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Development Document for Proposed Effluent Limitations Guidelines and New Source Performance Standards for the

AIR TRANSPORTATION

Segment of the Transportation Industry

Point Source Category

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

APRIL 1974

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Publication Notice

This is a development document for proposed effluent limitations guidelines and new source performance standards. As such, this report is subject to changes resulting from comments received during the period of public comments on the proposed regulations. This document in its final form will be published at the time the regulations for this industry are promulgated.

This report has been entered into a computer to facilitate processing, print outs, and revisions. The various "machine commands" necessary to accomplish these steps are, therefore, present in this draft version. For example, line numbers are shown in the right margin, percent and dollar symbols represent underlining instructions, and a dash under individual letters is a reference point for making corrections. The commands will not appear in the final report.

Readers who desire clarification or amplification of the material presented while making their reviews are invited to contact:

James G. Taylor
Mail: National Field Investigations Center
5555 Ridge Avenue
Cincinnati, Ohio 45268
Phone: 513-684-4211

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DEVELOPMENT DOCUMENT

for

PROPOSED EFFLUENT LIMITATIONS GUIDELINES

and

NEW SOURCE PERFORMANCE STANDARDS

for the

AIR TRANSPORTATION SEGMENT

of the

TRANSPORTATION INDUSTRY

POINT SOURCE CATEGORY

April 1974

A. D. Sidio
Director

NATIONAL FIELD INVESTIGATIONS CENTER-CINCINNATI
U. S. ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF ENFORCEMENT AND GENERAL COUNSEL
Cincinnati, Ohio 45268

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ABSTRACT 3

This document presents the findings of an in-house study of the 6
Air Transportation Segment of the Transportation Industry. It was 8
completed by the EPA National Field Investigation Center - Cincinnati
for the purpose of developing effluent limitation guidelines and 9
federal standards of performance for the industry, to implement
Sections 304 and 306 of the Federal Water Pollution Control Act, as 10
amended.

Effluent limitations guidelines contained herein set forth the 12
degree of effluent reduction attainable through the application of 13
the best practicable control technology currently available and the
degree of effluent reduction attainable through the application of 14
the best available technology economically achievable which must be 15
achieved by existing point sources by July 1, 1977, and July 1, 1983,
respectively. The standards of performance for new sources contained 17
herein set forth the degree of effluent reduction which is achievable 18
through the application of the best available demonstrated control
technology, processes, operating methods, or other alternatives. 19

Supportive data and rationale for development of the proposed 21
effluent limitations guidelines and standards of performance are 22
contained in this report.

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FIGURES

SECTION I

CONCLUSIONS

The following major segments exist within the transportation industry: (1) railroad transportation, (2) air transportation; (3) truck transportation, and (4) waterborne shipping. This document deals with the air transportation segment.

For the purpose of developing effluent guidelines, this industry has been subcategorized according to the following principal operations.

1. Aircraft Ramp Service
2. Aircraft Rebuilding and Overhaul
    a. Engine Operations
    b. Airframe Operations (Exterior and Interior)
3. Aircraft Maintenance
    a. Routine
    b. Washing
4. Ground Vehicle Service and Maintenance
5. Fuel Storage Centers
6. Terminal and Auxiliary Facilities

The most significant industrial wastewater-producing activities in the air transportation industry are from the servicing, maintaining, overhauling and washing of aircraft and ground vehicles. The largest volume source is from aircraft rebuilding and overhaul facilities and may well run over 1,900 m(3)/day (0.50+mgd). Wastes from this source require the most treatment.

Oily wastes and suspended solids are almost always found in this industry's wastewaters. Other constituents which present problems are oxygen demanding materials, acids and alkalis and detergents. Phenols are of concern in stripping and repainting operations, and are present in some cleaning solvents used. Aircraft rebuilding and overhaul centers have the added problem of removing heavy metals and cyanides originating from metal plating operations.

A review of the waste treatment methods in use demonstrates that treatment is possible but efficient operation of the facilities employed is very much dependent on proper maintenance and control, good housekeeping practices, and reducing the water volumes used.

Treatment systems available for handling such wastewaters include gravity oil separation, chemical emulsion breaking, coagulation, dissolved air flotation, precipitation, biological treatment, filtration or carbon adsorption. The handling of metal plating wastes requires methods involving equalization, pH adjustment, oxidation, or reduction, chemical precipitation, and filtration. Cyanide wastes are destroyed by electrolytic decomposition or chemical oxidation. Any of these methods can be included in best practicable control technology currently available.

At installations where wastewater is low in volume, pretreatment and discharge to public owned treatment systems is desirable.

Recycling of treated wastewaters for use in washing and cooling purposes is considered economically achievable.

SECTION II

RECOMMENDATIONS

Best Practicable Control Technology Currently Available

Wastewater control technology in the air transportation industry involves two equally important aspects - source control and treatment technology.

Source Control

It is recommended that:

1. oils, grease, jet fuel and solvents be kept separate from metal plating wastes;

2. programs be implemented in maintenance and overhaul areas to prevent the occurrence of "routine" spills and leaks of fuel, lube oil, hydraulic fluids, cleaning agents (detergents and solvents) and paint strippers;

3. spent concentrated cleaning solutions be reprocessed, evaporated, or disposed of by means other than to wastewater systems;

4. dry processes be used to clean hangar floors to the maximum extent possible.

5. maintenance areas be so designed to contain the maximum spill expected so that removal can be accomplished without discharge to the wastewater system;

6. water requirements be reduced by eliminating continuous streams for intermittent use.

Treatment Technology

It is recommended, for discharge to surface waters, that:

1. wastewater from sources of free oil (such as maintenance hangars) be provided with a minimum of gravity separation before discharge to surface waters or to private or municipal treatment facilities;

2. wastewater from aircraft and ground vehicle maintenance complexes, including wash water and effluents from free oil "pre-separators" be combined and provided with treatment equivalent to equalization, gravity separation, emulsion-breaking, coagulation, air flotation, and clarification;

3. wastewater from aircraft rebuilding and overhaul facilities, which includes free and emulsified oily wastes, wash waters, paint strippings and metal plating wastes be provided with (1) treatment equivalent to gravity separation, equalization, emulsion-breaking, coagulation, air flotation, clarification and biological treatment for wastes other than derived from metal plating operations, and (2)

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treatment equivalent to equalization, metals precipitation, cyanide destruction, neutralization and filtration for metal plating wastes;

4. treatment systems be provided with equalization and pH adjustment, suitable sludge handling systems, treatment recycle ability, and controlled discharge techniques;

5. pretreatment for acceptance into publicly owned treatment systems include physical-chemical systems to remove oil, metals, cyanides, and any other incompatible constituents.

6. sanitary wastes from terminal and other separate facilities be provided with treatment equivalent to secondary levels consisting of physical-biological methods when treated on location.

Effluent Guidelines

Recommended effluent loading limits (monthly averages) per unit of activity for discharge to surface waters reflecting best practicable control technology currently available are listed in Table 1. Maximum daily loading limits should not exceed two times the values listed in Table 1.

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Table 1

Proposed Effluent Limitation Guidelines per Unit for Best Practicable Control Technology Currently Available Air Transportation Segment of Transportation Industry

Loading (monthly average) Activity	Unit	Flow per Unit		BOD_5		COD		Susp. Solids		Oil and Grease		Phenols		Cyanide		Cadmium		Total Chrome		Copper		Lead		Nickel		Zinc		pH Units
		liters	gal	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	
1. Aircraft Ramp Service	aircraft	760	200	*	*	*	*	.02	.04	.01	.02	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	6.0-9.0
2. Aircraft Rebuilding and Overhaul																												
Engine Operations	engine	283,900	75,000	7.1	15.6	35.5	78.2	7.1	15.6	2.9	6.3	0.30	0.60	0.03	0.06	0.04	0.09	0.14	0.31	0.14	0.31	0.03	0.06	0.28	0.63	0.28	0.63	6.0-9.0
Airframe Operations (Exterior & Interior)	aircraft	311,100	822,000	78	171	398	875	78	171	31.2	68.6	3.1	6.9	0.31	0.69	0.45	1.0	1.5	3.4	1.5	3.4	0.31	0.69	3.1	6.9	3.1	6.9	6.0-9.0
3. Aircraft Maintenance																												
Routine	aircraft	7,570	2,000	*	*	*	*	.19	.42	.08	.17	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	6.0-9.0
Washing	aircraft	30,300	8,000	*	*	*	*	0.53	1.67	.30	.67	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	6.0-9.0
4. Ground Vehicle Service and Maintenance	vehicle	37,850	10,000	*	*	*	*	0.95	2.09	.38	.83	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	6.0-9.0
5. Fuel Storage Centers	-	Not an industrial waste source																										
6. Terminal and Related Facilities	***			30 mg/l		*	*	30 mg/l		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	6.0-9.0

* Not a control parameter for activity listed

*** Effluent limitations for wastes discharged from this activity are subject to treatment requirements established for municipal systems treating sanitary wastes

NOTICE

These are tentative recommendations based upon information in this report and are subject to change based upon comments received and further internal review by EPA.

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Discharge of pretreated effluents from existing sources to publicly owned treatment works should meet, for incompatible pollutants, the most restrictive of (1) the above recommendations, with respect to incompatible pollutants, except that credit may be taken for cases where the publicly owned treatment works is committed by its permit to remove these pollutants, (2) the pretreatment regulations of Section 304(f) of the FWPC Act, or (4) the provisions of Section 307(a) of the Act with respect to toxic substances regulations.

Best Available Control Technology Economically Achievable

Source Control

It is recommended that:

1. all control measures or their equivalent as described for BPCTCA be followed as a minimum;

2. treated wastewater effluents from high volume sources be reused where applicable for washing purposes and as make-up water for recycled cooling waters;

3. uncontaminated surface runoff be segregated from treatment systems.

Treatment Technology

It is recommended that:

NOTICE
These are tentative recommendations based upon information in this report and are subject to change based upon comments received and further internal review by EPA.

1. treatment measures as described for BPCTCA or their equivalent be applied as a minimum;

2. further reduction for removal of oxygen demanding and phenolic wastes be attained through methods equivalent to chemical oxidation or carbon adsorption.

3. further reduction for removal of heavy metals from plating operations be attained through techniques equivalent to deep bed or multi media filtration.

4. storage, pumping and plumbing devices be added to permit recycle of wash and treated effluent water in all activities to the extent possible.

5. pretreatment of incompatible wastes for acceptance in publicly owned works be equivalent to that recommended for best practicable control technology currently available.

Effluent Guidelines

Recommended effluent loading limits (monthly averages) per unit of activity for discharge to surface waters reflecting best available control technology economically achievable are listed in Table 2. Maximum daily loading limits should not exceed two times the values listed in Table 2.

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Table 2

Proposed Effluent Limitation Guidelines per Unit for Best Available Control Technology Economically Achievable Air Transportation Segment of Transportation Industry

Loading (monthly average) Activity	Unit	Flow per Unit		BOD_5		COD		Susp. Solids		Oil and Grease		Phenols		Cyanide		Cadmium		Total Chrome		Copper		Lead		Nickel		Zinc		pH Units
		liters	gal	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	
1. Aircraft Ramp Service	aircraft	760	200	*	*	*	*	0.01	0.03	0.01	0.02	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	6 0-9 0
2. Aircraft Rebuilding and Overhaul																												
Engine Operations	engine	283,900	75,000	4.3	9.4	21.3	46.9	4.3	9.4	2.9	6.3	0.03	0.06	0.01	0.02	0.03	0.06	0.09	0.19	0.06	0 13	0.03	0.06	0.14	0 31	0.09	0.19	6.0-9.0
Airframe Operations (Exterior & Interior)	aircraft	311,100	822,000	46.8	103	234	514	46.8	103	31.2	68.6	0.31	0.69	0.08	0.17	0.31	0.69	0.94	2.06	0.62	1.37	0.31	0.69	1.56	3.43	0.94	2.06	6.0-9.0
3. Aircraft Maintenance																												
Routine	aircraft	7,570	2,000	*	*	*	*	0.11	0.25	.08	0.17	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	6.0-9.0
Washing	aircraft	30,300	8,000	*	*	*	*	.45	1.0	.30	0.67	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	6.0-9 0
4. Ground Vehicle Service and Maintenance	vehicle	37,850	10,000	*	*	*	*	0.57	1.25	0.38	0.83	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	6.0-9.0
5. Fuel Storage Centers		Not an industrial waste source																										
6. Terminal and Related Facilities	***			30 mg/l		*	*	30 mg/l		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	6 0-9.0

* Not a control parameter for activity listed

*** Effluent limitations for wastes discharged from this activity are subject to treatment requirements established for municipal systems treating sanitary wastes

NOTICE

These are tentative recommendations based upon information in this report and are subject to change based upon comments received and further internal review by EPA.

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Effluents to be discharged to publicly owned works meet the recommended pretreatment requirements for best practicable control technology currently available.

New Source Performance and Pretreatment Standards

It is recommended that discharges from new sources in the air transportation industry meet all source control, treatment technology, and effluent limit recommendations for best available control technology economically achievable for discharges to surface waters or to publicly owned treatment works, whichever is applicable.

SECTION III

INTRODUCTION

$%Purpose and Authority$%

Section 301 (b) of the Act requires the achievement by not later than July 1, 1977, of effluent limitations for point sources, other than publicly owned treatment works, which are based on the application of the best practicable control technology currently available as defined by the Administrator pursuant to Section 304 (b) of the Act. Section 301 (b) also requires the achievement by not later than July 1, 1983, of effluent limitations for point sources, other than publicly owned treatment works, which are based on the application of the best available technology economically achievable which will result in reasonable further progress toward the national goal of eliminating the discharge of all pollutants, as determined in accordance with regulations issued by the Administrator pursuant to Section 304 (b) of the Act.

