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USAFOEHL REPORT
89-009EQ0105BWA

FOR HEALTH & ENVIRONMENT

AD-A207 101

WASTEWATER CHARACTERIZATION SURVEY, LAUGHLIN AFB TX

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February 1989

Final Report

Distribution is unlimited; approved for public release

USAF Occupational and Environmental Health Laboratory
Human Systems Division (AFSC)
Brooks Air Force Base, Texas 78235-5501

NOTICES

This report has been reviewed and is approved for publication.

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A Wastewater Characterization survey was conducted at Laughlin AFB, Del Rio, TX by USAFOEHL personnel to provide the base with analytical data for the base National Pollutant Discharge Elimination System (NPDES) permit application. The analytical results from the wastewater survey showed excessive amounts of methylene chloride and chromium being discharged from the Corrosion Control Facility. Further, chromium and other heavy metals are accumulating in the sediment in the sewage lagoons. Effluent discharging off base contained small amounts of methylene chloride. Results of characteristic hazardous waste analyses showed the separator located outside the Corrosion Control Facility contains EP Toxic hazardous waste.

Recommendations: (1) Laughlin AFB should submit an Industrial Discharger NPDES Permit application. (2) The Corrosion Control Facility separator should be pumped out and (over)

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Paragraph 19, continued

the contents disposed of as hazardous waste. (3) Paint stripping practices at the Corrosion Control Facility need to be changed. (4) The Sewage Treatment Plant should be restored to treat base effluent prior to releasing to the sewage lagoons. (5) The base should test excavated material from previous lagoon deepening projects. (6) The base should establish a routine monitoring program to sample sediments at the bottom of lagoon No. 1.

Acknowledgements

The author greatly appreciates the technical expertise and hard work provided by the other members of our survey team, Lt Col Robert D. Binovi, 2Lt Shelia P. Scott, MSgt John Randall, Sgts Roberto Rolon and Harrold D. Casey, without whose valuable assistance this survey could never have been accomplished.

We also wish to acknowledge the staff of the Bioenvironmental Engineering Section at Laughlin AFB for the support they gave us during the survey.

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I. INTRODUCTION

On 4 Jan 88, Headquarters ATC, Environmental Planning Office, Randolph AFB, requested USAF Occupational and Environmental Health Laboratory (USAFOEHL) perform a wastewater characterization survey at Laughlin AFB. The data from the survey are required to complete a National Pollutant Discharge Elimination System (NPDES) permit application. The Base Civil Engineer has applied for a domestic discharge NPDES permit.

The objectives of the survey were to analyze the effluent leaving the base for NPDES contaminants and to evaluate the newly constructed sewage lagoons.

The survey was conducted in two parts: First, during June 7-10, Lts Attebery and Scott surveyed base maintenance operations determining chemical usage and discharge to the sewage system. Second, during June 13-17, Lt Col Robert D. Binovi, MSgt John Randall, and Sgts Harrold D. Casey and Roberto Rolon joined Lts Attebery and Scott to perform the necessary wastewater sampling and analyses required by Part 1 of the NPDES application.

Laughlin AFB is currently bypassing their sewage treatment plant clarifiers and sludge digester, and is discharging the raw wastewater into two large sewage lagoons. The lagoons were recently reconstructed to help control BOD and TSS levels in the effluent.

II. DISCUSSION

A. Introduction

Laughlin AFB, home of 47th UPT Flight Training Wing, is located six miles east of Del Rio, Val Verde County, Texas. The topography of the surrounding area is low rolling hills, and the terrain provides good irrigation for farming. The Georgetown Aquifer is believed to supply water to this region. The aquifer supplies water to San Felipe Springs from which Del Rio and Laughin AFB obtain their water. Del Rio has an arid climate, characterized by hot summers, mild winters, and very little precipitation. During the survey the average high and low temperatures were 92 and 72 degrees F, respectively; and the precipitation totaled a trace amount.

B. Wastewater Treatment System

In the past the wastewater treatment plant provided primary treatment of domestic sewage and industrial wastes. The treatment plant was designed to treat 1.0 MGD of sewage by sedimentation with two 62,500 gallon clarifiers in series and a sludge digester with three drying beds. Three sewage lagoons of 22.5 acres total area, with a 30 day retention period, provided secondary treatment. Two of the oxidation ponds have recently been dug deeper. The third is out of service awaiting modification.

The primary clarifiers are currently being bypassed because of the increased volume of sewage (1.25 MGD). Raw sewage is now discharged directly into two sewage lagoons. Lagoons 1 and 2 were renovated in early 1988. Lagoon 1 is 10 feet deep near the influent. The depth decreases and levels off at 6 feet near the outfall into pond 2. Pond 2 is uniformly 6 feet deep.

The retention time is calculated to be 31 days based on 1.25 MGD of flow into the ponds. The sediment removed during the renovation procedures is buried adjacent to the new lagoons.

C. NPDES

Laughlin AFB NPDES permit must be renewed every three years. For renewal, an application with a detailed description of base activities and a detailed analytical analysis of effluent is required. The expired permit set limits on Biochemical Oxygen Demand (BOD) and Total Suspended Solids (TSS) at 30 mg/L limits. These limits are typical of a domestic discharge permit. The plant has had trouble meeting BOD and TSS limitations in the past.

Radian Corporation, Austin Tx, performed a survey in 1985 to address the source of the high BOD and TSS, and provide possible solutions to the problem. The report concluded the source of the high BOD in the effluent was primarily from algae growth in the lagoons and that the sludge digester (which is unmixed and unheated) was considered inefficient in the reduction of sludge solids. Subsequently, the oxidation ponds were deepened in an attempt to bring the BOD levels into compliance. Outfall of pond 2 flows off base onto a large ranch where the owner uses the wastewater for irrigation.

The base is required to re-apply for a new NPDES permit 180 days prior to the current permit expiration date. The base did not complete the application before the old permit expired in July 1988. Analytical results from this survey will be used to complete the application.

D. Procedures

The wastewater characterization survey was conducted in two parts: First, base maintenance operations were surveyed to determine chemical usage and possible discharges to the sewer system. The following individuals were contacted to discuss the sanitary sewer system and the chemical discharges into it:

2Lt Robert O'Brien, Chief, Bioenvironmental Engineering,
USAF Hosp/SGPB, AUTOVON 732-5006

2Lt Tim Green, Environmental Coordinator, DEEV, AUTOVON 732-5694

Mr Bill MacElhannon, Chief, Sewage Treatment Plant Laboratory,
AUTOVON 732-5645

All of the major industrial shops on Laughlin AFB were visited to observe industrial activities, discuss chemical waste disposal practices with shop personnel, and hand out waste disposal survey forms.

Second, wastewater sampling and analyses dictated by Part 1 of the NPDES permit application were performed. Twenty-four hour composite and grab samples were taken at the influent to and effluent from the sewage lagoons. Grab samples were taken at the corrosion control facility and the sewage treatment plant while stripping operations were going on. Sludge samples were taken from lagoon 1. On site analysis included Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Fecal Coliform, Total Suspended Solids (TSS) and Total Volatile Solids (VSS). Sampling sites are listed in Table 1. Analytical tests and preservation methods are presented in Table 2. A summary of the analytical tests performed at each sampling site is presented in Table 3. A map of Laughlin AFB, identifying the sampling sites, is presented in Appendix E.

Table 1. Sampling Sites

Site number	Location
1	Influent to sewage Lagoon 1
2	Effluent from sewage Lagoon 2
3	Influent to STP, building 1003
4	Corrosion Control Facility separator building 51.
5	Sludge from sewage lagoon 1 at 50 feet from the influent
6	Sludge from sewage lagoon 1 at 100 feet from the influent

Table 2. Analyses and Preservation Methods

Analyses	Preservation	Method	Where	Who
Volatile Residue Filterable	none	A160.3	on-site	USAFOEHL
Filterable residue	none	A160.1	on-site	USAFOEHL
Fecal Coliform	none	SM 409	on-site	USAFOEHL
BOD_5	none	E405.1	on-site	USAFOEHL
COD	none	Hach Kit	on-site	USAFOEHL
pH	none	A423	on-site	USAFOEHL
Temperature	none	E170.1	on-site	USAFOEHL
Ammonia-Nitrogen	H_2SO_4	E350.1	Brooks AFB	USAFOEHL
Nitrates-Nitrites	H_2SO_4	E353.2	Brooks AFB	USAFOEHL
Total Kjeldahl Nitrogen	H_2SO_4	E351.2	Brooks AFB	USAFOEHL
Total Organic Carbon	H_2SO_4	E415.2	Brooks AFB	USAFOEHL
Cyanide	NaOH	E335.3	Brooks AFB	USAFOEHL
ICP Metals Screen	HNO_3	E200.7	Brooks AFB	USAFOEHL
Mercury	HNO_3	E245.1	Brooks AFB	USAFOEHL
Chlorides	none	E325.1	Brooks AFB	USAFOEHL
Sulfate	none	E375.2	Brooks AFB	USAFOEHL
Sulfides	$Zn(C_2H_3O_2)_2$	E376.2	Brooks AFB	USAFOEHL
Phenols	H_2SO_4	E604	Contract Lab	Data Chem*
Oils and Grease	H_2SO_4	E423.1	Brooks AFB	USAFOEHL
Boron	none	E212.3	Brooks AFB	USAFOEHL
SW 8010	none	E8010	Brooks AFB	USAFOEHL
SW 8020	none	E8020	Brooks AFB	USAFOEHL
fecal coliform	none	A908C1	on-site	USAFOEHL
color	none	E110.1	Brooks AFB	USAFOEHL
fluoride	none	E340.3	Brooks AFB	USAFOEHL
MBAS	none	E425.1	Brooks AFB	USAFOEHL
Phosphorus	H_2SO_4	E365.4	Brooks AFB	USAFOEHL
radioactivity	none	-	Brooks AFB	USAFOEHL
Volatile Organics	H_2SO_4	E624	Brooks AFB	USAFOEHL
Base/Neutral/Acid Extractables	none	E625	Contract Lab	Data Chem
Characteristic Hazardous Waste (ignitability, corrosivity, reactivity, EP toxicity)	none		Brooks AFB	USAFOEHL

