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WASTEWATER CHARACTERIZATION SURVEY, BARKSDALE AFB, LA

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Final Report

USAF Occupational and Environmental Health Laboratory
Human Systems Division (AFSC)
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The USAFOEHL conducted an on-site wastewater quality survey at Barksdale AFB LA from 14 to 28 March 1988 at the request of the 2nd Strategic Hospital/SGPB. The survey was requested to resolve a 1 October 1987 EPA Region VI 30-day administrative order. All samples were analyzed for pH, chemical oxygen demand (COD), conductivity, total suspended soiids (TSS) and oil and grease. Samples taken from industrial areas were selectively analyzed for purgeable halocarbons, purgeable aromatics, total recoverable phenols (EPA Method 420), phenols (EPA Method 604), fluorides, surfactants (MBAS), characteristic hazardous waste and metals by the ICP metals screen. Lift stations (buildings 4725 and 3455) and NPDES site 003 were also analyzed for biochemical oxygen demand (BOD). Sampling results were evaluated against the following criteria: (1) Bossier City, Louisiana Wastewater Permit Standard BC0022; (2) Pretreatment Standards for E isting Sources, 40 CFR Part 433 - Metal finishing point source category; (3) NPDES Permit LA0007293 for Macks Bayou. Recommendations include the following: (1) The oiis and grease and BOD problems at (over)

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L.S. 3455 and L.S. 4725 can be reduced by improving maintenance or installing more effective grease traps at food serving facilities, and maintenance at the lift stations. Other facilities disposing organic compounds (solvents, soaps, ect.) to the sanitary sewer should take positive steps to minimize the amount of waste entering the sanitary sewer system. A wet garbage contract for the dining facilities will reduce BOD loading to the sewers. (2) The COD and oils and grease concentrations at NPDES site 003 can be reduced by redirecting the north and south aircraft washracks wastewater to the sanitary sewer system. The lift station at the north washrack should have the water level adjusted so that all wastewater enters the sanitary sewer. The same type of collection and diversion system should be installed at the south ramp. (3) Operations at the 917th Engine Shop that results in solvents being rinsed into the sanitary sewer should be minimized until the rinsate can either be containerized or sent to a pretreatment system. (4) Phenoxy soaps used by POL for cleaning contribute to exceeding the sanitary sewer discharge limit for phenols. Switching to a detergent which does not contain phenol derivatives should alleviate the problem. (5) The dumping of battery acid into the sanitary sewer may be responsible for a pH of 4.3 in the separators. Proper neutralization or drumming of waste acids should remedy the pretreatment violation. (6) The Corrosion Control Shop is exceeding the pretreatment limits for TTO, chromium and zinc. The 917th Engine Shop is exceeding the pretreatment limits for TTO. A pretreatment system should be installed servicing both shops to remove the contaminants prior to the waste entering the sanitary sewer. (7) Dragout from a 300 gallon stripping vat located outside the Corrosion Control Shop should be controlled. The tank should be moved inside where spills can be prevented from entering the environment. (8) All industrial wastewater discharges should be connected to the sanitary sewer system in order to meet NPDES standards. Barksdale AFB should only be discharging stormwater to Macks Bayou.

ACKNOWLEDGEMENTS

The authors sincerely appreciate the hard work and technical expertise provided by other members of the survey team including 1Lt Francis Slavich, TSgt Benjamin Hernandez, SSgt Mary Fields and Sgt Harold Casey.

We would also like to extend a wholehearted thanks to Capt Maria LaMagna-Reiter and the entire staff of the Bioenvironmental Engineering Section for the southern hospitality provided us during the visit.

Contents

Illustrations

I. INTRODUCTION

A. Purpose and Scope

The 2nd Strategic Hospital SGPB requested the USAF Occupational and Environmental Health Laboratory assist in resolving a 1 Oct 87 EPA Region VI 30-day Administrative Order. A meeting between base, AFRCE, and USAFOEHL personnel took place on 26 Oct 87. A response was submitted which included a proposed wastewater characterization survey by USAFOEHL in 1988.

This wastewater and hazardous waste characterization survey was conducted from 14 to 28 March by Lt Col Robert D. Binovi, 1Lt Francis E. Slavich, 1Lt Anthony T. Zimmer, TSgt Benjamin Hernandez, SSgt Mary M. Fields and Sgt Harold D. Casey. Capt Maria La Magna-Reiter, a Bioenvironmental Engineer, and Donna Kelly, the Environmental Coordinator were contacted.

The scope of the survey included the characterization of the industrial sanitary and stormwater discharges. Sites selected included National Pollution Discharge Elimination System (NPDES) site 002 and site 003 into Macks Bayou, the two sanitary sewage lift stations discharging off base (buildings 4725 and 3455) and oil/water separators discharging into the sanitary and storm systems. Also, flow measurements were taken in Macks Bayou near site 003, discharge from site 002, and at the north aircraft washrack.

A hazardous waste survey was also performed at ten selected shops on the base. The survey was accomplished to coincide with the wastewater survey and determine the facilities contributing industrial wastewater to the sanitary and stormwater systems.

B. Background

Barksdale AFB is located on the edge of Boosier City, about two miles east of and across the Red River from Shreveport. Base working population is about 8000. Base resident population is 5773.

The base is located in the flood plain of Red Chute Bayou. The low lying portions of the reservation are subject to partial inundation during headwater floods. The land is relatively flat and there are no natural formations other than the drainage courses. The soils are composed of horizontal lenses of silt, sandy silt, silty sand, and clay.

The annual precipitation has averaged about 49 inches. Precipitation in the peak rain months, December through May, averages about five inches per month. A total of 2.16 inches of rain fell between the 14th and 28th of March. The average high and low temperatures were 67 and 44 degrees Fahrenheit, respectively.

The base supports the 2nd Bomb Wing, Headquarters 8th Air Force, and a host of tenant organizations, including the 917th National Reserve Unit. Aircraft serviced are B-52s, KC-135s, KC-10s, and A-10s. Other industrial operations stem from facility and vehicle maintenance.

C. Wastewater System

The base has separate sanitary and storm drainage systems. Industrial effluent is discharged into both systems. In general, most industrial shops discharge into the sanitary system.

The storm system consists of various conveyances discharging ultimately into two bayous, Macks and Coopers. Macks Bayou originates on base near the base north gate, flowing slowly eastward to the Red River. Coopers Bayou also originates on base near the north gate, flowing westerly, then southerly, joining Macks Bayou and the Red River. Coopers Bayou receives stormwater from the runway and runoff from private residences and industrial establishments along Industry Ave. Since no wastewater is routinely discharged into Coopers Bayou from industrial operations on base, sampling of water quality in Coopers Bayou was beyond the scope of this survey.

The sanitary sewer system is a gravity and pressure system that is connected to the City of Boosier's sanitary sewer system via lift stations (L.S.) 4725 and 3455.

D. Discharge Limitations

Sanitary Sewer Discharge Limitations. Discharge limitations for Barksdale AFB are contained in the Bossier City Code, part 28, section 28-69.2. These restrictions apply to the two lift stations, building 3455 and 4725, responsible for pumping sewage waste to the Bossier City treatment plant. The daily flows from the two lift stations should not exceed 1,170,000 gallons. The discharge limitations applicable to L.S. 3455 and 4725 are found in Table 1.

Table 1. Sewer Discharge Permit

Parameter	Limitation
pH	5.5-9.5 Std Units
TSS	250 mg/l
BOD_5	250 mg/l
Oil & Grease	100 mg/l
Phenols	0.1 mg/l at head of POTW

Federal Pretreatment Standards may apply to point source discharges of industrial wastewaters into the sanitary sewer in lieu of local pretreatment ordinances. Point source discharges from industrial facilities (except for the NDI, Hospital and Photo Shops) on Barksdale AFB are regulated by 40 CFR, Part 433, Metal Finishing Point Source Category. Discharge limitations for the facilities are found in Table 2. NDI and photo shops are regulated by 40 CFR 459. Hospital discharges are regulated by 40 CFR 460.

Table 2. 40 CFR 433 Metal Finishing Pretreatment Standards

Parameter	Limitation (mg/l) Daily Max.	Monthy Avg
Cadmium	0.69	0.26
Chromium	2.77	1.71
Copper	3.38	2.07
Lead	0.69	0.43
Nickel	3.98	2.38
Silver	0.43	0.24
Zinc	2.61	1.48
Cyanide	1.20	0.65
Total Toxic Organics (TTO)	2.13	-------
pH	<5.00 units	

Stormwater System NPDES Permit. The following stormwater limitations are applicable to the outfalls 002, 003 and 004, located on Macks Bayou. Site 002 is located west of storage tank, building 5934, across Davis Avenue. Site 003 is located on Macks Bayou, south of building 6830, on a platform above the skimmer/oil separator. Site 004 is located at the outlet of the treatment system located between the south taxiway and taxiway E. The actual discharge limitations are found in Table 3.