Section 306 of the Act requires the achievement by new sources of a Federal standard of performance providing for the control of the discharge of pollutants which reflects the greatest degree of effluent reduction which the Administrator determines to be achievable through the application of the best available demonstrated control technology, processes, operating methods, or other alternatives, including, where practicable, a standard permitting no discharge of pollutants.

Section 304 (b) required the Administrator to publish within one year of enactment of the Act, regulations providing guidelines for effluent limitations setting forth the degree of effluent reduction attainable through the application of the best practicable control technology currently available and the degree of effluent reduction attainable through the application of the best control measures and practices achievable including treatment techniques, process and procedure innovations, operation methods and other alternatives. The regulations proposed herein set forth effluent limitations guidelines pursuant to Section 304 (b) of the Act for the air transportation segment of the transportation category of point sources.

Section 306 of the Act requires the Administrator, within one year after a category of sources is included in a list published pursuant to Section 306 (b) (1) (A) of the Act, to propose regulations establishing Federal standards of performance for new sources within such categories. The Administrator published in the Federal Register of January 16, 1973, (38 F.R. 1624), a list of 27 source categories. Proposed standards of performance for new sources within the air transportation segment of the transportation industry are included herein.

$%Summary of Methods Used for Development of Effluent Limitations$% 47
$%Guidelines$% 48

For purposes of development of transportation industry effluent 52
limitations guidelines the industry was divided into the categories 53
of railroad transportation, air transportation, highway 54
transportation, and waterborne shipping. Contacts were established 55
with trade associations representing broad segments of each of the 56
categories. These associations provided contacts for industrial 57
information-gathering visits. They also provided guidance, liaison, 59
and review functions throughout the guidelines development.

Each of the four transportation categories was subcategorized 61
into distinct activities (over-the-road hauling, maintenance and 62
repair, washing, etc.). The waste water potential of each of the 63
activities was examined to determine characteristic flows and waste
constituents. The waste water constituents which should be subject 64
to effluent limitations were then identified.

Control and treatment technologies for each of the activities 66
were identified, including both source control and treatment systems. 67
This included a determination of the effluent levels of various 68
constituents resulting from the application of such technologies. 69
The problems, reliability, and limitations of each and the required 70
implementation time were also identified. Environmental impact, 71
other than water quality, including energy requirements, was
identified as well as the cost of application of each technology. 72

The information, as outlined above, was evaluated to determine the levels of technology constituting the "best practicable control technology currently available" and the "best available technology economically achievable." Various factors were considered, including the total cost of application of technology in relation to the effluent reduction benefits to be achieved, the age of equipment and facilities, the engineering aspects of the application of a technology, and environmental impact, including energy requirements.

Data Base

Several of the Environmental Protection Agency Regional Officers provided Refuse Act permit application data for facilities within their respective regions. The data was of limited value.

Data were requested from various airlines through the Air Transport Association of America. Of those airlines where contacts were made, information was provided on materials used, operations conducted, wastewater flows, the type of treatment, methods employed and the numbers of units handled at each site. Information was obtained on a total of 8 airlines. Reports obtained from other sources provided information on other airlines.

Data were also requested from major airports through the Airport Operators Council International. Information was obtained from a few airports describing the operations carried out, wastewater flows and constituents, and the types of treatment used. As of writing seven

airline facilities and five airport facilities were visited to gain 103
first-hand knowledge of operations and activities.

Very little information directly describing air transportation 105
wastewater problems was found in a literature search. However a 107
review of books, reports and journals on waste treatment technology 108
did provide important information on treatment systems applicable to 109
the air transportation industry.

$%General Description of the Air Transportation Industry$% 111

The air transportation industry, as here considered, includes 114
chartered and common carriers for passenger and freight, and terminal
facilities which may discharge industrial wastes to surface waters. 115

Air transportation is a rapidly growing segment of commercial 117
transportation. Table 3 presents the growth in numbers of aircraft 118
in use for the period 1962 to 1972. Total numbers of air carrier 119
craft have increased 27% with turbine or jet-powered aircraft
steadily replacing piston-engine types. The number of general 121
aviation aircraft in use has increased by 60%.

Because larger and faster aircraft have been introduced into 123
service, available passenger miles have increased more than three 124
times in the 10-year period (1962 to 1972) and available cargo ton-
miles have increased by four times.

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TABLE 3

Active Aircraft in the Civil Aviation Fleet

	1962	1967	1971	1972
Air Carrier				
Piston	1,164	456	60	63
Turbine	647	1,718	2,315	2,249
Rotorcraft	20	22	14	14
Total	1,831	2,196	2,389	2,326
% of Total	2.1	1.9	1.8	1.7
General Aviation				
Piston	82,434	109,910	124,628	128,900
Turbine	213	1,281	2,483	2,800
Rotorcraft	967	1,899	2,352	2,500
Other	507	1,096	1,685	1,800
Total	84,121	114,186	131,148	136,000 (E)
% of Total	97.9	98.1	98.2	98.3
Total	85,952	116,380	133,537	138,326

(E) Estimated

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Use of available passenger miles and cargo ton-miles has been 126
fairly consistent at about 50% of the potential. Figure 1 127
illustrates the increase in passenger and cargo haulage since 1962.
The airline industry now transports more passengers than any other 128
form of commercial transportation and has been increasing its share 129
yearly.

Table 4 presents some pertinent statistics for U.S. scheduled 131
airlines in 1972. They experienced a net loss in income in 1970 but 132
have recovered in 1972. The return on investment of 4.9% was, 133
nevertheless, still considerably less than the 12% which the Civil
Aeronautics Board considers fair and reasonable. 134

There has also been an increase of 50% in the number of airports 136
since 1962 (Table 5) according to "Air Transport 1973" by the Air 137
Transport Association. However, the number of airports receiving 138
scheduled service has declined about 15% through consolidation of 139
operations. The Federal Aviation Administration (FAA) listed 581 140
certificated airports in August 1973, 110 more than listed in Table
4. Apparently the difference lies in those which are permitted to 141
have scheduled service and those which actually receive it. 142

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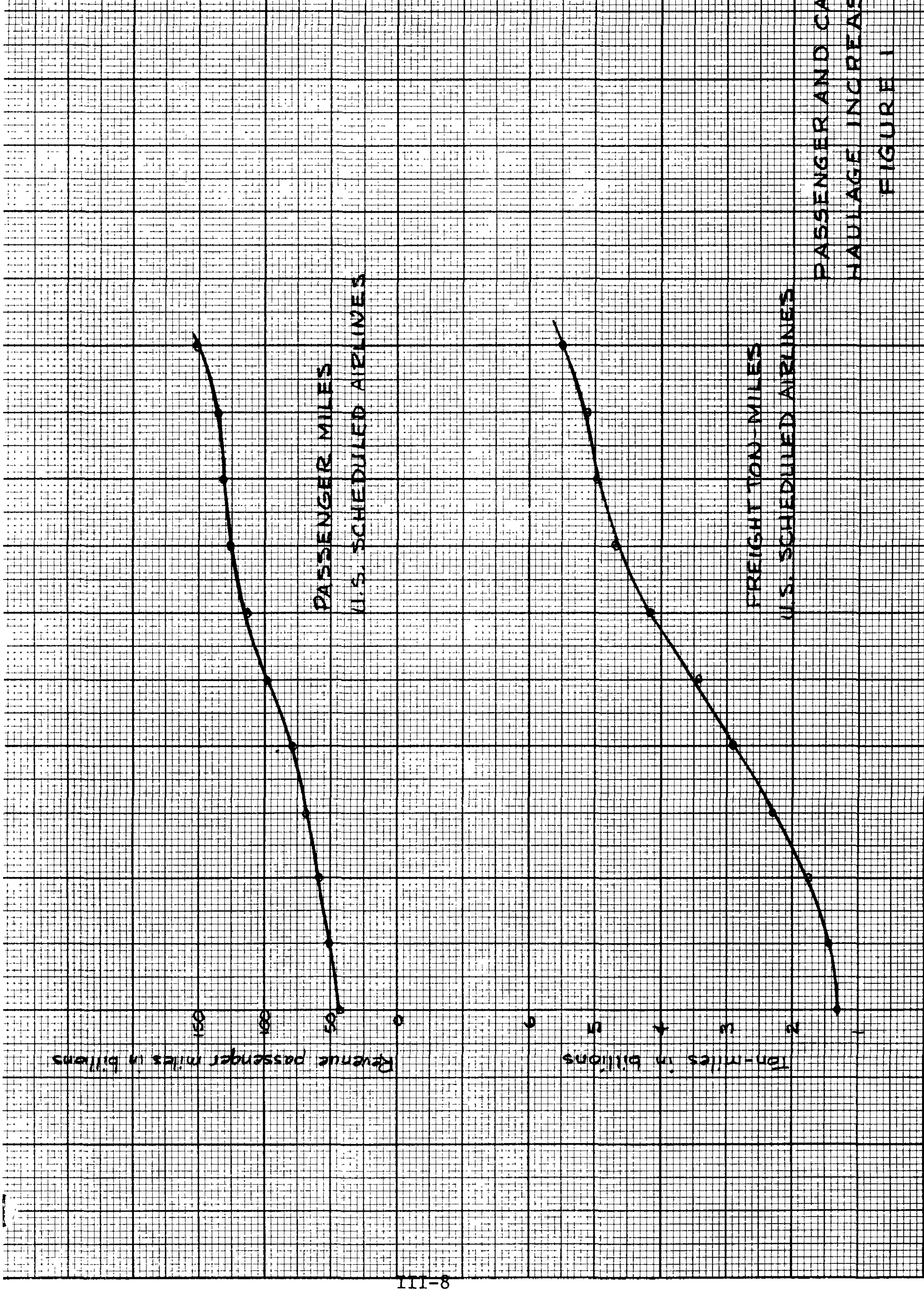

PASSENGER AND CARGO HAULAGE INCREASE
FIGURE 1

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TABLE 4

STATISTICAL HIGHLIGHTS - U.S. SCHEDULED AIRLINES

(1972)

PLANT AND EQUIPMENT	
Net investment (property and equipment)	$ 14,286,535,000
Number of aircraft	2,326
Aircraft Added in 1972	101
TRAFFIC	
Revenue Passenger-Miles	152,406,276,000
Freight Ton-Miles	5,495,072,000
Revenue per passenger mile	6.42¢
Revenue per ton-mile	21.52¢
Average length of haul (miles)	796
FINANCIAL RESULTS	
Operating Revenue	$ 11,203,271,000
Operating Expenses	$ 10,609,190,000
Net Operating Income	$ 594,081,000
Rate of Return on Investment	4.9%
EMPLOYMENT AND WAGES	
Average number of employees	301,127
Total Payroll	$ 4,192,081,000
Average yearly wages	$13,918

TABLE 5

Total U. S. Airports, FAA Control Towers and
Points Receiving Scheduled Airline Service

	1962	1967	1971	1972
Total Airports on Record with FAA	8,084	10,126	12,070	12,106
Total FAA Control Towers	270	313	346	352
Points Receiving Scheduled Airline Service (Certificated Airports)	569	525	479	471

The FAA classifies airports into three categories: (1) the 181
Primary System enplaning more than 1,000,000 passengers annually; (2) 182
the Secondary System enplaning 50,000 to 1,000,000; and (3) the 183
Feeder System enplaning less than 50,000 passengers annually. The 184
FAA's "1972 National Airport System Plan" shows 44 airports in the
first category, 416 in the second and 2,522 in the third. The 186
primary system generally handles the largest planes and most aircraft
rebuilding centers and large maintenance operations are found at the 187
airports comprising this system. 188

$%Comparison with Other Transportation Industry Segments$% 191

Table 6 lists freight and passenger haulage statistics for the 194
various carriers for the period 1966 through 1972. 195

In 1972, the airline industry accounted for more than 75% of the 197
total passenger miles recorded. Although air freight still 198
represented only a small fraction of the total tonnage hauled, the
rate of increase had almost doubled in the past seven years. 199

Table 7 lists the estimated energy consumed by various freight 201
carriers for the period 1966-1973. There was about a 22% combined 203
increase in energy used but only a 14% increase in tonnage hauled
(Table 6). This resulted because the bulk of the increase in the 204
transportation of freight was moved by trucks, pipelines, and 205
aircraft, all of which have higher energy requirements. Rail and 206

TABLE 6 219
TRANSPORTATION STATISTICS 1966-1972 220
Freight Hauled % of 222
(Billions of Ton Miles) Total 223

Type of $%Carrier	1966	1967	1968	1969	1970	1971	1972	1972$%	
									225 226
Rail	757	731	755	780	773	774	781	38.9	229
Truck	396	389	415	404	412	422	443	22.0	231
Pipeline	332	361	397	411	431	444	462	23.0	233
Barge	158	167	176	185	190	205	215	10.7	235
Great Lakes Vessels	115	109	106	115	116	104	103	5.1	238 239 240
Air	2.9	3.4	4.2	4.7	5.0	5.1	5.5	0.3	243
Total	1761	1760	1853	1900	1927	1954	2010	100.0	245

Passengers Carried 248
(billions of passenger-miles) 249

Auto	880	890	931	977	1027	1071	1125	84.7	251
Private Air	N.A.	10	8.1	9	10	9.2	10.1	0.8	253 254
Commercial Air	80	99	114	125	132	136	152	11.5	256 257
Bus	25	24.9	24.5	26	25	25.5	25.7	1.9	259
Rail	17	15.2	13.1	12.1	10.7	10	10.5	0.8	261
Water	3.3	4.0	3.5	4	4	4	4	0.3	263
Total	1005	1043	1094	1153	1208	1256	1327	100.0	265

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TABLE 7 268

ESTIMATED ENERGY USED IN MOVING FREIGHT (BTU x 10(12)) 270

Type of Carrier	]966	1967	1968	1969	1970	1971	1972	% Increase (Decrease) 1966-72	274 275 276 277 278
Rail	568	548	566	585	580	581	586	3.2	281
Truck	950	934	996	970	989	1013	1063	11.9	282
Pipeline	614	668	734	760	797	821	854	39.1	283
Barge	79	83	88	92	95	102	108	36.7	284
Lakes	57	54	53	57	58	52	51	(10.5)	285
Air	183	214	265	296	315	321	346	89.1	286
Total	2451	2501	2702	2760	2834	2890	3008	22.7	287

Note: BTU calculated at 750 BTU/ton-mile for railroads, 2400 for 291
trucks, 1850 for pipelines, 500 for barge and lakes, and 292
63,000 for air. Source "Energy in the Trans- 293
portation Sector" by William E. Mooz, Rand Corporation. 294

water transportation vehicles are particularly efficient users of 206
fuel; pipelines and trucks are the next best, and air freight 207
carriers trail far behind. Except for air transport, the diesel 208
engine is the main propulsion unit in all commercial vehicles.

