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ORGDP

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MARTIN MARIETTA

BAT REVIEW FOR THE K-1407-A AND K-1407-B WASTEWATER TREATMENT FACILITY

T. A. BOWERS

ENVIRONMENTAL MANAGEMENT DEPARTMENT

HEALTH, SAFETY, AND ENVIRONMENTAL AFFAIRS

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SUMMARY

The K-1407-A and K-1407-B wastewater treatment process receives waste streams routinely from the K-1501 Steam Plant and K-1401 and K-1420 metal preparation facilities. The heavy metal laden waste streams are neutralized, precipitated, and settled out prior to being discharged.

The point source category which is applicable to the waste streams is Electroplating and Metal Finishing. Comparing the analysis of samples collected at the K-1407-B holding pond discharge to the Best Available Technology Economically Achievable (BAT) limits given for the Electroplating and Metal Finishing category indicates that all values collected from 1979 through 1983 are within the limits except for one nickel value which occurred in 1980.

Modifications, which will be made in the near future to the K-1407-A and K-1407-B treatment process, include two new settling ponds for the treatment of coal-pile runoff and a new central neutralization facility for treating the wastewater generated from the metal preparation and cleaning facilities.

BAT Review for the K-1407-B Holding Pond at ORGDP

I. Introduction

The ORGDP is located on a level 640-acre tract of land near the junction of Poplar Creek and the Clinch River on the 37,300-acre Department of Energy Oak Ridge Reservation in Roane County, Tennessee. The primary purpose of the ORGDP is to enrich uranium (as uranium hexafluoride) in the U-235 isotope from its natural concentration of 0.7 percent to a concentration of approximately 3.0 percent which is then used as fuel in conventional light-water nuclear reactors.

In support of the enriching process, several facilities are located within the ORGDP for the cleaning and decontamination of equipment used in the various process buildings. The cleaning facilities located in the northeast section of the plant discharge metal laden solutions (including acids and caustics) to the K-1407-A and K-1407-B complex which provides neutralization and sedimentation treatment capabilities.

The K-1407-A neutralization facility consists of a 33,000-gallon reaction pit where sulfuric acid and calcium hydroxide are used for neutralization. The K-1407-B holding pond consists of a 1.3-acre impoundment with a storage volume of approximately one-million gallons. It is used primarily for the settling of metal hydroxide precipitates generated during neutralization and precipitation in the K-1407-A neutralization facility.

The effluent from the holding pond is monitored by a composite flow proportional sampler at the discharge weir. The pH of the holding pond is monitored continuously at K-1420 Decontamination Building and K-1650 Central Control Facility. The mechanical weir is electronically designed to automatically close when the pH exceeds the 6.0 - 9.0 National Pollution Discharge Elimination System (NPDES) limits.

An environmental line item project has been funded and construction has begun for replacing the K-1407-A neutralization facility. The new facility will include waste holding tanks, reaction vessels, chemical feed systems, neutralization, precipitation, centrifugation, and filtration equipment. The discharge from the new facility will continue to be piped to the K-1407-B pond and sampled at its discharge. The scheduled completion date for the facility is January 1987.

Presently, the K-1407-A and K-1407-B treatment process receives waste streams routinely from the K-1401 Metals Cleaning Shop, K-1420

Decontamination Facility, and K-1501 Steam Plant. The waste solutions include acids, bases, and rinse waters which are described in detail in the following sections. Occasionally, waste acids or bases generated from other facilities are transported to K-1407-A for neutralization.

II. Process and Waste Description

1. K-1401 Metal Cleaning Facility

The metals cleaning facility in K-1401 is used to prepare various metals for numerous fabrication and assembly operations. The primary method for accomplishing such preparations involves the use of cleaning baths containing hydrochloric acid, alkali, sodium bisulfate, rust inhibitor, and associated rinse water. The baths are contained in 10,000-gallon tanks which allow for large pieces of equipment to be submerged for adequate cleaning. These cleaning solutions are described in Table 1. Chemical analysis of the untreated discharges from each of these tanks are shown in Table 2. All of the tanks are discharged directly into K-1407-A for treatment prior to being discharged to K-1407-B. The annual generation rate from this facility is approximately 6 x 10^5 gallons per year.