Table 3. NPDES Stormwater Limitations

Parameter	Limitation (mg/l) Daily Ave	Daily Max
Flow	N/A	N/A
TTS	20	30
Oil and Grease	10	15
COD	60	90

II. DISCUSSION

A. Survey Procedures

1. Wastewater Characterization Survey

a. Macks Bayou Reconnaissance - Macks Bayou was walked from its origin near the North Gate to a point past the skimmer/oil separator designated by proposed discharge permit LA0007293 as site 003 to determine the various outfalls into the bayou. A sketch of the discharges into the bayou is included as Figure 1.

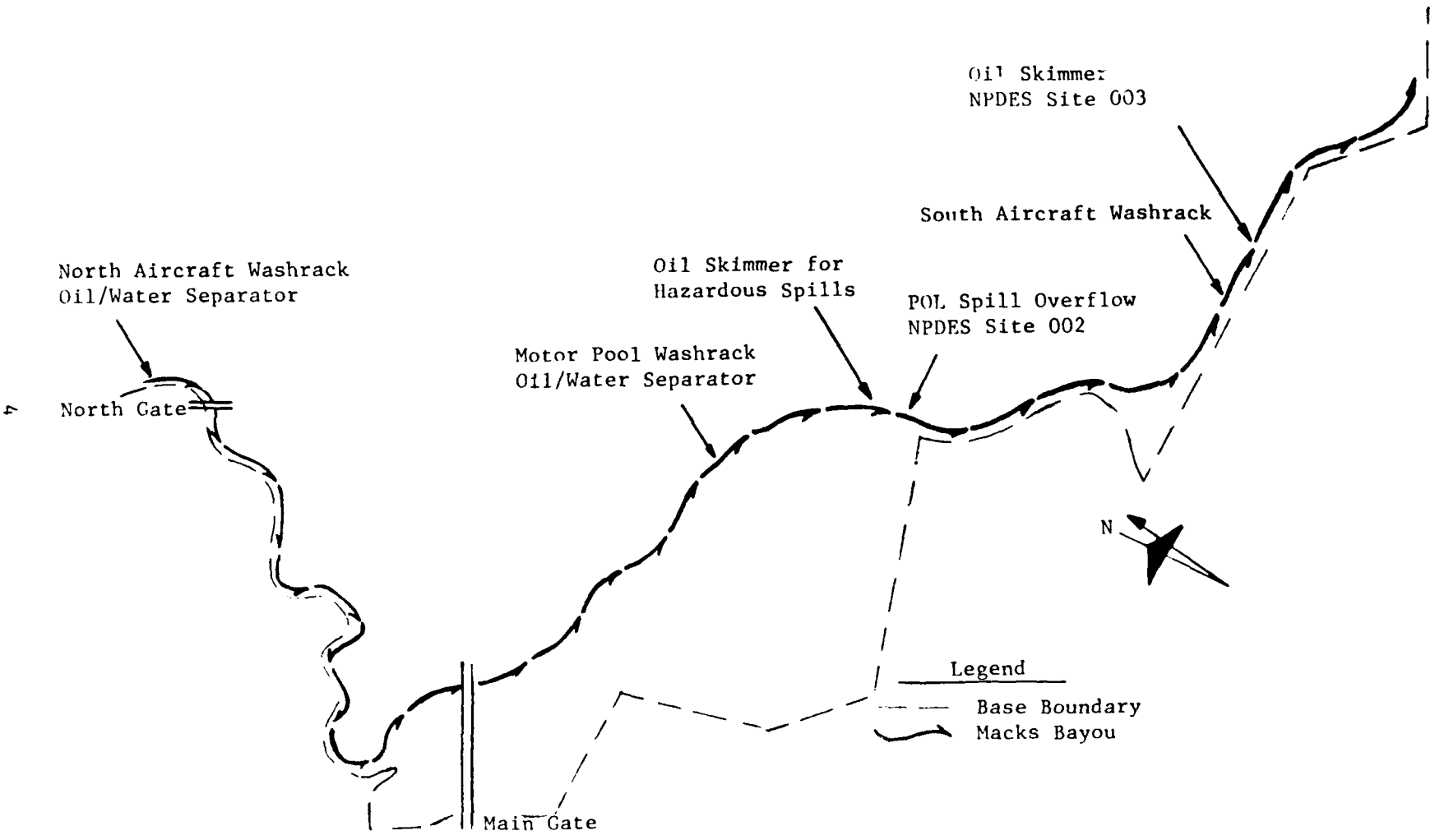

Figure 1. Various Outfalls Into Macks Bayou

b. Flow - Daily flow readings were calculated at lift stations 4725 and 3455, using time meter readings and pump capacities. Flow readings from site 003 at Macks Bayou were calculated using a Gurly meter to determine velocity and the cross sectional area of the bayou. Flow readings from site 002 were calculated using a Vee notch weir. Rainwater is periodically discharged to Macks Bayou from the POL emergency containment basin (Site 002) through release valves. Daily flow readings were calculated at the North Washrack using a Manning flowmeter. Due to instrument failure the actual flowrates could not be determined. Daily flows for these sites are shown in Table 4.

Table 4. Flow Measurements

Site	Date	Daily Flowrate (X1000 Gallons)	Site	Date	Daily Flowrate (X1000 Gallons)
L.S. 472	16 March	84.0	Outfall 003	16 March	98.0
	17 March	120.0		17 March	138.0
	18 March	190.5		19 March	568.0
	19 March	70.0		21 March	239.0
	20 March	70.0		22 March	220.0
	21 March	120.0		23 March	1955.0
	22 March	111.0			
L.S. 3455	16 March	21.0	Outfall 002	21 March	220.0
	17 March	118.5			
	18 March	40.5			
	19 March	66.0			
	20 March	66.0			
	21 March	67.5			
	22 March	75.0			

c. Sampling

(1) Sampling Site Numbers, Locations and type of wastewater system are included in Table 5.

Table 5. Wastewater Sampling Site Locations

Site	Location	Type
1	L.S. Building 4725, Influent channel	sanitary
2	L.S. Building 3455, Wet well	sanitary
3	Building 6824, 917th Conventional Fuels separator	sanitary
4	Building 6825, 917th Vehicle Washrack separator	sanitary
5	Building 6827, 917th Engine Shop separator	sanitary
6	Building 6638, POL Vehicle Fuel separator	sanitary
7	Building 5766/78, FMS washrack separator	sanitary
8	Building 4186, North Transportation separator	sanitary
9	Building 4186, South Transportation separator	sanitary
10	Building 6426, Fire Department washrack separator	sanitary
11	Building 4412, CE Transportation washrack	sanitary
12	Building 6213/4, Fuel Cell Repair separator	sanitary
13	Building 6215, Fuel Cell Repair separator	sanitary
14	Building 6447, FMS AGE washrack	sanitary
15	Fire Training Pit	to grade
16	Building 6437, Demineralized Water Plant separator	sanitary
17	Building 6626, FMS Corrosion Control separator	sanitary
18	Building 4565, Photo Lab	sanitary
19	Building 5755, NDI Shop lateral connection	sanitary
20	North Aircraft washrack separator	sanitary-storm
21	South Aircraft washrack outfall	storm
22	Site 003, Macks Bayou skimmer	storm
23	Site 002, POL storage area dike drain	storm

(2) Sampling Frequency. Five days of 24-hour equiproportional samples composited hourly were taken at Sites 1, 2 and 22, except for a 1-day grab sample taken on 21 March. The majority of the other sites were 1-day equiproportional samples composited hourly except for 1-day grab samples taken at sites 5, 11, 12, 13, 14, 15, 18 and 19. Isco 2700 Automatic Wastewater Composite Samplers were used at all sites. All volatile organic and oils and grease samples were grab samples.

(3) Sampling Strategy. The strategy for determining how many samples to analyze from any given site was based on the available resources, the changing nature of the wastewater, the probability of finding a particular parameter in the time frame, and the type of analysis required. A summary of the sites and the analyses performed is included in Table 6.