The average cost of shipping freight is about 1.4¢/ton-mile by 210
water, 1.6¢ by rail, 8.2¢ by truck, and 22.8¢ by air. Product 212
durability, bulkiness, weight, and delivery time are controlling
factors which keep each industry competitive. Fuel availability may 214
cause some readjustment in the competitive structure in addition to
affecting the quantity of many commodities using energy-based raw 215
materials such as petroleum and natural gas.

SECTION IV

INDUSTRY CATEGORIZATION

$%Introduction$%

The air transportation segment of the transportation industry includes establishments engaged in furnishing domestic and foreign air transportation and those that operate airports and terminals.

The industry is grouped in Standard Industrial Classification code categories 4511 Air Transportation, Certificated Carriers; 4521, Air Transportation, Noncertificated Carriers; and fixed facilities and services related to air transportation under SIC codes 4582, Airports and Flying Fields; and 4583, Airport Terminal Services.

Effluent limitations and standards are developed for SIC categories 4582 and 4583, the prime source of pollutants. SIC categories 4511 and 4521 cover activities engaged in the transportation of passengers between points. Since there is no waste discharge during flight, any wastes generated are disposed of at terminal point locations classified under SIC codes 4582 and 4583.

$%Development of Industry Subcategorization$%

For guidelines development the industry has been categorized according to the following operational activities:

1. Aircraft Ramp Service
2. Aircraft Rebuilding and Overhaul
   a. Engine Operations
   b. Airframe Operations
3. Aircraft Maintenance
   a. Routine
   b. Washing
4. Ground Vehicle Service and Maintenance
5. Fuel Storage Centers
6. Terminal and Related Facilities

One other activity conducted at airports is the washing of vehicles owned by rental car agencies. Guidelines for effluent limitations for this activity are thoroughly discussed in the development document for proposed effluent limitations for the auto and other laundries industry.

Aircraft Ramp Service

This operation consists of refueling the aircraft, removing various types of wastes, replenishing water and other supplies, inspecting and servicing aircraft preparatory to flight, and some minor maintenance and repair. These services are normally performed outside in the areas in which the cargo or passengers are to be loaded or unloaded. The largest service areas are the passenger terminal complex and the cargo terminals.

Aircraft Rebuilding and Overhaul 82

Airline companies have established their home maintenance base 85
facilities at large airports. These bases are equipped to overhaul 87
or rebuild virtually an entire aircraft. Generally these facilities 89
operate on three shifts, five days per week, and contain plating, 90
parts cleaning, painting, machine, upholstering, and other repair
shops.

These facilities are the principal sources of industrial wastes 92
requiring treatment. For this reason the activities conducted are 94
described in detail. 95

Engine Operations 97

Aircraft engines, both jet and prop type, are totally 99
disassembled, overhauled and rebuilt at these specialized facilities. 100
As the first step, detergent-water solutions are used to remove 102
accumulated carbon deposits and dirt. The engine is then 103
disassembled, and the components are cleaned in various alkaline,
acidic, or organic solvent-type baths; some of them then go through a 104
metal plating process.

Most large airline companies do all of their own metal plating, 107
but the smaller companies have this done under contract, particularly
when large components are involved. Plating operations generally 109
include alkaline cleaning, acid dipping, electroplating, rinsing, and 110

drying. Cadmium, chromium, copper, nickel, lead and zinc are the 111
metals primarily used. Engine overhaul is a closely controlled 113
operation in which all parts are inspected and checked for structural 114
stress-strain soundness before being reassembled. Engines are then 115
subjected to firing and load tests before being returned to service.

Airframe Operations (Exterior and Interior) 117

Major work includes overhauling and rebuilding such components as 120
airframes and their operating mechanisms, landing gear and wheel
units, air conditioning and heating equipment, and instrument,
hydraulic, and electrical systems. Parts are cleaned with solvents 122
and alkaline or acidic solutions, sometimes under pressure. Metal 123
plating operations are similar to those carried out in engine
overhauling activities. Operating and structural components are 125
inspected and tested for wear, corrosion, and metal fatigue. Usable 127
and replated parts are then installed in the aircraft.

Interior operations include the redecorating of cabins, repairing 130
fabrics and replacing seats, and general cleaning and servicing. 131

Paint stripping and repainting are included within airframe 133
overhaul operations. Some airlines use baked-on decals rather than 134
paint, while others paint a major part of the aircraft. Most 136
painting work is conducted inside hangars where better control over 137
the activity can be maintained. Aircraft are scheduled for painting 138
approximately every six years. For most airlines, major work 139

includes the painting of component areas, such as wheel wells, 140
landing gear, and fuselage undersides.

Because of the extent and nature of the wastes generated in these 143
operations, the wastewater is generally given physical/chemical 144
treatment before being discharged into surface waters or into 145
municipal or airport based sewer systems. 146

Aircraft Maintenance 148

Routine 150

Maintenance work on aircraft is normally performed in hangars. 152
The degree of maintenance or repair that is performed varies with the 153
particular airline's facilities, the availability of hangar space to 154
accommodate various sizes of aircraft and the work required.
Maintenance generally involves making minor repairs, such as 155
replacing hydraulic lines, changing, wheels or tires, replacing 156
engines or partially overhauling them, cleaning interiors, and spot 157
painting.

Washing 159

Aircraft washing is normally a scheduled operation which involves 163
the following: pressure spraying with cleaning agents, brushing with 165
an alkaline water base type cleaner, and hosing down with hot or cold 167
water. Any corrosive substances observed on the aircraft between 169
washings are immediately removed using strong solvents.

Washing is normally done at specified locations in or adjacent to 173
hangars; one to 20 aircraft may be washed each week. At some 174
airports, the wastewaters are permitted to flow directly into 175
sanitary sewer systems.

Ground Vehicle Service and Maintenance 177

The maintenance of ground vehicles, trucks, tractors, tows and 180
other automotive type equipment used to move, repair and service 181
aircraft is a significant factor in each airline's operation. Nearly 183
all airlines have a fully equipped and staffed shop where ground
vehicles can be completely overhauled, serviced, and spray painted. 184
In addition, engine and parts are often steam cleaned outside the 185
shop area. Many shops have tanks in which solvents are used to clean 186
parts and remove grease.

Fuel Storage Centers 188

Fuel is stored in underground or surface tanks remote from 191
terminals, hangars, and heavy traffic areas. Oil companies located 192
at airports which furnish fuel to the airlines can be a source of 194
accidental spills. Fuel is put into and removed from the tanks by 196
pipeline or trucks, and have the greater spill potential. Above- 198
ground tanks are usually diked in to contain the fuel if the tanks 199
rupture, are overfilled, or if a fire breaks out. Fuel storage 201
facilities are generally kept clean of ignitable materials to meet
safety and fire regulations.

Terminal and Auxiliary Facilities 203

Air terminals are the leading source of sanitary wastes. 206
Commercial firms in or near terminal buildings, such as airline 208
offices, car rental agencies, restaurants, banks, postal facilities,
service companies, and air freight handling centers contribute to the 210
sanitary waste volume generated. Most airports discharge these 211
wastes to regional or municipal treatment plants.

SECTION V 6

WASTE CHARACTERIZATION 8

General 10

The industrial wastewater generated at airports result from the 13
operations described in Section IV, but the volume produced is not 14
determined solely by the size of an airport. For example, relatively 16
few public airports have complete maintenance and overhaul
establishments, therefore, the complex waste loads associated with 17
such as metal plating, engine overhaul, stripping and painting, and 18
washing are not present. At feeder system airports, the waste load 19
is primarily derived from servicing aircraft and performing limited 20
maintenance work. Small airports having no public service or 21
scheduled flights are primarily operated and owned by individuals,
businesses, or private groups and have minimal or no industrial waste 22
discharges.

Wastewater Constituents 25

Constituents that are most likely to be found in wastewater 28
discharges from airport operations are listed in Table 8. The 30
greatest variety is from aircraft rebuilding and overhaul, aircraft 31
maintenance, and ground vehicle service and maintenance operations. 32

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TABLE 8

WASTEWATER CONSTITUENTS -- AIR TRANSPORTATION INDUSTRY

Source of Waste	Acids or Alkalis	Oxygen Demanding Materials	Detergents	Phosphates	Suspended Solids	Dissolved Solids	Oil and Grease	Organic Solvents	Phenols	Cyanides	Heavy Metals	Bacteria
1. Aircraft Ramp Service		X			X		X					
2. Aircraft Rebuilding and Overhaul												
a. Engine Operations	X	X	X	X	X	X	X	X	X	X	X	
b. Airframe Operations (Exterior and Interior)	X	X	X	X	X	X	X	X	X	X	X	
3. Aircraft Maintenance												
a. Routine	X	X	X	X	X	X	X	X	X	X	X	
b. Washing	X	X	X	X	X	X	X	X	X	X	X	
4. Ground Vehicle Service and Maintenance	X	X	X	X	X	X	X	X	X	X	X	
5. Fuel Storage Centers		X			X	X	X					
6. Terminal and Related Facilities		X	X		X	X						X

Aircraft Ramp Service 34

Wastes originating from this operation may consist of oil that 36
leaks from ground vehicles, aircraft engines, and hydraulic systems 37
(especially landing gear), and spills that occur when engine oils, 38
fuel, fresh and service water, hydraulic fluids, and sanitary 39
chemicals are added. There are occasional spills from the 41
connections which drain sanitary waste from the aircraft. While the 43
effect of each source is relatively minor, the combined effects may 44
be significant, especially during heavy rains, if they are not
cleaned up immediately. 45

Most fuel spills result from overfilling or "topping out" 47
aircraft fuel tanks. At some airports, fuel spills are rare, but 48
they may occur daily at others. Observance of fueling operations 49
indicates this problem can be averted. Granular products are used to 50
absorb the fuel, and residual material either evaporates or is 51
flushed away with water.

Inspections made of passenger terminal and cargo service areas 53
indicated that the amount of contaminants present on the surface 54
varied more in proportion to the housekeeping effort made than to the
amount of activity carried out. Many areas are cleaned by vacuum 55
scrubber units or contaminants are flushed off to drains. Generally, 56
airport regulations require that all spills be cleaned up
immediately. Normally, aircraft servicing should not be a 57

significant source of industrial wastewater. Wastewater constituents can include suspended solids, oil and grease, and oxygen demanding materials.

Aircraft Rebuilding and Overhaul

The amount of water used varies widely among airline rebuilding and overhaul bases. Flows range from 77,500 liters (20,000 gallons) per day for small works to over 194,000 liters (500,000 gallons) per day for large installations. Approximately one-half of the water is used in metal plating work and the remainder in cleaning engine and aircraft components.

Engine Operations

Solvents, degreasers, and detergents are used to clean carbon, metal oxides, oils, and other contaminants from engine components, oil coolers, oil tanks, engine housings, fuel systems, etc. Most of these chemicals are used until spent. In some instances, solvents are distilled and reused. Oil and solvent contaminants are found both in the free and emulsified state. Concentrated drain oils, sludges, and used solvents from engine overhaul work and similar materials trapped in floor drain sump units are generally put into holding tanks. They are disposed of separately and not sent through treatment systems. Wastewater overflow and runoff from the shop areas requires treatment because it contains free and emulsified oil,

solids, detergents, acids, alkalis, heavy metals, phenols, and oxygen 84
demanding materials.

Other wastes produced in this operation originate from the use of 86
rinse waters and occasional batch dumping of chromium, copper, 87
nickel, silver, cadmium plating, and stripping tanks. The wastewater 89
generally contains: (1) cyanide-alkaline wastes resulting from zinc
and cadmium plating operations; (2) chromium-acid type wastes 90
generated in plating, cleaning, anodizing and alodining operations; 91
and (3) miscellaneous acid-alkaline wastes resulting from acid and 92
alkali dips, metal pickling, and rinsing operations. "Drag over" of 94
plating solutions to the rinse tanks contributes to these waste
discharges. Rinse water volume and continuous flow are other 95
factors. The wastewater originating from engine overhaul represents 96
approximately 60% of the total daily flow from rebuilding and 97
overhaul operations. Flows may range from 575,000 liters (152,000 98
gallons) to 1,703,325 liters (450,000 gallons) per day. 99

Airframe Operations (Exterior and Interior) 101

The removal of carbon, oxidized metal, surface scaling, etc. 103
from airframes, landing gears, and other components requires large 104
amounts of water, detergents, and solvents. Considerable water use 106
is also used in metal plating operations. Wastewaters from these 107
activities contain the same types of constituents as those

found in the engine rebuilding and overhaul operations and are disposed of in same manner.