*Data Chem, 520 Warara Way, Salt Lake City, Utah 84108

Table 3. Analysis and Sampling Site Summary

Test method	Sites 1	2	3	4	5	6
pH	X	X	X	X	X	X
Fecal coliform	X	X				
Filterable residue	X	X				
Volatile residue, filterable	X	X				
COD	X	X		X		
BOD	X	X				
EPA 200.7	X	X		X	X	X
EPA 624	X	X				
EPA 625	X	X				
EPA 8010			X	X		
EPA 8020			X	X		
EPA 604			X	X		
TOC	X	X	X	X		
Oil & Grease	X	X	X			
Ammonia as N	X	X				
Nitrate as N	X	X				
Total Kjeldahl nitrogen	X	X				
Cyanide	X	X				
Boron	X	X				
Color	X	X				
Fluoride	X	X				
Sulfate	X	X				
Surfactants	X	X				
Bromide	X	X				
Sulfides	X	X				
Phosphorus	X	X				
Gross alpha	X	X				
Gross beta	X	X				
Characteristic hazardous waste			X			

b. Sampling Frequency

Equiproportional composite samples were taken hourly for three consecutive days at the influent to pond 1 (site 1) and the effluent to pond 2 (site 2). Samples from these sites were analyzed for the NPDES parameters listed in Table 1. The sampling was accomplished with ISCO Model 2700 Automatic Wastewater Composite Samplers. Grab samples were taken at the corrosion control facility and the influent to the sewage treatment plant and analyzed for the parameters listed in Table 2. Volatile samples were grabbed at Corrosion Control as the waste entered the oil/water/grit chamber separator. The contents of the separator were contained until all stripping operations were finished by turning off the pump. This was done to allow the survey team to take a representative sample of the discharge.

The pump was turned on and the separator drained into the sanitary sewer at a constant rate of 200 GPM. Effluent discharged for approximately 45 minutes. The flow time for the slug of corrosion control waste to reach the sewage treatment plant was calculated to be 180 minutes, by assuming the average velocity in the sewer system is 1 ft/sec. The grab sample was taken at the sewage treatment plant approximately 210 minutes after discharge from the separator to obtain a representative sample at the headworks of the plant.

E. Shop Wastewater Discharge Survey

The following represents a shop-by-shop description of the major chemical users on base and chemical discharges to the sanitary sewer.

1. Shop: Corrosion Control — Building: 51
   Contact: TSgt Boschue — AUTOVON: 732-5480

Personnel from Building 51 are responsible for stripping, corrosion prevention and painting T-37 and T-38 aircraft. Aircraft are brought into the hangar where nonphenolic stripper (B&B 4411, a methylene chloride based stripper - 400 gallons per month) is sprayed on to remove the paint. The stripper is allowed to set; then scraped and washed off. The process is often repeated. Phenolic based stripper (Eldorado Chemical 3500-100 gallons per month) is used sometimes to strip stubborn areas. Stripping is performed on Monday, starting at 1200 and ending at 2400. Water is run continuously to keep the floor clean. Planes are stripped on Monday and Tuesday, and touched-up in the paint barn Wednesday thru Friday. Approximately 500 gallons of stripper are used per month. The paint and stripping waste are flushed into an oil/water separator connected to the sanitary sewer. Sludge from the oil/water separator is pumped out by a contractor. Thirty gallons per month of waste phosphoric acid (used for corrosion treatment) are discharged to the separator.

Personnel from the paint barn next to building 51 are responsible for cleaning, corrosion prevention and touch-up painting of aircraft parts. All paint waste and thinners are collected in 55 gallon drums and sent to the accumulation site. Most of the paint used is polyurethane, but some enamel and laquer paints and solaramic coatings are also used. About 80 gallons of MEK is used per month. The solvent is used up in process. About 15 gallons of chromic acid and 24 gallons of chromate conversion compound (alodine solution) used to treat metal prior to painting, are discharged to the separation tank per month.

The daily average flow at the sewage treatment plant was measured as 484,000 gallons at the time of the survey. An estimate of the maximum daily flow from the Corrosion Control shop is 9,000 gallons based on a 45 minute discharge time of the Corrosion Control shop separator and a pump output of 200 GPM. Wastes from stripping operations were contained and discharged at one time for this survey. Wastes are typically discharged intermittently throughout the day by an automatic pumping system. Since the Corrosion Control separator discharges at a constant rate, the concentrations of toxic chemicals found in the sewer are representative of normal operation. The total discharge from the Corrosion Control separator is slightly less than 2% of the measured daily average total flow to the sewage lagoons.

2. Parts Cleaning — Building: 68
   Contact: TSgt Kingsley — AUTOVON: 732-5798

Personnel of the Parts Cleaning Shop are responsible for processing aircraft and nonaircraft metal parts. The shop consists of eight cleaning and rinse tanks (see Table 4 for contents, quantities and change out frequencies of each tank). All tanks except the rinse tanks and phosphoric acid tank are changed out and drummed for disposal by DRMO. The hot permanganate rinse tank and cold phosphoric acid rinse tanks (700 gallon capacities) are drained to the sanitary sewer weekly. The cold rinse tank used for stripper and carbon remover rinse is discharged daily because of drag-out contamination. Sodium bicarbonate is available for neutralizing any spills of phosphoric acid. Shop personnel had operated a plating shop previously.

3. Wheel and Tire Shop — Building: 50
   Contact: Mr Magana — AUTOVON: 732-5578

Wheel and Tire shop personnel perform periodic inspections and maintenance of T-37 and T-38 aircraft landing systems. Shop personnel use aircraft soap (diluted 15:1) for cleaning operations. The soap is discharged to the sanitary sewer. PD-680 cleaning solvent is used to clean bearings. All fuels, petroleum products and solvents are drummed and disposed of through DRMO.

4. Jet Engine Test Cell
   Contact: TSgt Villareal — AUTOVON: 732-5182

Jet Engine Test Cell personnel inspect, troubleshoot, and test J-69 and J-85 jet engines. Aircraft soap is used to clean equipment and the interior of the run bay. The soap is rinsed down the drain which discharges to an oil/water separator. Small amounts of waste fuel and oil are discharged to the oil/water separator. The separator is pumped out by contractor.

5. Fuels Yard — Building: 5
   Contact: SSgt Bukowski — AUTOVON: 732-5878

Liquid Fuels personnel maintain stationary fuel systems, and clean fuel tanks. The main source of wastewater is washrack water and Hotsy Corporation biodegradeable soap mixture which are discharged to an oil/water separator and then to the sanitary sewer system. Small amounts of petroleum ether and isopropyl alcohol are used for spot cleaning but evaporate before entering the sewer system. All other wastes such as contaminated JP-4 are drummed and disposed of through DRMO.

Table 4. Parts Cleaning Vat Contents, Quantities

Vat	Contents	Quantity	Change-out	Disposal
1	Phosphoric Acid	500 gallon	annually	Neutralized with sodium bicarbonate discharged to STP
2	Cold Water	700 gallon	weekly	discharged to STP
3	Permanganate Solution	500 gallon	annually	drummed
4	Hot Water	700 gallon	weekly	discharged to STP
5	Alkaline Descaler	500 gallon	annually	drummed
6	Cold Water	700 gallon	daily	discharged to STP
7	Carbon Remover	500 gallon	biannually	drummed
8	Hot Stripper	150 gallon	as needed	drummed

NOTE: = Permanganate solution contains a mixture of sodium carbonate, potassium permanganate and sodium hydroxide

6. Fuel Systems Repair — Building: 53
   Contact: TSgt Garet — AUTOVON: 732-5364

Aircraft Fuel System Repair personnel remove and replace aircraft system components such as pumps, valves and fuel bladders. The fuel system repair hangar is capable of holding three aircraft at a time. The hangar has two troughs to remove JP-4 vapors and catch spills from leaking aircraft. The spilled fuel goes to an oil/water separator connected to the sanitary sewer. The oil/water separator is periodically pumped out by the CE Plumbing Shop personnel. A pneumatic vacuum is used to depuddle the aircraft after its fuel tanks have been drained. Approximately 20 gallons/month of JP-4 is collected from the depuddling operation. When full, the pneumatic vacuum is emptied into a bowser brought in from flight line support.

