEMISTRY		
Conductivity	EPA, Revised 1983: 120.1	Ecology
Alkalinity	EPA, Revised 1983: 310.1	Ecology
Hardness	EPA, Revised 1983: 130.2	Ecology
Fluoride	EPA, Revised 1983: 340.3	Ecology
Fluoride (soil)	EPA, Revised 1983: 340.3	Ecology
Grain Size	Tetra Tech, 1986:TC–3991–04	Soil Technology, Inc.
SOLIDS		
TS	EPA, Revised 1983: 160.3	Ecology
TNVS	EPA, Revised 1983: 160.3	Ecology
TSS	EPA, Revised 1983: 160.2	Ecology
TNVSS	EPA, Revised 1983: 160.2	Ecology
% Solids	APHA, 1989: 2540G.	Ecology
% Volatile Solids	EPA, Revised 1983: 160.4	Ecology
OXYGEN DEMAND PARAMETERS		
BOD5	EPA, Revised 1983: 405.1	Ecology
COD	EPA, Revised 1983: 410.1	Analytical Resources, Incorporated
TOC (water)	EPA, Revised 1983: 415.1	Analytical Resources, Incorporated
TOC (soil/sed)	EPA, Revised 1983: 415.1	Analytical Resources, Incorporated
NUTRIENTS		
NH3–N	EPA, Revised 1983: 350.1	Ecology
NO2+NO3–N	EPA, Revised 1983: 353.2	Ecology
Total–P	EPA, Revised 1983: 365.3	Ecology
MISCELLANEOUS		
Oil and Grease (water)	EPA, Revised 1983: 413.1	Analytical Resources, Incorporated
Oil and Grease (soil/sed)	EPA, Revised 1983: 413.1	Analytical Resources, Incorporated
F–Coliform MF	APHA, 1989: 9222D.	Ecology
Cyanide (total)	EPA, Revised 1983: 335.2	Ecology
Cyanide (wk & dis)	APHA, 1989: 4500–CNI.	Ecology
Cyanide (wk & dis soil/sed)	APHA, 1989: 4500–CNI.	Ecology
ORGANICS		
VOC (water)	EPA, 1986: 8260	Ecology
VOC (soil/sed)	EPA, 1986: 8240	Ecology
BNAs (water)	EPA, 1986: 8270	Ecology
BNAs (soil/sed)	EPA, 1986: 8270	Ecology
Pest/PCB (water)	EPA, 1986: 8080	Ecology
Pest/PCB (soil/sed)	EPA, 1986: 8080	Ecology
PAH (water)	EPA, 1986: 8310	Ecology
METALS		
PP Metals (water)	EPA, Revised 1983: 200–299	Ecology
PP Metals (soil/sed)	EPA, Revised 1983: 200–299	Ecology
Aluminum–ICP	EPA, Revised 1983: 220.7	Ecology
BIOASSAYS		
Salmonid (acute 100%)	Ecology, 1981.	Beak Consultants, Inc.
Daphnia magna (acute)	EPA 1985	Beak Consultants, Inc.
Ceriodaphnia (chronic)	EPA 1989: 1002.0	Beak Consultants, Inc.
Fathead Minnow (chronic)	EPA, 1989: 1000	Beak Consultants, Inc.
Hyallela (solid acute)	Nebeker, 1984	Parametrix Laboratory
Microtox (solid acute)	Beckman, 1982	Parametrix Laboratory

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Appendix D - Priority Pollutant Cleaning Procedures and QA/QC Concerns - Kaiser Aluminum (Mead), 1993.

PRIORITY POLLUTANT SAMPLING EQUIPMENT CLEANING PROCEDURES

1. Wash with laboratory detergent
2. Rinse several times with tap water
3. Rinse with 10% HNO3 solution
4. Rinse three (3) 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

SPECIFIC QA/QC CONCERNS

1. COD spike and spike duplicate sample analysis for Ecology sanitary sewage influent composite sample were not within acceptable limits and these results should be used with caution.

2. Sediment samples for BNA and Pesticides/PCB analyses were extracted five days past the recommended holding times. Since these samples were stored in the proper containers at the proper temperature this extraction should not have a significant effect on the results. Also, surrogate recoveries for the sediment method blanks were low, but results do not warrant rejection or qualification since no target analytes were detected in the samples.

3. Di-n-butylphthalate was detected in the method blanks for two BNA analyses. The Di-n-butylphthalate data have been qualified by the "U" qualifier to indicate that this analyte was not detected at a level more than 10 times greater than suspected laboratory contamination.

4. Organic data failing to meet initial and continuing calibration minimum response criteria were qualified with the "UJ" qualifier for non-detect results and the "J" qualifier for detected results.

Appendix E – VOA, BNA, & Pesticide/PCB Water Scan Results – Kaiser Aluminum (Mead), 1993.

Parameter I	**Location:**	**S–Inf–1**	**S–Inf–2**	**S–EF–1**	**S–Ef–2**	**C–Inf–1**	**C–Inf–2**	**Ef–1**	**Ef–2**
	Type:	**grab**	**grab**	**grab**	**grab**	**grab**	**grab**	**grab**	**grab**
	Date:	**5/19**	**5/19**	**5/19**	**5/19**	**5/19**	**5/19**	**5/19**	**5/19**
	Time:	**1046**	**1441**	**1026**	**1447**	**1135**	**1542**	**1111**	**1527**
	Lab Log#:	**218280**	**218281**	**218284**	**218285**	**218288**	**218289**	**218291**	**218292**
VOA Compounds		(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
Chloromethane		2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Bromomethane		2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Vinyl Chloride		2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Chloroethane		2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Methylene Chloride		2 U	2 U	2 U	2 U	2 U	2 U	1.3 J	2 U
Acetone		5 U	17 J	5 U	13 J	5 U	5 U	5 U	5 U
Carbon Disulfide		1 U	1 U	1 U	2.5	1 U	1 U	1 U	1 U
1,1–Dichloroethene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1–Dichloroethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans–1,2–Dichloroethene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis–1,2–Dichloroethene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2–Dichloroethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2–Butanone (MEK)		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,1–Trichloroethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon Tetrachloride		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Vinyl Acetate		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2–Dichloropropane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis–1,3–Dichloropropene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dibromochloromethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2–Trichloroethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Benzene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans–1,3–Dichloropropene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2–Chloroethylvinyl Ether		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromoform		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
4–Methyl–2–Pentanone (MIBK)		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2–Hexanone		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Tetrachloroethene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2–Tetrachloroethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Toluene		1 U	1 U	3.1	4.5	1 U	1 U	1 U	1 U
Chlorobenzene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Ethylbenzene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Styrene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Total Xylenes		2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Trichlorofluoromethane		2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,1,2–Trichlorotrifluoroethane		2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,3–Dichlorobenzene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4–Dichlorobenzene		11	9.8	1 U	1	1 U	1 U	1 U	1 U
1,2–Dichlorobenzene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U