Very small amounts of water are used to wash interior surfaces. Waste constituents generally consist of alkaline materials, detergents, suspended solids, and oxygen demanding materials.

Wastewater from paint stripping and painting activities contain concentrations of phenols, suspended solids, acids, alkalis, detergents, oil and grease, heavy metals, and oxygen demanding materials. Bulk stripping wastes are caught in troughs suspended under the fuselage and in plastic sheets spread under the wings to keep as much of this material out of the wastewater as possible.

The wastewater flow from airframe overhauling constitutes approximately 40% of the total daily flow from rebuilding and overhauling operations. Flows range from 382,000 liters (101,000 gallons) to 1,135,500 liters (300,000 gallons) per day.

Aircraft Maintenance

Routine

Wastewaters generated by this activity are similar to those derived from aircraft rebuilding and overhauling operations, but, the volumes are much smaller. They do not contain wastes from metal plating operations and have few wastes resulting from minor painting

and engine and aircraft maintenance activities. Flows are on the 139
order of 3,800 to 7,600 liters (1,000 to 2,000 gallons) per day.

Generally, the wastewater contains oils, lubricants, solids, 141
solvents, alkalis, detergents, and oxygen demand materials. 142

Washing 144

Washing is conducted inside and outside hangars at designated 147
locations. Some airlines wash one or two aircraft a week, others as 149
many as 20. These wastes consist of a mixture of alkalis, 150
detergents, oil, carbon deposits, hydraulic fluids, fuels and other 151
solids. The amount of water used ranges from approximately 11,400 to 152
45,400 liters (3,000 to 12,000 gallons) per aircraft, depending upon 153
aircraft size and water control. Various detergents are used and the 154
preparations vary from concentrated solutions for small corroded 155
areas to diluted mixtures for general washing.

Ground Vehicle Service and Maintenance 157

The wastewater produced can include crankcase oil, dissolved 159
greases, solvents, cleaning compounds, and paint sludges. Some steam 161
cleaning, maintenance, and parking areas observed were covered with
oil and grease as a result of leaks and spills.

The materials used in these operations include some of the 163
chemicals employed in aircraft overhaul and maintenance activities. 164
Wastewaters are generally low in volume but can contain 165

concentrations of oily materials, suspended solids, detergents, 166
alkalis, and acids. Estimated water use is between 3,800 to 7,600 167
liters (1,000 to 2,000 gallons) per day.

Fuel Storage Centers 170

Very few wastes are produced at these sites because safety 172
precautions require good housekeeping practices to avoid fires and 173
explosions. At the locations observed, fuel spillage was nil, and 174
only minimal amounts of crankcase oil drippings or grease from fuel
trucks had collected on paved surface areas. At some fuel centers, 176
fuel is pumped to and from the storage facilities by pipelines, which
rarely rupture. Normally, above-ground fuel storage tanks have 177
earthen or concrete dikes built around them to hold fuel if a tank
ruptures or is overfilled. As a result of control maintained at fuel 178
centers, runoff during dry or wet weather is a minimal source of
pollution. Possible wastewater contaminants are suspended solids, 179
oil and grease, and oxygen demanding materials. 180

Terminal and Auxiliary Facilities 182

Wastes associated with activities conducted at these facilities 184
are derived from food preparation and disposal, floor and equipment 185
cleaning, domestic wastes, and solid wastes from packaging materials.
The waste constituents present are BOD, suspended solids, detergents 186
and bacteria. 187

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Sanitary waste flows from terminal facilities, airplanes, 189
aircraft maintenance locations, and other operations are often the
largest waste discharge from airports. These wastes may be treated 191
separately or combined with pretreated industrial wastes and 192
discharged to municipal systems. Data on sanitary flow volumes are 193
difficult to obtain if airport wastes are processed by a municipal
treatment systems. One major airport that treats its own sanitary 194
waste has an approximate flow of 3,028 m(3)/day (0.8 mgd); the plant 195
used was designed to handle a 8,327 m(3)/day (2.2 mgd) average flow.

Raw Waste Loads 198

The pollutional constituents found in industrial wastewaters 201
generated at airport complexes vary widely in volume and in 202
concentration. No analysis is generally made of the raw wastewater 203
but only of the treated effluent. Data that was obtained on raw 205
wastewater constituent concentrations is limited. Table 9 has been 206
developed to illustrate estimated raw waste loads per unit of 207
activity within the industry categories. The waste constituents of 208
interest are solids, oil and grease, phenols, cyanides, heavy metals, 209
pH and oxygen demanding materials. 210

$\frac{lbs}{(8.34)(.075)} = mg/l$

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Table 9

Estimated Raw Waste Loads Per Unit of Activity
Air Transportation Segment of Transportation Industry

Activity	Unit	Flow liters	Flow gal	pH units	BOD_5 kg	BOD_5 lbs	COD kg	COD lbs	Susp. Solids kg	Susp. Solids lbs	Dissolved Solids kg	Dissolved Solids lbs	Oil and Grease kg	Oil and Grease lbs	Phenols kg	Phenols lbs	Detergents kg	Detergents lbs	Cyanide kg	Cyanide lbs	Cadmium kg	Cadmium lbs	Total Chrome kg	Total Chrome lbs	Copper kg	Copper lbs	Lead kg	Lead lbs	Nickel kg	Nickel lbs	Zinc kg	Zinc lbs
1. Aircraft Ramp Service	aircraft	760	200	6-10	0.19	0.42	0.45	1.0	0.15	0.33	0.30	0.67	0.11	0.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2. Aircraft Rebuilding and Overhaul																																
Engine Operations	engine	283,900	75,000	2-12	71	156	170	375	57	125	114	250	43	94	2.3	5.0	-	-	0.87	1.9	0.59	1.3	3.4	7.5	1.7	3.8	0.14	0.31	0.59	1.3	0.29	0.63
Airframe Operations (Exterior & Interior)	aircraft	311,100	822,000	2-12	779	1714	1870	4113	623	1371	1246	2742	467	1028	25	54.8	-	-	9.4	20.6	6.2	13.7	37.4	82.3	18.7	41.1	1.56	3.43	6.2	13.7	3.14	6.9
3. Aircraft Maintenance																																
Routine	aircraft	7,570	2,000	6-10	1.9	4.2	4.5	10.0	1.52	3.34	3.03	6.67	1.14	2.5	0.06	0.13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Washing	aircraft	30,300	8,000	6-10	7.6	16.7	18.1	40.0	6.05	13.3	12.1	26.7	4.5	10.0	0.24	0.53	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4. Ground Vehicle Service Maintenance	vehicle	37,850	10,000	6-10	9.5	20.8	22.7	50.0	7.6	16.7	15.2	33.4	5.7	12.5	0.30	0.67	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5. Fuel Storage Centers	-	-	-		Not an industrial waste source																											
6. Terminal and Related Facilities				6.5-8.0	200±mg/1		-	-	200±mg/1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

SECTION VI

POLLUTANT PARAMETERS

The significant wastewater constituents discussed in Section V form the basis for selecting control parameters for each activity carried out. In many cases, the removal of one constituent eliminates another, and this, in turn, reduces monitoring requirements. The following discussion presents the rationale for selecting and rejecting control parameters.

Aircraft Ramp Service

Selected Control Parameters

The waste constituents selected as control parameters are:

1. oil and grease
2. suspended solids

Jet fuels, hydraulic leaks and drippings from aircraft and ground vehicles produce oily wastes and suspended solids. Practicable treatment is gravity separation of oil and suspended solids, thus their concentration should be monitored.

Constituents Not Selected As Control Parameters

The waste constituents present but not included as control parameters are:

1. oxygen demanding materials (BOD and COD)

The primary source of BOD and COD is from the materials stated 48
above. If the latter are removed and the wastewater effluent is 49
monitored, there is no need to use BOD and COD as control parameters. 51

Aircraft Rebuilding and Overhaul 54

Because of the nature of the work and the materials used in 57
aircraft rebuilding and overhauling operations, the wastewater 58
generated is the largest in volume and contains the highest number of 59
waste constituents requiring treatment. In some cases, a series of 61
treatment methods may have to be employed, while in others, simpler 62
treatment schemes and fewer control parameters can be involved. For 64
example, if metal plating operations are not conducted, control
parameters may be limited to oil and grease, BOD, COD, suspended 65
solids, pH, and phenols. 66

Selected Control Parameters 70

The parameters selected for control are: 72

1. pH 75
2. COD or BOD 76
3. suspended solids 77
4. oil and grease 78
5. phenols 79
6. cyanides 80
7. cadmium 81
8. chromium 82

9. copper 83

10. lead 84

11. nickel 85

12. zinc 86

Oil, suspended solids, acids and alkalis are concentrated in the 92
wastewater, whose pH may range from 2.0 to 12. This spread exists 95
because there are continuing fluctuations in the amounts and 96
concentrations of the constituents contributed by parts cleaning and 97
paint stripping activities. Emulsified oil and grease, paint 98
strippings, dirt and chemical flocs appear as suspended solids, and 100
the first steps in treatment are directed in controlling them. Oil, 101
suspended solids and pH must, therefore, be monitored to determine 102
the degree of treatment efficiency achieved.

Large amounts of oxygen demanding materials are generally present 104
and must be removed, possibly by providing biological treatment in 106
addition to physical-chemical methods. The ratio of COD to BOD is 108
high primarily because the complex organic chemicals present degrade
slowly. COD is the preferred control parameter because of its 109
shorter analysis time and thus quicker operator response to greatly 110
varying treatment conditions, and its use as an indicator of the 111
removal of complex organics, many of which can be toxic to aquatic 112
life. Solvents containing phenols are used in removing paint and 113
cleaning engine and airframe components. Because of their 115

prevalence, potential toxicity, and taste and odor effects phenols 116
must also be monitored.

Cyanides are generated in the metal plating operations. Cyanide 119
baths are used to control plating rates of metal ions, such as zinc 120
and cadmium, which are electro-deposited on ferrous metals. Drag- 122
over of the plating solution containing cyanide ions and metal
cyanide complexes contaminates rinsing baths and should be treated. 124

The heavy metal plating wastes listed above are generated during 127
engine overhaul and airframe refinishing activities and entirely
different and complex waste streams result. The wastes can be acidic 129
or alkaline (depending on the type of plating operations performed), 130
and they should be given separate treatment. Because of their 131
potential toxicity, cyanide and the metals of cadmium, chromium, 132
copper, lead, nickel, and zinc must be included in control
parameters.

Constituents Not Selected As Control Parameters 134

The waste constituents present but not included as control 136
parameters are: 137

1. dissolved solids 140
2. detergents 141
3. phosphates 142

Dissolved solids are not included as a control parameter because 143

it is impracticable to remove them. Detergents and phosphorus are 146
reduced by physical-chemical treatment given other materials. 14

Aircraft Maintenance 14

Routine 151

Selected Control Parameters 153

This activity is a small source of oily wastewaters. 157

The control parameters of concern are: 159

1. oil and grease 162
2. suspended solids 163
3. pH 164

The principal waste constituents originating from general 169
maintenance operations are oil and suspended solids. Acid and 171
alkaline detergents used to emulsify the oil may result in the 172
wastewater having a high or low pH. In most cases, it will be high 173
because alkaline cleaners are normally used. Physical-chemical 175
treatment will remove free and emulsified oil and suspended solids 176
and adjust the pH. The effluent must, therefore, be monitored for 177
these parameters.

Constituents Not Selected As Control Parameters

The waste constituents present but not included as control parameters are:

1. dissolved solids
2. detergents
3. phosphates
4. oxygen demanding materials
5. phenols
6. heavy metals (Cd, Cr, Cu, Pb, Ni, Zn)

Dissolved solids are also present in the wastewater and are generally increased in number if chemicals are used to remove any emulsified oils and adjust the pH. Since there is no practicable way to remove dissolved solids, they will not be used as a control parameter.

Detergents containing phosphates are effectively removed by the emulsion-breaking and coagulation techniques used to eliminate oil and suspended solids. Thus monitoring the effluent for oil and suspended solids indirectly monitors its detergent and phosphate content. Detergents and phosphates therefore need not be control parameters.

Most of the BOD and COD loads in the wastewaters are derived from oil and detergents and these can be effectively controlled. BOD and COD are, therefore, not selected as control parameters.

Phenols are present in solvents used to clean various aircraft 212
parts, but the number is so small that phenols are not used as a 216
control parameter. Treatment of the oily wastes resulting from this 217
operation will remove some phenols, and monitoring of the effluent 219
will indicate the adequacy of source control achieved.

Small amounts of dissolved and particulate heavy metals 220
undoubtedly enter the wastewater stream from metal surfaces because 221
of oxidation, and cleaning, but some will precipitate if physical- 222
chemical treatment is used to remove oil and suspended solids. Thus 224
the use of metals as control parameters is not considered necessary.