7. Shop: NDI — Building: 52
   Contact: MSgt Meakins — AUTOVON: 732-5235

Personnel of the NDI shop perform nondestructive tests inspecting T-37 and T-38 aircraft and their components. Chemicals stored for penetrant inspection processes are penetrant (110 gallon vat) and emulsifier (110 gallon vat). Parts to be inspected are dipped in penetrant, emulsifier, and finally in a 110 gallon rinse bath. The parts are allowed to air dry prior to fluorescent light inspection. Chemicals used in the penetrant vat and emulsifier vat (110 gallons/year of penetrant and 440 gallons/year of emulsifier) are changed out annually and quarterly, respectively, and placed into 55 gallon drums for disposal through DRMO. The rinse vat is drained to the sanitary sewer weekly.

8. Shop: Propulsion — Building: 68
Contact: MSgt Bisorbi — AUTOVON: 732-5872

The Propulsion Shop personnel are responsible for the tear-down, build-up and maintenance of aircraft engines. Engine Repair Shop personnel perform scheduled and unscheduled maintenance on J-69 and J-85 engines. The major wastes generated by this shop are waste oils. All wastes generated from the Propulsion Shop are drummed and disposed of through DRMO.

9. Transportation — Building: 131
Contact: Mr Wann — AUTOVON: 732-5032

Vehicle Maintenance Shop personnel repair and maintain military vehicles. Waste battery acid is left in the battery cases. The spent batteries are palletized and sent to DRMO for eventual disposal. Waste antifreeze, aircraft soap (J&B Duo-Brite), and washing solvents are drained to the sanitary sewer. The shop utilizes Safety Kleen solvents for degreasing. Waste oil and waste hydraulic fluid are placed into 55 gallon drums for eventual disposal through DRMO. One washing solvent utilized at the vehicle washrack is J&B Aqua-Solvent. This solvent contains xylene.

10. Roads and Pavements — Building: 113
Contact: TSgt Jordan — AUTOVON: 732-5961

The Roads and Pavements personnel are responsible for the maintenance and building of roads and walkways on base. Shop personnel utilize only petroleum-based products and no chlorinated solvents for the cleaning of vehicles, vehicle maintenance, and washing. No discharge of any chemical wastes to the sanitary sewer system takes place.

11. T-38 Phase Maintenance — Building: 210
Contact: Mr Magana — AUTOVON: 732-5578

Phase Maintenance personnel are responsible for scheduled maintenance of T-38 aircraft. The only waste discharged to the sanitary sewer system is aircraft soap. Shop personnel wash 3 planes per day and use 165 gallons of biodegradeable aircraft soap per month. The soap is diluted 15 to 1 for normal washing operations. Phase Maintenance personnel operate a wheel and tire cleaning area, utilizing PD-680 cleaning vats. Wastes from these operations are drummed and disposed of through DRMO.

12. Aerospace Ground Equipment (AGE) Building: 206
Contact: MSgt Snodgrass AUTOVON: 732-5461

AGE personnel are responsible for the maintenance of all aerospace ground equipment. The shop discharges no wastes to the sanitary sewer. All washing of equipment is done at the building 210 washrack. Shop personnel use small amounts of Citrikleen solvent to clean small parts. Waste solvent is drummed and disposed of through DRMO.

13. Fire Department Building: 207
Contact: SSgt Riojas AUTOVON: 732-5036

Fire Department personnel are responsible for fire protection base-wide. The only discharge to the sanitary sewer system is wastewater containing Hotsy Corporation biodegradeable soap (local purchase). All fire truck maintenance is done by the Transportation Squadron. The fire training pit is self-contained. The contents are pumped out and disposed of by contractor.

14. Photo Lab Building: 304
Contact: Mrs Biesiada AUTOVON: 732-5310

Photo Lab contract personnel are responsible for all the photographic needs of the base. The shop has a relatively small mission. They develop 40 rolls of black and white, and 15 rolls of color film per month. Shop personnel utilize an automatic photo processing unit to develop the film. Photographic wastes are transported to the NDI shop for silver recovery and ultimate disposal in the sanitary sewer.

15. T-37 Phase Maintenance Building: 414
Contact: SMSgt McGarvey AUTOVON: 732-5713

Phase Maintenance personnel are responsible for sheduled maintenace of T-37 aircraft. The only waste discharged to the sewer system is wastewater containing aircraft soap. Shop personnel wash 2 planes per day and use 55 gallons of biodegradeable aircraft soap every 2-3 weeks. The soap is diluted 15 to 1 for normal washing.

16. Liquid Fuels Maintenance Building: 5
Contact: MSgt Rushing AUTOVON: 732-5952

Liquid Fuels personnel maintain stationary fuel systems, and clean aboveground and underground fuel tanks. The main waste is sludge contaminated with JP-4 from tank cleaning operations. Tank cleaning wastes are drummed and disposed of through DRMO.

17. Plumbing Shop — Building: CE Complex
Contact: Mr Luna — AUTOVON; 732-5953

Plumbing Shop personnel are responsible for all base plumbing needs. The major chemicals discharged to the sewers are sewer and draincleaners. Sewer drain cleaner (sodium hydroxide - 15 gallons per month) and drain cleaner (sulfuric acid - 3 gallons per month) are used to unclog sewer blockages.

18. Paint Shop — Building: CE Complex
Contact: Mr Salzone — AUTOVON: 732-5054

Paint Shop personnel are responsible for all major and minor painting on base. The only discharges to the sanitary sewer system are water based paints. All other paints and thinners are drummed and disposed of through DRMO.

19. Battery Shop — Building: 50
Contact: Mr Gonzalez — AUTOVON: 732-5175

Battery Shop personnel are responsible for the neutralization and disposal of NiCad batteries. Calcium hydroxide from the NiCad batteries is neutralized with an equal amount of boric acid and discharged to the sanitary sewer system. The shop neutralizes approximately five gallons of calcium hydroxide per month.

20. Dental Clinic — Building: 375
Contact: MSgt Wood — AUTOVON: 732-6398

Dental Clinic personnel perform routine dental restoration and maintenance on base personnel. The Clinic has x-ray development capabilities. Chemicals used in film development are discharged to the sanitary sewer system after silver recovery. The Clinic laboratory discharges very small amounts of n-alkyl dimenthylbenzyl ammonium chloride and n-alkyl dimethylethylbenzyl ammonium chloride.

21. Auto Hobby Shop — Building: 525
Contact: Mr Cothers — AUTOVON: 732-5844

The base Auto Hobby Shop is a "garage type" facility offering base personnel state-of-the-art automotive repair equipment and expert automotive repair advice. Degreasing solvents and waste oils are not discharged to the sanitary sewer. These wastes are drummed and disposed of by contractor or DRMO. The only discharges are expected to be biodegradeable soap from the washrack plus small amounts of spilled oil and fuel.

SUMMARY OF DISCHARGES TO THE SANITARY SEWAGE SYSTEM

1. The major contributor of industrial wastes to the sanitary sewer system is the Corrosion Control facility. The facility discharges various chlorinated and phenolic strippers as well as chromic acid, metals and paint chips. The total discharge from the corrosion control separator is slightly less than 2% of the measured daily average total flow to the sewage lagoons.

2. Parts cleaning personnel typically discharge rinsewater which potentially contains phosphoric acid, manganese, sodium hydroxide, carbon remover, and chlorinated strippers (all from cleaning vat drag-out).

3. Transportation discharges an automobile cleaning solvent containg xylene.

4. Biodegradeable soaps are discharged with rinsewater at both aircraft washracks.

5. Plumbing shop personnel discharge sulfuric acid and sodium hydroxide to the sanitary sewer during drain and sewer cleaning operations.

F. Wastewater Characterization: Complete analytical results are presented in Appendix B.

1. Site 1 - Influent to Sewage Lagoon 1.

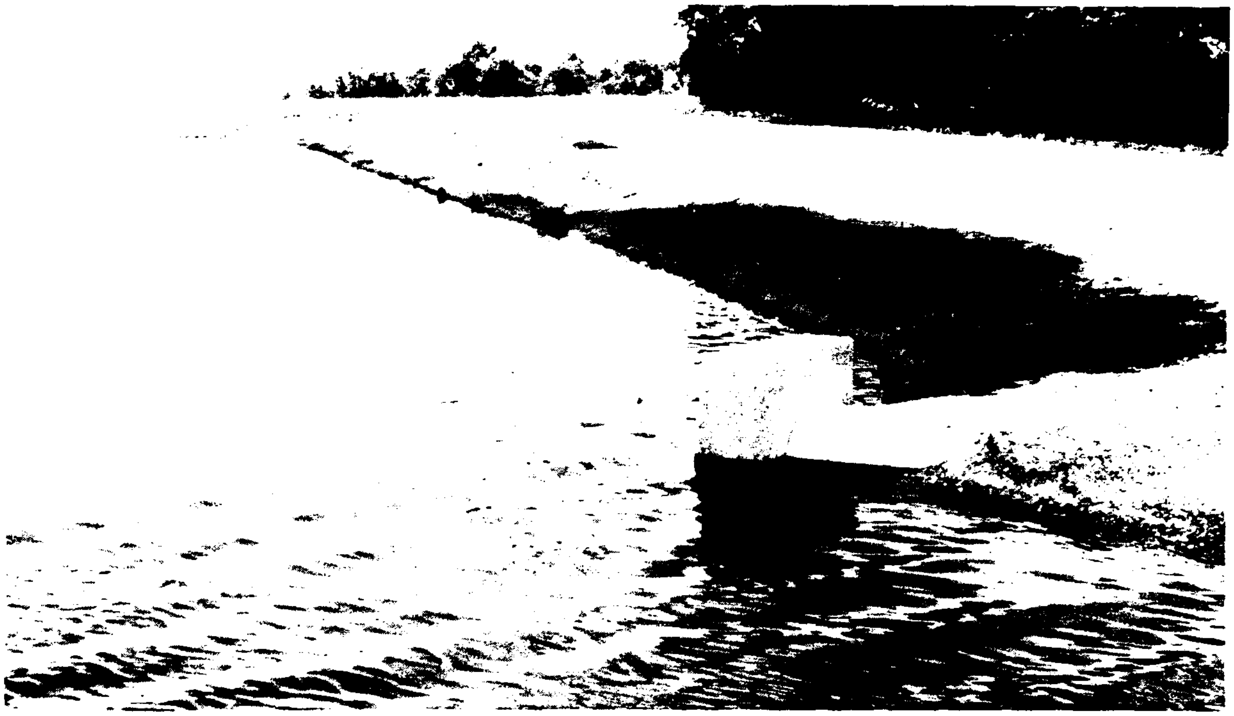
Site 1 is located approximately 50 yards from the inlet to sewage lagoon 1 at an open air junction box (Figure 1). Composite and grab samples were taken on three consecutive days.