Table 6. Site/Analyses

Parameters	Site Number	1	2	3	4	5	6	7	8	9	10	11	12	13
pH		X	X	X	X	X	X	X	X	X	X	X	X	X
Temperature		X	X	X	X	X	X	X	X	X	X	X	X	X
Conductivity		X	X	X	X	X	X	X	X	X	X	X	X	X
Total Suspended Solids		X	X	X	X	X	X	X	X		X	X	X	X
Biochemical Oxygen Demand		X	X											
Chemical Oxygen Demand		X	X	X	X	X	X	X	X	X	X	X	X	X
Oils and Grease		X	X	X	X	X	X	X	X	X	X	X	X	X
Total Phenols		X	X				X					X		
Phenols (EPA Method 604)		X	X											
Volatile Hydrocarbons		X	X			X								
Metals		X	X					X	X	X		X		
Fluorides											X			
Surfactants (MBAS)		X	X				X	X	X	X	X	X	X	X
Char. Haz. Waste.				X	X									

Parameters	Site Number	14	15	16	17	18	19	20	21	22	23
pH		X	X	X	X	X	X	X	X	X	X
Temperature		X	X	X	X	X	X	X	X	X	X
Conductivity		X	X	X	X	X	X	X	X	X	X
Total Suspended Solid		X	X	X	X	X	X	X	X	X	X
Biochemical Oxygen Demand										X	
Chemical Oxygen Demand		X	X	X	X	X	X	X	X	X	X
Oils and Grease		X	X	X	X	X	X	X	X	X	X
Total Phenols					X			X	X	X	
Phenols (EPA Method 604)					X						
Volatile Hydrocarbons			X		X		X			X	
Metals					X	X	X	X	X	X	
Fluorides			X								
Surfactants (MBAS)		X	X		X			X	X	X	
Char. Haz. Waste.											

(4) Sampling Analyses. The method of analysis and sample preservation prescribed for each parameter are listed in Table 7.

Table 7. Analyses and Sample Preservation Methods

Parameter	Preservation	Method	Where	Who
Biochemical Oxygen Demand	none	E405.1	on-site	USAFOEHL
Characteristic Hazardous Waste	none	E625	Brooks AFB	USAFOEHL
Chemical Oxygen Demand	H_2SO_4	E410.4	Brooks AFB	USAFOEHL
Conductivity	none	A205	on-site	USAFOEHL
Fluoride	none	E340	Brooks AFB	USAFOEHL
ICP Metals Screen Ag, Al, As, Be, Cd, Cd, Co, Cr, Cu, Fe, Hg, Pb, Mg, Mn, Mo, Ni, Ti, V	HNO_3	E200.7	Brooks AFB	USAFOEHL
Oils and Grease (Total Recoverable)	H_2SO_4	E418.1	Brooks AFB	USAFOEHL
Phenols	none	E604	contract-lab	UBTL
Phenols (Total Recoverable)	H_2SO_4	E420	Brooks AFB	USAFOEHL
pH	none	A423	on-site	USAFOEHL
Purgeable Halocarbons	none	S8010	contract-lab	UBTL
Purgeable Aromatics	none	S8020	contract-lab	UBTL
Surfactants (MBAS)	none	E425.1	Brooks AFB	USAFOEHL
Temperature	none	E170.1	on-site	USAFOEHL
Total Suspended Solids	none	A209	on-site	USAFOEHL

Notes: A indicates Standard Methods for the Evaluation of Water and Wastewater[1]
E indicates EPA Methods for Chemical Analysis of Water and Wastes[4]
S indicates SW-846 Hazardous Waste Analysis Method
UBTL is Utah Biomedical Test Laboratories, Salt Lake City UT

d. Hazardous Waste Survey. The hazardous waste survey was performed to assist in characterizing the wastewater being discharged to the sanitary and stormwater systems. Ten shops were visited to determine the shop duties, chemicals used in the facility and methods of waste disposal. Survey members toured the shops and distributed hazardous waste forms (see Figure 2) for supervisors to record chemical usage and disposal practices.

B. Results:

The following is a discussion by sites of the wastewater characterization survey. Only results that are pertinent in characterizing the wastewater from the sanitary and stormwater systems will be discussed. The Bossier City, Louisiana Wastewater Discharge Permit standards (permit no. BC0022) are applicable to the two lift stations, 4725 and 3455, leaving the base to the treatment plant. Pretreatment standards (40 CFR, PART 433- Metal Finishing Point Source Category) are applicable to industrial facilities discharging to the sanitary sewer except at NDI, Hospital and Photo Shops. NPDES permit standards (permit no. LA0007293) are applicable to sites on Macks Bayou.

1. Wastewater Site Descriptions and Results

a. Five Day Sites. Due to quality control problems, three out of five days of sampling for BOD_5 can be reported confidently.

Site 1. Lift Station, building 4725 receives sewage from the 917th National Reserve Unit, Hospital, Civil Engineering complex, housing areas and dormitories. Samples were taken at the influent channel of the lift station. A BOD/COD ratio of 0.56 suggests that the waste is mostly domestic in nature. Wastewater is generally considered to be more industrial in nature when the ratio falls below 0.30. Results for total suspended solids (TSS), pH, oils and grease, and phenols were well below city discharge limitations (see Table 1 for discharge limitations). One BOD_5 result of 360 mg/l exceeded the BOD_5 discharge permit limit of 250 mg/l. A large amount of floating scum was observed in the influent channel throughout the entire sample period. Scum adds greatly to the BOD concentration when included in a sample. Volatile halocarbons (SW-846 Method 8010), volatile aromatics (SW-846 Method 8020) and ICP metals, although detected, are not regulated under the current discharge permit. EPA Method 8010 compounds found were chlorobenzene (88 µg/l) and o-xylene (38 µg/l). The highest metal concentrations detected from five days of samples were 0.027 mg/l, 0.195 mg/l and 0.193 mg/l for lead, nickel and zinc, respectively.

Site 2. Lift Station, building 3455, receives sewage from the base housing complex, base transportation and 2 FMS facilities. Samples were taken from the pump station wet well. BOD/COD ratios over a three day period suggest that the waste is domestic in nature. The average BOD/COD ratio was 0.60. TSS, pH and oil and grease five day averages were well below city discharge limits, although an oils and grease concentration of 126 mg/l on 22 March exceeded the discharge limit of 100 mg/l. Three days of BOD_5 averaged results were 407 mg/l, exceeding the discharge limit of 250 mg/l. The limit was exceeded on all three days of confirmed BOD_5 samples. The 5-day average for total extractable phenols (EPA Method 420.2) was .186 mg/l, exceeding the discharge limit of 0.10 mg/l. Large amounts of floating scum were

Shop:
Shop Supervisor:
Shop Duties:

Building Number:
Autovon: 2-

CATACOMBS OF WASTE AND DISPOSAL METHODS

TYPE OF WASTE	DISPOSAL METHOD	AMOUNT GENERATED (gal/month)	COMMENTS
1. * PAINT WASTE AND THINNERS	XXXXXXXX		
2. * STRIPPING WASTE	XXXXXXXX		
3. * WASTE ACIDS	XXXXXXXX		
4. * SOAPS/CLEANERS			
5. * WASTE OIL			
6. * WASTE FLUIDS			
7. * WASTE FUELS			
8. USED ANTIFREEZE			
9. * WASTE SOLVENTS OTHER THAN FD-680	XXXXXXXX		
10. * FD-680 a. USED IN A TANK/VAT (NORMALLY DRUMMED)	D		
b. USED FOR WASHING (NORMALLY RINSED DD)	DDD		
11. * PHOTO WASTES	XXXXXXXX		
12. *			

* specify the types used on next page

Examples of disposal Practices:

D-DRUMMED BTT-RETURNED TO FUEL TANKS DD-DOWN DRAIN PIT-PLACED IN TANK
NDD-NEUTRALIZED FIRST THEN PLACED DOWN DRAIN NA-NOT APPLICABLE

SPECIFIC CHEMICALS USED

PAINT WASTE AND THINNERS

Specific Waste Types	Waste Disposal Method	Amount of Waste Generated per Month
Paints		
Latex		
Polyurethane		
Enamel		

Thinners (list)

DOES THE SHOP USE ANY SAFETY KLEEN UNITS TO CLEAN PAINTING EQUIPMENT?
(YES / NO) CIRCLE ONE
IF SO HOW MANY UNITS?
CAPACITY OF EACH UNIT:

STRIPPERS

Name of Stripper	Manufacturer	National Stock Number	Amt used/month or Tank Cap.	Amt used/month or Change out Freq.	Disposal METHOD

ACIDS

Name of Acid	Manufacturer	Amt used/mo	Disposal Method
Battery Acid	XXXXXXXXXX		

SOAPS/CLEANERS

Name of Soap	Manufacturer	Amt used/mo	National Stock Number

Chemical listing (cont.)

OILS/FLUIDS

Type of oil/fluid	Amt used/month	Disposal Method (If waste goes to a Tank give Capacity and location)
Brake Fluid		
Transmission Fluid		
Hydraulic Fluid		
7808 Oil		

SOLVENTS/DEGREASANTS

Name of Chemical	Manufacturer	NSN	Amt used/month or Tank Cap.	Amt used/month or Change out Freq.	Disposal METHOD
Carbon Remover					
FD-680 used in a tank/vat		XXXXXXXX			
FD-680 used on the Wash-rack		XXXXXXXX			

DOES THE SHOP USE ANY SAFETY KLEEN DEGREASING UNITS (Y/N)? IF SO HOW MANY:
CAPACITY OF EACH UNIT:

PHOTO CHEMICALS

Name of Chemical	Manufacturer	Amt/month or Tank Cap.	Amt/month or Change out Freq.	Disposal Method

Chemical listing (cont.)