2. K-1420 Decontamination Facility

Equipment used in the gaseous diffusion process gradually accumulates uranium-bearing compounds. When this equipment is removed for maintenance or disposal, it must be decontaminated to meet radiation standards. The decontamination process is performed in the K-1420 building at the ORGDP.

The primary cleaning method includes mechanical removal in combination with cleaning solutions consisting of water, steam, weak nitric acid, and sodium carbonate. The waste solutions contain uranium along with several other metallic ions. A listing of the various treatment baths is provided in Table 3.

All waste solutions from K-1420 requiring treatment are piped to the K-1407-A Neutralization Pit for treatment. The chemical composition of the untreated wastewaters from the various cleaning and plating facilities in the K-1420 building are listed in Table 4.

3. K-1501 Steam Plant

The ORGDP Steam Plant generates steam which is used for process purposes and for space heating. This facility has seven fossil-fueled boilers with a combined steam producing capacity of 370,000 lb/hr.

TABLE 1. K-1401 METAL CLEANING SOLUTIONS

Cleaning Solution	Composition	Quantity Discharged (Gal/Yr)
Hydrochloric Acid	26-38% HCl Rust Inhibitor Rodine 50 40-50% 1,3,5 Ortho Methylphenyl 1,3,5 Triazine 20-25% Water 6-10% Formaldehyde <0.5% Ortho-Toluidine	60,000
Alkali	Paint Stripper Mersostrip 1286 >95% Sodium Hydroxide	30,000
Diversey	>95% Sodium Bisulfate	10,000
Rinse Water	Trace amounts of above	500,000

TABLE 2. K-1401 CHEMICAL ANALYSIS OF UNTREATED TANK EFFLUENTS

SOURCE (mg/l)

Parameter	Hot Water Rinse Tank	HCL-Tank	Alkali Tank	Diversey Tank
Silver	<0.5	0.18	<0.05	<0.06
Aluminum	<0.2	<0.2	31.0	400.0
Boron	<0.2	0.34	1.3	1.70
Barium	<0.1	<0.1	0.91	0.098
Beryllium	<0.02	<0.02	<0.02	<0.003
Calcium	25.0	140.0	110.0	830.0
Cadmium	<0.04	0.54	<0.04	0.20
Chloride	10.0	----	----	125.0
Cobalt	<0.06	1.4	0.18	0.22
Chromium	<0.05	15.0	5.6	1.4
Copper	0.62	120.0	5.8	12.0
Cyanide	<0.002	<0.002	----	0.006
Iron	15.0	9500.0	130.0	480.0
Fluoride	6.0	<1.0	<1.0	<1.0
Potassium	2.35	24.3	230.0	44.7
Lithium	0.01	0.07	0.07	3.0
Magnesium	6.3	28.0	16.0	84.0
Manganese	0.22	71.0	0.24	0.03
Molybdenum	<0.2	<0.2	<0.2	<0.1
Sodium	17.6	70.8	61450	408.0
Niobium	<0.08	<0.08	<0.08	0.14
Nickel	1.4	0.15	1.6	0.21
Phosphorous	<2.0	<2.0	75.0	18.0
Lead	<0.5	<0.5	65.0	<0.5
Silicone	1.8	0.57	76.0	13.0
Strontium	0.04	<0.02	0.28	1.4
TTO	<0.01	0.79	<0.25*	<0.25*
Uranium	<1.0	10.0	<1.0	5.0
Zinc	0.15	6.3	30.0	0.06
Zirconium	<0.02	<0.02	<0.02	0.10

*Due to the concentration of the caustic solution, the sample was diluted which raised the detection limit to 0.25 mg/l.

