Closure Plan
Spent Potlining Management Facility
Kaiser Aluminum & Chemical Corporation
Tacoma Works

June 6, 2002

Prepared for

Kaiser Aluminum & Chemical Corporation

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1.0 INTRODUCTION

This plan presents the procedures for final clean closure of the spent potlining management facility at the Kaiser Aluminum & Chemical Corporation (Kaiser) Tacoma Plant. The plan is prepared to respond to closure requirements contained in the Washington State Dangerous Waste Regulations (WAC 173-303-610).

1.1 PLANT DESCRIPTION

The Kaiser Tacoma Plant is located at 3400 Taylor Way in Tacoma, Washington (see Figure 1). The plant occupies 96 acres between the southeast ends of the Hylebos and Blair Waterways on Commencement Bay in the highly industrialized Port of Tacoma. All but about 15 acres of the plant is fenced, and entrance to the plant is controlled by security guards on a 24-hour basis. The site is generally level, and is bordered on all sides by industrial uses.

The Hylebos Waterway, the primary receiving waters for liquid discharge from the plant, is located approximately 1,000 ft to the north of the plant. Water discharged from the plant is piped to a detention pond (see Figure 2) Water from this pond is then piped to the Hylebos Waterway, discharging at outfall 001.

The plant consists of a primary aluminum production facility, an aluminum rod mill, and associated facilities. The plant has three potlines using the horizontal stud soderberg process. Total production capacity is approximately 227 tons of aluminum metal per day, or about 83,000 tons per year. Production at the Tacoma Works facility is currently curtailed. The potlines were fully curtailed in June 2000, and the rod mill was fully curtailed in May 2001.

1.2 BACKGROUND

The area where the spent potlining management facility is located was used from 1943 to 1985 to temporarily store spent potlining and occasionally potroom duct dust[(1)]. Between 1943 and 1967, the spent potlining was stored on the unpaved ground surface. The facility, including concrete pad, runoff sump, storage tanks, and associated piping, was not constructed until 1967. The facility to be closed under this plan includes the spent potlining removal and storage pad (approximately 19,500 ft^2) with segregated runoff, two 15,000-gallon leachate storage tanks and associated leachate and sludge, one

(1) Material removed from potroom air control system duct work.

12,400-gallon leachate treatment tank, and ancillary pumps and piping. Figure 3 shows the layout of the former spent potlining management facility.

Spent potlining is created when an aluminum reduction cell (pot) fails. During the operation of the spent potlining management facility, failed pots were removed from the potline and the cathode portion was transported to the potlining removal and storage pad. At the pad, the pot was sprayed with water to fracture and soften the carbonaceous cathode material and to control fugitive dust. The potlining was then removed from the steel cathode shells by jack hammering the material and turning the shells upside down with a crane. The steel pot shell was returned to service and the carbonaceous potlining was temporarily stored on the pad until enough potlining had accumulated for shipment by truck trailer to the Chem-Security Systems, Inc. (CSSI) hazardous waste management facility near Arlington, Oregon for disposal.

Leachate generated and stored at the facility consisted of fresh water sprayed onto the pot to loosen and fracture the spent potlining and to control dust. Leachate, along with stormwater runoff collected from the pad, was drained into a sump and pumped into the two 15,000-gallon leachate storage tanks at the facility. The stored leachate was then batch-treated in a 12,400-gallon treatment tank before being discharged to the plant stormwater system. A water usage diagram for the spent potlining management area is presented in Figure 4.

Specific methods used for treating potlining leachate are discussed in section 1.5, Treatment at Spent Potlining Management Facility.

On August 1, 1984, Kaiser was issued a renewed NPDES permit with effluent limits measured at the pot soaking area for benzo(a)pyrene, antimony, nickel, aluminum, and fluoride in accordance with guidance contained in 40 CFR 421.23(p); and a concentration limit for cyanides. Order DE 84-442 was also issued on the same date to install a treatment system to achieve the effluent limits of NPDES Permit WA-000093-1. Kaiser determined that conversion to an indoor dry removal process was the most environmentally acceptable and cost effective compliance alternative. In December 1985, Kaiser converted to a dry potlining process and moved the spent potlining management activities to Building 3 after approval of the new operation by the Washington Department of Ecology (Ecology 1985).

1.3 WASTE CHARACTERIZATION

As indicated above, the principal types of waste stored or handled at the spent potlining management facility are spent potlining, duct dust, and leachate. This section presents data on the composition of these wastes and volumes handled.

1.3.1 SPENT POTLINING

The removed potlining varies in size from fine particulates to chunks 2 to 3 ft in length and weighing several hundred pounds. The potlining has a variable composition including carbon, sodium aluminum fluoride (cryolite), aluminum oxide, calcium fluoride, lithium fluoride, metallic sodium (trace), metallic and oxides of iron, aluminum carbide, aluminum nitride, sodium oxide, sodium fluoride, silicon dioxide, and free and complex cyanides. A typical elemental breakdown of potlining follows (percent by approximate weight):

C	F	Na	Al	Ca	Fe	Si	Oxides, etc.
33	16	14	15	2	1	2	17

The composition of spent potlining is highly variable (e.g., carbon can vary from 15 to 65 percent and cyanide can vary from 0.03 to 0.6 percent)

Prior to the spent potlining being federally listed as federal waste code K088, static fish bioassays were performed and spent potlining from the Kaiser Tacoma Plant was classified as an extremely hazardous waste (EHW) under the Washington State Dangerous Waste Regulations (WAC 173-303) with an associated waste number of WT01.