MOS CHEMICALS

Name of Chemical	Manufacturer	National Stock Number	Amt/month or Tank Cap.	Amt/month or Change out Freq.	DISPOSAL METHOD
Emulsifier					
Dye Penetrant					
Developer					

Other Chemicals Not Listed

Name of Chemical	Manufacturer	NSN	Amt/month or Tank Cap.	Amt/month or Change out Freq.	DISPOSAL METHOD

SIGNATURE OF PERSON FILLING OUT THE FORM:

Figure 2. Hazardous Waste Form

observed in the lift station wet well, contributing to BOD and oils and grease problems. Volatile halocarbons, volatile aromatics and ICP metals, although detected, were not regulated by the current discharge permit. A 1-day grab sample for volatile halocarbons yielded a 10 µg/l concentration of tetrachloroethylene. A 1-day composite sample for phenols (EPA Method 604) yielded an 18 µg/l concentration of pentachlorophenol. The highest 1-day metal concentrations were 0.194 mg/l for nickel and 0.205 mg/l for zinc.

Site 22. The oil skimmer on Macks Bayou is a NPDES permitted site identified by the permit as site 003 (see Table 3 for discharge limitations). Samples were taken midstream on the discharge side of the skimmer. A major portion of the stormwater runoff from the west side of the base flows through this site (see Figure 3). The 5-day average for COD (81 mg/l) exceeded the NPDES discharge limit. This limit of 60 mg/l was exceeded on three out of the five days of samples. The 5-day average for oils and grease and TSS did not exceed the NPDES discharge limits. However, a 1-day oils and grease concentration of 18 mg/l on March 21 did exceed the NPDES discharge limitation of 10 mg/l. A 1-day grab sample for volatile halocarbons and aromatics found none of these compounds. A 1-day composite sample for metals found no significant concentrations.

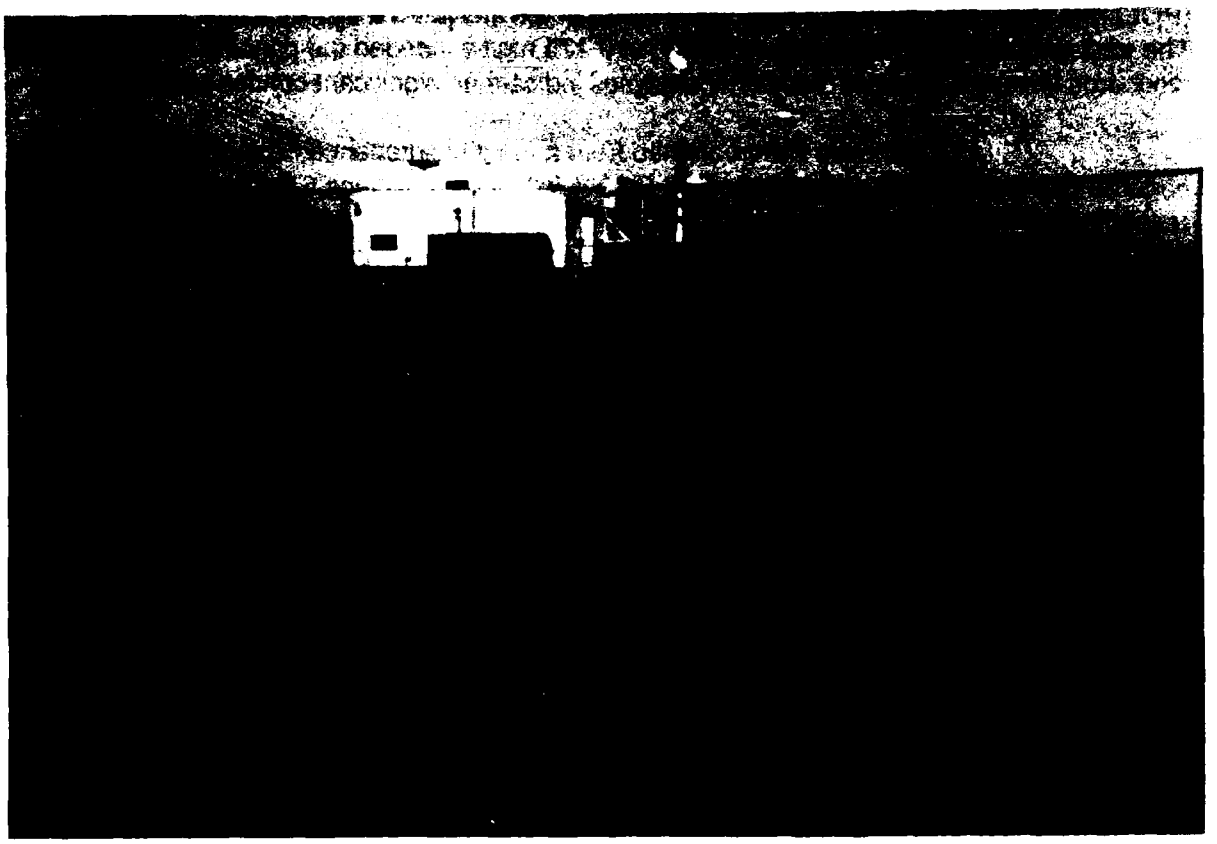

Figure 3. NPDES Site 003, Oil/Water Skimmer

b. One Day Sites.

Site 3. Samples were collected at the separator located adjacent to the 917th Fuel Systems and Corrosion Control facility, building 6824. Parameter analyses indicate no significant concentrations. Characteristic hazardous waste results indicate the sample was not hazardous and essentially water.

Site 4. Samples collected at the 917 vehicle washrack separator located adjacent to building 6825 showed no significant results. Characteristic hazardous waste results indicate that the sample was essentially water.

Site 5. Samples were collected at the 917th Engine Shop separator, located adjacent to building 6827. A COD concentration of 2860 mg/l suggested an industrial discharge. A low pH of 5.0, combined with a conductivity of 4000 µmhos, suggest possible discharge of an acidic waste. The summation of two priority pollutants (2.7 mg/l of 1,1,1-trichloroethane and 8.5 mg/l of 1,3-dichlorobenzene) exceeded the Total Toxic Organic (TTO) pretreatment limit (40 CFR, Part 433) of 2.13 mg/l (see Table 2 for discharge limitations). Concentrations of other parameters analyzed were not significant.

Site 6. Samples were collected at the Petroleum, Oils, and Lubricants Branch (POL) fuel separator, building 6638. A pH result of 5.5 indicated a slightly acidic wastewater. The total extractable phenols concentration of 0.175 mg/l exceeded the sanitary sewer discharge limit of 0.10 mg/l. Additional analyses indicate no significant concentrations.

Site 7. Samples were obtained from a Field Maintenance Squadron (FMS) separator servicing the Machine Shop and Propulsion Shop, buildings 5766 and 5778, respectively. Metal concentrations of 0.436 mg/l for nickel and 0.137 mg/l for zinc were below the pretreatment standards of 3.98 mg/l and 2.61 mg/l. Additional parameter analyses indicated no significant concentrations.

Site 8. Samples were obtained from an oil/water separator north of building 4186, Base Transportation. COD results of 3540 mg/l indicated the industrial wastewater contained organic compounds. Metal concentrations of 0.083 mg/l, 0.410 mg/l and 0.497 mg/l were detected for lead, nickel and zinc, respectively. The metal concentrations were well below pretreatment limits for lead (0.69 mg/l), nickel (3.98 mg/l) and zinc (2.61 mg/l). Concentrations were not significant for other parameters analyzed.

Site 9. Samples were obtained from an oil/water separator south of building 4186. An oils and grease result of 96 mg/l combined with a COD concentration of 2150 mg/l indicates the presence of organic compounds in the wastewater. A pH result of 4.3 was below the pretreatment limit of 5.0 and suggests that the shop may be disposing battery acid down the drain. Metal concentrations of 0.444 mg/l for nickel and 2.266 mg/l for zinc were below the pretreatment standards of 3.98 mg/l and 2.61 mg/l for both respective metals. An iron concentration of 49.5 mg/l (not regulated by pretreatment standards) probably indicates iron oxide dissolving into solution under acidic conditions. Additional parameter analyses indicated no significant concentrations.

Site 10. Samples were obtained from the Fire Department separator, building 6426. Parameter results indicated an effluent of domestic nature.

Site 11. Samples were obtained from the Civil Engineering washrack, building 4412. The total extractable phenols concentration of .015 mg/l was well below the sewer discharge limit for phenols of 0.10 mg/l. A metal concentration of 0.166 mg/l for nickel was well below the pretreatment limit of 3.98 mg/l. Analyses of additional parameters indicate no significant concentrations.