Washing 227

Selected Control Parameters 229

The washwater varies widely in volume and is generally combined 232
with wastewater from aircraft maintenance operations for treatment. 233

The control parameters selected are: 235

1. oil and grease 238
2. suspended solids 239
3. pH 240

The rationale for selecting these control parameters is the same 246
as that discussed under Routine Maintenance. 247

Constituents Not Selected As Control Parameters 250

The parameters present but not selected for control are: 253

1. dissolved solids 256
2. detergents 257
3. phosphates 258
4. oxygen demanding materials 259
5. phenols 260
6. heavy metals (Cd, Cr, Cu, Pb, Ni, Zn) 261

The rationale for not selecting these wastewater constituents as 264
control parameters is the same as that presented under Routine 265
Maintenance.

Ground Vehicle Service and Maintenance 267

This activity is normally low in wastewater volumes containing 269
oily materials. 270

Selected Control Parameters 273

The waste constituents selected as control parameters are: 275

1. oil and grease 278
2. suspended solids 279
3. pH 280

The rationale for the selecting these constituents as control 284
parameters is the same as that discussed under Aircraft Maintenance. 285

Constituents Not Selected As Control Parameters

The waste constituents present but not selected as control parameters are:

1. dissolved solids
2. detergents
3. phosphates
4. oxygen demanding materials
5. phenols
6. heavy metals

The rationale for not including these constituents as control parameters is the same as that presented under Aircraft Maintenance.

Fuel Storage Centers

This activity produces no industrial wastewater, therefore no control parameters are required.

Terminal and Auxiliary Facilities

The wastewater discharge from this activity is of a sanitary, not industrial, nature.

Selected Control Parameters

The waste constituents selected as control parameters are:

1. BOD
2. suspended solids
3. bacteria (total coliform)

Sanitary wastewater generally contains large amounts of BOD, 334
suspended solids and bacteria. It must be given the equivalent of 336
secondary biological treatment since the wastes in it are primarily 337
biodegradable organic materials. Efficiency of treatment is normally 339
determined by analyzing the effluent with regard to above parameters. 340

Constituents Not Selected As Control Parameters 343

Waste constituents present but not included as control parameters 346
are:

1. detergents 349
2. dissolved solids 350

Detergents are effectively removed in an efficiently operated 352
biological treatment system and therefore were not selected as a 354
control parameter.

There is no practicable way to remove dissolved solids from 356
wastewater, and most of these materials are controlled when 357
biological treatment is provided. They are, therefore, not used as a 358
control parameter.

Summary of Pollution Control Parameters 361

Table 10 summarizes the selected control parameters for each 364
activity carried out within the air transportation industry. 365

TABLE 10

Summary of Pollution Control Parameters for the Air Transportation Industry by Activities

Source of Waste	pH	BOD	COD	Suspended Solids	Oil and Grease	Phenols	Cyanide	Cadmium	Total Chrome	Copper	Lead	Nickel	Zinc	Bacteria
1. Aircraft Ramp Service				X	X									
2. Aircraft Rebuilding and Overhaul														
a. Engine Operations	X	X	X	X	X	X	X	X	X	X	X	X	X	
b. Airframe Operations (Exterior & Interior)	X	X	X	X	X	X	X	X	X	X	X	X	X	
3. Aircraft Maintenance														
a. Routine	X			X	X									
b. Washing	X			X	X									
4. Ground Vehicle Service and Maintenance	X			X	X									
5. Fuel Storage Centers														
6. Terminal and Related Facilities		X		X										X

SECTION VII

CONTROL AND TREATMENT TECHNOLOGY

Historical Treatment

Historically, wastes originating from airports have caused little concern, being discharged into on-site or off-site facilities of limited design and efficiency or discharged directly into receiving streams.

With the rapid development of air travel and expanding airport complexes, waste volumes became a matter of concern. Because oily wastes were prevalent and immediately visible, treatment has primarily been directed to their removal.

Gravity sump separator units ranging widely in size, design, and effectiveness have been used. They range from simple small oil sumps to large separators that meet the design specifications of the American Petroleum Institute (API). These units are common at hangar facilities and often include chemical treatment for breaking emulsions containing oils, solvents, detergents, etc. Wastes containing heavy metal contaminants have been treated by methods involving precipitation and sedimentation. Sludge disposal has generally been to landfill sites.

More recent development has seen the routing of all these wastes 32
to a central treatment plant, where incompatible wastes are first 33
pretreated and then combined with one another for final treatment.

State-of-the-Art Treatment Technology 36

If properly applied and monitored, treatment methods presently 39
used are usually efficient in removing the industrial wastes 40
generated at airports. Depending on circumstances, some modified 41
procedures may be called for, but, in general, no highly
sophisticated techniques are required. The essentials for success 43
are source control and good housekeeping practices.

For the wastes described in Section V, the technology employed 45
consists of physical-chemical (in some instances biological) 46
treatment. In general, the wastes involved are oils, grease, 47
phenols, solids, organic solvents, detergents, cyanides, and heavy 48
metals. The state-of-the-art in oil removal is described in detail 49
in "Manual on Disposal of Refinery Wastes, Volume on Liquid Wastes," 50
American Petroleum Institute, 1969. The state-of-the-art in heavy 51
metals removal is thoroughly discussed in the effluent limitations
guidelines for the electroplating industry. 52

Present treatment of wastes originating within the industry is 54
described in the following summaries.

Aircraft Ramp Service 56

Normally, if large amounts of fuel, oils, sanitary wastes, etc. 58
are spilled at aircraft service points, they are covered with dry, 59
granular, absorbing-type products and then swept up. Any residual 61
material is flushed to storm, sanitary, or combined sewer systems.
At some large airports, water is used to flush the spilled material 62
into a lagoon. At other installations, gravity separators located in 63
the sewer systems collect any settleable or floatable material. Most 65
of these units are merely concrete sumps and are periodically pumped
out and the settled and floating material disposed of. Their 67
effectiveness depends on proper maintenance and design.

Aircraft Rebuilding and Overhaul 69

If industrial oil wastes generated during engine and airframe 72
overhaul operations can be controlled at the point where they
originate, they are collected in drums or tanks and disposed of 73
separately under contract.

Frequently, however, the wastes cannot be isolated and flow into 75
sewer lines leading from outdoor steam-cleaning points, maintenance 76
shop and hangar floors, aircraft washing areas, painting areas, and 77
engine overhaul locations. In these cases, the airlines normally 78
install gravity oil separator systems on the sewer lines. Some of 79
the separators are, in fact, only small sumps, while others are large
units that have been designed to meet the criteria of the American 80

Petroleum Institute. At installations where low flow or intermittent 81
flow conditions prevail, baffle plate type separators are 82
satisfactory if properly maintained. The characteristic of the oil 83
or other light density substance to be separated from the water has a 84
marked effect on capacity and efficiency. In addition, operating 85
efficiency is a function of detention time. Settled sludge and free 86
oil from the separators are generally stored in tanks and
periodically disposed of by waste contractors. The effluent from 88
separators may drain into either sanitary or storm drain systems, or
may require additional treatment. Following separation, waste 90
effluents, highly concentrated in oil emulsions and phenols, are 91
introduced into a mixing tank where they are broken by chemical
coagulation. This is followed by air flotation to entrap and collect 92
floc-forming particulate matter and reduce the phenols. Further 94
treatment consisting of biological oxidation or activated carbon
filtration methods may be required if the waste constituents have not 95
been satisfactorily reduced.

Metal plating wastewaters are handled separately. The diluted 98
overflow from metal plating or surface treating rinse tanks is
discharged into an on-site industrial waste treatment system for 99
processing. Most plating solutions in use have been in tanks two to 100
four years, or more without being emptied. New plating solution is 101
added as required. At some installations, plating solutions no 102
longer usable are pumped out and placed in separate holding tanks and 103

hauled away by contract for disposal. At other locations this 104
material is also discharged into the on-site industrial waste 105
treatment system for processing. Here the wastes discharged from the 106
cyanide, chrome and miscellaneous acid-alkaline dip or soak tanks and 107
rinse tanks are chemically treated.

Cyanide wastes are treated by electrolytic decomposition or the 109
chlorine destruction process. In the electrolytic decomposition 110
method, concentrated cyanide waste is subjected to electrolysis at
high temperatures (approximately 200 degrees F) for several days. 111
Initially, cyanide is oxidized to carbon dioxide and ammonia. Post 113
chlorination generally completes this process. In the latter case, 114
chlorine and caustic chemicals are injected under close control to 115
break cyanides down into carbon dioxide and nitrogen.

Chromium wastes are reduced from the hexavalent state to the 117
trivalent form by adding sulfuric acid and sulfur dioxide. 118

Miscellaneous plating wastes are combined with these partially 120
treated cyanide and chromium wastes, and then mixed and treated with 121
chemicals such as alum or lime for precipitation of the heavy metals. 122
The resulting sludge is either filtered and/or placed in containers 123
and hauled away to disposal sites. At base installations where 125
plating operations are minimal, with the bulk of the work done on 126
outside contract, rinse water overflow is directly discharged to the
sanitary sewers. At one installation all industrial wastes resulting 127

from overhaul operations are disposed of by deep well injection after 128
gravity separation and equalization steps.

Aircraft Maintenance 130

Wastewater from this operation contains accumulations of dirt, 132
oils, solvents and detergents from maintenance of aircraft and 133
emulsion mixture wastes resulting from the washing of aircraft.
Treatment involves gravity separation of free oil and settleable 134
solids followed by emulsion breaking with chemical treatment and 135
dissolved air flotation where wash waters are combined with the other 136
waste loads. (See previous description for these wastes under 137
Aircraft Rebuilding and Overhaul.)

Where little aircraft washing is done, wastewaters are generally 139
passed into gravity separators and then on to municipal treatment 140
plants. Any free oil and sludge retained in the separator system is 141
normally removed by waste contractors.

Ground Vehicle Service and Maintenance 143

The wastewater generated by these operations contains solids, 145
free and emulsified oils, organic solvents, detergents, paint and 146
paint strippings, etc. These wastes are normally treated in gravity 147
separators followed by emulsion breaking, chemical treatment and
dissolved air flotation as necessary. 148

Fuel Storage Centers

Practically no wastewaters originate from this source because of tight fire and safety regulations. If fuel storage tanks are located above ground, they are surrounded by dikes to contain spills. Waste treatment systems are not normally provided for this operation.

Terminal and Auxiliary Facilities

Only sanitary waste is generated by these sources, and it is given biological treatment at municipal or regional facilities or on the airport. The type treatment employed depends on the volume generated, climate, and economical considerations. Treatment facilities can vary from septic tanks or filter beds to large systems using combinations of secondary treatment technology.

Waste Constituent Reductions Achieved Through Present Treatment Technology

Treatment for the parameters defined will depend on their concentrations in the waste stream relative to the limitations set in the effluent guidelines for the industry. Where wastes that are monitored indicate levels below guideline limits, treatment for such waste characteristics must be considered if synergistic tendencies are observed.

The general results that can be expected by using present treatment technology are described below:

Phenols 182

If biological treatment is provided, phenols in the effluent 184
range from 0.1 mg/l to 4.0 mg/l in concentration. Extended aeration 186
can attain levels of 0.1 mg/l for phenols. Facilities having 187
multiple treatment sequences which include such methods as air 188
flotation, filtration, and activated carbon treatment will reduce
phenols concentrations to less than 1.0 mg/l. 189

Oil and Grease 191

Satisfactory removals of oil and grease are achieved if gravity 193
separation, skimming,and breaking up of waste emulsions are employed. 194
Effluent concentrations of 10 mg/l or less can be achieved if 195
chemicals, such as calcium chloride or hydrochloric acid are used to 196
break up oil-water emulsions and precipitation, air flotation, 197
skimming, and filtration are provided. Good control and operation 198
are essential in maintaining high removal levels.

Zinc 200

Zinc can be removed as zinc hydroxide by adjusting the pH, 202
usually with lime, to achieve an alkaline condition. Coagulation and 204
sedimentation are used in conjunction with a properly designed
clarifier to reduce the level of the zinc to less than 1 mg/l. 205

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Copper

Precipitation of copper to concentrations of 0.5 to 2.5 mg/1 are attainable by lime treatment. Effluent concentrations below 0.5 mg/1 are achieved on a consistent basis only with proper pH control and either proper clarification or sand filtration.

Nickel

Nickel can also be reduced to about 1 mg/1 by lime precipitation, and the procedure is most effective if the pH is close to 10. Experience has shown that if the nickel hydroxide sludge is conditioned with ferric chloride and run through a sand filter, the concentration can be reduced to a level as low as 0.09 mg/1.

Total Chromium

One standard reduction treatment technique calls for lowering the waste stream pH to 3.0 or below by adding sulfuric acid. The addition of a chemical reducing agent such as sulfur dioxide converts the hexavalent chromium to trivalent chromium. The trivalent chromium is then removed by precipitating it with lime. Levels of 0.5 to 1.0 mg/1 can be achieved. By using a coagulating aid to improve the precipitation-sedimentation of chromic hydroxide, lower levels are possible.

Cadmium

Cadmium can be removed if the pH is adjusted up to 10 to achieve an alkaline condition; it then precipitates as cadmium hydroxide. Coagulation and sedimentation reduce the cadmium ion level in the effluent o 0.10 mg/l. A range of 0.15 to 0.20 mg/1 should be achievable on a regular basis. Complete removal by co-precipitation with iron hydroxide at pH 8.5 is possible.

Lead

Lead generally is most effectively precipitated out of solution by using soda ash or a caustic. Little data are available on effluent lead values after treatment. However, good conversion of dissolved lead to insoluble lead should be achieved using the methods described.