Because the subject spent potlining management facility ceased operation in December 1985, no potlining designated as a K088 listed hazardous waste was managed in the facility, as this waste was not listed until 4 years later.

1.3.2 DUCT DUST

Duct dust from the potroom air control ducts is a combination of coal tar pitch fumes, alumina dust, and bath particulates. Based on knowledge of the material, an estimated composition of the duct dust from the Tacoma facility is as follows: 20 percent polycyclic aromatic hydrocarbons (PAH), 10 percent carbon, 20 percent fluoride, 4 percent sodium, and 46 percent aluminum oxide. Because the duct dust contains over 1 percent polycyclic aromatic hydrocarbons (PAH), it is classified as EHW under Washington State Dangerous Waste Regulations, with an associated WPO3 waste number indicating a persisent dangerous waste.

1.3.3 POTLINING LEACHATE

Spent potlining, which was temporarily stored at the former potlining management facility prior to transport to CSSI, was subject to climatic exposure. Available data indicated that certain constituents, including trace amounts of free and metallic-complexed cyanides, were leached from exposed piles by rainwater and during loosening of potlining material in the pots by water. Table 1 presents a typical spent potlining leachate analysis

1.4 EXTENT OF PRIOR CONTAMINATION

Prior to placement of the 19,500 ft^2 spent potlining removal and storage pad in 1967, spent potlining had been handled and stored in the general area of the spent potlining facility since 1943. From 1943 to 1967, the area was not paved. For most of the earlier part of this period, the area was not at its present grade Continuing potlining management and earth-moving operations resulted in distribution of spent potlining throughout adjacent areas.

Fluoride and cyanide are components of spent potlining which are of concern for potential soil and groundwater contamination The spent potlining management facility has been the subject of investigations designed to characterize the extent and distribution of soil and groundwater contamination attributable to spent potlining handling and storage procedures at the Kaiser Tacoma Plant The first such study, prepared by Dames & Moore (1985), reported the results of a hydrogeologic investigation to assess the extent of contaminant migration in groundwater at the facility. From the results of this study, contribution of cyanide and fluoride to the Hylebos Waterway from groundwater flow at Kaiser was estimated to be very low (less than 0.003 mg/l).

The contamination of the ground at the storage facility occurred prior to installation and use of the potlining management facility and prior to regulation of the potlining waste by Ecology. There is no evidence of releases of dangerous waste from the facility. Therefore, it is expected that the soil and groundwater issues will be addressed separately under a Model Toxics Control Act (MTCA) cleanup. As a result, previous reports and studies have not been included here. Detailed discussion is presented in section 1.7 of the expected separation of the issue of closure of the spent potlining facility pad under the Dangerous Waste Regulations from the issue of soil and groundwater cleanup under MTCA Periodic groundwater monitoring has been and continues to be conducted by Landau Associates for wells in the area of the former spent potlining facility.

1.5 TREATMENT AT SPENT POTLINING MANAGEMENT FACILITY

1.5.1 SPENT POTLINING AND DUCT DUST

None of the spent potlining or duct dust stored at the spent potlining management facility has been treated onsite. The material was hauled to CSSI for disposal.

1.5.2 POTLINING LEACHATE

During operation of the spent potlining management facility, leachate and runoff from the potlining removal and storage pad was drained into the sump and pumped into two 15,000-gallon leachate storage tanks. The stored leachate was batch-treated with sodium hypochlorite in the 12,400-gallon treatment tank to reduce the cyanide concentrations to less than 50 ppm prior to discharge into the storm sewer system. During facility operation, treatment occurred one to five times per month (depending on rainfall). After the water had been treated and prior to release, it was analyzed for total cyanide using the Distillation/Chlorination Method as described in parts 201A and 207C of Standard Methods for Examination of Water and Waste Water (APHA, AWWA, WPCF 1971).

If cyanide concentrations were detected above 50 ppm, additional sodium hypochlorite was added and the water was resampled and analyzed. This process was continued until concentrations were reduced to levels acceptable for release.

1.6 DISCHARGE TO SURFACE WATER

Effluents from the Kaiser Tacoma Plant have been and are currently discharged under limitations established in national Pollutant Discharge Elimination System (NPDES) waste Discharge Permit Number WA 000093-1. This NPDES permit has been renewed or modified on numerous dates over the years and was last modified on February 13, 2002. The plant is currently permitted to discharge a specified daily mass, in pounds, of total suspended solids, fluoride, and aluminum. Also, discharge is concentration limited for oil and grease, PCBs, benzo(a)pyrene, and free cyanide.

For a short period of time after the use of the management facility was discontinued, stormwater runoff from the former spent potlining pad was sampled and tested for cyanide. Table 2 shows the analysis of the runoff samples that were tested to determine total cyanide concentrations. This table shows that the initial measured concentrations in January 1986 ranged from 0.32 ppm to 6.4 ppm. However, samples collected and tested in March and April 1986 had substantially lower and even non-detectable levels of total cyanide.