Site 12. Samples were obtained from the Fuel Cell Repair separator located between buildings 6213 and 6214. Parameter analyses indicate no significant concentrations.

Site 13. Samples were obtained from the Fuel Cell Repair separator, building 6215. Parameter results indicated no significant elevations in levels of pollutants.

Site 14. Samples were obtained from the FMS Aerospace Ground Equipment washrack near building 6447. Parameter results indicated an effluent with no specific problems.

Site 15. Samples were obtained from the Fire Training Pit. Volatile halocarbon and aromatic compounds were not detected. Additional parameter analyses indicate no other significant concentrations.

Site 16. Samples were obtained from the Demineralized Water Plant separator, building 6437. The wastewater had a suspended solids content of 158 mg/l, below the sewer ordinance limit of 250 mg/l. Concentrations were not significant for other parameters analyzed.

Site 17. Samples were collected at the 2nd FMS Corrosion Control separator, building 6626. High COD results of 13600 mg/l indicated an industrial wastewater with a high pH (10.3). Four priority pollutants found (11 mg/l of methlene chloride, 26 mg/l of 1,4-dichlorobenzene, 16 mg/l of toluene and 4.68 mg/l of total extractable phenols) greatly exceeded the Total Toxic Organic (TTO) pretreatment limit of 2.13 mg/l (40 CFR, Part 433, Table 3). The pretreatment standards for chromium of 2.77 mg/l and zinc of 2.61 mg/l were also exceeded by results of 4.29 mg/l and 3.09 mg/l, respectively. The sanitary sewer discharge limitation (see Table 1) of 100 mg/l for oils and grease was also exceeded (127.2 mg/l).

Site 18. Samples were collected at the Photo Lab sanitary sewer connection near building 4565. The wastewater had a fairly high suspended solids content of 132 mg/l. Metals analysis detected a silver concentration of 0.11 mg/l. Concentrations were not significant for other parameters analyzed.

Site 19. Samples were obtained from the Non-Destructive Inspection (NDI) lateral connection located adjacent to building 5755. Volatile halocarbon and aromatic results yielded no significant findings. Metals analyses detected a silver concentration of 0.05 mg/l. Additional parameter analyses indicate no significant concentrations.

Site 20. Samples were obtained from the north aircraft washrack separator located adjacent to building 6208. Dye testing demonstrated that although the separator is connected to the sanitary sewer directly, during high flow, a portion of the wastewater from the separator enters Macks Bayou. No total extractable phenols were detected. Concentrations were not significant for other parameters analyzed.

Site 21. Samples were obtained from the south aircraft washrack outfall located in the 917th Reserve complex (see Figure 4). Rinsewater from the cleaning operations on the ramps drains to Macks Bayou. No total extractable phenols were detected. A nickel concentration (0.120 mg/l) was well below the pretreatment standard of 3.98 mg/l. Concentrations were not significant for other parameters analyzed.

Figure 4. South Aircraft Washrack Outfall

Site 23. Samples were taken at a NPDES permitted Site 002, located on Macks Bayou west of storage tank 5934 (see Figure 5). Concentrations for COD (15 mg/l), TSS (15 mg/l) and oils and grease (none detected) were well within the NPDES discharge limitations of 60 mg/l, 20 mg/l and 10 mg/l, respectively.

Figure 5. NPDES Site 002, West of Storage Tank 5934

2. Shop-by-Shop Description of Industrial Practices

a. 917th Corrosion Control — Building: 6824
Shop Supervisor: Mr Williams — AUTOVON: 781-6824

Corrosion Control Shop personnel spot strip, corrosion treat and paint small sections of A-10 aircraft. About 1/2 gallon/month of waste alodine is drained to the sanitary sewer via an oil/water separator. All paint waste and thinners (4 gallons/month) and stripping waste (methylene chloride base, 4 gallons/month) are drummed separately as hazardous waste and placed at a secured hazardous waste accumulation site located adjacent to the building. All

drummed waste is sent to the Defense Reutilization Management Office (DRMO) for eventual disposal. The shop also has an indoor washrack facility for cleaning A-10 aircraft. Aircraft soap (380 gallon/month, diluted 10:1) is used for cleaning aircraft. Cleaning wastes drain to the sanitary sewer via an oil/water separator.

b. 917th Engine Shop — Building: 6827
Shop Supervisor: Mr Neely — AUTOVON: 781-2379

Engine Shop personnel are responsible for the buildup and repair of TF-34 engines and auxiliary power plants. Waste aircraft soap (50 gallons/month, diluted 10:1) and PD-680 (25 gallons/month) are used for cleaning equipment and floors. Cleaning wastes are drained directly to the sanitary sewer via an oil/water separator. Waste 7808 and 1010 engine oils (30 gallons/month), fuels (5 gallons/month) and wastes from the parts cleaning room (see Figure 6) are drummed separately. These wastes are placed at a secured accumulation site, located in front of the facility, for eventual disposal by DRMO. Waste hydraulic fluid (1 gallon/ month) is sent to the Aerospace Ground Equipment (AGE) accumulation site, building 6447. The shop also has a 30 gallon Safety Kleen degreasing unit that is changed out by contractor every 3 months.

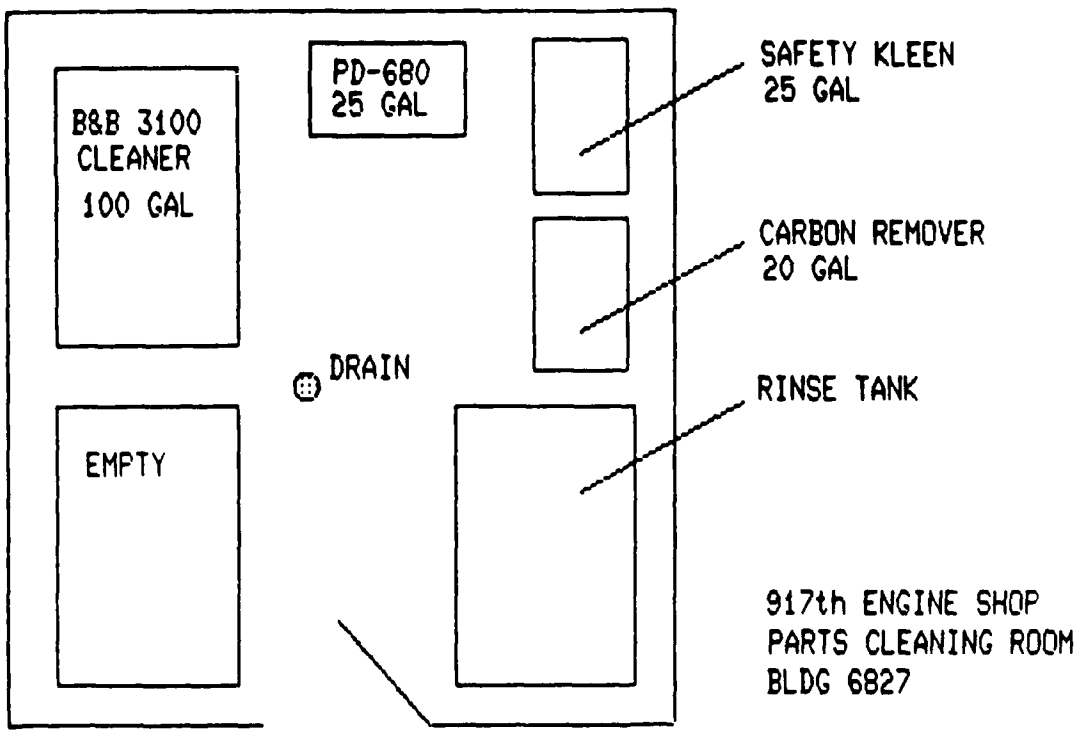

Figure 6. Parts Cleaning Room, 917th Engine Shop

c. 917th Fuel Cell Repair — Building: 6824
Shop Supervisor: MSgt Steward — AUTOVON: 781-4455

Fuel Cell Repair personnel are responsible for the repair of internal and external fuel systems on A-10 aircraft. About 110 gallons/month of JP-4 jet fuel are generated from the repair of fuel systems. About 100 gallons of fuel are vacuumed into bowsers for reuse by POL. Approximately 10 gallons of fuel cannot be recaptured and is drained to a fuel/water separator that drains directly to the sanitary sewer. The separator is cleaned out when needed.

d. 2nd FMS AGE Shop — Building: 6447
Shop Supervisor: SSgt Hickman — AUTOVON: 781-3569

Aerospace Ground Equipment (AGE) personnel are responsible for the inspection and maintenance of approximately 250 pieces of AGE equipment. All unserviceable batteries are sent to the 2nd FMS Battery Shop. Waste oils (72 gallons/month), hydraulic fluid (25 gallons/month) and fuels (95 gallons/ month) are all placed into separate 55 gallon drums. These wastes are placed at a secured accumulation site located adjacent to the facility for eventual disposal by DRMO. The shop also has two 25 gallon Safety Kleen degreasing units that are changed out by contractor every 3 months. Aircraft soap (25 gallons/month, diluted 10:1) used at the washrack for cleaning equipment is rinsed down the drain to the sanitary sewer via an oil/water separator.