Cyanide

Oxidation of cyanide to carbon dioxide and nitrogen can usually be accomplished within a short time by chlorination if the pH is maintained at 8 - 8.5. More chlorine must be added than the amount needed just to oxidize the cyanide to cyanate to avoid liberating highly toxic cyanogen chloride gas. Cyanogen chloride is the intermediate produce of the oxidation of cyanide to cyanate. It breaks down very rapidly and poses no problem at pH 10+. However, at the lower pH excess chlorine is needed to speed the breakdown.

Another process used for destruction of cyanide waste is electrolytic decomposition. It is primarily used by industry for destruction of cyanide in concentrated spent metal plating solutions. Levels less than 0.1 mg/l are achievable.

Suspended Solids

A double liming clarification system is adequate to reduce the suspended solids concentration in the effluent to a level of 25 mg/l which in turn removes most metals concurrently. This treatment includes coagulation, flocculation, precipitation, and clarification. A level of 10 mg/l or less may be reached by applying filtration.

Examples of Waste Treatment Practices at Various Airline Overhaul and Maintenance Bases

The preceding information is a general description of the treatment and control methods employed at airports. More specific information on waste treatment and control by some airlines is presented in the following text.

Site A

Since January 1960, this airline has been disposing of the industrial wastewater generated at its maintenance and engineering center by pumping it into a deep well. It is the only airline known to be using this method.

Basically, the entire system consists of a lift station, a 296
clarifier unit, an equalization tank, an injection pumphouse, and a 297
well head. All treatment is physical in nature. 298

All the wastewater goes into a gravity collection system and then 300
into a sump; it is pumped to the clarifier unit. The clarifier unit 302
is primarily an oil-water-solids separator and was designed to
operate at a flow rate of 486 gpm and provide a 64-minute detention 303
time. Surface wastes, such as oil and solvents, are skimmed off and 305
put into a storage tank; heavier materials settle to the bottom and 307
form a sludge, which is removed as required.

The wastewater then flows by gravity to a 55-foot diameter by 12- 309
foot deep equalization tank. There the slugs of waste of varying 311
concentrations are equalized, mixed and held until pumped into the 312
well. When activated by switches connected to a float on the inside 313
of the tank, three injection pumps withdraw wastewater from the 314
basin, pass it through the well head, and send it down the well at a 315
pressure of about 420 pounds per square inch gage (psig). These 60- 316
horsepower, positive displacement type units run about 22 hours per 317
day. Flow has been averaging over 500,000 gallons/day for the past 318
two years. About 2,200 gallons per month of surface sludge from both 319
the clarifier and the equalization basin are collected and hauled 320
away under contract to a land fill site off the premises. 321

The well was driven through the underlying limestone layer and drilling stopped at a depth of 3,036 feet because granite was encountered. The well is cased into the limestone layer to keep the earth above from becoming contaminated. Extensive analysis on waste constituents has not been performed. All sanitary wastes are treated by the municipal sewage treatment plant.

Site B

The industrial wastes generated from this airline's maintenance and overhaul base are treated in a combined physical-chemical-biological waste treatment plant placed in operation in October 1972. The plant was designed to treat 1.3 mgd of wastewater and the flow is presently about 0.50 mgd; it can be expanded to handle 2.3 mgd. Only the effluent is analyzed to determine the waste characteristics. Figure 2 presents a schematic of this treatment system.

Treatment of general oily waste

General oily wastes are batch-treated by a series of procedures, all of which are interlocked to avoid processing errors or unintentional dumping of a partially filled tank.

The waste enters the bottom of a screw pump pit through a coarse bar screen. The screenings are removed, drained, and placed in the grit hopper. The oily waste is then lifted to the free-oil and grit-removal basin by one of two 42-inch diameter screw pumps. The

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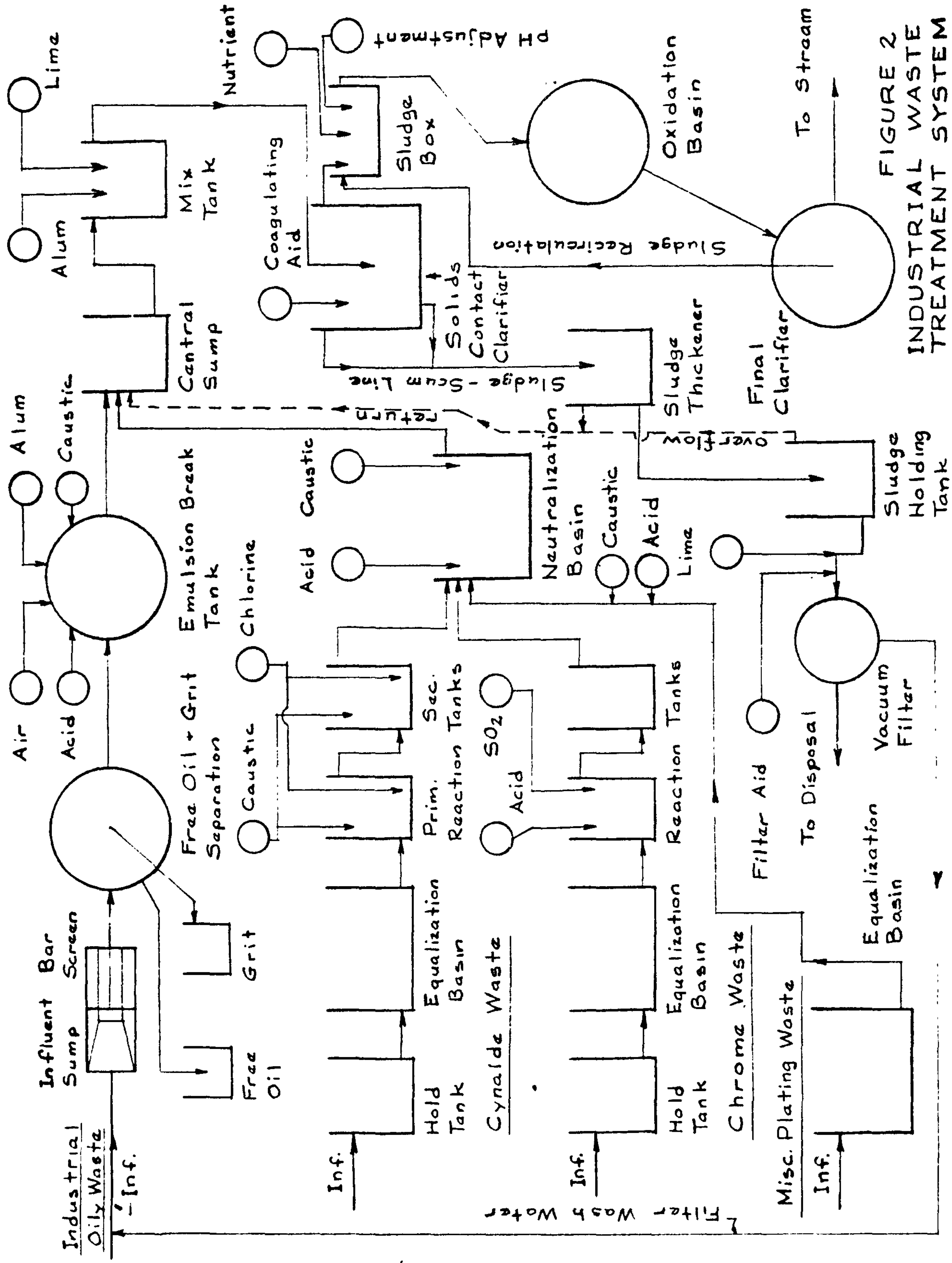

FIGURE 2
INDUSTRIAL WASTE TREATMENT SYSTEM

settled grit is washed and sent to the grit hopper; it is later 349
placed in a landfill. Free-floating oil is skimmed into a trough and 351
flows into a 5,000 gallon underground storage tank where it is picked 352
up by an oil reclamation company.

The waste leaving the basin passes over a fine screen and into 354
the oily waste sump. Centrifugal pumps move the waste from the sump 355
into one of three 500,000 gallon emulsion break tanks which are 356
alternated in use. Each has a design flow of 1.0 mgd. 357

Emulsion breaking 359

Each tank is equipped with three treatment lines -- one 361
feeds alum, another caustic, and the other carries acid. 362

When a tank is full, a sample is withdrawn from it so that the 365
proper chemical dosage can be calculated to break the emulsions. 367

After tests in the laboratory show that the emulsions are 369
satisfactorily broken, the operator open the drain valve. The 371
contents then enter the central sump and are mixed with treated and
neutralized plating waste. 372

Cyanide plating waste treatment 374

Waste cyanide concentrate from the cadmium plating tank is pumped 376
into a cyanide holding tank outside the plating shop. The waste then 378
moves from the holding tank through a gravity line to a cyanide 379

equalization basin. After being held for 12 hours in the basin, the wastewater is mechanically homogenized. Transfer pumps move this wastewater to the reaction tanks where it is treated with chlorine and caustic chemicals on a continuous flow basis. The amount of chemical used depends on the pH and the oxidation reduction potential (ORP). Cyanide is oxidized to cyanate in the first tank. The reaction occurs at a pH range of 8.5 to 10.0 in about two hours. The second reaction tank is used to oxidize cyanate to carbon dioxide, nitrogen and water. Reaction proceeds at a pH of 8.5 to 9.0 in approximately two hours.

Chrome waste

Wastes from chrome plating, anodizing and alodining rinse tanks are physically handled in the same manner as cyanide wastes. They feed through a gravity line directly into a chrome equalization basin. Concentrated chrome solutions enter a holding tank and are fed, as convenient, to the basin. After being mixed, the waste is transferred to the chrome reaction tanks where sulphur dioxide and sulfuric acid are added automatically in amounts determined by the pH and the ORP. Hexavalent chromium is reduced in this reaction to a trivalent state, at a pH of 2.0 to 2.5. Once processed, the waste is discharged into the neutralization basin, where it mixes with the treated cyanide waste and the acid-alkaline wastes.

Acid-alkaline plating waste 404

Miscellaneous acid-alkaline plating wastes flow from the 406
plating shop, at pH values of from 3-11, through a gravity line to an 408
equalization basin. Mechanical stirrers homogenize the mix, which is 409
pumped to the neutralization tank. Corrections in pH are made 411
automatically. Caustic and acid are fed into the mechanically 412
agitated tank as required. The pH must be kept between 7.0 and 8.0. 413
The neutralized waste then flows by gravity to the central sump, 414
where it joins the treated oily waste. 415

Combined wastes to mix tank 417

At this point, all wastes come together in the mixing tank 419
and have a pH value of 5.5 to 6. At this point, lime and alum are 421
added to precipitate the trivalent chrome and other heavy metals. A 423
magnetic flow meter paces the feeding of lime and alum to keep it
proportional to flow. The combined waste, recirculated sludge, lime 425
and alum are thoroughly mixed. A floc trap of alum catches non- 426
emulsified oils and heavy metals.

The mix flows to the solids contact clarifiers designed for a 428
waste flow of 2.0 mgd. After heavy sludge particles, built to a 430
proper size with polymer, are trapped in the alum floc, along with 431
precipitated metals and broken emulsions, the mass settles. Skimmers 432
move any floating matter into a scum trough, where it goes into scum

pits. Float-operated scum pumps move sludge into the sludge 433
thickener or sludge holding tank.

Biological treatment of combined wastes 435

Activated, recirculated sludge from the final clarifier is 437
mixed with clarified liquid from the solids contact clarifiers, and 439
nutrients in the form of aqua ammonia and phosphoric acid are intro-
duced. A pH probe located at the influent end of the oxidation 441
ditchs automatically adjusts the pH at the sludge box by causing 442
controlled feed of either caustic or acid to maintain the biological 443
digestion process.

An extended aeration process, which reduces the BOD by approxi- 445
mately 90%, takes place in the oxidation ditches equipped with 447
aerating rotors. The depth to which the rotors are submerged is 448
critical, because it determines both oxygen transfer and BOD 449
reduction.

Final treatment 451

Flow from the oxidation ditches enters the final clarifier. 453
Settled sludge is removed by a multi-draw scraper and placed in a 454
sump where one of two propeller-type pumps recirculates the underflow 455
back to the sludge box located ahead of the oxidation ditches. This 457
sludge is recirculated to the ditches and any excess sludge is
directed to the sludge thickener. 458

Effluent from the final clarifier moves through the Parshall 460
flume and flow measurement is recorded. It flows into the final 462
oxidation pond (or temporary polishing pond) prior to discharge to 463
receiving waters.

Sludge disposal 465

Solids from the de-emulsified oils, precipitated heavy 467
metals and aluminum hydroxide (alum) floc, settle as sludge to the 468
bottom of the solids contact clarifiers. The sludge is then moved to 470
the sludge thickener tank, while the liquid discharges over the 471
effluent weir and flows to the oxidation ditches. The thickened 472
sludge moves to the sludge holding tank, where it is pumped to the 473
vacuum filters.

The thickened sludge has a solids content of 5-6% by weight. 475
Additions of pulverized quicklime and a polymer as sludge 476
conditioners prepares the material for vacuum filtration. Filtration 478
increases the solids content to 25-30% by weight. The filter cake is 479
picked up and disposed of under contract at a landfill.

Site C 611

Industrial wastes generated at this airline's jet center are 614
processed in its waste treatment plant using physical-chemical

methods. The waste is further treated upon discharge to the municipal system. Average flow is estimated to be 0.25 mgd.

The maintenance facility generates the following types of waste: process, acid-alkali, cyanides, chrome acid, silver cyanide, cadmium cyanide, and sludges.