1.7 SCOPE OF CLOSURE

Kaiser is seeking to close the spent potlining management facility under final clean closure status requirements. Since construction of the spent potlining pad in 1967, spent potlining has been handled at Tacoma in a manner to prevent soil and groundwater contamination. Due to the pre-existing contamination of soil and groundwater resulting from activities prior to construction of the pad in 1967 (as discussed above), Kaiser expects that future actions related to soils and groundwater that may be required will be handled under MTCA. According to *Guidance for Clean Closure of Dangerous Waste Facilities* (Ecology 1994), clean closure may be granted if contamination was pre-existing to construction of the facility

For the purposes of this plan, the facility to be closed includes the following:

- The 19,500 ft^2 spent potlining removal and storage pad with segregated runoff
- Two 15,090-gallon leachate/runoff storage tanks and contents
- One 12,400-gallon treatment tank and contents
- Ancillary pumps and piping and contents
- Heavy equipment (loader, crane, skips) used at the facility during operation
- Brooms and shovels used to clean surface of pad during facility operation
- Protective clothing, gloves, etc. used by facility cleanup personnel.

2.0 PROCEDURES FOR CLOSURE

This section establishes the procedures for closure of the subject spent potlining management facility. The procedures and content of this section are responsive to federal and state regulations governing final clean closure The spent potlining management facility (see Figure 3) will be completely closed under this plan. For the purposes of closure, the facility consists of the components listed in section 1.7, Scope of Closure.

2.1 CLOSURE PERFORMANCE STANDARD

The spent potlining management facility will be closed in accordance with the closure performance standard found at WAC 173-303-610(2). According to the closure performance standard, all dangerous waste management facilities must be closed in a manner that:

(1) Minimizes the need for further maintenance

(2) Controls, minimizes, or eliminates to the extent necessary to protect human health and the environment, post-closure escape of dangerous waste.

The performance standard applies to the items being closed as discussed in section 1.7. The performance standard will not apply to pre-existing contamination of soil and groundwater at the facility. To comply with the performance standard, some closure activities have already been performed (see section 2.4) and various additional closure activities are planned for implementation upon approval of this plan (see section 2.5).

2.2 MTCA CLEANUP LEVELS

In accordance with WAC 173-303-610(2)(b)(i), numeric clean closure concentration levels were determined for the concrete pad using residential exposure assumptions according to MTCA. Soil cleanup levels are used to establish cleanup levels for the concrete pad. This is a conservative approach since human exposure by pathways such as inhalation or ingestion of dust is greatly reduced with concrete compared to soil.

There are no Method A soil cleanup levels for cyanide or fluoride. Using MTCA Method B direct contact cleanup levels, the soil cleanup level for cyanide is 1,600 milligrams per kilogram (mg/kg) and the soil cleanup level for fluoride is 4,800 mg/kg. Cleanup levels for cyanide and fluoride do not need to be adjusted to account for similar toxic endpoints because their toxic endpoints are different. Due to the non-leachable nature of the concrete matrix, the MTCA method for protection of groundwater was not considered.

need to check Ecology with prog.

protection of ground water if potable

not true

true only if area GW is not potable

During sampling of the concrete pad (see section 2.6), if concrete samples exceed these MTCA concentrations, additional cleanup action will be required. If all concrete samples are determined to be below these concentrations, then no additional cleanup action will be taken for the concrete pad.

2.3 VOLUMES OF WASTE STORED

There is currently no volume of waste materials stored at the former spent potlining management facility and there has not been any waste material stored at this facility since December 1985. Maximum volumes of potlining waste stored onsite at any one time on the concrete pad during the period of operation from 1967 to 1985 are as follows:

- The 19,500 ft^2 potlining removal and storage pad had a maximum volume of 600 yd^3 of combined (spent potlining and duct dust) waste material; generally, the pad contained less than 100 yd^3 at any time
- The volume of duct dust stored at the facility never exceeded 30 yd^3 of material
- The two potlining leachate storage tanks have a maximum capacity of 30,000 gallons (15,000 each)
- The potlining leachate treatment tank has a maximum capacity of approximately 12,400 gallons.

The total cumulative volumes of spent potlining, duct dust, and leachate historically stored or handled at the spent potlining management facility were:

- Spent Potlining: 90,000 tons (or 90,000 yd^3), based on estimated 5,000 tons per year over the 18-year life of the facility
- Duct Dust: 100 tons, based on average volumes generated per duct cleaning episode and number of cleanings estimated over life of the facility
- Leachate/Runoff: 14 million gallons, based on average production of 1.5 gallons per minute over the life of the facility

2.4 CLEANING/DECONTAMINATION CONDUCTED TO DATE

The following activities were performed after the final spent potlining waste was removed from the facility in December 1985

2.4.1 POTLINING REMOVAL AREA AND STORAGE AREA (CONCRETE PAD)

During the period December 10 through 31, 1985, the potlining concrete dumping pad was swept of particulates and dust. Solids collected from sweeping of the pad were disposed of to CSSI. The pad was then flushed with water until the cyanide concentration of the generated rinsate was less than 50 ppm. Rinsate from flushing the pad that exceeded 50 ppm was treated with sodium hypochlorite in the 12,400-gallon treatment tank before discharging to the storm sewer system. Total cyanide was measured to evaluate the effectiveness of pad cleaning. Polyaromatic hydrocarbons (PAH) were not measured in runoff because of the small volume of duct dust handled at the pad, and because they are practically insoluble and would be found (if present) in the tank sludges.

The concrete pad has been inactive, uncovered, and exposed to weather and rainfall for more than the 16 years since removal of all potliner material. Due to the previous cleaning activities and weathering over time, residual contamination of the concrete pad is not expected.