S	Sanitary sewage treatment plant sample.
C	Cooling water sample.
Inf	Influent sample.
Ef	Effluent sample.
grab	Grab sample

J	The analyte was positively identified. The associated numerical value is an estimate.
U	Analyte not detected at or above the reported result.

Appendix E (cont.) – VOA, BNA, & Pesticide/PCB Water Scan Results – Kaiser Aluminum (Mead), 1993.

Parameter I	Location:	S–Inf–E	S–Ef–E	Ef–E	S2–Pool	S2–Ef–GC
	Type:	E–comp	E–comp	E–comp	E–comp	grab/comp
	Date:	5/19–20	5/19–20	5/19–20	5/19–20	5/20
	Time:	@	@	@	@	1230&1626
	Lab Log#:	218282	218286	218293	218304	218307
BNA Compounds		(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
Phenol		2 U	1.2 J	2 U	2 U	2 U
Bis(2–Chloroethyl)Ether		1 U	1 U	1 U	1 U	1 U
o–Chlorophenol		1 U	1 U	1 U	1 U	1 U
1,3–Dichlorobenzene		1 U	1 U	1 U	1 U	1 U
1,4–Dichlorobenzene		5.2	1.6 J	1 U	1 U	1 U
Benzyl Alcohol		5 U	2.3 J	5 U	5 U	5 U
1,2–Dichlorobenzene		1 U	1 U	1 U	1 U	1 U
2–Methylphenol		1 U	1 U	1 U	1 U	1 U
Bis(2–Chloroisopropyl)Ether		1 U	1 U	1 U	1 U	1 U
4–Methylphenol		1 U	1.7 J	1 U	1 U	1 U
N–Nitroso–di–n–Propylamine		1 U	1 U	1 U	1 U	1 U
Hexachloroethane		2 U	2 U	2 U	2 U	2 U
Nitrobenzene		1 U	1 U	1 U	1 U	1 U
Isophorone		1 U	0.7 J	1 U	1 U	1 U
2–Nitrophenol		5 U	5 U	5 U	5 U	5 U
2,4–Dimethylphenol		2 U	2 U	2 U	2 U	2 U
Benzoic Acid		10 U	7.6 J	10 UJ	10 U	10 U
Bis(2–Chloroethoxy)Methane		1 U	1 U	1 U	1 U	1 U
2,4–Dichlorophenol		3 U	3 U	3 U	3 U	3 U
1,2,4–Trichlorobenzene		1 U	1 U	1 U	1 U	1 U
Naphthalene		0.4 J	1 U	1 U	1 U	1 U
4–Chloroaniline		3 U	3 U	3 U	3 U	3 U
Hexachlorobutadiene		2 U	2 U	2 U	2 U	2 U
4–Chloro–3–Methylphenol		2 U	2 U	2 U	2 U	2 U
2–Methylnaphthalene		1 U	1 U	1 U	1 U	1 U
Hexachlorocyclopentadiene		5 U	5 U	5 U	5 U	5 U
2,4,6–Trichlorophenol		5 U	5 U	5 U	5 U	5 U
2,4,5–Trichlorophenol		5 U	5 U	5 U	5 U	5 U
2–Chloronaphthalene		1 U	1 U	1 U	1 U	1 U
2–Nitroaniline		5 U	5 U	5 U	5 U	5 U
Dimethyl Phthalate		1 U	1 U	1 U	1 U	1 U
Acenaphthylene		1 U	1 U	1 U	1 U	1 U
3–Nitroaniline		5 U	5 U	5 U	5 U	5 U
Acenaphthene		1 U	1 U	1 U	1 U	1 U
2,4–Dinitrophenol		10 U	10 U	10 UJ	10 U	10 U
4–Nitrophenol		5 U	5 U	5 U	5 U	5 U
Dibenzofuran		1 U	1 U	1 U	1	1

S	Sanitary sewage treatment plant sample.
Inf	Influent sample.
Ef	Effluent sample.
E-comp	Ecology composite sample
grab/comp	Grab-composite sample
@	Composite sampling period: 07:00–07:00
E	Ecology sample
Pool	Coke calciner mill receiving pool.
S2	Coke calciner mill sewage treatment plant.

J	The analyte was positively identified. The associated numerical value is an estimate.
U	Analyte not detected at or above the reported result.
UJ	The analyte was not detected at or above the reported estimated result.

Appendix E (cont.) – VOA, BNA, & Pesticide/PCB Water Scan Results – Kaiser Aluminum (Mead), 1993.