e. 2nd FMS Corrosion Control Shop — Building: 6626
Shop Supervisor: SSgt Clayton — AUTOVON: 781-4405

Corrosion Control Shop personnel are responsible for stripping, corrosion treatment and painting small sections of B-52, KC-135 and KC-10 aircraft. Paint waste and thinners (55 gallons/month) are drummed separately and placed at a secured waste accumulation site located adjacent to the building. Waste acids (1 gallon/month, neutralized with sodium bicarbonate) and waste strippers (20 gallons/month, NS 8010-00-348-7716) are drained to the sanitary sewer via an oil/water separator. The facility also has a 300 gallon vat of hot wheel stripper (NS 8010-01-048-1059) that is changed out every 6 months. The vat is currently located outside. The dragout from the hot stripper appears to have killed all surrounding vegetation in about a 10 foot radius. The shop has a large washrack for cleaning aircraft. About 600 gallons/month of aircraft soap and 300 gallons/month of PD-680 are used for cleaning and degreasing the aircraft. The cleaning wastes pass through an oil/water separator before entering the sanitary sewer.

f. 2nd FMS Propulsion Shop — Building: 5778
Shop Supervisor: SSgt Walter — AUTOVON: 781-3740

Shop personnel are responsible for the tear-down and build-up of J-57 jet engines. Waste oils (100 gallons/month of 7808,1010 oils), waste fuel (55 gallons/month of JP-4), carbon remover (3 gallons/month) and waste hydraulic fluids (30 gallons/month) are drummed separately and placed at a secured waste accumulation site located adjacent to the facility.

The wastes are sent to DRMO for eventual disposal. Aircraft soap (55 gallon/month) used for cleaning floors is rinsed to the sanitary sewer via an oil/water separator. The shop also has a 40 gallon Safety Kleen degreasing unit that is changed out by contractor every 3 months.

g. 2nd FMS NDI — Building: 5755
Shop Supervisor: SSgt Martin — AUTOVON: 781-3146

Personnel of the NDI shop perform six nondestructive tests to inspect B-52, KC-135 and K-10 aircraft components. NDI personnel are responsible for x-ray inspection, engine oil analysis, magnetic particle inspection, dye penetrant inspection, ultrasonic and eddy current inspections. Chemicals used for the x-ray inspection (60 gallons/year of developer and fixer) are sent to the Photo Lab for silver recovery before entering the sanitary sewer system. Engine oil (5 gallons/month) used for the oil analysis is sent to the Jet Shop accumulation site (building 5778) for disposal through DRMO. Developers (220 gallons/year) used in the dye penetrant inspection are drained to the sanitary sewer. Magnetic particle inspection fluid (15 gallons/ month), 1,1,1-trichlorethane (5 gallons/month), dye penetrants (220 gallons/year) and emulsifiers (220 gallons/year) are drummed as hazardous waste and sent to DRMO for eventual disposal.

h. 2nd BMW Vehicle Maintenance — Building: 4186
Shop Supervisor: MSgt Richard — AUTOVON: 781-3947

Personnel at the Vehicle Maintenance Shop are responsible for inspecting, servicing, and maintaining about 800 base vehicles. The shop has two 20 gallon Safety Kleen degreasing units that are changed out by contractor about every 3 months. Clean-Crete (100 gallons/ month, diluted 10:1) used for cleaning floors and equipment is drained to the sanitary sewer through an oil/water separator. Stripping waste that cannot be collected and drummed (3 gallons/month) is also washed down the drain to the sanitary sewer. Paint waste and thinners (18 gallons/months) are drummed as a hazardous waste and is placed in a secured hazardous waste accumulation site for eventual disposal through DRMO. Battery acid (20 gallon/month) is placed into 15 gallon plastic drums and disposed of through DRMO as a hazardous waste. Waste brake fluid (3 gallons/month), transmission fluid (15 gallons/month), hydraulic fluid (15 gallons/month) and motor oil (300 gallons/month) are stored in a 500 gallon above ground tank. When full, the wastes are taken to DRMO for eventual disposal. All fuels (100 gallon/month) are stored in a fuel bowser and taken to POL for reclamation. Waste antifreeze (100 gallons/month) is given to Civil Engineering and applied on the roads in the winter.

i. 2nd BMW Fire Department — Building: 6426
Shop Supervisor: MSgt Peacock — AUTOVON: 781-2642

Fire Department personnel are responsible for fire control throughout the base. Maintenance duties include cleaning and performing light maintenance of fire department vehicles. Waste oils (8 gallon/month), PD-680 (10 gallons/month) and hydraulic fluid (4 gallons/ month) are drummed separately and sent to building 4186, Vehicle Maintenance Shop. About 20 gallons/month of aircraft soap from cleaning operations is drained to the sanitary sewer via an oil/water separator.

j. Photo Lab — Building: 4565
Shop Supervisor: SSgt Palmer — AUTOVON: 781-2521

Photo Lab personnel are responsible for black and white and color photo processing throughout the base. All waste fixers (33 gallons/month) are passed through silver recovery units then drained to the sanitary sewer. All other photographic chemicals are drained directly to the sanitary sewer. The Base Hospital, Dental Clinic and NDI shop also use the Photo Lab's silver recovery unit.

III. CONCLUSIONS

Sites 1 and 2. The BOD discharge limit of 250 mg/l was exceeded for 1 out of 2 days of confirmed samples for L.S. 4725 and for 3 out of 3 days of confirmed samples for L.S. 3455. High BOD concentrations indicate the presence of organic compounds in the sanitary sewer wastewater. An oils and grease result of 126 mg/l exceeded the discharge limit of 100 mg/l for L.S. 3455 on 1 out of 5 days of samples. The concentration for total extractable phenols exceeded the discharge permit standard of 0.10 mg/l on 2 out of 5 days of samples for L.S. 3455. The phenols exceedance may be to a great extent phenoxy soaps used in cleaning operations at the washracks. Large amounts of floating scum were also observed in the lift station wet well which contributed to high BOD and oil and grease concentrations. A possible source of that grease is from food serving facilities.

Site 22. The average COD concentration was 81 mg/l. COD concentrations exceeded the NPDES discharge limitation of 60 mg/l on 3 out of the 5 days of samples for site 003. An oils and grease concentration of 18 mg/l exceeded the NPDES discharge limitation of 10 mg/l on 1 out of 5 days of samples. Both the COD and oils and grease violation are probably due to effluent from the 917th washrack.

Site 5. A TTO concentration of 11.2 mg/l (2.7 mg/l of 1,1,1-trichloroethane and 8.5 mg/l of 1,3-dichlorobenzene) exceeded the pretreatment standard of 2.13 mg/l in the 917th Engine Shop separator. The TTO results indicate the release of degreasing solvents to the sanitary sewer. This shop needs a pretreatment process if the rinsewater cannot be collected as a hazardous waste. Pretreatment, in the form of air stripping or powdered activated charcoal (PAC) adsorption could be performed at a central location on wastes from this shop and Corrosion Control Shop. A low pH of 5.0 combined with a conductivity of 4000 µmhos suggests the discharge of an acidic waste to the sanitary sewer.

Site 6. A total extractable phenol concentration of 0.175 mg/l for the POL separator exceeded the sanitary sewer discharge limitation of 0.10 mg/l. Phenoxy soaps from cleaning operations are probably responsible for the phenols in the wastewater.

Sites 8 and 9. A COD concentration of 3540 mg/l from the North and South Transportation separators indicate the presence of organic compounds in the form of solvents, oils or fuels. A pH of 4.3 exceeds the pretreatment limit of 5.0 and suggests the disposal of insufficiently neutralized battery acid down the drain. Sources of the significant iron concentration of 49 mg/l could include corroding plumbing from acid discharge, or vehicle rust removal.

Site 17. A high COD concentration of 13,600 mg/l from the Corrosion Control separators indicate the presence of an industrial wastewater containing organic compounds. A high pH of 10.3 indicates an alkaline wastewater. The TTO concentration of 57.68 mg/l greatly exceeded the pretreatment standard of 2.13 mg/l. The high concentrations of TTO demonstrate that significant amounts of strippers, thinners and solvents are entering the sanitary system. Concentrations of 4.29 mg/l for chromium and 3.09 mg/l for zinc exceeded pretreatment limits of 2.77 mg/l and 2.61 mg/l for both respective metals. The high metal concentrations could have possibly resulted from zinc chromate found in primers and chromic acid found in the alodine treatment. A 1-day oils and grease sample concentration of 127.2 mg/l exceeded sanitary sewer discharge limitations of 100 mg/l. The high oils and grease concentration probably resulted from parts cleaning prior to stripping and painting operations.