2.4.2 LEACHATE/RUNOFF STORAGE AND TREATMENT TANKS

Immediately after the storage pad rinsate was treated and discharged, residual sludges in the storage tanks and sump were removed and shipped to CSSI. Sludges that may be currently in storage tanks would have been generated after December 1985 from collection of stormwater runoff from the concrete pad. Sludges currently present in former spent potlining facility tanks will be removed as described later in this section.

2.4.3 HEAVY EQUIPMENT

The heavy equipment (loader, crane, skips, etc.) previously used at the spent potlining facility were relocated to indoor pot demolition facilities and are no longer components of the subject facility.

2.4.4 CLEANUP EQUIPMENT

Brooms and shovels, and permanent protective equipment used during the site cleanup were relocated to indoor pot demolition facilities. Disposable protective equipment used during cleanup was discarded daily and sent to CSSI.

2.5 CLOSURE ACTIVITIES FOR FACILITY COMPONENTS

The closure activities for the former spent potlining management facility include removal and disposal of sludge; pressure washing and decommissioning of tanks and their associated piping and pumps including collection and proper disposal of wash water; confirmation sampling of the concrete pad; and proper disposal of protective clothing and decontamination materials. These closure activities are described in detail below in this section.

2.5.1 REMOVAL OF SLUDGE

The two 15,000-gallon leachate storage tanks, one 12,400-gallon leachate treatment tank, the ancillary pumps and piping, and the sump at the concrete pad will all be examined for the presence of sludge. Residual sludge will be removed to the extent possible from the tanks and the sump. Sludge will be removed by physical means if in a solid state, or sludge may be removed by a high-vacuum evacuation truck if in a more liquid state. Additional rinse water may be applied, if necessary, to remove the sludge. If sludge is present in piping or pumps, then it will be removed by flushing with water applied at a pressure adequate to evacuate the sludge.

Based on visual observations, it is estimated that there is less than 500 pounds of sludge to be removed. Collected sludge will be sent to a permitted hazardous waste disposal facility. Once sludge has been removed and all other closure activities have been completed, confirmation sampling of the runoff drainage sump for the concrete pad will be performed, as described below in Section 2.6.

2.5.2 TANKS, ANCILLARY PUMPS, AND PIPING

All spent potlining facility tanks, pumps, and piping will be pressure washed with water to remove residual scale and contamination. Pressure washing will be performed by a contractor experienced in tank cleaning and in accordance with alternative treatment standards for hazardous debris (40 CFR 268.45, Table 1, item 2(a), chemical extraction - water washing and spraying). Pressure washing with water is expected to be an effective manner to decontaminate the tanks, pumps, and piping. Water is an appropriate solvent to dissolve fluoride and cyanide salts. Solubility data for some fluoride and cyanide compounds are presented in Table 3. Application of the wash water at a high pressure will ensure that any solids that may contain low solubility compounds are removed and collected with the wash water runoff as well.

Tanks, piping, and pumps will be dismantled to the extent necessary to adequately pressure wash all surfaces previously exposed to spent potlining waste. The pressure washing shall be performed such that all surfaces are wetted with wash water for a minimum period of 15 minutes. The pressure washing unit will be capable of generating a minimum pressure of 500 pounds per square inch (psi) and will be capable of heating the water. Pressure wash water will be applied at a minimum temperature of 100°F to enhance removal of spent potlining and the associated fluoride and cyanide compounds.

After pressure wash cleaning, the tanks, pumps, and ancillary piping will be dismantled or cut into sections and salvaged or disposed of to landfill. All wash water will be collected from the tanks and the drainage sump of the concrete pad. All wash water will be removed from the tanks and the sump by vacuum truck or transferred by sump pump into 55-gallon drums. Wash water will be sampled, and will be treated and/or disposed of by the tank cleaning contractor in accordance with all applicable requirements based on results of sampling.

2.5.3 SPENT POTLINING STORAGE AND REMOVAL PAD

As discussed in Section 2.4, the spent potlining concrete dumping pad was cleaned and swept to remove particulate material, surficial potlining, and duct dust waste. This concrete pad has been inactive, uncovered, and exposed to weather and rainfall over the past 16 years. Due to previous cleaning activities and weathering over time, residual contamination of the concrete pad would not be expected.

Confirmatory sampling of the concrete pad will be performed to verify that cyanide and fluoride concentrations are lower than MTCA cleanup levels. The detailed sampling procedures are presented in Section 2.6. Following confirmatory sampling, the concrete pad will remain onsite to be used as a storage location for equipment or materials.

2.5.4 PROTECTIVE EQUIPMENT

Disposable protective equipment used during cleanup/decontamination will be discarded into 55-gallon drums. Upon completion of closure activities, the drum(s) of used personal protective equipment will be disposed of to a permitted hazardous waste disposal facility.

2.6 SAMPLING PLAN

The 19,500 ft^2 former spent potlining concrete pad will be sampled to confirm that MTCA cleanup concentrations for cyanide and fluoride, which were presented in section 2.2, are met. Using the statistical sampling method presented in Statistical Methods for Environmental Pollution Monitoring (Gilbert 1994), to achieve 90 percent confidence of detecting a contaminated circular area of 25-ft radius, a total of six samples will be collected from a grid pattern laid out over the concrete pad.