Parameter l	Location:	S–Inf–E	S–Ef–E	Ef–E	S2–Pool	S2–Ef–GC
	Type:	E–comp	E–comp	E–comp	E–comp	grab/comp
	Date:	5/19–20	5/19–20	5/19–20	5/19–20	5/20
	Time:	@	@	@	@	1230&1626
	Lab Log#:	218282	218286	218293	218304	218307
BNA Compounds		(μg/L)	(μg/L)	(μg/L)	(μg/L)	(μg/L)
2,4–Dinitrotoluene		5 U	5 U	5 U	5 U	5 U
2,6–Dinitrotoluene		5 U	5 U	5 U	5 U	5 U
Diethyl Phthalate		3.6	2.5	1 U	1 U	1 U
4–Chlorophenyl Phenylether		1 U	1 U	1 U	1 U	1 U
Fluorene		1 U	1 U	1 U	1 U	1 U
4–Nitroaniline		5 U	5 U	5 U	5 U	5 U
4,6–Dinitro–2–Methylphenol		10 U	10 U	10 U	10 U	10 U
N–Nitrosodiphenylamine		1 U	1 U	1 U	1 U	1 U
4–Bromophenyl Phenylether		1 U	1 U	1 U	1 U	1 U
Hexachlorobenzene		1 U	1 U	1 U	1 U	1 U
Pentachlorophenol		5 U	5 U	5 U	5 U	5 U
Phenanthrene		1 U	0.3 J	1 U	1 U	1 U
Anthracene		1 U	1 U	1 U	1 U	1 U
Carbazole		1 U	1 U	1 U	1 U	1 U
Di–n–Butyl Phthalate		1 U	1 U	1 U	1 U	1 U
Fluoranthene		1 U	1 U	1 U	1 U	1 U
Pyrene		1 U	1 U	1 U	1 U	1 U
Butylbenzyl Phthalate		3.1	2.2	1 U	1 U	1 U
3,3'–Dichlorobenzidine		5 U	5 U	5 U	5 U	5 U
Benzo(a)Anthracene		1 J	1 U	1 U	1 U	1 U
Bis(2–Ethylhexyl)Phthalate		1 U	1.7 J	1 U	1 U	1 U
Chrysene		1 U	1 U	1 U	1 U	1 U
Di–n–Octyl Phthalate		1 U	1 U	1 U	1 U	1 U
Benzo(b)Fluoranthene		1 U	1 U	1 U	1 U	1 U
Benzo(k)Fluoranthene		1 U	1 U	1 U	1 U	1 U
Benzo(a)Pyrene		1 U	1 U	1 U	1 U	1 U
Indeno(1,2,3–cd)Pyrene		1 U	1 U	1 U	1 U	1 U
Dibenzo(a,h)Anthracene		1 U	1 U	1 U	1 U	1 U
Benzo(g,h,i)Perylene		1 U	1 U	1 U	1 U	1 U

S	Sanitary sewage treatment plant sample.
Inf	Influent sample.
Ef	Effluent sample.
E-comp	Ecology composite sample
grab/comp	Grab-composite sample
@	Composite sampling period: 07:00-07:00
E	Ecology sample
Pool	Coke calciner mill receving pool.
S2	Coke calciner mill sewage treatment plant.

J	The analyte was positively identified. The associated numerical value is an estimate.
U	Analyte not detected at or above the reported result.

Appendix E (cont.) – VOA, BNA, & Pesticide/PCB Water Scan Results – Kaiser Aluminum (Mead), 1993.

Parameter I			
Location:	Ef–E	S2–Pool	S2–Ef–GC
Type:	E–comp	E–comp	grab/comp
Date:	5/19–20	5/19–20	5/20
Time:	@	@	1230&1626
Lab Log#:	218293	218304	218307
Pesticide/PCB Compounds	(µg/L)	(µg/L)	(µg/L)
alpha–BHC	0.05 U	0.05 U	0.05 U
beta–BHC	0.05 U	0.05 U	0.05 U
delta–BHC	0.05 U	0.05 U	0.05 U
gamma–BHC (Lindane)	0.05 U	0.05 U	0.05 U
Heptachlor	0.05 U	0.05 U	0.05 U
Aldrin	0.05 U	0.05 U	0.05 U
Heptachlor Epoxide	0.05 U	0.05 U	0.05 U
Endosulfan I	0.05 U	0.05 U	0.05 U
Dieldrin	0.1 U	0.1 U	0.1 U
4,4'–DDE	0.1 U	0.1 U	0.1 U
Endrin	0.1 U	0.1 U	0.1 U
Endosulfan II	0.1 U	0.1 U	0.1 U
4,4'–DDD	0.1 U	0.1 U	0.1 U
Endosulfan Sulfate	0.1 U	0.1 U	0.1 U
4,4'–DDT	0.1 U	0.1 U	0.1 U
Methoxychlor	0.5 U	0.5 U	0.5 U
Endrin Ketone	0.1 U	0.1 U	0.1 U
Endrin Aldehyde	0.1 U	0.1 U	0.1 U
alpha–Chlordane	0.05 U	0.05 U	0.05 U
gamma–Chlordane	0.05 U	0.05 U	0.05 U
Toxaphene	5 U	5 U	5 U
Aroclor–1016	1 U	1 U	1 U
Aroclor–1221	2 U	2 U	2 U
Aroclor–1232	1 U	1 U	1 U
Aroclor–1242	1 U	1 U	1 U
Aroclor–1248	1 U	1 U	1 U
Aroclor–1254	1 U	1 U	1 U
Aroclor–1260	1 U	1 U	1 U

S	Sanitary sewage treatment plant sample.
C	Cooling water sample.
Inf	Influent sample.
Ef	Effluent sample.
E-comp	Ecology composite sample
grab/comp	Grap-composite sample
@	Composite sampling period: 07:00–07:00
E	Ecology sample
Pool	Coke calciner mill receving pool.
S2	Coke calciner mill sewage treatment plant.

J	The analyte was positively identified. The associated numerical value is an estimate.
U	Analyte not detected at or above the reported result.

Appendix E (cont.) – BNA & Pesticide/PCB Sediment Scan Results – Kaiser Aluminum (Mead), 1993.