Several metals were detected in the wastewater discharging to lagoon 1. However, some of the contaminants such as magnesium and calcium can be attributed to natural hardness in the water. The metals being discharged from industrial operations on base included: barium (104 μg/L); chromium (397 μg/L); nickel (931 μg/L); sodium (37.2 mg/L); zinc (101 μg/L); aluminum (127 μg/L). Metals attributed to natural hardness are as follows: iron (214 μg/L); calcium (79.2 mg/L); magnesium (8.8 mg/L); and potassium (5.4 mg/L).

Few purgeable halocarbons were detected in the influent to lagoon 1. Halocarbons detected were dichloromethane (methylene chloride - 29 μg/L), toluene (7.3 μg/L) plus trace amounts of ethylbenzene and 1,2 & 1,4-dichlorobenzene.

Bis(2-ethylhexyl)phthalate was detected in the wastewater influent at 5.7 μg/L.

Other parameters analyzed for at site 1 included Total Organic Carbon (TOC), Oil & Grease, ammonia, nitrate, Total Kjekdahl Nitrogen, cyanide, boron, color, fluoride, sulfate as SO_4, surfactants, bromide, sulfides, and phosphorus.



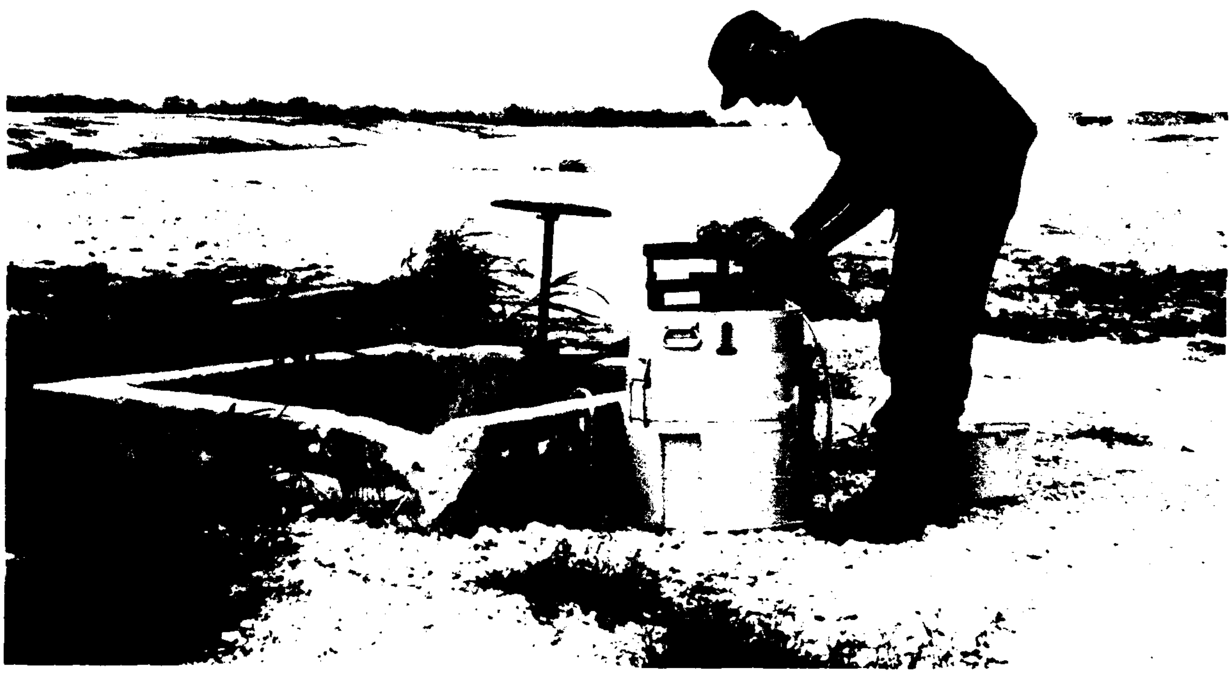


Figure 1. Influent to Sewage Lagoon 1.

The results of the previously mentioned tests for the influent and effluent to the sewage lagoons show no elevated levels for any of the tested parameters. Some interesting results are a decrease of ammonia from influent to effluent of 9.8 to 0.8 mg/L and an increase in color from 20 to 63 units.

2. Site 2 - Effluent from Sewage Lagoon 2 (Figure 2)

Site 2 is located next to the perimeter fence at the outfall from Sewage Lagoon 2. Composite and grab samples were taken for three consecutive days.

Figure 2: Effluent From Sewage Lagoon 2

Several metals were detected in the effluent from pond 2. Nickel, found at 910 µg/L, was the only metal detected that resulted from industrial operations. Other metals that are considered naturally occurring are: calcium (56.9 mg/L); magnesium (10.4 mg/L); potassium (7.7 mg/L); and sodium (51.7 mg/L).

Few purgeable halocarbons were detected in the effluent from lagoon 2. The only halocarbon detected was dichloromethane (methylene chloride - 5 µg/L).

3. Site 3 - Influent to the STP

Site 3 is located at the influent flume at the headworks to the STP (Figure 3). One grab sample was taken from this site while stripping waste was being discharged.

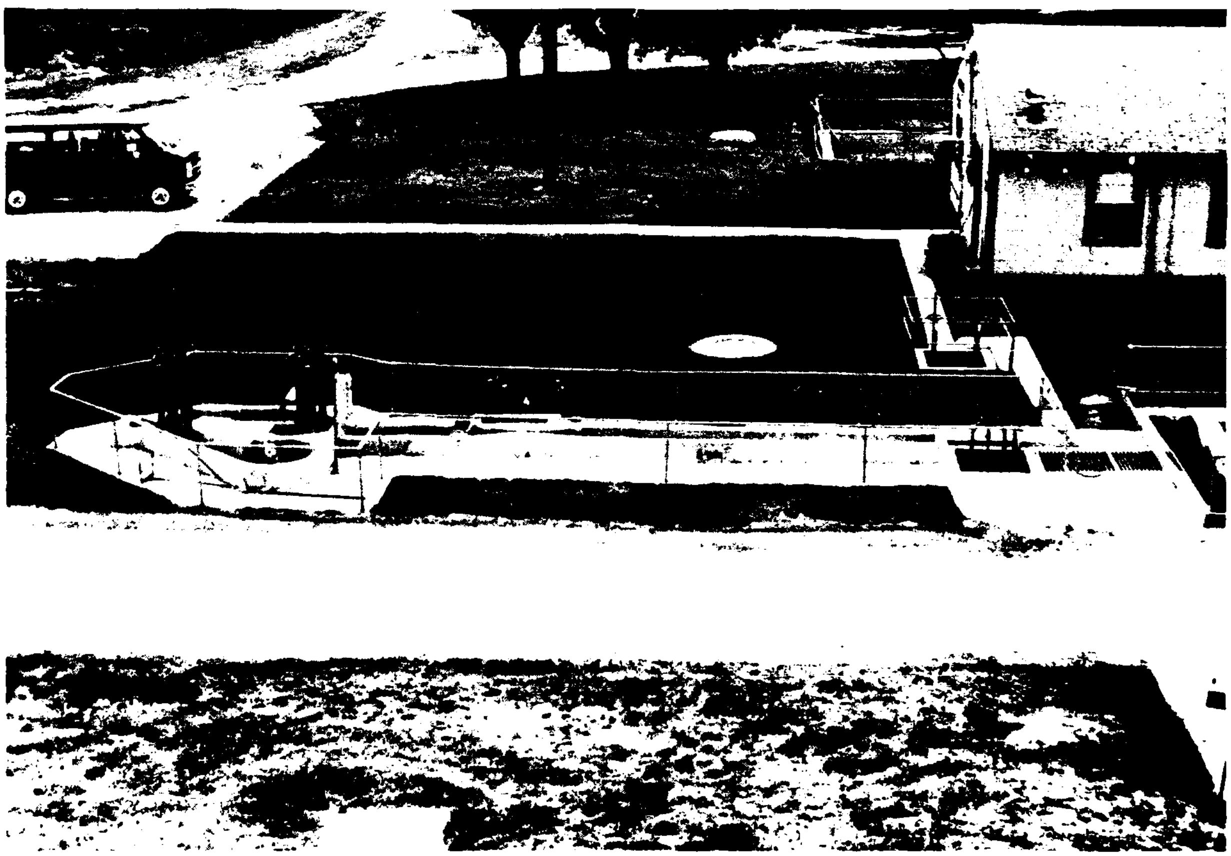


Figure 3: Influent to the STP

Several metals were detected in the influent to the STP. Metals discharged from industrial operations included chromium (248 µ/L) and nickel (1028 µ/L). Other metals that are considered naturally occurring are: calcium (81.2 mg/L); magnesium (9.1 mg/L); potassium (2.9 mg/L); and sodium (34.8 mg/L).