In addition, once all of the sludge has been removed from the runoff drainage sump, confirmation sampling of this sump will be performed. Confirmation sampling for the small sump area will consist of collecting one composite sample from the bottom concrete surface. The one composite sample will comprise concrete removed from three separate locations at the bottom of the sump.

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collect from cracks

Each concrete sample from the concrete pad and from the sump will be chipped up from the surface of the concrete down to an approximate depth of 0.6 centimeters (cm). The concrete samples will be analyzed for cyanide and fluoride by EPA Methods 335.2 and 340.2, respectively

2.7 HEALTH AND SAFETY

All workers participating in decontamination of the spent potlining management facility will be qualified contractors. Prior to implementation of decontamination activities at the facility, a health and safety plan will be prepared by the contractor.

All work conducted during decontamination at the facility will be in compliance with Occupational Safety and Health Administration (OSHA) and Washington Industrial Safety and Health Administration (WISHA) requirements.

3.0 CLOSURE SCHEDULE AND CERTIFICATION

Within 180 days from the date Ecology approves the facility closure plan, Kaiser will complete the closure activities identified in this closure plan. Closure in accordance with the approved plan will be certified by a qualified independent registered professional engineer after an inspection of the site and the closure/verification documentation associated with closure activities. The professional engineer will assist Kaiser in the preparation of the closure certification, which will consist of a report detailing closure procedures and documenting the verification process

Within 60 days of receipt of the confirmatory sampling results showing achievement of closure requirements, Kaiser will submit the closure certification to Ecology by registered mail certifying that the former spent potlining facility was closed in accordance with the requirements and specifications of the approved closure plan. The closure certification will be signed by Kaiser and signed and stamped by an independent qualified registered professional engineer. The following will be provided with the closure certification:

- A description of any minor deviations from the approved closure plan and justification for these deviations
- Documentation of the final disposition of: all sludge removed from tanks, piping, and pumps; all debris (including tanks, pumps, and associated piping); and all residual runoff from decontamination of debris by pressure washing
- All laboratory and field data, including quality control/quality control data, for all samples collected and field measurements taken
- A summary report that itemizes the data reviewed by the independent, qualified, registered, professional engineer and tabulates the analytical results of samples taken to confirm clean closure
- Field notes related to closure activities

Additional documentation supporting the closure certification will be provided to Ecology on request.

* * * * * *

This document has been prepared under the supervision and direction of the following key staff.

LANDAU ASSOCIATES, INC.

Joseph A. Kalmar, P.E.
Senior Project Engineer

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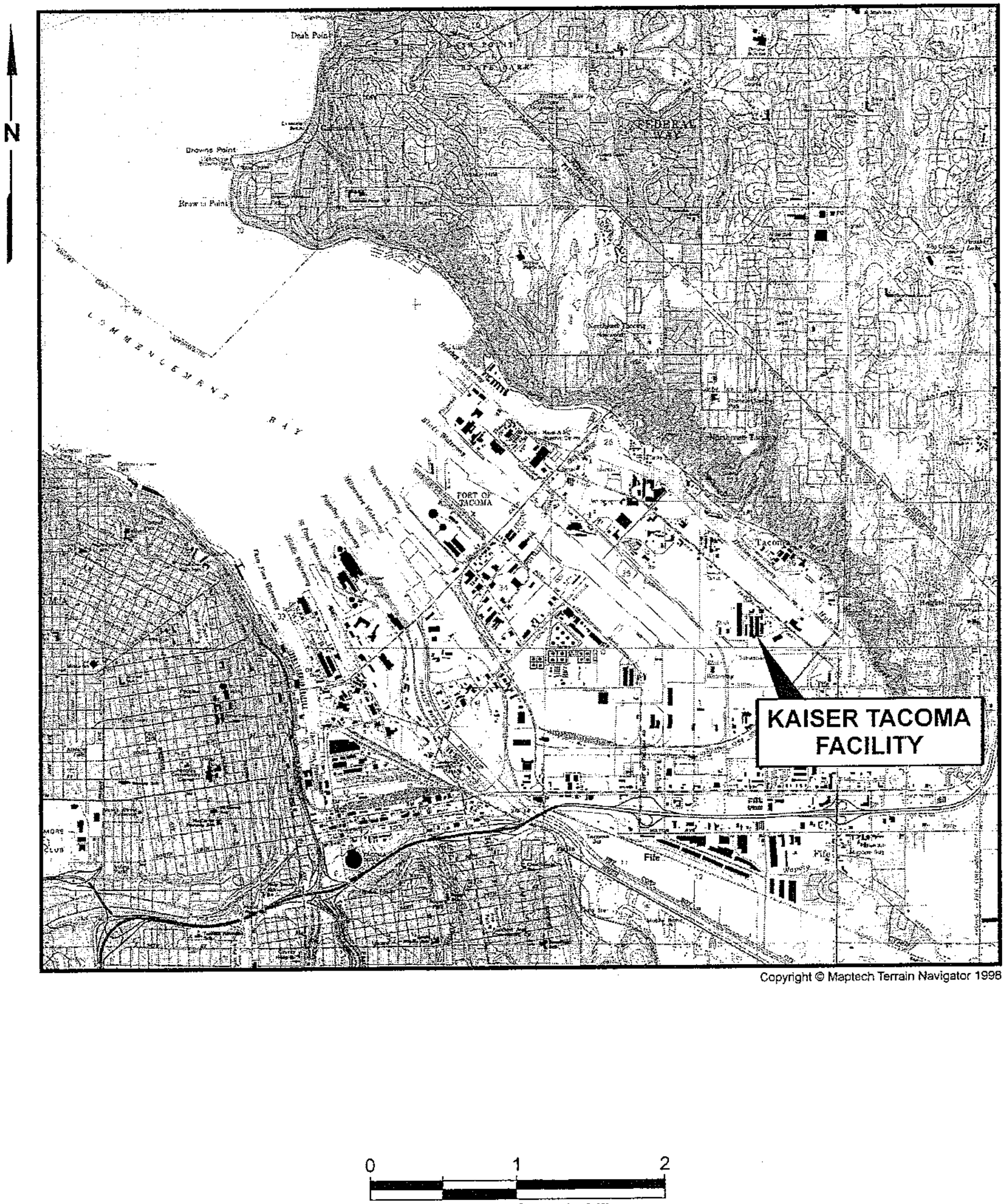