TABLE 3 - K-1420 BATH AND PROCESS DESCRIPTIONS

Source	Composition	Process	Quantity Discharged (Gal/Yr)
Electro Nickel Sulfamate Bath	Nickel Sulfamate Nickel Chloride Surfactant Boric Acid Sulfamic Acid pH 3.5	Electrical Plating of Process Parts and Equipment	1,600
Electro Nickel Sulfamate Rinse Tank	Trace HCl	Rinsing of Parts and Equipment Prior to Nickel Plating	277,000
Electro Nickel Sulfamate-HCl Batch	21% HCl	Metal Preparation for Nickel Electro Plating	1,000
Hydrochloric Acid Tank	21% HCl	Metal Preparation for Nickel Electroless Plating	200
Nitric Acid Stripping Tank	53% NHO_3	Removal of Nickel Plating From Parts and Equipment	3,000
Hydrochloric Acid-Nickel Stripping Tank	21% HCL	Metal Preparation for Electro Nickel Plating	3,000
Rinse Water Stripping Tank	Trace HNO_3	Rinse for HNO_3	262,800
Plating Rinse	Trace HCl	Remove Excess HCl Prior to Nickel Plating	2,000,000
Electroless Nickel Sulfamate Bath	Nickel Sulfate Sodium Lead Sulfate Sodium Hydroxide Surfactant	Chemical Plating of Nickel on Process Equipment	2,800

TABLE 4 - CHEMICAL ANALYSES OF K-1420 UNTREATED EFFLUENTS

SOURCE (mg/l)

Parameter	Rinse Water Stripping Tank	Electro Nickel Sulfamate Bath	Electro Nickel Sulfamate Rinse	Electro Nickel Sulfamate-HCL	HCL Tank	HCL Nickel Stripping	HNO_3 Stripping Tank	Plating Rinse	Electroless Nickel Sulfamate
Aluminum	<0.2	4.6	<0.2	12	<0.2	<0.2	1.2	<0.2	4.9
Barium	<0.1	0.11	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.11
Beryllium	<0.02	<0.02	<0.02	0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Boron	<0.2	0.86	<0.2	2.0	2.0	<0.2	1.2	<0.2	1.2
Cadmium	<0.04	0.18	<0.04	4.9	1.8	<0.04	0.41	<0.04	0.04
Calcium	32	240	36	41	62.0	68.0	2.3	32	110
Chloride	100	27.0	10.0	----	----	----	<1.0	3.0	230
Chromium	<0.05	4.9	<0,05	0.83	18.0	57.0	2.0	<0.05	5.1
Cobalt	<0.06	34.0	<0.06	0.07	0.56	0.5	2.0	<0.06	36
Copper	0.06	<0.05	<0.05	26.0	23.0	12.0	<0.05	<0.05	<0.05
Cyanide	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.027
Fluoride	<1.0	3.0	4.0	<1.0	<1.0	<1.0	<1.0	<1.0	3.0
Iron	2.4	20.0	5.4	130.0	3600.0	2700.0	61.0	0.19	23
Lead	<0.5	<0.5	<0.5	0.7	7.7	4.8	6.1	<0.5	<0.5
Lithium	0.01	1.20	0.01	<0.01	<0.01	<0.01	0.3	<0.01	0.90
Magnesium	8.6	54.0	8.6	9.3	17.0	18.0	0.46	8.6	58
Manganese	<0.02	0.56	<0.02	1.4	25.0	19.0	0.49	<0.02	0.60
Molybdenum	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Nickel	2.6	5500	1.4	63.0	52.0	870.0	12000.0	<0.1	5600
Niobium	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
Phosphorous	7.9	72000	<2.0	14.0	10.0	37.0	1900	3.6	78000
Potassium	2.74	60.6	2.38	2.12	3.3	3.3	0.4	2.4	61.2
Silicon	1.3	49.0	1.6	2.2	3.7	4.4	0.56	1.3	51
Silver	<0.05	<0.05	<0.05	<0.05	0.29	0.26	0.41	<0.05	<0.05
Sodium	14.4	23000	6.9	16.2	26.7	24.3	296.0	9.9	24500
Strontium	0.06	0.34	0.06	0.1	0.13	0.15	0.006	0.06	0.29
TTO(2)	0.05	<0.01	<0.01	<0.25(1)	1.89	<0.25(1)	0.45	0.19	<0.01
Uranium	<1.0	<1.0	<1.0	4.0	62.0	14.0	<1.0	<1.0	11
Zinc	0.08	3.2	0.06	2.6	6.4	1.2	<0.03	<0.03	5.1
Zirconium	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