The following volatile hydrocarbons were detected: dichloromethane (methylene chloride - 53,300 µ/L); chlorobenzene (31 µ/L); ethylbenzene (11 µg/L); toluene (190 µg/L); p-xylene (6.7 µg/L); and o-xylene (16 µg/L). Phenols were detected in the STP influent. Phenols detected were 2-chlorophenol (24 µg/L), 2-nitrophenol (2.6 µg/L), and phenol (2500 µg/L).

4. Site 4 - Corrosion Control Facility

Site 4 is located behind building 51 at the facility separator (Figure 4). One grab sample of composited wastes was taken from the separator after stripping wastes had been collected. Also, one volatile sample (EPA 8010 and 8020) was taken from the stripping bay drainage trough while aircraft stripping operations were being conducted.

Figure 4: Corrosion Control Facility Separation

The only volatile hydrocarbon detected was methylene chloride - 345,000 µg/L.

No volatile aromatics were detected in the stripping wastes discharged to the oil/water separator.

Phenols were detected in the corrosion control facility oil/water separator. Phenols detected were 2-chlorophenol (7 ug/L) and phenol (7400 µg/L).

The waste in the Corrosion Control oil/water separator is a hazardous waste. Results of the EP Toxicity test showed a chromium concentration of 18.2 mg/L.

5. Site 5 is located 50 feet from the inlet to lagoon 1 in the middle of the lagoon (Figure 5). The following metals were found in the sludge: barium (584 µg/L); chromium (815 µg/L); copper (109 µg/L); iron (4701 µg/L); lead (262 µg/L); manganese (162 µg/L); mercury (9.3 µg/L); nickel (911 µg/L); zinc (1328 µg/L); calcium (375.8 µg/L); magnesium (15.6 µg/L); potassium (9.4 µg/L); sodium (42.7 µg/L); vanadium (265 µg/L); and aluminum (1868 µg/L).

6. Site 6 is located 100 feet from the inlet to lagoon 1 in the middle of the lagoon. The following metals were found in the sludge: barium (2197 µg/L); chromium (320 µg/L); iron (6089 µg/L); lead (426 µg/L); manganese (1535 µg/L); mercury (14.2 µg/L); nickel (1108 µg/L); zinc (1469 µg/L); calcium (852 µg/L); magnesium (31.8 µg/L); potassium (11.2 µg/L); sodium (43.3 µg/L); and vanadium (503 µg/L).

Figure 5: Sludge Sampling from Sewage Lagoon 1

III. CONCLUSIONS

The following standards, Pretreatment Standards for Existing Sources, Metal Finishing Point Source Category, are contained in the Code of Federal Regulations, Section 40, Part 433. However, these standards do not apply to Laughlin AFB since the base has its treatment system and does not discharge to a Publicly Owned Treatment Works (POTW). They are relevant in that they serve as a guideline for point source industrial discharges.

Table 5. Pretreatment Standards for Existing Sources, Metal Finishing Point Source Category

Parameter	Max 1-Day Concentration	Monthly Average
	mg/l	
Cadmium (T)	0.69	0.26
Chromium (T)	2.77	1.71
Copper (T)	3.38	2.07
Lead (T)	0.69	0.43
Nickel (T)	3.98	2.38
Silver (T)	0.43	0.24
Zinc (T)	2.61	1.48
Cyanide (T)	1.20	0.65
TTO (Total Toxic Organics)	2.13	---

** Note TTO is the summation of the individual concentrations of chemicals listed in Attachment 1 sampled on any one day.

1. The wastestream discharged to the corrosion control shop separator is highly industrial in nature. In fact, a sample taken while stripping operations were in progress contained 335 mg/L of methylene chloride. The methylene chloride concentration in the corrosion control shop oil/water separator was calculated to be 92 mg/L (see Appendix A for calculations), approximately 43 times greater than the PSES TTO standard of 2.13 mg/L (Table 2). The sludge from the separation tank was characterized as an EP toxic hazardous waste because of a chromium concentration of 18 mg/L.

According to 40 CFR 261.3(1), Definition of a Hazardous Waste, a wastestream is considered hazardous if the average weekly usage of the following solvents, methylene chloride, 1,1,1-trichloroethane, chlorobenzene, o-dichlorobenzene, cresols, cresylic acid, nitrobenzene, toluene, methyl ethyl ketone, carbon disulfide, isobutane, pyridine, and spent chlorofluorocarbon solvents, divided by the average weekly flow into the headworks of the facility's wastewater treatment or pretreatment system is more than 25 ppm. Industrial wastestreams are usually excluded from this provision but because the wastewater is collected and stored prior to discharge to the sanitary sewer system the corrosion control industrial wastestream is not excluded. Also, the Corrosion Control Shop separator could be considered a pretreatment system.

2. The Texas Water Commission issued a lenient NPDES permit to Laughlin AFB. No limits have been set to control industrial wastewater. Although industrial wastewater is diluted with domestic sewage, priority pollutants discharged from industrial shops are being found in the lagoon sludge and effluent. A major source of industrial wastewater is the Corrosion Control Shop.

3. The corrosion control separator is designed for gravity separation, and as such is ineffective in removing chromium, volatile organic or volatile aromatic compounds from the shop's wastestream. These pollutants are being pumped directly into the sanitary sewer system.

4. According to 40 CFR 261.3, Definition of a Hazardous Waste, the corrosion control shop is discharging hazardous waste to the separation tanks by discharging in concentrations greater than 25 ppm methylene chloride. Additionally, the sludge in the corrosion control tank is hazardous, and unless the sludge is removed within a 90 day time period the tank would be considered as an underground hazardous waste storage unit, and would have to be RCRA permitted as one.

5. Pollutants discharged from the corrosion control shop are being detected in significant quantities in the influent to the sewage treatment plant. Even though the corrosion control shop constitutes less than two percent of the total daily average flow to the treatment plant on a daily basis, during separator discharge the flow amounts to approximately 56 percent of the total flow. Methylene chloride (53.3 mg/L) was detected at the influent to the sewer treatment plant. Chromium concentrations up to 0.248 mg/L were found. Priority pollutants are also being discharged in the sewage lagoon effluent (methylene chloride was detected at 5 µg/L).

6. U.S. Air Force Technical Order (T.O.) 1-1-8 governs the selection, application, and removal of paint strippers for aircraft, missiles, and associated material or equipment. T.O. 1-1-8 instructs personnel in the proper method of applying strippers, but does not give any indication as to the amount of stripper generally needed to remove polyurethane paint from a particular area on the plane. Personnel at the corrosion control shop at Laughlin AFB are using an average of 110 gallons of methylene chloride stripper per airplane. This amount appears to be excessive. Shop personnel stated that the stripper is sprayed onto the plane, agitated with a brush and simply rinsed off after a period of time, and then reapplied if needed. This procedure corresponds with instructions presented in T.O. 1-1-8, Section 2-20.

7. Each paint stripper listed in T.O. 1-1-8 must conform to the military specification, Mil-R-25134, which specifies methylene chloride as a component. This inflexibility prevents the selection of a paint stripper potentially less harmful to the environment than methylene chloride. The requirement for methylene chloride in paint strippers is unnecessary. The specification for paint strippers should be based on performance of the stripper, and not on specific compounds. Any stripper which performs as well as, or exceeds the standard stripper in military specification, MIL-R-25134, should be acceptable.

The possibility of amending Military Specification, MIL-R-25134, so that methylene chloride is not mandated as a component of paint strippers is obviously beyond the control of Laughlin AFB. USAFOEHL will draft a letter requesting HQ ATC to investigate amending the Military Specification.

8. Heavy metals are starting to accumulate in the sediment on the bottom of lagoon 1. The ponds were in operation for only 2 months at the time of the survey, but had already accumulated chromium (.815 mg/L), mercury (9.3 µg/L), zinc (1.469 mg/L, lead (.426 mg/L), manganese (1.535 mg/L) and vanadium (.503 mg/L). If heavy metals continue to accumulate and concentrations in the sediment exceed the RCRA limits, the lagoons would be considered hazardous waste storage facilities. A closure plan would have to be developed for the facilities.

Lagoon 1 sediment depths measured 10 inches near the influent, decreased to 8 inches at 50 feet, and disappeared at distances greater than 100 feet.

9. Because of the history of corrosion control operations the sediment that was excavated from the lagoons during deepening processes may be a hazardous waste.