Process wastes

Process waste is discharged by sump pumps into the bar screen chamber and then into the A.P.I. oil separator. Free oil and settled solids are removed in this unit. Oil that accumulates on the water is moved to the effluent end by continuously operated skimming equipment and is discharged into the free-oil sump. Bottom sludge is moved continuously by mechanical scrapers to sludge hoppers at the influent end. Separator effluent is then discharged into the waste equalization basin.

During normal operation, both compartments of the equalization basin are operated in parallel. The purpose of the basin is to provide sufficient detention time to even out the wide variation in quantity of the waste as it comes from the shops and hangars. This provides as uniform a mixture as possible for subsequent chemical treatment.

Waste is started through the chemical treatment process and alum is mixed with the raw waste to begin the oil emulsion breaking

process. Optimum pH in the mix tank is approximately 6.5. From this 640
tank the waste passes on to the acid mix tank where the addition of 641
sulfuric acid lowers the pH to approximately 3.0. At this point a 642
heavy floc forms.

The next step takes place in the air flotation unit where the 644
addition of dissolved air floats the floc and its entrapped oil, 645
dirt, and other material to the surface of the tank. The skimmer 647
mechanism is operated continuously while process waste is being
treated. 648

From the dissolved air flotation unit, the partially treated 650
waste enters caustic mix tanks which operate in series. In these 652
tanks, the pH of the waste is raised from 3.0 to approximately 8.3 by 653
adding caustic soda.

Following this pH adjustment, the waste goes through its final 655
treatment in the clarifier. Here, metal hydroxides settle out, and 656
any remaining oil floats to the surface. The equipment provided in 657
the clarifier is operated continuously to move the settled sludge to 658
the center hopper and the floating material to the scum box. The 659
treated effluent from the clarifier is discharged by gravity into the
nearby sanitary sewer.

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Acid-alkali wastes 661

Treatment of the acid-alkali waste is largely a neutra- 663
lization process. Waste that is pumped from the sump is discharged 665
into the acid-alkali storage tank to take advantage of the self- 666
neutralization characteristics of the raw waste.

The acid-alkali transfer pumps discharge the waste into the 668
caustic mix tanks where pH adjustment to 8.3 takes place. The waste 670
then flows to the clarifier where metal hydroxides and other
insoluble materials settle out. 671

Cyanide destruction 673

Cyanide wastes that is pumped from the sump is stored in the 676
cyanide storage tank at the waste treatment plant.

First stage oxidation of cyanide to cyanate by the addition of 678
caustic soda and chlorine takes place in the cyanide oxidation tank. 679
A portion of the waste passing through the tank is recirculated and 680
liquid chlorine and liquid caustic soda are introduced as needed, 681
regulated by the oxidation reduction potential (ORP). 682

Following first stage oxidation, the waste passes on to the 684
cyanate oxidation tank for final oxidation. A portion of the flow 686
passing through the tank is recirculated into the chlorine room where
caustic soda and chlorine are introduced into the system. An ORP 688

value of 600 millivolts at this point indicates that the cyanates have been oxidized to carbon dioxide and nitrogen.

As long as the desired ORP value is maintained, the waste will pass into the mixing tanks where the pH is adjusted to approximately 8.3, at which value, copper and other insoluble metal hydroxides form. The waste then passes on to the clarifier where metal hydroxides settle out and are removed as sludge.

Chromic acid, silver cyanide, and cadmium cyanide

These wastes are pumped through individual closed-loop evaporative units located in the plating shop to recover them from the used rinse water. The rinse water from counter-current double chamber rinse tanks is processed through the evaporator units under vacuum, is distilled off, and the dilute plating solution is concentrated. The concentrate is returned to the plating tanks and the distilled water is sent back to the rinse tanks.

Sludges

Sludge is isolated from the A.P.I. oil separator, the waste equalization basin, and the clarifier. In addition, float (scum) from the air flotation unit is mixed with these sludges for processing in a centrifuge.

Sludge that accumulates in the hoppers at the influent end of the 715
separator is drawn off automatically and discharged into the float 716
storage tank.

Most of the sludge that settles in the waste equalization basin 718
is moved by the natural flow pattern through the basin to the hoppers 719
at the effluent end. Hydrostatic pressure discharges the material 720
from the equalization basin to the A.P.I. basin sludge hopper. 721
Sludge drawn off of the clarifier is first discharged to the sludge 722
hopper and from there to the float storage tank. 723

Float that is skimmed continuously from the dissolved air 725
flotation unit drops directly into the float storage tank. The 727
combined sludge and float are then transferred to the centrifuge and
dewatered. The dried sludge cake is removed to the landfill and the 728
clear filtrate is recirculated to the separator. 729

Site D 804

Site D uses gravity type separator units for containing oil, 806
grease, detergent or paint stripping wastes that drain from the 807
hangar or shop areas. Effluent from the separators is discharged to 808
the regional treatment plant and waste oil is removed under contract. 809
All wastewater receives physical, chemical treatment before being 810
discharged to the sanitary sewer. Analysis of wastewater 811
constituents and information on water usage are not available.

Metal plating wastes are primarily handled by containment, rinse 813
water control and reuse, separation of accidental spills, and batch 814
processing of spent plating solutions. 815

To contain metal plating solutions, the floor level beneath the 817
plating shop has been provided with several curbed collection areas. 818
In the unlikely event that a tank should rupture, the chemical would 819
be collected within its respective area and flow to the proper waste 820
sumps and holding tanks for treatment. Chemicals which would be 822
hazardous when mixed go into different curbed areas.

Cyanide control and treatment 824

If spillage occurs or a rupture takes place, the chemical 826
flows under the floor in glass drains to the cyanide sump. 827

From there it is pumped up into a 400-gallon cyanide holding 829
tank. It contains steam heating coils and 5,000 amphere rectifier 830
which are used to break down the cyanide electrolytically. This 832
method is also used to treat a spent solution. Complete breakdown of 833
the cyanide and precipitation of the metals is accomplished by adding 834
chemicals batchwise to the tank. The clear supernatant is then bled 835
off to a sump where it is mixed with rinse waters. The sludge is 836
disposed of off site.

All the rinse water tanks in the cyanide areas drain to one 838
control point where the water and the effluent from the cyanide 839

holding tank are mixed and pumped through a two-stage finalizer. Caustic and chlorine are introduced into the first stage to convert the cyanide into cyanates; final treatment in the second stage converts the cyanates into non-toxic end products, carbon dioxide and nitrogen.

The effluent is then pumped into the acid-alkali sump, its pH is adjusted and the effluent discharged to the sanitary sewer.

Acids and alkalis wastes

In case a tank ruptures, the effluent is collected in a curbed area and flows to the acid-alkali sump where its pH is adjusted before it is pumped to the sanitary sewer. The sump, which has a 1,500-gallon capacity is divided into two compartments. All waters used in acid-alkali rinsing operations are discharged into it, plus water that has been used to wash exhaust fumes from the fume scrubber units.

Chrome wastes

The chrome effluent flows to its own sump area, where it is pumped into a 4,000-gallon chrome holding tank. The effluent is batch treated with bisulfite to reduce hexavalent chrome to trivalent chrome. Caustic soda is added to precipitate chromium hydroxide, the supernatant bled off and the settled sludge is removed and disposed of by a waste contractor.

The effluent is then pumped into a two stage tank. Here final reduction of hexavalent chromium to the trivalent state is accomplished with sulphur dioxide and sulphuric acid and the chromium precipitated by the addition of caustic soda.

The treated effluent is then pumped to the acid-alkali sump where the final pH is adjusted before the discharge enters the sanitary sewer.

Degreaser pit

Aircraft engine parts are initially degreased in a central location so no oily contaminants are introduced into the cleaning or plating tanks. A still allows complete recovery of the degreasing solvent from those wastes, prior to the disposal of grease residues in drums.

This area is separate, has no drain sump, and in case of a cleaning tank rupture, all solvents would be totally contained.

Water usage

Water is conserved by employing control timers on all large rinse tanks. The water that is used in the fume scrubbers has already been used to cool the air conditioning system of the main office. Water used to wash the fume scrubbers in the chrome plating shop is added to the chrome solutions to replenish evaporation loss.

"Drag out" of plating solutions into rinse tanks is generally 892
reduced by first rinsing the part over the plating tank before 893
proceeding to the rinse tank. This procedure achieves a very low 895
level of rinse water contamination and reduces the cost of chemicals 896
that are normally lost in drag out.

Site E 898

Site E provides no specific treatment of its waste discharges 900
other than passing them through gravity separators on the sewer 901
system and discharging the effluent to the regional treatment plant. 902
No data are available on analysis of wastewaters of direct industrial 903
water usage.

Site F 905

Site F provides limited physical-chemical treatment of the wastes 907
generated before discharging them into the sanitary sewer system. 908
Flow averages 21,000 gallons per day. No analysis of wastewater has 910
been conducted. This treatment system was put on line in the summer 911
of 1973.

Site G 481

At present, there are four distinct waste streams generated at 483
the industrial complex which comprises this airline's overhaul 484
facility. The streams are alkaline-cyanide, acid-chrome, industrial- 485
petroleum, and sanitary. Only methods used in treating the first 487

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three will be discussed. Treatment consists of physical-chemical and biological means. The flow rate averages 0.5 mgd and analysis is periodically made of the effluent.

Metal finishing wastes

Complete stripping and plating of the aircraft's components and engines take place in the engine overhaul building and two entirely different and complex waste streams are generated. One contains all cyanide and alkaline wastes, and the other contains all chrome, acids, and other heavy metal wastes. An equilization basin is provided at the treatment plant for each of the two waste streams. The wastes are then pumped at a constant rate to process basins.

The cyanide-bearing waste is destroyed by the alkaline-chlorination process (caustic soda and chlorine) which oxidizes cyanide to carbon dioxide and nitrogen. The waste then overflows into a two-hour basin where additional chlorine and caustic soda are added to complete the cyanide oxidation. Part of the effluent from the two-hour basin is recycled to serve as water for the chlorine injection system. The remaining effluent from this basin combines with the effluent from the chrome treatment process before passing into a settling basin.

The chrome bearing waste is treated in the 30-minute basin by the addition of ferrous sulfate and sulfuric acid which reduce the hexavalent chrome to the trivalent state. From here the waste

overflows into a basin where caustic soda precipitates the trivalent 514
chrome as the hydroxide. The effluent is then combined with that 516
from the cyanide treatment process.

Combining the two wastes before they pass into the settling basin 518
produces a neutralized effluent that may be discharged to a stream or 519
receive further treatment. The sludge is removed through a time 521
controlled blow-off valve to the sludge storage vault. 522

Petroleum waste 524

Petroleum wastewaters emanate from the engine overhaul and 526
airframe overhaul buildings. The first contributes most of the oil, 528
while wastewaters from the second contain some oil, paint, paint 529
strippers, solvents, degreasers, commercial laundry and washdown 530
water as the major constituents. Similar wastes from ground support 531
equipment maintenance operations are combined with these two streams 532
and are pumped to the free oil clarifiers. 533

The petroleum waste treatment plant is designed to remove oil by 535
gravity separation and the addition of chemicals (ferrous sulfare and 536
caustic soda).

Gravity separation will not separate all oil from the wastewater, 538
and a small quantity remains as an emulsion. To break the emulsions, 540
the pH of the incoming liquid is lowered and ferrous sulfate is
added. The ferrous ions oxidize to the ferric state and precipitate 541

as the hydroxide. After the pH is raised by the addition of caustic 542
soda, the oxidation and hydration processes are completed. The oil 544
rises to the surface as free oil for removal or is trapped in the
floc particles formed.

In the free oil clarifier, a portion of the solvents and free oil 546
is skimmed off the surface and taken to an underground oil storage 547
tank. The sludge which settles out is withdrawn and placed in a 548
sludge storage vault.

Equalized waste 550

The liquid passes from the free oil clarifier into an 552
equalization storage basin where additional sedimentation and oil 553
separation take place. The oil scum and sludge collected are 555
discharged into the oil storage tank and sludge storage vault, 556
respectively.

The equalized wastewater passes into a pump station which directs 558
it at a constant rate to the next treatment station, which consists 559
of an acid mix chamber, a clarifier, and an alkaline mix chamber. 560
After sulfuric acid and ferrous sulfate are added in the acid mix 561
chamber, the liquid passes into the clarifier where the emulsions 562
break down and coagulation particles start to form. The liquid then 564
passes into the alkaline mix chamber where caustic soda is added to
raise the pH and to complete the coagulation process. 565

A solids contact or up-flow basin is the last unit in the system. 567
In this unit, the waste is clarified by flowing up through the sludge 568
blanket. The sludge is removed through a time controlled blow-off 569
valve to the sludge vault.

Secondary treatment 571

The secondary treatment facilities consist of a trickling 573
filter, secondary clarifier, and pump station. The trickling filter 575
reduces BOD, COD and phenolic characteristics of the effluent being 576
discharged to the receiving stream. The filter can accommodate 577
temporary increases in BOD or hydraulic loadings. The clarifier's 578
primary purpose is to provide the time required for the biological
growth in the filter effluent to settle. 579

A pump station lifts the chemically treated wastewater and 581
recycled liquor to the trickling filter. The filter's application 583
rate is 1,200 gpm; any difference between this rate of flow and the 584
treatment flow rate is made up by wastewater recirculation. A rapid 585
mix chamber is provided in the flow path prior to the raw waste
combining with the recycle liquor in the wet well. In this chamber, 587
the pH is continuously monitored and controlled by adding acid to 588
neutralize the waste for biological treatment.