(1) Due to the acid concentration of the solution, the sample was diluted which raised the detection limit to 0.25 mg/l.

(2) Total Toxic Organics are calculated according to 40 CFR 413 Section 413.02.

The primary liquid effluents discharged from this facility include blowdown from the boilers, mud drum pipes, sodium chloride and sulfuric acid solutions from water softening equipment, and leachate from the coal pile storage areas. The quantity of water which is treated and blown down from K-1501 is directly proportional to the steam demand. Typically, the winter months require more steam production than the other seasons of the year. The annual discharge volume from the K-1501 Steam Plant is in the order of 12.5×10^6 gallons per year.

The continuous blowdown from the boilers contains sodium sulfate which is the product from the reaction between sodium sulfite and oxygen. The purpose of the sodium sulfite is to complex the available free oxygen to provide corrosion control for the boiler tubes. The blowdown also contains phosphates which are added to soften the incoming makeup water. The usage rates for sodium sulfite and phosphate are approximately 7,200 lbs/yr each. An anti-foam agent (sodium bisulfate) is also added to the boiler water to prevent foaming at a rate of approximately 300 lbs/yr. The total quantity of water discharged from the boilers is approximately 6.0×10^6 gal/yr. Currently, the blowdown is discharged directly to the K-1407-B pond for sedimentation of solids. The chemical composition of the blowdown is shown in Table 5.

A portion of the sulfate and phosphate precipitates from the boilers settles in the mud-drum pipes. Approximately three times a day, the mud-drum valves are opened, and the solids-laden solution is discharged directly to the K-1407-B pond for settling. The annual blowdown rate from the mud drums is approximately 670,000 gal/yr. The chemical composition of this blowdown is shown in Table 5.

The water used in the boiler tubes is softened to minimize deposition of metallic compounds on the inside of the boiler tubes. This is accomplished by using a sodium and hydrogen zeolite water treatment system. The sodium zeolite softening process exchanges sodium ions for all cations of two or more positive charges. When water containing the hardened salts of calcium and magnesium are passed through the cation-exchange bed, the sodium ions in the bed replace the hard ions which result in a water hardness close to zero. When the sodium bed has been used to a point where it will release no more sodium ions for calcium or magnesium, it is necessary to regenerate the zeolite bed. The regeneration is accomplished by washing the sodium bed with a strong salt (sodium chloride) which reverses the reaction and removes the calcium and magnesium from the sodium. This solution is then discharged to the K-1407-A neutralization pit for treatment. The annual discharge from the sodium softener is approximately 1.1×10^6 gal/yr. The annual usage of sodium chloride is approximately 24,000 lbs. The chemical composition of this discharge is shown in Table 5.

TABLE 5 - CHEMICAL ANALYSES OF UNTREATED LIQUID EFFLUENTS

FROM K-1501 STEAM PLANT

(mg/l)