10. STP personnel stated that the STP clarifiers and sludge digester were being bypassed because they were being overloaded. The plant was designed to accomodate 1 MGD but was receiving 1.25 MGD. Flow measurements taken at the influent to the STP during the survey showed flows that averaged 0.48 MGD. Base population estimates of approximately 5000 personnel support an average flow of 0.5 MGD based on 100 gpcd of wastewater. If the STP clarifiers were reinstated into the sewage treatment loop the sewage retention time in each clarifier would be 3.125 hours for a flow of .48 MGD. The hydraulic loading (overflow) rate would be approximately 50 gpd/sq ft. If the clarifiers were redesigned to run in parallel the retention time and hydraulic loading rate would be doubled or 6.25 and 25 gpd/sq ft, respectively. For domestic wastewater, primary settling tanks (clarifiers) are usually designed for retention times of 1.5 hours (minimum) and overflow rates (hydraulic loading) of 800 to 1000 gpd/sq ft, based on the 24-hour average flow, to obtain 50 to 60 percent suspended solids removal.

11. Oxidation is occurring in the lagoons. For example, ammonia from the influent is oxidized to nitrate and nitrite. However, nitrate and nitrite are readily utilized by algae, adding to the BOD and TSS problems in the effluent from pond 2.

IV. RECOMMENDATIONS

1. Laughlin AFB should submit an industrial discharger NPDES permit application, not a domestic discharger permit, as a consequence of the methylene chloride detected in the oxidation pond effluent. These results indicate, at times, a significant portion of the Laughlin AFB wastewater is industrial in nature.

2. Clean out the separation tank at the Corrosion Control shop and dispose of the sludge as hazardous waste. Subsequently pressure test the tank to insure its integrity. If the tank is leaking it should be closed up to prevent acceptance of further discharge. An EPA approved closure plan should be formulated to govern the removal of the tank from the ground.

3. Current discharge practices for paint stripping waste from the Corrosion Control shop should be changed. The following are possible treatment or process change alternatives for paint stripping

a. Convert to bead blasting for stripping paint.

b. Collect all paint stripping waste in drums and dispose of as hazardous waste.

c. Convert to a wet sanding process for paint stripping.

d. Design a pretreatment system to include chemical coagulation for metals removal, physical separation (i.e., gravity sedimentation, filtration, or screening) and volatile organic removal (i.e., packed towers, packed activated charcoal). Such a system might consist of interception of paint chips, i.e., a slotted discharge pipe with a series of screens of decreasing mesh to collect the paint chips, filters, etc. The wastewater could then be passed through a packed tower aeration column to remove the methylene chloride before discharge to the sanitary sewer. The paint chips should be drummed and disposed of as hazardous waste. Air sampling might have to be performed to insure that workers are not being overexposed to methylene chloride vapors, and regional air pollution control agencies should be notified if a tower is proposed.

4. The base should consider repairing the sewage treatment plant clarifiers and sludge digester and using them. Continued bypassing of the clarifiers will result in an accumulation of sludge and an unsightly appearance of the sewage lagoons. The sludge digester needs to be modified to utilize both heat and mixing, as outlined in Radian Corp 1985 report.

5. The base should test the sediment excavated from the lagoons for EP toxic hazardous waste characteristics. If the sediment is found to be hazardous, the base should prepare to recover the site and dispose of the waste in an approved landfill.

6. The base should establish a routine monitoring program to sample sediment accumulating on the bottom of oxidation pond 1. Heavy metals should be monitored to insure the ponds do not accumulate enough contaminants to technically be considered hazardous waste storage facilities.

REFERENCES

1. Conversation with Mr MacElhannon, STP Laughlin AFB Superintendant, June 1988.

2. APHA, Standard Methods for the Examination of Water and Wastewater, 16th Ed., American Public Health Association, Washington DC, (1985).

3. Code of Federal Regulations Title 40, Part 433 - Metal Finishing Point Source Category, Office of the Federal Register, Washington DC (1987).

4. Code of Federal Regulations Title 40, Part 261.3 - Definition of a Hazardous Waste, Office of the Federal Register, Washington DC (1987).

5. Code of Federal Regulations Title 40, Part 265 - Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities, Office of the Federal Register, Washington DC (1987).

6. Code of Federal Regulations Title 40, Part 270 - EPA Administered Permit Program: Hazardous Waste Permit Program, Office of the Federal Register, Washington DC (1987).

7. USEPA, Methods for Chemical Analysis of Water and Wastewater, EPA-600/4-79-020, March 1983.

8. US Air Force Technical Order 1-1-8.

9. US Air Force Technical Order 1-1-1.

10. Department of Defense, Document MIL-R-25134, Military Specification for Paint Strippers, Republican Press, Hamilton OH.

11. Fair, G.M., J.C. Geyer, and D.A. Okun, Water and Wastewater Engineering: Volume 1, Water Supply and Wastewater Removal, John Wiley & Sons, Inc., New York NY, 1966.

12. Water Pollution Control Federation, Wastewater Treatment Plant Design: MOP/8, Water Pollution Control Federation, Washington, DC, 1977.

13. Radian Corporation, Wastewater Treatment System Evaluation, Laughlin AFB TX, Contract No. F33615-83-D-4001, June 1985.

Appendix A

NPDES Permit Analytical Requirements

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TABLE 1. NPDES Permit Analytical Requirements

Volatiles:

acrolein
acrylonitrile
benzene
bromoform
carbon tetrachloride
chlorobenzene
chlorodibromomethane
chloroethane
2-chloroethylvinyl ether
chloroform
dichlorobromomethane
1,1-dichloroethane
1,2-dichloroethane
1,1-dichloroethylene
1,2-dichloropropane
1,3-dichloropropylene
ethylbenzene
methyl bromide
methyl chloride
methylene chloride
1,1,2,2-tetrachloroethane
tetrachloroethylene
toluene
1,2-trans-dichloroethylene
1,1,1-trichloroethane
1,1,2-trichloroethane
trichloroethylene
vinyl chloride

Acid Compounds:

2-chlorophenol
2,4-dichlorophenol
2,4-dimethylphenol
4,6-dinitro-o-cresol
2,4-dinitrophenol
2-nitrophenol
4-nitrophenol
p-chloro-m-cresol
pentachlorophenol
phenol
2,4,6-trichlorophenol

Base/Neutral:

acenaphthene
acenaphthylene
anthracene
benzidine
benzo(a)anthracene
benzo(a)pyrene
3,4-benzofluoranthene
benzo(ghi)perylene
benzo(k)fluoranthene
bis(2-chloroethoxy)methane
bis(2-chloroethyl)ether
bis(2-chloroisopropyl)ether
bis(2-ethylhexyl)phthalate
4-bromophenyl phenyl ether
butylbenzyl phthalate
2-chloronaphthalene
4-chlorophenyl phenyl ether
chrysene
dibenzo(a,h)anthracene
1,2-dichlorobenzene
1,3-dichlorobenzene
1,4-dichlorobenzene
3,3'-dichlorobenzidine
diethyl phthalate
dimethyl phthalate
di-n-butyl phthalate
2,4-dinitrotoluene
2,6-dinitrotoluene
di-n-octyl phthalate
1,2-diphenylhydrazine
fluroranthene
fluorene
hexachlorobenzene
hexachlorobutadiene
hexachlorocyclopentadiene
hexachloroethane
indeno(1,2,3-cd)pyrene
isophorone
napthalene
nitrobenzene
N-nitrosodimethylamine
N-nitrosodi-n-propylamine
N-nitorsodiphenylamine
phenanthrene
pyrene
1,2,4-trichlorobenzene

Pesticides:

aldrin
alpha-BHC
beta-BHC
gamma-BHC
delta-BHC
chlordane
4,4'-DDT
4,4'-DDE
4,4'-DDD
dieldrin
alpha-endosulfan
beta-endosulfan
endosulfan sulfate
endrin
endrin aldehyde
heptachlor
heptachlor epoxide
PCB-1242
PCB-1254
PCB-1221
PCB-1232
PCB-1248
PCB-1260
PCB-1016
toxaphene

Other Toxic Pollutants:

antimony, total
arsenic, total
beryllium, total
cadmium, total
chromium, total
copper, total
lead, total
mercury, total
nickel, total
selenium, total
silver, total
thallium, total
zinc, total
cyanide, total
phenols, total

Conventional and Nonconventional Pollutants Required to be Tested by Existing Dischargers if Expected to be Present:

bromide
chlorine, total residual
color
fecal coliform
fluoride
nitrate-nitrite
nitrogen, total organic
oil & grease
phosphorus, total
radioactivity
sulfate
sulfide
sulfite
surfactants

aluminum, total
barium, total
boron, total
cobalt, total
iron, total
magnesium, total
molybdenum, total
manganese, total
tin, total
titanium, total

Toxic Pollutants and Hazardous Substances Required To Be Identified by Existing Dischargers if Expected To Be Present:

acetaldehyde
allyl alcohol
allyl chloride
amyl acetate
aniline
benzonitrile
benzyl chloride
butyl acetate
butylamine
captan
carbaryl
carbofuran
carbon disulfide
chlorpyrifos
coumaphos
cresol
crotonaldehyde
cyclohexane
2,4-D
diazinon
dicamba
dichlobenil
dichlone
2,2-dichloropropionic acid
dichlorvos
diethyl amine
dimethyl amine
dinitrobenzene
diquat
disulfoton
diuron
dodecylbenzenesulfonate
epichlorohydrin
ethion
ethylene diamine
ethylene dibromide
formaldehyde
furfural
guthion
isoprene
isopropanolamine dodecylbenzenesulfonate
kelthane
kepone
malathion
mercaptodimethur
methoxychlor
methyl mercaptan
methyl methacrylate
methyl parathion
mevinphos
mexacarbate
monoethyl amine
monomethyl amine
naled
napthenic acid
nitrotoluene
parathion
phenosulfanate
phosgene
propargite
propylene oxide
pyrethrins
quinoline
resorcinol
strontium
strychnine
styrene
2,4,5-T
TDE
2,4,5-TP
trichlorofan
triethanolamine
triethylamine
trimethylamine
uranium
vanadium
vinyl acetate
xylene
xylenol
zirconium