Parameter II	Location:	Sed−1	Sed−2	Sed−3
	Type:	grab	grab	grab
	Date:	5/20	5/20	5/20
	Time:	0620	0720	0745
	Lab Log #:	218300	218301	218302
BNA Compounds		(µg/Kg-dry wt.)	(µg/Kg-dry wt.)	(µg/Kg-dry wt.)
Phenol		150 U	140 U	140 U
Bis(2−Chloroethyl)Ether		73 U	72 U	68 U
o−Chlorophenol		73 U	72 U	68 U
1,3−Dichlorobenzene		73 U	72 U	68 U
1,4−Dichlorobenzene		73 U	72 U	68 U
Benzyl Alcohol		360 U	360 U	340 U
1,2−Dichlorobenzene		73 U	72 U	68 U
2−Methylphenol		73 U	72 U	68 U
Bis(2−Chloroisopropyl)Ether		73 U	72 U	68 U
4−Methylphenol		73 U	72 U	68 U
N−Nitroso−di−n−Propylamine		73 U	72 U	68 U
Hexachloroethane		150 U	140 U	140 U
Nitrobenzene		73 UJ	72 U	68 U
Isophorone		73 U	72 U	68 U
2−Nitrophenol		360 U	360 U	340 U
2,4−Dimethylphenol		150 U	140 U	140 U
Benzoic Acid		730 U	720 U	680 U
Bis(2−Chloroethoxy)Methane		73 U	72 U	68 U
2,4−Dichlorophenol		220 U	210 U	200 U
1,2,4−Trichlorobenzene		73 U	72 U	68 U
Naphthalene		73 U	20 J	68 U
4−Chloroaniline		220 U	210 U	200 U
Hexachlorobutadiene		150 U	140 U	140 U
4−Chloro−3−Methylphenol		150 U	140 U	140 U
2−Methylnaphthalene		73 U	28 J	68 U
Hexachlorocyclopentadiene		360 U	360 U	340 U
2,4,6−Trichlorophenol		360 U	360 U	340 U
2,4,5−Trichlorophenol		360 U	360 U	340 U
2−Chloronaphthalene		73 U	72 U	68 U
2−Nitroaniline		360 U	360 U	340 U
Dimethyl Phthalate		73 U	72 U	68 U
Acenaphthylene		73 U	72 U	68 U
3−Nitroaniline		360 U	360 U	340 U
Acenaphthene		73 U	130 J	68 U
2,4−Dinitrophenol		730 U	720 U	680 U
4−Nitrophenol		360 U	360 U	340 U
Dibenzofuran		73 U	32 J	68 U

Sed-1	Ecology downstream sediment sample from Deadman Creek	J	The analyte was positively identified. The associated numerical value is an estimate.
Sed-2	Ecology near outfall sediment sample from Deadman Creek		
Sed-3	Ecology upstream sediment sample from Deadman Creek	U	Analyte not detected at or above the reported result.
grab	Grab sample	UJ	The analyte was not detected at or above the reported estimated result.

Appendix E (cont.) – BNA & Pesticide/PCB Sediment Scan Results – Kaiser Aluminum (Mead), 1993.

Parameter II	**Location:**	**Sed–1**	**Sed–2**	**Sed–3**
	Type:	**grab**	**grab**	**grab**
	Date:	**5/20**	**5/20**	**5/20**
	Time:	**0620**	**0720**	**0745**
	Lab Log #:	**218300**	**218301**	**218302**
BNA Compounds		(μg/Kg-dry wt.)	(μg/Kg-dry wt.)	(μg/Kg-dry wt.)
2,4–Dinitrotoluene		360 U	360 U	340 U
2,6–Dinitrotoluene		730 U	360 U	340 U
Diethyl Phthalate		73 U	72 U	68 U
4–Chlorophenyl Phenylether		73 U	72 U	68 U
Fluorene		73 U	140 J	68 U
4–Nitroaniline		360 U	360 U	340 U
4,6–Dinitro–2–Methylphenol		730 U	720 U	680 U
N–Nitrosodiphenylamine		73 U	72 U	68 U
4–Bromophenyl Phenylether		73 U	72 U	68 U
Hexachlorobenzene		73 U	72 U	68 U
Pentachlorophenol		360 U	360 U	340 U
Phenanthrene		53 J	1500	68 U
Anthracene		73 U	140	68 U
Carbazole		73 U	240	68 U
Di–n–Butyl Phthalate		73 U	72 U	68 U
Fluoranthene		120 J	2300	68 U
Pyrene		93 J	1700	68 U
Butylbenzyl Phthalate		73 U	72 U	68 U
3,3'–Dichlorobenzidine		360 U	360 U	340 U
Benzo(a)Anthracene		74 J	1000	68 U
Bis(2–Ethylhexyl)Phthalate		73 U	74 J	68 U
Chrysene		91 J	1300	68 U
Di–n–Octyl Phthalate		73 U	72 U	68 U
Benzo(b)Fluoranthene		150	1800 U	68 U
Benzo(k)Fluoranthene		160 U	2000	68 U
Benzo(a)Pyrene		93 J	1200	68 U
Indeno(1,2,3–cd)Pyrene		79 J	700	68 U
Dibenzo(a,h)Anthracene		73 U	190	68 U
Benzo(g,h,i)Perylene		59 J	490	68 U

Sed-1	Ecology downstream sediment sample from Deadman Creek
Sed-2	Ecology near outfall sediment sample from Deadman Creek
Sed-3	Ecology upstream sediment sample from Deadman Creek
grab	Grab sample

J	The analyte was positively identified. The associated numerical value is an estimate.
U	Analyte not detected at or above the reported result.

Appendix E (cont.) – BNA & Pesticide/PCB Sediment Scan Results – Kaiser Aluminum (Mead), 1993.