There are two basic alternatives available to reduce the concentrations of TTO and metals to below the pretreatment limits. One alternative is to drum the stripping and paint waste and rinsewater as hazardous waste for disposal. This would essentially remove the hazardous waste from the sanitary sewer.

The other alternative is to install a pretreatment system at the point of generation before it enters into the sanitary sewer system. A principal method used for metals removal is pH adjustment, precipitation and filtration. Two methods available to reduce the concentrations of TTO in the effluent are air stripping (to volatilize the TTO compounds to the ambient air) or PAC adsorption (to adhere TTO compounds to the activated charcoal).

It was also observed during the hazardous waste survey that a 300 gallon hot stripper vat was being used outside the facility. A large amount of vegetation surrounding the vat had been killed off. The stripping vat should be moved inside the facility where dragout can be collected and disposed of in an environmentally acceptable manner.

Macks Bayou Reconnaissance. During the Macks Bayou Reconnaissance a new oil/water separator was being constructed to service a washrack in the vehicle maintenance complex and the effluent would be discharged to the bayou. This discharge would amount to an unpermitted discharge adding to the oils and grease and COD problem. This separator should be connected to the sanitary sewer system.

IV. RECOMMENDATIONS

Sites 1 and 2. The oils and grease and BOD problem at L.S. 3455 and L.S. 4725 can be reduced by improving maintenance or installing more effective grease traps at food serving facilities, and maintenance at the lift stations. Other facilities disposing organic compounds (solvents, soaps, etc.) to the sanitary sewer should take positive steps to minimize the amount of waste entering the sanitary sewer system. A wet garbage contract for the dining facilities will reduce BOD loading in the sewers.

Site 22. The COD and oils and grease concentrations at NPDES site 003 can be reduced by redirecting the north and south aircraft washracks wastewater to the sanitary sewer system. The lift station at the north washrack should have the water level adjusted so that all wastewater enters the sanitary sewer. The same type of collection and diversion system should be installed at the south ramp.

Site 5. Operations at the 917th Engine Shop that result in solvents being rinsed into the sanitary sewer should be minimized until the rinsate can either be containerized or sent to a pretreatment system.

Site 6. Phenoxy soaps used by POL for cleaning operations contribute to exceeding the sanitary sewer discharge limit for phenols. Switching to a detergent which does not contain phenol derivatives should alleviate the problem.

Sites 8 and 9. The dumping of battery acid to the sanitary sewer may be responsible for a pH of 4.3 in the separators. Proper neutralization or drumming of waste acids should remedy the pretreatment violation.

Site 17. The Corrosion Control Shop is exceeding the pretreatment limits for TTO, chromium and zinc. The 917th Engine Shop is exceeding the pretreat- ment limits for TTO. A pretreatment system should be installed servicing both shops to remove the waste prior to entering the sanitary sewer.

Site 17. Dragout from a 300 gallon stripping vat located outside the Corrosion Control Shop should be controlled. The tank should be moved inside where spills can be prevented from entering the environment.

Macks Bayou Reconnaissance. All industrial wastewater discharges should be connected to the sanitary sewer system in order to meet NPDES standards. Stormwater should be the only wastewater entering Macks Bayou from Barksdale AFB.

REFERENCES

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2. Bossier City, Louisiana, "Wastewater Discharge Permit," (permit number BC0022), 1983.

3. Code of Federal Regulations, Title 40, Part 433, Office of the Federal Register, Washington DC, (1987).

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

5. USEPA, Treatability Manual. Technologies for Control/Removal of Pollutants, Vol. III, (1980).

6. USEPA, Region VI, National Pollution Discharge Elimination System, (permit no. LA0007293).

APPENDIX

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Wastewater Sampling Site Locations

Site	Location	Type
1	L.S. Building 4725, Influent channel	sanitary
2	L.S. Building 3455, Wet well	sanitary
3	Building 6824, 917th Conventional Fuels separator	sanitary
4	Building 6825, 917th Vehicle Washrack separator	sanitary
5	Building 6827, 917th Engine Shop separator	sanitary
6	Building 6638, POL Vehicle Fuel separator	sanitary
7	Building 5766/78, FMS washrack separator	sanitary
8	Building 4186, North Transportation separator	sanitary
9	Building 4186, South Transportation separator	sanitary
10	Building 6426, Fire Department Washrack separator	sanitary
11	Building 4412, CE Transportation washrack	sanitary
12	Building 6213/4, Fuel Cell Repair separator	sanitary
13	Building 6215, Fuel Cell Repair separator	sanitary
14	Building 6447, FMS AGE washrack	sanitary
15	Fire Training Pit	sanitary
16	Building 6437, Demineralized Water Plant separator	sanitary
17	Building 6626, FMS Corrosion Control separator	sanitary
18	Building 4565, Photo Lab	sanitary
19	Building 5755, NDI Shop lateral connection	sanitary
20	North Aircraft washrack outfall	sanitary-storm
21	South Aircraft washrack outfall	storm
22	Site 003, Macks Bayou skimmer	storm
23	Site 002, Macks Bayou fuel release	storm

Temperature, pH, Conductivity and Total Suspended Solids Results (TSS)

Site	Date	Temperature °C	pH	Conductivity (µmhos)	TSS (mg/l)
1	17 MAR	19	6.9	450	92
1	18 MAR	16	7.4	428	48
1	19 MAR	19	6.9	450	169
1	21 MAR	19	6.9	490	191
1	22 MAR	12	6.7	455	47
1	23 MAR	11	7.3	440	106
2	18 MAR	17	7.1	470	105
2	19 MAR	21	7.0	430	100
2	21 MAR	23	6.9	600	195
2	22 MAR	16	6.1	600	155
2	23 MAR	12	6.1	500	134
3	18 MAR	19	7.8	465	37
4	18 MAR	21	6.8	72	11
5	18 MAR	19	5.0	4000	34
6	18 MAR	14	5.5	162	12
7	18 MAR	13	7.4	195	10
8	19 MAR	18	8.2	265	19
9	19 MAR	17	4.3	600	NR
10	19 MAR	14	6.3	140	58
11	21 MAR	26	6.6	300	24
12	21 MAR	23	6.4	200	50
13	21 MAR	19	6.6	210	6
14	22 MAR	21	7.5	150	56
15	22 MAR	24	8.7	110	13
16	22 MAR	16	6.1	70	158
17	22 MAR	20	10.3	650	77
18	23 MAR	15	8.4	410	132
19	23 MAR	12	7.3	180	6
20	18 MAR	15	6.9	88	5
21	18 MAR	16	7.4	205	16
22	18 MAR	27	7.1	92	8
22	19 MAR	19	6.5	60	6
22	21 MAR	18	6.8	110	13
22	22 MAR	10	6.6	95	5
22	23 MAR	12	6.6	110	12
23	22 MAR	9	8.0	50	15

NR = Not Reported

BOD, COD, Surfactant and Oils and Grease Results (mg/l)

Site	Date	BOD	COD	BOD/ COD	Surfactants (MBAS)	Oils and Grease
1	17 MAR	NR	335	NR	NR	67.6
1	18 MAR	NR	268	NR	NR	22.8
1	19 MAR	NR	232	NR	NR	13.2
1	21 MAR	360	320*	1.13*	NR	40.4
1	22 MAR	223	400	0.56	NR	30.4
2	18 MAR	NR	335	NR	NR	18.0
2	19 MAR	NR	350	NR	NR	16.8
2	21 MAR	300	425	0.71	NR	48.0
2	22 MAR	490	1200	0.41	NR	126.0
2	23 MAR	430	626	0.69	NR	26.8
3	18 MAR	NR	285	NR	NR	12.1
4	18 MAR	NR	37	NR	NR	ND
5	18 MAR	NR	2860	NR	NR	17.4
6	18 MAR	NR	330	NR	1.48	28.0
7	18 MAR	NR	257	NR	0.3	13.5
8	19 MAR	NR	3540	NR	1.2	73.2
9	19 MAR	NR	2150	NR	1.42	96.0
10	19 MAR	NR	57	NR	0.68	21.0
11	21 MAR	NR	37	NR	0.12	ND
12	21 MAR	NR	65	NR	0.24	8.24
13	21 MAR	NR	25	NR	ND	2.52
14	22 MAR	NR	63	NR	0.58	3.48
15	22 MAR	NR	82	NR	1.0	ND
16	22 MAR	NR	360	NR	NR	12.72
17	22 MAR	NR	13600	NR	28.0	127.2
18	23 MAR	NR	775	NR	NR	NR
19	23 MAR	NR	45	NR	NR	NR
20	18 MAR	NR	35	NR	0.1	ND
21	18 MAR	NR	35	NR	0.11	ND
22	18 MAR	NR	ND	NR	NR	ND
22	19 MAR	NR	187	NR	NR	2.68
22	21 MAR	52	90	0.58	NR	18.0
22	22 MAR	32	63	0.51	0.95	ND
22	23 MAR	22	55	0.40	0.58	ND
23	22 MAR	NR	15	NR	NR	ND