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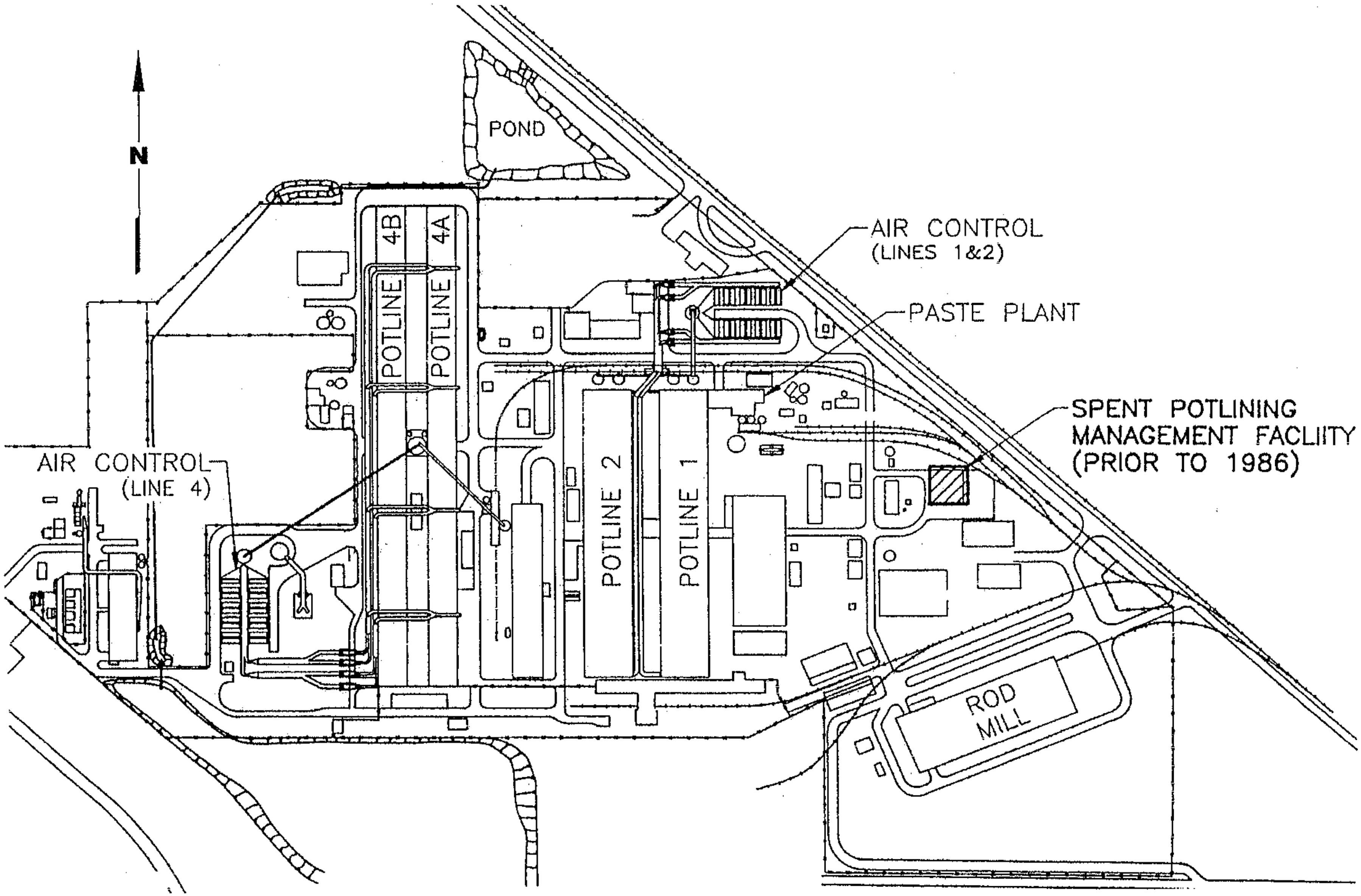
LANDAU ASSOCIATES

Kaiser Aluminum & Chemical Corporation Tacoma, Washington	**Vicinity Map**	Figure 1

Kaiser Aluminum & Chemical Corporation | T:\018\015\012\Closure Plan\Fig2_3_4.dwg (A) "Figure 2" 5/3/2002