Parameter II	**Location:**	**Sed–1**	**Sed–2**	**Sed–3**
	Type:	**grab**	**grab**	**grab**
	Date:	**5/20**	**5/20**	**5/20**
	Time:	**0620**	**0720**	**0745**
	Lab Log #:	**218300**	**218301**	**218302**
Pesticide/PCB Compounds		(µg/Kg-dry wt.)	(µg/Kg-dry wt.)	(µg/Kg-dry wt.)
alpha–BHC		3.7 U	3.7 U	3.5 U
beta–BHC		3.7 U	3.7 U	3.5 U
delta–BHC		3.7 U	3.7 U	3.5 U
gamma–BHC (Lindane)		3.7 U	3.7 U	3.5 U
Heptachlor		3.7 U	3.7 U	3.5 U
Aldrin		3.7 U	3.7 U	3.5 U
Heptachlor Epoxide		3.7 U	3.7 U	3.5 U
Endosulfan I		3.7 U	3.7 U	3.5 U
Dieldrin		7.2 U	7.2 U	6.8 U
4,4'–DDE		7.2 U	7.2 U	6.8 U
Endrin		7.2 U	7.2 U	6.8 U
Endosulfan II		7.2 U	7.2 U	6.8 U
4,4'–DDD		7.2 U	7.2 U	6.8 U
Endosulfan Sulfate		7.2 U	7.2 U	6.8 U
4,4'–DDT		7.2 U	7.2 U	6.8 U
Methoxychlor		37 U	37 U	35 U
Endrin Ketone		7.2 U	7.2 U	6.8 U
Endrin Aldehyde		7.2 U	7.2 U	6.8 U
alpha–Chlordane		3.7 U	3.7 U	3.5 U
gamma–Chlordane		3.7 U	3.7 U	3.5 U
Toxaphene		370 U	370 U	350 U
Aroclor–1016		72 U	72 U	68 U
Aroclor–1221		150 U	150 U	140 U
Aroclor–1232		72 U	72 U	68 U
Aroclor–1242		72 U	72 U	68 U
Aroclor–1248		72 U	72 U	68 U
Aroclor–1254		72 U	72 U	68 U
Aroclor–1260		72 U	72 U	68 U

Sed-1	Ecology downstream sediment sample from Deadman Creek
Sed-2	Ecology near outfall sediment sample from Deadman Creek
Sed-3	Ecology upstream sediment sample from Deadman Creek
grab	Grab sample
U	Analyte not detected at or above the reported estimate.

Appendix F – PAH and Metals Scan Results – Kaiser Aluminum (Mead), 1993.

Parameter I	**Location:**	**S–Ef–E**	**C–Inf–E**	**Ef–E**
	Type:	**E–comp**	**E–comp**	**E–comp**
	Date:	**5/19–20**	**5/19–20**	**5/19–20**
	Time:	**@**	**@**	**@**
	Lab Log#:	**218286**	**218290**	**218293**
Polynuclear Aromatic Hydrocarbons		(µg/L)	(µg/L)	(µg/L)
Naphthalene		1.8 U	1.8 U	1.8 U
Acenaphthylene		2.3 U	2.3 U	2.3 U
Acenaphthene		1.8 U	1.8 U	1.8 U
Fluorene		0.2 U	0.2 U	0.2 U
Phenanthrene		0.6 U	0.6 U	0.6 U
Anthracene		0.7 U	0.7 U	0.7 U
Fluoranthene		0.4 JN	0.4	0.3 JN
Pyrene		0.2 JN	0.3 U	0.3 U
Benzo(a)Anthracene		0.08 JN	0.01 JN	0.01 U
Chrysene		0.1 JN	0.2 U	0.2 U
Benzo(b)Fluoranthene		0.1 JN	0.02 JN	0.02 JN
Benzo(k)Fluoranthene		0.06 JN	0.01 JN	0.02 U
Benzo(a)Pyrene		0.08 JN	0.01 JN	0.02 U
Dibenz(a,h)Anthracene		0.07 JN	0.03 U	0.03 U
Benzo(ghi)Perylene		0.09 JN	0.08 U	0.08 U
Indeno(1,2,3–cd)Pyrene		0.1 JN	0.04 U	0.04 U

Parameter I	**Location:**	**S–Inf–E**	**S–Ef–E**	**C–Inf–E**	**Ef–E**	**Ef–K**	**S2–Pool**	**S2–Ef–GC**	**S2–In**	**Intake**
	Type:	**E–comp**	**E–comp**	**E–comp**	**E–comp**	**K–comp**	**E–comp**	**grab/comp**	**grab**	**grab**
	Date:	**5/19–20**	**5/19–20**	**5/19–20**	**5/19–20**	**5/19–20**	**5/19–20**	**5/20**	**5/20**	**5/19**
	Time:	**@**	**@**	**@**	**@**	**@**	**@**	**1230&1626**	**1238**	**1238**
	Lab Log#:	**218282**	**218286**	**218290**	**218293**	**218294**	**318304**	**218307**	**218313**	**218296**
Metals		(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
Antimony		30 U	30 U	30 U	30 U	30 U	30 U	30 U	30 U	30 U
Arsenic		2.5 P	3.1 P	4 P	3.2 P	2.2 P	2.6 P	2.6 P	2 P	2.7 P
	Pentavalent									
	Trivalent									
Beryllium		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cadmium		0.24 P	0.17 P	0.34 P	0.25 P	0.31 P	0.1 U	0.1 U	0.1 U	0.1 U
Chromium		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
	Hexavalent									
	Trivalent									
Copper		38	18 P	27 P	14 P	14 P	3 U	3.9 P	3.3 P	19 P
Lead		2.6 P	1.4 P	2.9 P	1.3 P	1 U	1 P	1 U	1 U	1 U
Mercury		0.05 U	0.096 P	0.05 U	0.05 U	0.5 U	0.05 U	0.05 U	0.05 U	0.5 U
Nickel		10 U	10 U	15 P	10 U	10 U	10 U	10 U	10 U	10 U
Selenium		2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Silver		0.5 UJ	0.5 UJ	0.5 UJ	0.5 UJ	0.5 UJ	0.5 U	0.5 UJ	0.5 UJ	0.5 UJ
Thallium		2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
Zinc		48.3	35 P	58.3	30 U	41.9	9.1 P	4 U	90.1	12 P
Aluminum		784			1160	1170				28 P

S	Sanitary sewage treatment plant sample.
C	Cooling water sample.
Inf	Influent sample.
Ef	Effluent sample.
E-comp	Ecology composite sample
@	Composite sampling period: 07:00–07:00
E	Ecology sample
Pool	Coke calciner mill receving pool.
S2-In	Coke calciner mill intake sample.

N	For metals analytes the spike sample recovery is not within control limits.
P	The analyte was detected above the instrument detection limit, but below the established minimum quantitation limit.
U	The analyte was not detected at or above the reported result.
JN	There is evidence that the analyte is present. The associated numerical result is an estimate.
UJ	The analyte was not detected at or above the reported estimated result.
Intake	Smelter intake sample.