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Appendix B

Wastewater Discharge Shop Survey Forms

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APPENDIX B

Shop: Building Number:
Shop Supervisor: Autovon:
Shop Duties: ____________________

CATAGORIES OF WASTE AND DISPOSAL METHODS

TYPE OF WASTE	DISPOSAL METHOD *(D, DD)	AMOUNT GENERATED (per month)	COMMENTS
1. PAINT WASTES			
2. WASTE THINNERS			
3. $ STRIPPING WASTE			
4. $ WASTE ACIDS			
5. WASTE BATTERY ACID			
6. $ SOAPS			
7. $ OILS			
8. TRANSMISSION FLUID			
9. BRAKE FLUID			
10. HYDRAULIC FLUID			
11. JET FUEL			
12. AUTOMOTIVE FUEL			
13. ANTIFREEZE			
14. $ SOLVENTS			
15. $ DEGREASANTS			
16. $ PHOTO WASTES			
17. $			

$ specify the types used on next page
* USED DISPOSAL CODES BELOW:

D-DRUMMED RTT-RETURNED TO FUEL TANKS UIP-USED IN PROCESS

DD-DOWN DRAIN FTP-GOES TO FIRE TRAINING PIT KIT-KEPT IN TANK

NDD-NEUTRALIZED FIRST THEN PLACED DOWN DRAIN O-OTHER (specify)

RDD-RINSED OFF AND RINSEWATER GOES DOWN DRAIN E-EVAPORATED

SRDD-SILVER RECOVERY UNIT THEN DOWN DRAIN NA-NOT APPLICABLE

SPECIFIC CHEMICALS USED

STRIPPERS

Name of Stripper	Manufacturer	Amt used/wk	National Stock Number

SOLVENTS/DEGREASANTS

Name of Solvent	Manufacturer	Amt used/wk	National Stock Number

SOAPS

Name of Soap	Manufacturer	Amt used/wk	National Stock Number

OILS

Name of Oil	Amt used/week	Disposal Method

Chemical listing (cont.)

ACIDS

Name of Acid	Manufacturer	Amt used/wk	National Stock Number

PHOTO CHEMICALS

Name of Chemical	Manufacturer	Amt used/wk	National Stock Number

NDI CHEMICALS

Name of Chemical	Manufacturer	Amt used/wk	National Stock Number

Other Chemicals Not Listed

Name of Chemical	Manufacturer	Amt used/wk	National Stock Number

Shop supervisors signature: ______________________

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Appendix C

Calculations for Methylene Chloride Concentrations in the Corrosion Control Separator

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1. Total Flow = $500{,}000\ \frac{\text{gallons}}{\text{day}}$ = $347\ \frac{\text{gallons}}{\text{min}}$

2. Corrosion Control (when discharging) = $200\ \frac{\text{gallons}}{\text{min}}$

3. Methylene Chloride Concentration in STP influent. = 53.3 mg/L

4. From base inspection: all MC comes from corrosion control.

5. Concentration of MK in CC separator

$$\frac{347\ \frac{\text{gallons}}{\text{min}}}{200\ \frac{\text{gallons}}{\text{min}}} \times 53.3\ \text{mg/L} = 92\ \text{mg/L}$$

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Appendix D

Analytical Results

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SUMMARY OF ANALYTICAL RESULTS FOR LAUGHLIN AFB

SITE	LOCATION
1	influent to sewage lagoon 1
2	effluent to sewage lagoon 2
3	influent to STP
4	Corrosion Control Shop O/W separator
5	sludge from lagoon 1, 50 feet from inlet
6	sludge from lagoon 1, 100 feet from inlet

Metals	Site					
results in µg/L	1	2	3	4	5	6
arsenic	<100	<100	<100	-	<100	<100
barium	104	<100	<100	-	584	2197
cadmuim	<100	<100	<100	-	<100	<100
chromium	397	<100	248	-	815	320
copper	<100	<100	<100	-	109	<100
iron	214	<100	<100	-	4701	6089
lead	< 20	< 20	< 20	-	262	426
manganese	<100	<100	<100	-	162	1535
mercury	< 1	< 1	< 1	-	9.3	14.2
nickel	931	910	1028	-	911	1108
selenium	< 10	< 10	< 10	-	< 10	< 10
silver	< 10	< 10	< 10	-	< 10	< 10
zinc	101	<100	<100	-	1328	1469
calcium (mg/L)	79.2	56.9	81.2	-	375.8	852.6
magnesium (mg/L)	8.8	10.4	9.1	-	15.6	31.8
potassium (mg/L)	5.4	7.7	2.9	-	9.4	11.2
sodium (mg/L)	37.2	51.7	34.8	-	42.7	43.3
antimony	< 10	< 10	< 10	-	< 10	< 10
beryllium	<100	<100	<100	-	<100	<100
thallium	< 10	< 10	< 10	-	< 10	< 10
vanadium	<100	<100	<100	-	265	503
aluminum	127	<100	<100	-	1868	<100
cobalt	<100	<100	<100	-	<100	<100
molybdenum	<100	<100	<100	-	<100	<100
titanium	<100	<100	<100	-	<100	<100

NOTE: Average is for three days. Where averages were made with one or more numbers identified as, for example <100, 100 was used for calculating the average.

EPA Method 624 *results in µg/L*	Sites 1	2
chloromethane	ND	ND
bromomethane	ND	ND
vinyl chloride	ND	ND
chloroethane	ND	ND
dichloromethane	29	5[1]
trichlorofluoromethane	ND	ND
1,1-dichloroethane	ND	ND
1,1-dichloroethene	ND	ND
trans-1,2-dichloroethene	ND	ND
chloroform	ND	ND
1,2-dichloroethane	ND	ND
1,1,1-trichloroethane	ND	ND
carbon tetrachloride	ND	ND
bromodichloromethane	ND	ND
1,2-dichloropropane	ND	ND
trans-1,3-dichloropropene	ND	ND
trichloroethene	ND	ND
benzene	ND	ND
chlorodibromomethane	ND	ND
1,1,2-trichloroethane	ND	ND
cis-1,3-dichloropropene	ND	ND
2-chloroethylvinyl ether	ND	ND
bromoform	ND	ND
1,1,2,2-tetrachloroethane	ND	ND
tetrachloroethene	ND	ND
toluene	7.3[2]	ND
chlorobenzene	ND	ND
ethylbenzene	TRACE	ND
1,3-dichlorobenzene	ND	ND
1,2 & 1,4-dichlorobenzenes	TRACE	ND

[1]Three samples analyzed. One was found to contain 5 µg/L, others were found to contain trace amounts or not detected (ND).

[2]Three samples analyzed. One was found to contain 7.3 µg/L, others were not detected.

Acid/base/neutral extractables (EPA Method 625) *results in µg/L*	Sites 1	2
N Nitrosodimethylamine	ND	ND
Phenol	ND	ND
Bis(2-Chloroethyl)ether	ND	ND
2-Chlorophenol	ND	ND
1,3-Dichlorobenzene	ND	ND
1,4-Dichlorobenzene	ND	ND
1,2-Dichlorobenzene	ND	ND
Bis(2-Chloroisopropyl)Ether	ND	ND
N-Nitrosodi-n-propylamine	ND	ND
Hexachloroethane	ND	ND
Nitrophenol	ND	ND
Isophorone	ND	ND
2-Nitrophenol	ND	ND
2,4-Dimethylphenol	ND	ND
Bis(2-Chloroethoxy)Methane	ND	ND
2,4-Dichlorophenol	ND	ND
1,2,4-Trichlorobenzene	ND	ND
Naphthalene	ND	ND
Hexachlorobutadiene	ND	ND
4-Chloro-3-methylphenol	ND	ND
Hexachlorocyclopentadiene	ND	ND
2,4,6-Trichlorophenol	ND	ND
2-Chloronaphthalene	ND	ND
Dimethylphthalate	ND	ND
2,6-Dinitrotoluene	ND	ND
Acenaphthylene	ND	ND
Acenaphthene	ND	ND
2,4-Dinitrophenol	ND	ND
4-Nitrophenol	ND	ND
2,4-Dinitrotoluene	ND	ND
Diethyl Phthalate	ND	ND
4-Chlorophenyl-phenylether	ND	ND
Fluorene	ND	ND
2-Methyl-4,6-dinitrophenol	ND	ND
n-Nitrosodiphenylamine	ND	ND
4-Bromophenyl-phenylether	ND	ND
Hexachlorobenzene	ND	ND
Beta-BHC	ND	ND
Pentachlorophenol	ND	ND
Phenanthrene	ND	ND
Anthracene	ND	ND
delta-BHC	ND	ND
Heptachlor	ND	ND
Di-n-butyl phthalate	ND	ND
Aldrin	ND	ND
Heptachlor Epoxide	ND	ND
Fluoranthene	ND	ND
Pyrene	ND	ND