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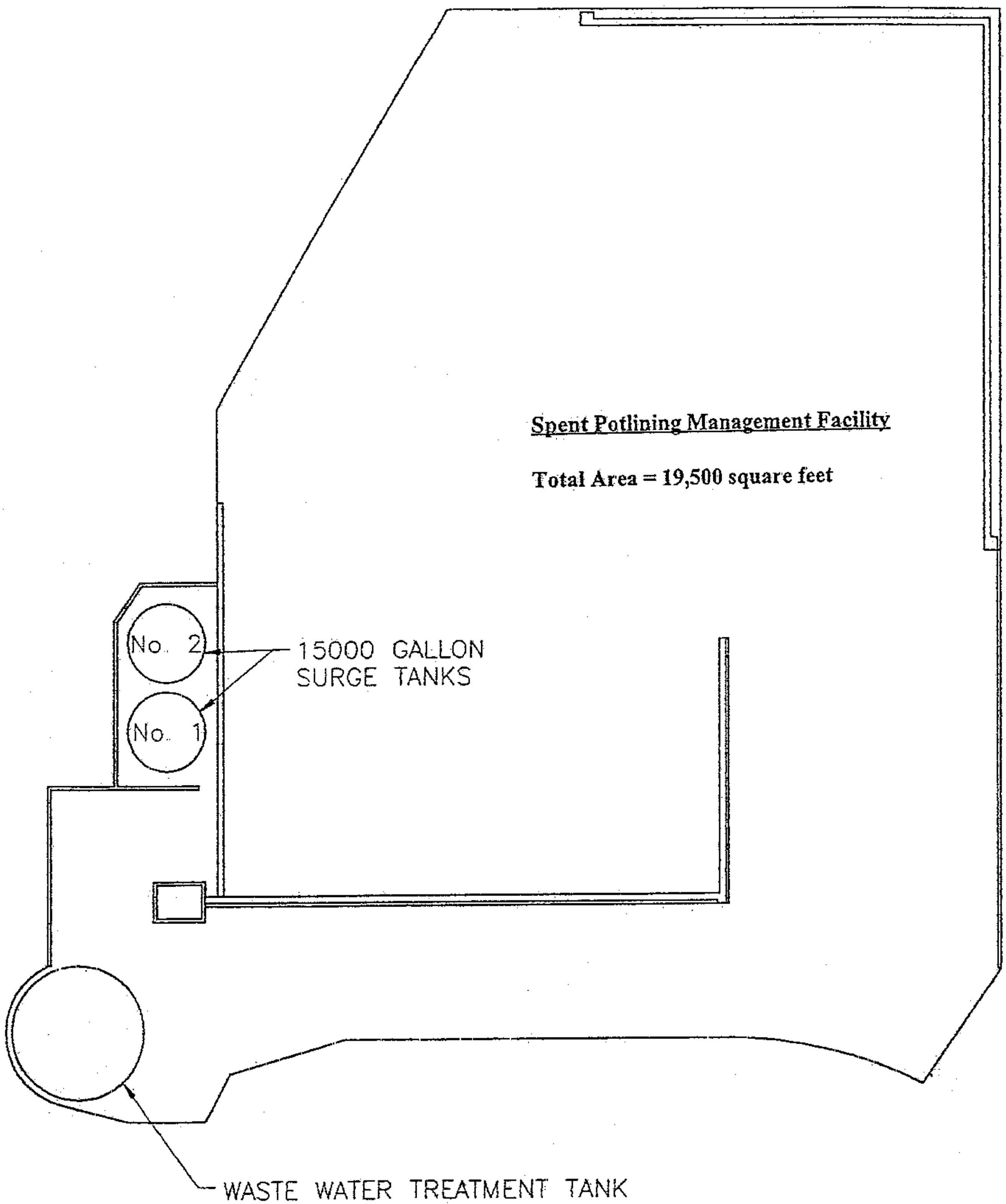
Kaiser Aluminum & Chemical Corporation Tacoma, Washington	**Site Plan-Kaiser Aluminum Tacoma Works**	Figure 2



Landau Associates	Kaiser Aluminum & Chemical Corporation Tacoma, Washington	Site Plan - Spent Potlining Management Facility	Figure 3

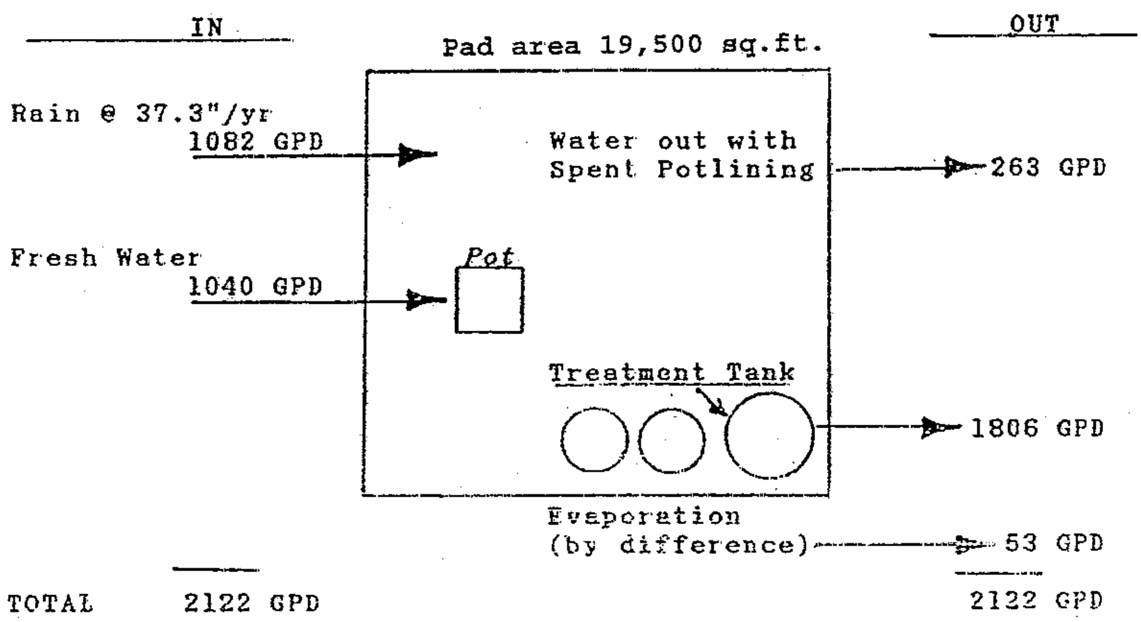
Kaiser Aluminum & Chemical Corporation | T:\018\015\012\Closure Plan\Fig2_3_4.dwg (A) "Figure 3" 5/3/2002