NR Indicates No Results
ND Indicates None Detected
* Probably Indicates an Analytical Error

Volatile Halocarbons, SW-846 Method 8010
Detectable Analytical Results (µg/l)*

Parameter	Site	1	2	5	15	17	19	22
Benzyl Chloride		ND	ND	ND	ND	ND	ND	ND
Bromobenzene		ND	ND	ND	ND	ND	ND	ND
Bromodichloromethane		ND	ND	ND	ND	ND	ND	ND
Bromoform		ND	ND	ND	ND	ND	ND	ND
Bromomethane		ND	ND	ND	ND	ND	ND	ND
Carbon Tetrachloride		ND	ND	ND	ND	ND	ND	ND
Chlorobenzene		ND	ND	ND	ND	ND	ND	ND
Chloroethane		ND	ND	ND	ND	ND	ND	ND
2-Chloroethylvinyl Ether		ND	ND	ND	ND	ND	ND	ND
Chloroform		ND	ND	ND	ND	ND	ND	ND
Chlorohexane		ND	ND	ND	ND	ND	ND	ND
Chloromethane		ND	ND	ND	ND	ND	ND	ND
Chlorotoluene		ND	ND	ND	ND	ND	ND	ND
Dibromochloromethane		ND	ND	ND	ND	ND	ND	ND
Dibromomethane		ND	ND	ND	ND	ND	ND	ND
1,1,2-Dichlorobenzene		ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene		ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene		ND	ND	ND	ND	ND	ND	ND
Dichlorodifluoromethane		ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane		ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane		ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethylene		ND	ND	ND	ND	ND	ND	ND
(trans) 1,2-Dichloroethylene		ND	ND	ND	ND	ND	ND	ND
Dichloromethane		ND	ND	ND	ND	1000	ND	ND
1,2-Dichloropropane		ND	ND	ND	ND	ND	ND	ND
(cis) 1,3-Dichloropropene		ND	ND	ND	ND	ND	ND	ND
(trans) 1,3-Dichloropropene		ND	ND	ND	ND	ND	ND	ND
1,1,1,2-Tetrachloroethane		ND	ND	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane		ND	ND	ND	ND	ND	ND	ND
Tetrachloroethylene		ND	10	ND	ND	ND	ND	ND
1,1,1-Trichloroethane		ND	ND	2700	ND	ND	ND	ND
1,1,2-Trichloroethane		ND	ND	ND	ND	ND	ND	ND
Trichloroethylene		ND	ND	ND	ND	ND	ND	ND
Trichlorofluoromethane		ND	ND	ND	ND	ND	ND	ND
Trichloropropane		ND	ND	ND	ND	ND	ND	ND
Vinyl Chloride		ND	ND	ND	ND	ND	ND	ND

* ND indicates none detected (e.g., less than the detection limit)

Volitile Aromatics, SW-846 Method 8020
Detectable Analytical Results (µg/l)*

Parameter	Site	1	2	5	15	17	19	22
Benzene		ND	ND	ND	ND	ND	ND	ND
Chlorobenzene		88	120	ND	ND	ND	1.7	ND
1,2-Dichlorobenzene		ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene		ND	ND	8500	ND	ND	ND	ND
1,4-Dichlorobenzene		ND	280	ND	ND	26000	ND	ND
Ethylbenzene		ND	24	ND	ND	ND	ND	ND
Toluene		ND	83	ND	ND	16000	1.4	ND
P-Xylene		ND	20	ND	ND	ND	ND	ND
M-Xylene		ND	ND	ND	ND	ND	ND	ND
O-Xylene		38	62	ND	ND	ND	ND	ND

* ND indicates none detected (e.g., less than the detection limit).

Phenols, EPA Method 604 (µg/l)*

Parameter	Site / Date **	1 / 17	1 / 18	1 / 21	2 / 17	2 / 18	2 / 21	17 / 22
2,4,6-Trichlorophenol		ND	ND	ND	ND	ND	ND	ND
2,4-Dichlorophenol		ND	ND	ND	ND	ND	ND	ND
2,4-Dimethylphenol		ND	ND	ND	ND	ND	ND	ND
2,4-Dinitrophenol		ND	ND	ND	ND	ND	ND	ND
2-Chlorophenol		ND	ND	ND	ND	ND	ND	ND
2-Methl-4,6-dinitrophenol		ND	ND	ND	ND	ND	ND	ND
2-Nitrophenol		ND	ND	ND	ND	ND	ND	ND
4-Chloro-3-methylphenol		ND	ND	ND	ND	ND	ND	ND
4-Nitrophenol		ND	ND	ND	ND	ND	ND	ND
Pentachlorophenol		ND	ND	ND	ND	ND	18	ND
Phenol		ND	ND	ND	ND	ND	ND	ND

Total Extractable Phenols, EPA Method 420.2 (µg/l)*

Site	Date	Total Extractable Phenols
1	17	52
1	18	52
1	19	50
1	21	46
1	22	66
2	18	70
2	19	70
2	21	75
2	22	340
2	23	375
6	18	175
11	21	15
17	21	4675
20	18	ND
21	18	ND

* ND indicates none detected (e.g., less than the detection limit).
** Samples were taken in March 1988

ICP Metals Screen, EPA Method 200.7 (µg/l)*

Parameter	Detection limit (µg/l)	Site 1 Average (µg/l)	1 High	1 Low	2 Average	2 High	2 Low
Aluminum	100	800	1101	577	824	1328	518
Arsenic	100	ND	ND	ND	ND	ND	ND
Barium	100	128	210	ND	101	104	ND
Beryllium	100	ND	ND	ND	ND	ND	ND
Cadmium	100	ND	ND	ND	ND	ND	ND
Chromium	100	ND	ND	ND	ND	ND	ND
Cobalt	100	ND	ND	ND	ND	ND	ND
Copper	100	ND	ND	ND	ND	ND	ND
Iron	100	1545	2295	706	869	1649	451
Lead	20	21	27	ND	ND	ND	ND
Manganese	100	152	205	111	ND	ND	ND
Mercury	1	ND	ND	ND	ND	ND	ND
Molybdenum	100	ND	ND	ND	ND	ND	ND
Nickel	100	170	195	154	169	194	143
Titanium	100	ND	ND	ND	ND	ND	ND
Vanadium	100	ND	ND	ND	109	147	ND
Zinc	100	129	193	103	121	205	ND

Parameter	Detection limit	Site 7	8	9	11	17	18	19
Aluminum	100	444	609	712	984	6280	779	407
Arsenic	100	ND	ND	ND	ND	ND	ND	ND
Barium	100	ND	ND	ND	ND	ND	ND	ND
Beryllium	100	ND	ND	ND	ND	ND	ND	ND
Cadmium	100	ND	ND	ND	ND	ND	ND	ND
Chromium	100	ND	ND	ND	ND	4286	ND	ND
Cobalt	100	ND	ND	ND	ND	ND	ND	ND
Copper	100	ND	ND	ND	ND	228	ND	ND
Iron	100	514	2229	49530	1954	2821	730	129
Lead	20	ND	83	ND	ND	ND	ND	ND
Manganese	100	ND	ND	459	523	ND	ND	ND
Mercury	1	ND	ND	ND	ND	ND	ND	ND
Molybdenum	100	ND	339	ND	ND	ND	ND	ND
Nickel	100	436	410	444	166	197	ND	ND
Titanium	100	ND	ND	ND	ND	ND	ND	ND
Vanadium	100	ND	ND	ND	ND	ND	ND	ND
Zinc	100	137	497	2266	ND	3086	ND	ND
Silver	10	ND	ND	ND	ND	DN	110	50

* ND indicates none detected (e.g., less than the detection limit).

ICP Metals Screen, EPA Method 200.7 µg/l)*

Parameter	Detection limit µg/l)	Site 20	21	22
Aluminum	100	210	800	318
Arsenic	100	ND	ND	ND
Barium	100	ND	ND	ND
Beryllium	100	ND	ND	ND
Cadmium	100	ND	ND	ND
Chromium	100	ND	ND	ND
Cobalt	100	ND	ND	ND
Copper	100	ND	ND	ND
Iron	100	216	396	219
Lead	20	ND	ND	ND
Manganese	100	119	ND	ND
Mercury	1	ND	ND	ND
Molybdenum	100	ND	ND	ND
Nickel	100	ND	120	ND
Titanium	100	ND	ND	ND
Vanadium	100	ND	ND	ND
Zinc	100	ND	ND	ND

* ND indicates none detected (e.g., less than the detection limit).

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