Parameter	Coal Pile Run-Off	Continuous Blowdown	MUD Drum Blowdown	Sodium Softener	Hydrogen Softener
Silver	<0.006	<0.006	0.032	<0.0061	0.007
Aluminum	5.0	0.44	4.5	0.12	1.0
Arsenic	<0.05	<0.05	<0.05	<0.5	<0.05
Beryllium	0.0019	<0.003	<0.0003	<0.0003	<0.0003
Cadmium	<0.003	<0.003	<0.003	<0.003	<0.003
Chloride	37	75	57	5200	20
Chromium	0.10	0.038	0.19	<0.01	0.014
Copper	0.092	0.094	1.3	<0.004	<0.004
Dis Solids	701	1007	520	—	—
Fluoride	0.13	0.32	0.20	0.06	0.05
Nickel	0.18	0.012	0.11	<0.01	0.023
Nitrates	3.0	29	8.3	2.2	4.05
Lead	<0.05	<0.05	<0.05	0.25	<0.05
pH	3.0	11.8	10.7	6.9	0.8
Selenium	<0.05	<0.05	<0.05	<0.05	<0.05
TTO	<0.01	<0.0	<0.01	0.75	0.07
Uranium	0.006	0.003	0.006	0.004	0.006
Zinc	0.71	0.21	0.30	0.76	0.16

The effluent from the sodium softener has a pH of 7.0 - 8.0; however, when it is passed through the boiler tubes, it is concentrated through the evaporation and the pH is increased to 10-11. In order to prevent corrosion damage to the boiler tubes, low pH water must be added to the system to maintain a neutral pH. However, before the low pH water can be added to the system, it must also be softened to remove ions such as calcium and magnesium. This water softening process is accomplished with a hydrogen zeolite softener. The zeolite consists of a sulfinated polystyrene gel which has the property to exchange hydrogen for cations such as calcium and magnesium. When water containing these cations is passed through the zeolite, the ions are exchanged for hydrogen and the bicarbonate, sulfate, nitrate and chloride radicals are converted to their respective acids; carbonic acid (H_2CO_3), sulfuric acid (H_2SO_4), nitric acid (HNO_3), and hydrochloric acid (HCL) resulting in the low pH water for mixing with the boiler tube water.

When the hydrogen zeolite is exhausted (1 - 2 times/day) it is backwashed with sulfuric acid for regeneration. The effluent from the regeneration process is discharged to the K-1407-A neutralization pit. The regeneration process requires 60 gallons of sulfuric acid (H_2SO_4) per regeneration. The annual usage rate of acid is estimated to be approximately 33,000 gallons. The flow rate from this facility is approximately 4.8 x 10^6 gallons per year. The chemical composition of the hydrogen softener blowdown is shown in Table 5.

Due to the cost and safety concerns associated with the storage and handling of sulfuric acid, the use of the hydrogen softener will be discontinued in the near future. To avoid the need of the soft-low-pH water in the system, the blowdown rate from the boiler tubes will be increased and recycling discontinued. This will prevent the water from becoming caustic, thus eliminating the need for soft-low-pH water. The increased blowdown will also be discharged to the K-1407-A neutralization pit.

The primary fuel source for the K-1501 Steam Plant is coal. The average coal consumption at the steam plant is about 110 tons/day. To maintain the coal supply needed, two coal piles are used for storage which have a combined surface area of about five acres. During heavy rainfall periods, an acidic leachate (pH 2.5 - 3.0) is discharged from the coal piles at a rate of approximately 3.7 X 10^6 gallons per year. In the past this runoff was discharged untreated to Poplar Creek. This practice was discontinued when pH violations were being experienced at K-1700 (NPDES location 001). Since that time, the coal pile runoff has been diverted to the K-1407-A pit for neutralization prior to being discharged to the K-1407-B pond. This practice has resulted in the accumulation of solids in the K-1407-B holding pond. To provide for more efficient solids management, a project was initiated and construction has begun to install two new ponds to be used for sedimentation of the coal pile solids precipitated during neutralization. This will eliminate the mixing of this sludge with materials presently in K-1407-B, thus facilitating less costly disposal of the coal pile runoff sludge. The neutralization, precipitation, and sedimentation processes will generate approximately 2.0 x 10^5 gallons of sludge per year. The chemical composition of the untreated coal pile runoff is shown in Table 5.

III. Housekeeping and Waste Control

An integral part of the operating procedure for each of the facilities previously described is the minimization of wastes through close process control and/or recycle. The use of routine chemical analysis, on line instrumentation, and visual inspection are all used to effect this objective.