FIGURE 4

WATER USAGE DIAGRAM

FOR

SPENT POTLINING MANAGEMENT FACILITY
KAISER ALUMINUM & CHEMICAL CORPORATION
TACOMA, WASHINGTON



NOTES:

1. The treatment tank is 18' diameter X 8.5' tall. With 2' of required freeboard, the total discharge volume is 12,400 gallons. However, about 500 gallons of treatment chemicals are required per batch, therefore, 11,900 gallons of waste water are discharged per batch.

2. The 1806 GPD of waste water treated is based upon 220 dumps over a four year period or one dump of 11,900 gallons of waste water every 6.59 days.

3. The average rainfall is based upon a Tacoma average of 37.06"/yr for 1930-1959 and a Sea-Tac Airport average of 37.55"/yr for 1950-1980. (Source: National Weather Service)

4. Moisture out with the spent potlining is based upon 4000 tons/yr containing 10% moisture.

5. Fresh water usage of 1040 GPD is based upon measurements made during a 164 day period in 1983.

TABLE 1
TYPICAL ANALYSIS OF SPENT POTLINING LEACHATE (BEFORE TREATMENT) (a)

Parameter	Concentration (mg/l unless otherwise noted)
Total Cyanide	438 (b)
Cyanide (chloride amenable)	336.0
Fluoride	872.0
pH (pH units)	11.15
Total Suspended Solids	52.7
Chronical Oxygen Demand	185.0
Total Oxygen Demand	50.6
Aluminum	141.0
Arsenic	0.073
Cadmium	0.7
Chlorine	31.0
Copper	5.3
iron	33.0
Fluoranthene	0.004
Potassium	14.6
Sodium	2,367.0
Nickel	0.38
Pyrene	0.002
Antimony	0.020
Silicon Dioxide	63.0
Sulfate	140.0
Zinc	0.57

(a) The above results are from one sample analyzed by Kaiser's Center for Technology (CFT), their sample number: A.R.D 1133106. The results were reported in "Water Management Study, Kaiser Aluminum & Chemical Corp., Moderation Project Tacoma Plant," prepared by CH3M Hill Northwest Inc., October 1983

(b) A leachate sample collected in October 1983 (TAC-111 or CFT No ARD 138206) had the following associated concentrations:

Total Cyanide	898
Free Cyanide	700
Fluoride	1930

TABLE 2
ANALYSIS OF RUNOFF FROM EXISTING STORAGE PAD
(After Discontinuation of Operations)

Date in 1986 Treater Tank Released	Cyanide (ppm)
6-Jan	3.6
8-Jan	2.36
14-Jan	1.8
17-Jan	3.5
20-Jan	5.6
21-Jan	3.2
22-Jan	3.8
23-Jan	6.4
27-Jan	3.0
30-Jan	5.4
3-Feb	5.6
12-Feb	1.36
14-Feb	2.72
17-Feb	3.8
24-Feb	2.96
25-Feb	2.16
26-Feb	0.32
Avg (Jan & Feb)	3.39
7-Mar	0.48
12-Mar	0.40
17-Mar	0.08
24-Mar	2.88
28-Mar	2.40
4-Apr	0.01
11-Apr	0.01
16-Apr	0.40
25-Apr	0.01
29-Apr	0.60
2-May	0.28
9-May	0.01
13-May	0.01
20-May	0.04
6-Jun	<0.01

TABLE 3
SOLUBILITY DATA FOR FLUORIDE AND CYANIDE COMPOUNDS

Compound	Formula	Solubility (a) (g/100 mL)	Reference
Aluminum fluoride	AlF_3	0 56	Alcoa
Calcium fluoride	CaF_2	0.0016	CRC. 1992
Cryolite (Na_3AlF_6)	Na_3AlF_6	Not Given	Merck & Co 1989
Iron (III) ferrocyanide	$Fe_4[Fe(CN)_6]_3$	0 004	Calculated. K_{sp} = 3 3x10^{-41} at 25°C
Sodium cyanide	Na(CN)	Freely Soluble	Merck & Co. 1989
Sodium ferrocyanide	$Na_4[Fe(CN)_6]$	14 7	14 7% at 25°C, Merck & Co. 1989
Sodium fluoride	NaF	4 22	CRC. 1992

(a) Solubility in water at 20°C unless otherwise noted