Appendix F – PAH and Metals Scan Results – Kaiser Aluminum (Mead), 1993.

Parameter II	Location:	Creek-1	Creek-2	Creek-3	Creek-4
	Type:	grab	grab	grab	grab
	Date:	5/20	5/20	5/20	5/20
	Time:	0620	0720	0745	1000
	Lab Log #:	218297	219298	218299	218308
Polynuclear Aromatic Hydrocarbons		(μg/L)	(μg/L)	(μg/L)	(μg/L)
Naphthalene		1.8 U	1.8 U	1.8 U	1.8 U
Acenaphthylene		2.3 U	2.3 U	2.3 U	2.3 U
Acenaphthene		1.8 U	1.8 U	1.8 U	1.8 U
Fluorene		0.2 U	0.2 U	0.2 U	0.2 U
Phenanthrene		0.6 U	0.6 U	0.6 U	0.6 U
Anthracene		0.7 U	0.7 U	0.7 U	0.7 U
Fluoranthene		0.2 U	0.2 U	0.2 U	0.2 U
Pyrene		0.3 U	0.3 U	0.3 U	0.3 U
Benzo(a)Anthracene		0.01 U	0.01 U	0.01 U	0.01 U
Chrysene		0.2 U	0.2 U	0.2 U	0.2 U
Benzo(b)Fluoranthene		0.02 U	0.02 U	0.02 U	0.02 U
Benzo(k)Fluoranthene		0.02 U	0.02 U	0.02 U	0.02 U
Benzo(a)Pyrene		0.02 U	0.02 U	0.02 U	0.02 U
Dibenz(a,h)Anthracene		0.03 U	0.03 U	0.03 U	0.03 U
Benzo(ghi)Perylene		0.08 U	0.08 U	0.08 U	0.08 U
Indeno(1,2,3-cd)Pyrene		0.04 U	0.04 U	0.04 U	0.04 U

Parameter II	Location:	Creek-1	Creek-2	Creek-3	Creek-4	Sed-1	Sed-2	Sed-3
	Type:	grab	grab	grab	grab	grab	grab	grab
	Date:	5/20	5/20	5/20	5/20	5/20	5/20	5/20
	Time:	0620	0720	0745	1000	0620	0720	0745
	Lab Log #:	218297	219298	218299	218308	218300	218301	218302
Metals		(μg/L)	(μg/L)	(μg/L)	(μg/L)	(mg/Kg-dry wt.)	(mg/Kg-dry wt.)	(mg/Kg-dry wt.)
Antimony		30 U	30 U	30 U	30 U	3 UN	3 UN	3 UN
Arsenic		2.6 P	2.4 P	2.6 P	2 P	5.04 U	5.75	3.78
	Pentavalent							
	Trivalent							
Beryllium		1 U	1 U	1 U	1 U	0.41 P	0.52 P	0.25 P
Cadmium		0.1 U	0.1 U	0.1 U	0.1 U	0.092 P	0.164	0.042 P
Chromium		5 U	5 U	5 U	5 U	9.38	9.26	6.06
	Hexavalent							
	Trivalent							
Copper		3.5 P	5.4 P	3 U	3 U	7.95	18.2	3.35
Lead		1.3 P	1 U	1.9 P	1.3 P	9.47	10.3	4.67
Mercury		0.05 U	0.05 U	0.05 U	0.05 U	0.0066 P	0.013 P	0.005 U
Nickel		10 U	10 U	10 U	10 U	8.3 P	11.6	5.5 U
Selenium		2 U	2 U	2 U	2 U	0.4 U	0.4 U	0.4 U
Silver		0.5 UJ	0.5 UJ	0.5 UJ	0.5 UJ	0.1 U	0.1 U	0.1 U
Thallium		2.5 U	2.5 U	2.5 U	2.5 U	0.5 UJ	0.5 U	0.5 U
Zinc		5.4 P	5.5 P	9.2 P	5.5 P	43.1 B	67.5 U	28.5 U
Aluminum		1180	416	914	870	9200	9900	5410

Creek-1	150 ft. downstream from outfall Deadman Creek sample
Creek-2	Near outfall Deadman Creek sample
Creek-3	100 ft upstream from outfall Deadman Creek sample
Creek-4	Several miles downstream from outfall Deadman Creek sample
Sed-1	Ecology downstream sediment sample from Deadman Creek
Sed-2	Ecology near outfall sediment sample from Deadman Creek
Sed-3	Ecology upstream sediment sample from Deadman Creek
grab	Grab sample

N	For metals analytes the spike sample recovery is not within control limits.
P	The analyte was detected above the instrument detection limit, but below the established minimum quantitation limit.
U	The analyte was not detected at or above the reported result.
UJ	The analyte was not detected at or above the reported estimated result.

Appendix G - Tentatively Identified Compounds - Kaiser Aluminum (Mead), 1993

Sample Location: S-Inf-1
Type: grab
Date: 5/19
Time: 1046
Sample ID: 218280

Volatile Organics:

Compound Name	Estimated Concentration (μg/L)	Qualifier
1. Unknown Hydrocarbon (b.p. m/e 68)	28	J
2. Unknown Hydrocarbon (b.p. m/e 57)	17	J
3. Unknown Hydrocarbon (b.p. m/e 57)	15	J
4. Unknown Hydrocarbon (b.p. m/e 57)	5	J

Sample Location: S-Inf-2
Type: grab
Date: 5/19
Time: 1441
Sample ID: 218281

Volatile Organics:

Compound Name	Estimated Concentration (μg/L)	Qualifier
1. Unknown Hydrocarbon (b.p. m/e 68)	16	J
2. Unknown Hydrocarbon (b.p. m/e 57)	19	J
3. Unknown Hydrocarbon (b.p. m/e 119)	5	J
4. Unknown Hydrocarbon (b.p. m/e 57)	18	J
5. Unknown Hydrocarbon (b.p. m/e 57)	7	J

Sample Location: S-Ef-2
Type: grab
Date: 5/19
Time: 1447
Sample ID: 218285

Volatile Organics:

Compound Name	Estimated Concentration (μg/L)	Qualifier
1. Unknown Compound (b.p. m/e 57)	12	NJ

Appendix G (cont.) - Tentatively Identified Compounds - Kaiser Aluminum (Mead), 1993

Sample Location: S-Inf-E
Type: comp
Date: 5/19-20
Time: 24 hours
Sample ID: 218282

BNAs:

Compound Name	Estimated Concentration (μg/L)	Qualifier
1. 1-(2-Methypropoxy)-2-Propanol	7	NJ
2. Unknown (b.p. m/e 57)	20	J
3. C10.H18.O Isomer (B.P. m/e 59)	6	NJ
4. Butoxyethoxyethanol Isomer (b.p. m/e 45)	7	NJ
5. C13.H28 Isomer (b.p. m/e 57)	14	NJ
6. C13.H28 Isomer (b.p. m/e 57)	7	NJ
7. 2-(2-Butoxyethoxy)-Ethanol Acetate	20	NJ
8. Unknown Hydrocarbon (b.p. m/e 57)	7	NJ
9. Unknown Hydrocarbon (b.p. m/e 57)	16	NJ
10. Unknown (b.p. m/e 58)	10	J
11. Unknown Hydrocarbon (b.p. m/e 57)	8	NJ
12. Tetradecanoic Acid	8	NJ
13. 3,7-Dihydro-1,3,7-Trimethyl-1H-Purine-2,6-Dione	8	NJ
14. 9-Hexadecanoic Acid	7	NJ
15. Hexadecanoic Acid	68	NJ
16. Unknown Hydrocarbon (b.p. m/e 55)	27	NJ
17. Unknown (b.p. m/e 55)	29	J
18. Unknown (b.p. m/e 55)	56	J
19. C27.H48.O Isomer (b.p. m/e 43)	51	NJ
20. Sterol Isomer (b.p. m/e 43)	54	NJ

Sample Location:	S-Ef-E
Type:	comp
Date:	5/19-20
Time:	24 hours
Sample ID:	218286

BNAs:

Compound Name	Estimated Concentration ($\mu g/L$)	Qualifier
1. Unknown (b.p. m/e 57)	42	J
2. Unknown (b.p. m/e 59)	25	J
3. 1-(2-methoxy-1-methyloxy)-2-Propanol	19	NJ
4. 1-(2-Methypropoxy)-2-Propanol	47	NJ
5. Unknown (b.p. m/e 57)	15	J
6. Unknown (b.p. m/e 61)	14	J
7. Unknown Alcohol Type (b.p. m/e 45)	31	NJ
8. 2-(2-Butoxyethoxy)-Ethanol Acetate	31	NJ
9. Unknown Hydrocarbon (b.p. m/e 57)	17	NJ
10. Unknown (b.p. m/e 60)	68	J
11. Tetradecanoic Acid	69	NJ
12. 9-Hexadecanoic Acid	22	NJ
13. Hexadecanoic Acid	470	NJ
14. Hexadecanoic Acid	16	NJ
15. Unknown Hydrocarbon (b.p. m/e 55)	440	NJ
16. Octadecanoic Acid	520	NJ
17. 2-Butoxy Ethanol Phosphate (3:1)	22	NJ
18. Unknown (b.p. m/e 69)	26	J
19. Sterol Isomer (b.p. m/e 43)	34	NJ
20. Sterol Isomer (b.p. m/e 43)	30	NJ

Sample Location: Ef-E
Type: E-comp
Date: 5/19-20
Time: 24 hours
Sample ID: 218293

BNAs:

Compound Name	Estimated Concentration (μg/L)	Qualifier
1. 1,1,2,2-Tetrachlorethane	24	NJ
2. Unknown (b.p. m/e 43)	6	J
3. Unknown (b.p. m/e 61)	6	J
4. Unknown (b.p. m/e 61)	15	J
5. Butoxyethoxyethanol Isomer (b.p. m/e 45)	22	NJ
6. 2-(2-Butoxyethoxy)-Ethanol Acetate	39	NJ

Sample Location: Sed-1
Type: grab
Date: 5/20
Time: 0620
Sample ID: 218300

BNAs:

Compound Name	Estimated Concentration (μg/Kg)	Qualifier
1. Unknown Hydrocarbon (.bp. m/e 55)	370	NJ
2. Hexadecanoic Acid	570	NJ
3. Unknown (b.p. m/e 55)	830	J
4. Unknown Hydrocarbon (.bp. m/e 57)	150	NJ
5. Unknown (b.p. m/e 55)	180	J
6. Unknown Hydrocarbon (.bp. m/e 57)	460	NJ
7. Unknown Hydrocarbon (.bp. m/e 40)	170	NJ
8. PNA Isomer (b.p. m/e 55)	240	NJ
9. Unknown Hydrocarbon (.bp. m/e 57)	660	NJ
10. Unknown Hydrocarbon (.bp. m/e 43)	1200	NJ
11. Unknown Hydrocarbon (.bp. m/e 57)	530	NJ
12. Unknown Hydrocarbon (.bp. m/e 57)	590	NJ
13. (3.Beta.)-Cholest-5-en-3-ol	3500	NJ
14. Unknown (b.p. m/e 43)	760	J
15. Unknown (b.p. m/e 207)	220	J
16. Unknown (b.p. m/e 205)	540	J
17. Unknown (b.p. m/e 43)	2200	J
18. Unknown (b.p. m/e 43)	360	J
19. Unknown (b.p. m/e 43)	870	J
20. Unknown (b.p. m/e 43)	530	J

Appendix G (cont.) - Tentatively Identified Compounds - Kaiser Aluminum (Mead), 1993

Sample Location: Sed-2
Type: grab
Date: 5/20
Time: 0720
Sample ID: 218301

BNAs:

Compound Name	Estimated Concentration (μg/Kg)	Qualifier
1. 9-Hexadecanoic Acid	1000	NJ
2. Hexadecanoic Acid	1600	NJ
3. Unknown (b.p. m/e 204)	830	J
4. Unknown (b.p. m/e 55)	690	J
5. Unknown (b.p. m/e 55)	1100	J
6. C17.H12 Isomer (b.p. m/e 216)	540	NJ
7. C17.H12 Isomer (b.p. m/e 215)	510	NJ
8. C18.H14 Isomer (b.p. m/e 230)	430	NJ
9. Unknown Hydrocarbon (b.p. m/e 57)	620	NJ
10. Unknown (b.p. m/e 41)	480	J
11. C20.H12 Isomer (b.p. m/e 252)	1100	NJ
12. Unknown Hydrocarbon (b.p. m/e 57)	560	NJ
13. Unknown Alcohol Type (b.p. m/e 43)	880	NJ
14. Methyl Ester Hexadecadienoic Acid Isomer (b.p. m/e 43)	630	NJ
15. Unknown Hydrocarbon (b.p. m/e 43)	590	NJ
16. Unknown Hydrocarbon (b.p. m/e 57)	600	NJ
17. Unknown (b.p. m/e 43)	1800	J
18. Unknown (b.p. m/e 43)	500	J
19. Sterol Isomer (b.p. m/e 43)	1700	NJ
20. Unknown (b.p. m/e 55)	2200	J

Sample Location: Sed-3
Type: grab
Date: 5/20
Time: 0745
Sample ID: 218302

BNAs:

Compound Name	Estimated Concentration (μg/Kg)	Qualifier
1. 1,1,2,2-Tetrachlorethane	310	NJ
2. Unknown (b.p. m/e 55)	410	J

Appendix H - GLOSSARY

ABN	Acid base-neutral, semivolatile organics, see BNA
AED	Atomic Emission Detector
BNA	Base-neutral acids, semivolatiles, see ABN
BOD	Biological Oxygen Demand
CLP	Contract Laboratory Program
COD	Chemical Oxygen Demand
co-elutants	When two or more compounds have the same chromatographic retention time
CVAA	Cold Vapor Atomic Absorption
d-deuterium	An isotope of hydrogen
DL	Detection Limit
DOC	Dissolved Organic Carbon
DW	Dangerous Waste
ECD	Electron Capture Detector-Sensitive to halogen compounds - use: halogenated hydrocarbons
EHW	Extremely Hazardous Waste
ELD	Electrolytic Detector - Hall
EP TOX	Extraction Procedure Toxicity
Fatty Acid	Monobasic organic acids derived from hydrocarbons; include both saturated and unsaturated acids
FID	Flame Ionization Detector-Sensitive to carbon compounds, used in the determination of hydrocarbons
Flash Point	Minimum temperature that will enable combustion or explosions to take place
FTIR	Fourier Transform Infra-Red
GC	Gas Chromatography
GCMS	Gas Chromatography Mass Spectrometry, also GC/MS
HC	Hydrocarbon
HDPE	High Density Polyethylene
HH	Halogenated Hydrocarbon
HPLC	High Performance Liquid Chromatography
HSD	Halogen-Specific Detector - use: halogenated hydrocarbons
HW	Hazardous Waste
HWPAH	Hazardous Waste Polynuclear Aromatic Hydrocarbon
ICP	Inductively Coupled Plasma
ICP/MS	Inductively Coupled Plasma/Mass Spectrometry
IDL	Instrument Detection Limit
isomer	One of two or more substances which have the same elementary composition but differ in structure and hence in properties
isotope	One of two or more nuclides having the same atomic number, but differing in mass number

Appendix H - (continued)

Isotopically labelled	The substitution of one or more isotopes for elements in a compound
kg	kilogram (1 X 10^3 grams)
L	Liter (1 X 10^3 milliliters)
LC50	Concentration which is lethal to 50% of the test organisms
LOD	Limit of Detection
LOEC	Lowest Observable Effect Concentration
m^3	Cubic meter (1 X 10^3 liters)
MBAS	Methylene Blue Active substances
metalloids	Elements that exhibit transitional characteristics between metals and non-metals, examples include silver, selenium, antimony
MF	Membrane Filter
mg	milligram (1 X 10^{-3} grams)
mL	Milliliter (1 X 10^{-3} liters)
MPN	Most Probable Number
ng	Nanogram (1 X 10^{-9} grams)
nm	Nanometer (1 X 10^{-9} meters)
NOEC	No Observable Effect Concentration
NPDES	National Pollution Discharge Elimination System
NPOC	Non-Purgeable Organic Carbon
NTU	Nephelometric Turbidity Unit
OSHA	Occupation Safety and Health Administration
OSW	Office of Solid Waste
PCB	Polychlorinated Biphenyl
PE	Polyethylene
pg	Picogram (1 X 10^{-12} grams)
pH	Hydrogen Ion Concentration
PID	Photoionization Detector - use: aromatic hydrocarbons
PLM	Polarized Light Microscopy
POC	Purgeable Organic Carbon
Polyvalent	Capable of having more than one valance state
PP	Priority Pollutant
ppb	Parts per billion (1 X 10^{-9} ug/L or ug/kg)
ppm	Parts per million (1 X 10^{-6} ug/L or ug/kg)
ppt	Parts per thousand (1 X 10^{-3} ug/L or ug/kg)
PQL	Practical Quantitation Limit
PUF	Polyurethane Foam
SDWA	State Drinking Water Act
SOW	Statement of Work
SW	Solid Waste

TC	Target Compounds or Total Carbon
TCD	Thermal Conductivity Detector
TCL	Target Compound List
TCLP	Toxicity Characteristic Leaching Procedure
TDS	Total Dissolved Solids
TIC	Total Inorganic Carbon or for GCMS Tentatively Identified Compound
TNVS	Total Non-Volatile Solids
TNVSS	Total Non-Volatile Suspended Solids
TOC	Total Organic Carbon
TP	Total Phosphorous
TPH	Total Petroleum Hydrocarbons
TS	Total Solids
TSS	Total Suspended Solids
TVS	Total Volatile Solids
ug	Microgram (1 X 10^{-6} grams)
ug/m^3	Microgram per cubic meter
VOA	Volatile Organic Analysis
VOC	Volatile Organic Carbon
ZHE	Zero Headspace Extractor