Acid/base/neutral extractables (EPA Method 625): *Results in µg/L*	Sites 1	2
Endosulfan I	ND	ND
4,4'-DDE	ND	ND
Benzidine	ND	ND
Dieldrin	ND	ND
Endrin	ND	ND
4,4'-DDD	ND	ND
Endosulfan II	ND	ND
Endrin Aldehyde	ND	ND
Benzyl-butylphthalate	ND	ND
4,4'-DDT	ND	ND
Endosulfan Sulfate	ND	ND
Bis(2-ethylhexyl)phthalate	5.7	ND
Benz(a)Anthracene	ND	ND
Chrysene	ND	ND
3,3'-Dichlorobenzidine	ND	ND
Di-n-octyl phthalate	ND	ND
Benzo(b)fluoranthene	ND	ND
Benzo(a)pyrene	ND	ND
Indeno(1,2,3-cd)pyrene	ND	ND
Dibenzo(a,h)anthracene	ND	ND
Benzo(ghi)perylene	ND	ND
Chlordane	ND	ND
Toxaphene	ND	ND
Arochlor 1016	ND	ND
Arochlor 1221	ND	ND
Arochlor 1232	ND	ND
Arochlor 1242	ND	ND
Arochlor 1254	ND	ND
Arochlor 1260	ND	ND
Arochlor 1248	ND	ND

SW 846 8010 Volatile Hydrocarbons *results in µg/L*	Sites 3	4
benzyl chloride	ND	ND
bromobenzene	ND	ND
bromodichloromethane	ND	ND
bromoform	ND	ND
bromomethane	ND	ND
carbon tetrachloride	ND	ND
chlorobenzene	ND	ND
chloroethane	ND	ND
2-chloroethylvinyl ether	ND	ND
chloroform	ND	ND
chlorohexane	ND	ND
chloromethane	ND	ND
chlorotoluene	ND	ND
dibromochloromethane	ND	ND
dibromomethane	ND	ND
1,2-dechlorobenzene	ND	ND
1,3-dichlorobenzene	ND	ND
1,4-dichlorobenzene	ND	ND
dichlorodifluoromethane	ND	ND
1,1-dichloroethane	ND	ND
1,2-dichloroethane	ND	ND
1,1-dichloroethylene	ND	ND
trans-1,2-dichloroethylene	ND	ND
dichloromethane	53,300	345,000
1,2-dichloropropane	ND	ND
cis-1,3-dichloropropene	ND	ND
trans-1,3-dichloropropene	ND	ND
1,1,1,2-tetrachloroethane	ND	ND
1,1,2,2-tetrachloroethane	ND	ND
tetrachloroethylene	ND	ND
1,1,1-trichloroethane	ND	ND
1,1,2-trichloroethane	ND	ND
trichloroethylene	ND	ND
trichlorofluoromethane	ND	ND
trichloropropane	ND	ND
vinyl chloride	ND	ND

NOTE: ND = not detected

SW 846 8020 *results in µg/L*	Sites 3	4
benzene	ND	ND
chlorobenzene	31	ND
1,2-dichlorobenzene	ND	ND
1,3-dichlorobenzene	ND	ND
1,4-dichlorobenzene	ND	ND
ethylbenzene	11	ND
toluene	190	ND
P-xylene	6.7	ND
M-xylene	ND	ND
O-xylene	16	ND

EPA Method 604 Phenols *results in µg/L*	Sites 3	4
4-chloro-3-methylphenol	ND	ND
2-chlorophenol	24	47
2,4-dichlorophenol	ND	ND
2,4-dimethylphenol	ND	ND
2,4-dinitrophenol	ND	ND
2-methyl-4,6-dinitrophenol	ND	ND
2-nitrophenol	2.6	ND
4-nitrophenol	ND	ND
pentachlorophenol	ND	ND
phenol	2500	7400
2,4,6-trichlorophenol	ND	ND

Miscellaneous Tests	sites				
	1	2	3	4	units
total organic carbon (TOC)	21.7	16	70	380	mg/L
oil and grease	8.7	4 8	15.1	124	mg/L
ammonia as N	9.8	0.8	-	-	mg/L
nitrate as N	0.15	< 0.1	-	-	mg/L
total Kjeldahl nitrogen as N	16.1	10.0	-	-	mg/L
cyanide	0.025	< 0.005	-	-	mg/L
boron	<200	367	-	-	µg/L
color	20	63	-	-	units
fluoride	0.4	0.54	-	-	mg/L
sulfate as SO4	37	36	-	-	mg/L
surfactants	3.1	0.2	-	-	mg/L
bromide	< 0.1	< 0.1	-	-	mg/L
sulfides	0.2	0.2	-	-	mg/L
phosphorus	2.8	3.2	-	-	mg/L
gross alpha	1.5	< 1.35	-	-	picocuries/L
gross beta	3.1	3.75	-	-	picocuries/L
pH	7.0	7.8	-	8.6	units
fecal coliform	80,000	300	-	-	colonies/100ml
TSS	55	64	-	30	mg/L
VSS	62	70	-	53	mg/L
COD	154	110	495		mg/L
BOD	60	-	-	18	mg/L

Characteristic Hazardous Waste Results

Parameter	Site 4
Corrosivity	non-corrosive
reactivity	non-reactive
ignitability	> 140°F
EP Toxicity: (mg/L)	
arsenic	< 0.1
barium	< 1.0
cadmium	< 0.1
chromium	18.02
lead	< 0.1
mercury	< 0.01
selenium	< 0.01
silver	< 0.1

Appendix E

Identification of Sampling Sites

Laughlin AFB TX

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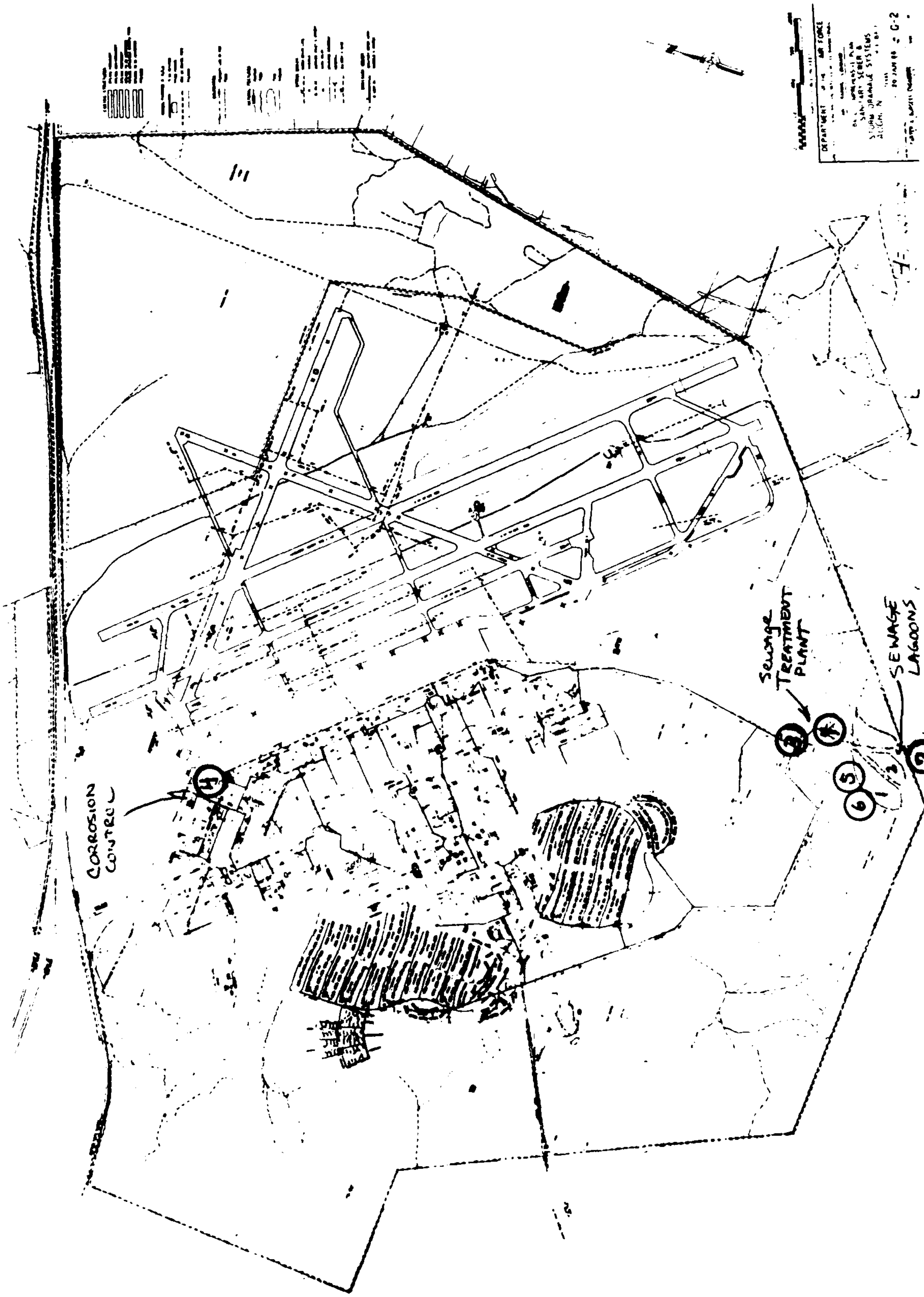
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