The hydrogen and sodium softeners at the K-1501 Steam Plant each consist of dual systems to allow for one to operate while the other is being regenerated. The hydrogen softener has the capacity for treating 150,000 gallons of water before the system must be regenerated. In order to maximize efficiency and minimize the volume of blowdown, the system contains a flow monitor which automatically controls the frequency of the regeneration cycle.

The same system is used for the sodium softener, except that the treatment capacity is 70,000 gallons before regeneration is necessary.

The blowdown rate from the steam plant blowers is determined by the amount of suspended solids in the solution. In order to optimize the amount of blowdown being discharged, samples are collected every two hours for suspended solid analysis. The normal operating range for suspended solids is 300 - 500 mg/l of suspended solids. Therefore, should the concentration exceed this limit, the blowdown must be increased, while low values would necessitate a blowdown reduction in the rates.

The cleaning and plating baths in K-1420 Decontamination Facility are routinely analyzed for impurities to allow for evaluation of cleaning capability. When impurities are found, efforts are made to remove the impurities by chemical precipitation and/or filtration in order to allow for recycle. Should recycling efforts fail, the baths are discharged and replaced with new solutions. Visual inspections of treatment baths and finished parts are also performed to determine cleaning efficiencies. When finished parts are pitted and/or the bath is dirty, it must be replaced. The rate at which the baths are replaced depends upon the level of activity in the facility. Presently, the baths are replaced annually.

The metals cleaning baths located in the K-1401 Machine Shop are also analyzed weekly to evaluate their cleaning capability. This is in addition to visual inspections of finished parts. Presently, the cleaning baths are discharged and replaced 2-3 times per year depending upon the level of activity.

IV. Review of Applicable Point Source Categories

The point source categories which are most applicable for the waste streams discharged to the K-1407-A and the K-1407-B include Electroplating and Metal Finishing (40 CFR Parts 413 and 433) and Steam Electric Power Generating (40 CFR Part 423).

The K-1401 and K-1420 facilities meet the definition of Subcategory Metal Finishing (40 CFR Part 433.10) in that the facility processes include electroplating, electroless plating, metals cleaning, and grinding. It is also appropriate that the uranium decontamination process performed at K-1420 should be included in the metal finishing category in as much as it involves grinding, brushing, and otherwise cleaning parts with mild acids.

The other processes performed in the K-1401 and K-1420 buildings involve metal plating and finishing as described in 40 CFR, Parts 413 and 423. The K-1401 and K-1420 discharges would also be considered as captive, integrated, and direct discharges as described in 40 CFR, Parts 413 and 423. The discharges are: captive, in that greater than 50 percent of the surface area treated per year is owned by the Department of Energy (DOE); integrated, since the discharge streams are mixed with process waste streams not covered by the electroplating and metal finishing category prior to treatment; and direct, since the treated waste streams are discharged to waters of the United States which are subject to NPDES requirements.

The discharges from the K-1501 Steam Plant are not totally applicable to the point source category of steam electric power generating (40 CFR, Part 423). By definition, the steam electric power generating category pertains to discharges resulting from the operation of a generating unit by a facility primarily engaged in the generation of electricity for distribution and sale. The K-1501 Steam Plant is used totally for steam production for internal use only.

The parameters for which BAT limits are given under the steam electric category include free available chlorine, total residual chlorine, the 126 priority pollutants contained in additives for cooling tower maintenance, and total copper and iron discharged from chemical metal cleaning. The chlorine limits are not applicable since chlorine is not used at the steam plant. The limits for the 126 priority pollutants are also nonapplicable since there are no cooling towers used at the facility. The limits for copper and iron would only apply to the extent that the boiler tubes and mud-drum water may contain copper and iron from contact with the boiler tubes. However, the mud-drum and boiler-tube water are not used for metal cleaning. However, for this BAT review, the discharge concentrations from the steam plant have been compared to the limits given in 40 CFR, part 423.

V. K-1407-B Pond Effluent Review

The effluent data collected from the K-1407-B holding pond from 1979 through 1983 is shown in Table 6. A summary of this data is shown in Table 7. During January and February 1984, samples were collected from the holding pond for organic analyses. Samples were collected on a weekly basis for eight weeks and analyzed by gas chromatography-mass spectrometry for volatile organics. The analytical results of these samples are shown in Table 8. Table 9 shows a summary of the K-1407-B effluent data which can be compared to the BAT limits for Metal Finishing and Steam Electric Point Source Categories. The effluent data is also compared to treatability guidelines found in the EPA Treatability Manual.

Comparing the K-1407-B effluent data to the Metal Finishing BAT limits shows that all parameters are below the maximum limits given except for the one nickel concentration of 7.68 mg/l which occurred during 1980. When the discharge data is compared to the Steam Electric Category, only the one chromium concentration of 0.54 mg/l, which was detected in 1979, exceeds the BAT limits.

The sums of the organic concentrations shown in Table 8 are also well within the 2.13 TTO limit for the Metal Finishing Category.

TABLE 6 - K-1407-B EFFLUENT DATA (1979 - 1983)

Parameter	1979 mg/1			1980 mg/1			1981 mg/1			1982 mg/1			1983 mg/1		
	Minimum	Maximum	Average	Minimum	Maximum	Average	Minimum	Maximum	Average	Minimum	Maximum	Average	Minimum	Maximum	Average
Aluminum	0.31	0.86	0.54	0.39	0.78	0.60	0.10	0.80	0.49	0.07	0.88	0.32	0.15	0.80	0.34
Cadmium	<0.002	0.005	0.003	<0.002	0.005	0.002	<0.002	0.006	0.002	<0.002	0.003	0.002	<0.002	0.002	0.002
Chromium	0.005	0.54	0.051	<0.01	0.02	0.01	<0.01	0.02	0.012	<0.01	0.02	0.011	<0.01	0.04	0.017
Copper	0.01	0.08	0.03	0.01	0.07	0.04	0.01	0.04	0.030	0.004	0.04	0.01	0.005	0.08	0.021
Total U	0.07	1.26	0.56	1.64	1.64	0.69	0.16	2.65	0.74	0.02	0.40	0.19	0.07	3.63	0.56
Cyanide	<0.002	0.01	<0.004	<0.002	<0.002	<0.002	<0.002	0.007	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
COD	7.0	42.0	18.50	5.001	31.00	14.30	<5.00	28.00	<14.80	<5.00	26.00	<12.50	<5.00	25.00	<13.90
Nickel	0.19	1.18	0.46	0.10	7.68	1.18	0.13	1.11	0.47	0.01	0.46	0.14	0.04	0.47	0.22
Nitrate	3.20	15.18	8.90	0.55	13.28	4.71	0.68	8.59	3.93	0.70	12.30	4.38	0.40	12.8	3.03
Zinc	0.02	0.10	0.05	<0.02	0.05	<0.03	<0.02	0.30	0.06	0.02	0.27	<0.04	0.02	0.08	0.04
TSS	<5.00	17.00	<7.80	<5.00	18.00	<7.81	<5.00	13.66	<7.22	<5.00	10.00	<7.00	<5.00	16.00	<8.66
Fluoride	0.87	1.70	1.36	0.62	3.10	1.52	0.32	1.8	1.04	0.20	1.00	0.48	0.20	4.00	1.44
Lead	0.01	0.02	<0.015	<0.01	0.02	<0.01	<0.01	0.03	<0.012	<0.01	0.02	<0.012	<0.01	0.03	<0.012
Manganese	0.08	0.32	0.15	0.02	0.10	0.07	0.002	0.12	0.05	0.03	0.17	0.06	0.02	0.23	0.11
Mercury	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

TABLE 7 - K-1407-B EFFLUENT SUMMARY DATA (1979 – 1983)

(mg/l)

Parameter	Minimum	Maximum	Average*
Aluminum	0.07	0.88	0.46 ± 0.05
Cadmium	<0.002	0.006	<0.0025 ± 0.0003
Chromium	0.005	0.54	0.021 ± 0.017
COD	<5.0	42.0	14.83 ± 2.02
Copper	<0.004	0.08	<0.028 ± 0.005
Cyanide	<0.002	0.015	<0.002 ± 0.0005
Fluoride	0.20	4.0	1.17 ± 0.20
Lead	<0.01	0.03	<0.013 ± 0.001
Manganese	0.002	0.33	0.09 ± 0.015
Mercury	<0.001	0.004	<0.001 ± 0.0001
Nickel	0.01	7.68	0.49 ± 0.25
Nitrate	0.40	15.18	4.98 ± 0.013
Suspended Solids	<5.0	18.0	<7.56 ± 0.92
Uranium	0.02	3.63	0.54 ± 0.15
Zinc	<0.02	0.30	0.045 ± 0.013

*Averages are calculated at 95 percent confidence level.

TABLE 8 - K-1407-B ORGANIC EFFLUENT DATA

Parameter	Minimum	Maximum (mg/l)	Average*
Methylene Chloride	<0.01	<0.01	<0.01 ± 0.00
Trichloroethane	<0.01	<0.01	<0.01 ± 0.00
Trichloroethylene	0.01	0.13	0.06 ± 0.01
Perchloroethylene	0.01	0.60	0.09 ± 0.07
Halomethanes	<0.01	<0.01	<0.01 ± 0.00
Freon 113	<0.01	0.04	0.18 ± 0.015
Acetone	0.06	0.18	0.118 ± 0.043
2,2,3,3, Tetrachloro-hexafluoride	0.02	0.04	0.03 ± 0.02
2-Propanol	0.01	0.04	0.02 ± 0.018
1,2, Trans-Dichloroethylene	0.01	0.02	0.014 ± 0.005

*Averages calculated at 95 percent confidence level.

TABLE 9 - COMPARISONS OF PERTINENT EFFLUENT LIMITS AND K-1407-B EFFLUENT DATA

Parameter	BAT Effluent Limits for Metal Finishing Point Source Category mg/l(1)		BAT Effluent Limits for Steam Electric Point Source Category mg/l(2) Average		Treatability Manual Effluent Guidelines mg/l(3)	K-1407-B Effluent Data mg/l(4)		
	Daily Maximum	Monthly Average	Daily Maximum	Monthly Average	Achievable Concentration	Minimum	Maximum	Average
Cadmium	0.69	0.26	---	---	<0.009	<0.002	0.006	<0.002 ± 0.0003
Chromium	2.77	1.71	0.2	0.2	0.340	0.005	0.54	<0.021 ± 0.017
Copper	3.38	2.07	1.0	1.0	0.052	<0.004	0.08	<0.028 ± 0.005
Cyanide	1.20	0.65	---	---	---	<0.002	0.015	<0.002 ± 0.0005
Iron	---	---	1.0	1.0	---	---	---	---
Lead	0.69	0.43	---	---	0.051	<0.01	0.03	<0.013 ± 0.001
Nickel	3.98	2.38	---	---	0.540	0.01	7.68	0.49 ± 0.25
Silver	0.43	0.24	---	---	<0.004	<0.007 (5)	<0.007	<0.007 ± 0.00
Zinc	2.61	1.48	1.0	1.0	0.640	<0.02	0.30	0.45 ± 0.013
TTO	2.13	---	---	---	---	0.04	0.30	0.12 ± 0.03

(1) 40 CFR Part 433, Subpart A, Section 433.14.
(2) 40 CFR Part 423, Section 423.13.
(3) EPA Treatability Manual Volume 1, Section 1.4 Treatment Process of Sedimentation With Chemical Addition (Lime).
(4) Data Collected from 1979 through 1983.
(5) Represents data collected for an eight-week period only.
(6) See Table 8 for organic analysis.