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Tertiary treatment

The tertiary treatment portion of the plant consists of two lagoons with a total surface area of 2.0 acres. They operate in series and act as polishing units for the combined effluents from the secondary and plating waste clarifiers. They can also serve as backup units if overload problems develop. The larger of the two can be used to confine any accidental chemical spills. An auxiliary pump can be placed into service to pump the waste back to the head of the plant for retreatment. The smaller cell can be used as a sludge dump if the vacuum filter should fail.

Vacuum filter

A cloth media vacuum filter system is employed to handle the sludge. A sludge thickening basin (sludge storage vault) is included as an integral part of the filter building that is capable of storing two to three days' sludge volume. The sludge is pumped from this unit to the filter, dried and removed to the disposal area by truck. An additional pump is provided to return the supernatant in the vault to the plant influent.

Site H

Oily industrial and metal plating wastes originating in the overhaul and maintenance base complex of this airline are treated by separate systems. The waste is pretreated by physical-chemical means

before discharge into the airport lagooning system. Flow rate from 737
data received is estimated to be 0.5 mgd.

Industrial oily wastes 739

A compact treatment plant in which chemical coagulation and 741
pressure floation techniques are employed is used to remove 742
contaminants from oily industrial wastes. 743

In the pressure flotation process, air bubbles generated within 745
the wastes attach themselves to the dispersed material in the wastes 746
and float it to the surface. This method effects separations much 748
more rapidly than gravity clarification.

To handle variations in flow and to remove as much free oil as 750
possible, a pretreatment storage tank is provided. The free-floating 752
oil that accumulates there is periodically skimmed directly into the 753
scum concentration tank.

In the flotator system, a pressurized feed volume is withdrawn 755
from the bottom of the pretreatment tank. If the pretreatment tank 757
overflows, the wastewater moves by gravity and enters the flotation 758
unit concentrically with the pressurized flow. In this way, a 759
significant degree of treatment is achieved even during prolonged
plant overloads. 760

Liquid alum and activated silica are injected into the waste 762
stream withdrawn from the pretreatment tank. 763

This is done through chemical feed taps provided at three 765
locations in the feed line to the flotator to allow selection of 766
optimum treatment.

The amount of flocculant material produced depends not only on 768
the strength of the wastes but also on the required use of coagulant 769
and the frothiness of the float. Since float cannot be disposed of 771
on site, its volume must be reduced as much as possible before it is 772
loaded into tank trucks. A large scum concentration tank is provided 773
for this purpose.

Metal plating wastes 775

A separate system is used to treat concentrated and rinse 777
tank plating wastewaters. Generally discharge from rinsing 779
operations is the continuous source of contaminants. The use of a 780
closed loop system which allows the treated water to be reused is to
be implemented in 1974. 781

Plating tank solutions that have been spent are treated on a 783
batch basis, as required. They are pumped out of the plating tanks 784
and processed by the application of physical-chemical methods. 785
Cyanide wastes are destroyed by the electrolytic oxidation process; 786
the addition of chlorine then removes the residual cyanide. Chrome 788
plating wastewaters are treated by the sulfur dioxide reduction
process in which hexavalent chromium is reduced to the trivalent 789
state. Treatment of other miscellaneous acid-alkaline plating wastes 790

is achieved by pH adjustment, neutralization, and precipitation of 791
metals.

All of the neutralized wastes are piped to a precipitation system 793
consisting of four tanks. When a tank is full, lime and a 795
polyelectrolyte are added to precipitate metals and solids. When the 797
sludge has settled, the supernatant is discharged to the industrial
waste treatment plant for further treatment. 798

The sludge from the precipitation tanks is pumped to a holding 800
tank before being taken by tank truck to a landfill. About 3,000 802
gallons of sludge are produced each week.

Effluent Waste Loads 914

Table 11 summarizes the effluent waste loads discharged at 917
airline maintenance bases where surveys were conducted. 918

Table 12 summarizes typical influent and effluent waste load that 920
pass through the industrial oxidation ponds maintained at a large 921
west coast airport. Industrial wastewaters are first isolated, 923
separated or treated and then discharged to the storm drainage system 924
channels and then pumped to one of two lagoons. One can hold 925
20,000,000 gallons and the other 2,600,000. Wastes spilled on 926
aircraft parking or ramp areas remain there until cleaned up or
washed into the storm system by flushing or by rain. A certain 928
amount of oil flotation and solids settling takes place in the

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TABLE 11

Average Effluent Waste Loads From
Airline Maintenance Base Facilities

Site	pH	BOD mg/1	COD mg/1	Suspended Solids mg/1	Oil & Grease mg/1	Phenols mg/1	CN mg/1	Cd mg/1	Cr mg/1	Cu mg/1	Fb mg/1	Ni mg/1	Zn mg/1	Effluent Flow(avg)mgd	Time Study Period
A	-	-	-	-	-	-	-	-	-	-	-	-	-	.523	Jan 72 thru Aug 73
B	7.1	60	-	22	8	2.41	.005	.024	.638	.046	<0.1	.261	.138	0.498	Apr thru Oct 73 (avg)
C	8.6	31		67.2	84.2	-	0.05	-	1.20	0.16	-	0.26	0.03	0.253	May 3,4,7,8,9/73 (avg)
D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Flow unmeasured
E	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Flow unmeasured
F	-	-	-	-	-	-	-	-	-	-	-	-	-	0.021	Estimated Flow
G	6.7	-	.178	-	.31	.138	.01	.015	.184	.015	-	.438	-	0.50+	Plant analysis January 1974
H	7.8	-	-	-	16.25	0.5	0.24	0.08	1.05 (total)	0.16	0.11	0.40	0.25	0.520	24-hour composites 10-17,24 30-73;11-7-73
I	7.1	-	2,771	46.0	204.6	5,380	0.02	0.64	0.48 (total)	2.53	1.72	0.27	2.15	110 gpd (washing only) (low flow)	Industrial Waste Survey Dade County, Florida Report September 1971
J	6.8	-	47	4.0	87.9	13.6	0.01	<0.01	1.08 (total)	0.02	0.16	0.15	-	0.500	Industrial Waste Survey Dade County, Florida Report Sept. 1971

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TABLE 12
Average Waste Loads from Industrial Waste Treatment Lagoons
at a West Coast Airport

		Flow mgd	Detention Time - days	pH	BOD mg/l	COD mg/l	Grease mg/l	Phenols mg/l	CN mg/l	Cd mg/l	Cr mg/l	Cu mg/l	Pb mg/l	Ni mg/l	Ag mg/l	Zn mg/l	
South Lagoon	Influent		17	6 - 9	62.5	395	110	0.29	≤ 0.06	0.53	0.21	0.35	0.13	0.18	0.02	0.20	Avg 9-67 thru 10-68
	Effluent	0.14 dry weather		6-10.2	-	-	12.5	0.05	≤ 0.06	≤0.04	0.05	0.07	0.13	0.05	0.04	0.40	Avg 12-68 thru 5-73
North Lagoon	Influent		20	4 - 9	88	254	24	1.0	<0.1	0.16	0.9	0.31	0.29	0.42	0.04	0.48	Avg 2-67 thru 2-69
	Effluent	1.01 dry weather		6-10	-	-	12.5	0.2	0.06	0.06	0.18	0.10	0.06	0.17	0.04	0.61	Avg 9-67 thru 5-73

channel and lagoon areas. Oil is collected and disposed of as required, but some oils and solids are flushed into the Bay when it rains.

Table 13 presents a summary analysis of the wastewater sampling data collected at a large east coast airport during the period May 15 - December 15, 1972. This work was performed under contract by a consultant firm. The objective was to determine the types and amounts of material being discharged into the bay area from the airport's outfalls.

The apparent problems of concern are oil and grease, and possibly solids and phenols. Analysis indicates that the concentrations of heavy metals are within acceptable limits and present no problem of concern.

Other than one major airline that has extensive treatment facilities at its overhaul center, the major type of treatment employed at this airport was a gravity type sump or separator used to collect oily waste and settleable matter. All sanitary wastes are processed at the municipal sewage treatment plant.

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TABLE 13

<u>Summary Analysis of Wastewater Discharge
From an East Coast Airport</u>

pH	6.6 to 8.4
BOD mg/l	4 to 162
COD mg/l	10 to 750
Oil and Grease mg/l	1 to 88
Phenols mg/l	0.1* to 0.31
Suspended Solids mg/l	5 to 210
Surfactants mg/l	0.50* to 2.30
Cyanide mg/l	0.02*
Cadmium mg/l	0.05*
Chromium (Total) mg/l	0.10*
Arsenic mg/l	0.01*
Iron mg/l	0.10 to 30
Lead mg/l	0.10*
Nickel mg/l	0.05*
Copper mg/l	0.30
Zinc mg/l	0.40
Mercury mg/l	0.002*
Phosphorous (Total) mg/l	0.33 to 1.94

*Indicates values below minimum detectable concentration.

SECTION VIII

COST, ENERGY AND NON-WATER QUALITY ASPECTS

Air Transportation

Introduction

The air transporation industry has been subcategorized into six major types of operations for the purposes of recommending effluent limitations. The cost discussion in this section has been organized along the lines of the subcategorization.

Aircraft Ramp Service

Good housekeeping practices will insure that the runoff from most aircraft service areas is uncontaminated by grease and oils and will meet the recommended effluent limits. In some areas of concentrated service activity, it may be impossible or uneconomical to maintain a level of housekeeping adequate to prevent surface water contamination. In such instances, one of two situations may exist, each calling for a different control strategy. If the surface water is already collected in storm sewers, the recommended effluent limitations would require that the waters pass through a grit removal-gravity separation process prior to discharge. If the area is not sewered, then the recommended guidelines would require the installation of an appropriate runoff collection system as well as the treatment system.

In most cases, the least cost approach to meeting the effluent 37
requirement will be the observance of tight operating procedures to 38
contain spills and remove the grease, oil, and other hydrocarbons 39
quickly by dry methods. In other instances, airport management may 40
decide to collect and/or treat contaminated runoff from areas of 41
concentrated service activities.

The costs of meeting the recommended effluent limitations under 43
these latter conditions have been estimated in Tables 14 and 15. In 45
Table 14, it has been assumed that surface runoff from the area had
not previously been contained so the cost of containment, collection, 46
and treatment has been estimated. In Table 15, only the costs of 48
treatment have been estimated because a containment and collection 49
system has been assumed in existence. The costs in the tables have 50
been developed for two typical size service areas of one-half and one 51
acre in area. The costs of providing best practicable control 52
technology currently available (BPCTCA) for larger areas would 53
increase at an exponentially decreasing rate such that an area of 10 54
acres would require an expenditure only 3-5 times that of the 55
expenditure required for the one acre area.

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TABLE 14

ESTIMATED COSTS OF BPCTCA (1973 dollars)
Air Transporation - Aircraft Ramp Service Areas
(one-half acre and one acre areas
no collection system in existence)

	One-half Acre Area	One Acre Area
Investment Costs:		
Collection System:		
Paving removal	$ 3,750	$ 6,000
Excavation	750	1,100
Collection channel	21,500	32,600
Grating over channel	13,500	19,000
Curb	1,200	1,700
Overhead, profit, contingencies	9,300	14,600
	$50,000	$75,000
Treatment System		
Gravity Separator	15,000	20,000
Total	$65,000	$95,000
Annual Costs:		
Capital	$ 5,200	$ 7,600
Depreciation	3,300	4,500
Operation and Maintenance	1,200	1,600
Total Annual	$ 9,700	$13,700
Power	100	1,50

TABLE 15

ESTIMATED COSTS OF BPCTCA
Air Transportation - Aircraft Ramp Service Areas
(one-half acre and one acre areas
collection system already in existence)

	One-half Acre Area	One Acre Area
Investment Costs		
Gravity Separator and pipe modifications	$ 17,000	$22,500
Annual Costs:		
Capital	$ 1,350	1,800
Depreciation	850	1,100
Operation and Maintenance	1,200	1,600
Power	100	150
Total	$ 3,500	$ 4,650

The requirements of best available technology economically achievable (BATEA), new source performance standards (NSPS), and pretreatment for existing and new sources are all the same as those for BPCTCA. The costs for these other limitations, therefore, are the same as those for BPCTCA that appear in Tables 14 and 15.

Aircraft Rebuilding and Overhaul

The recommended effluent guidelines were already being met by several installations that were surveyed as part of the field work supporting the development document. Depending on the size and type of operations, the installed costs of the existing waste treatment facilities varied from $500,000 to $2,500,000. The fact that these systems have been built and are operating testifies to the technical and cost feasibility of the control systems. Nevertheless, for those installations that may have only some or no treatment at all, the costs of achieving BPCTCA have been estimated. The costs have been estimated for one typical size waste treatment facility with a daily wastewater flow of 500,000 gallons per day. The wastewaters come from both engine and airframe rebuilding and overhaul activities. Half of the total flow (250,000 gpd) is assumed to originate from washing, cleaning and rinsing activities, and the remainder is assumed to come from metal plating operations. A treatment system based on BPCTCA technology has been assumed to be similar to that shown in Figure 2 of Section VII. The washing, cleaning, and rinsing wastes are segregated from the metal plating wastes. The metal plating wastes are given a treatment equivalent to that specified in the effluent guidelines for the electroplating point source category. According to the electroplating development document, the investment cost of the treatment system for handling metal plating wastes from airline plating shops should be between $150,000 and $250,000

depending upon the amount of water used in the plating operation 168
(26). For the purposes of the cost estimate here, the treatment 169
system is assumed to cost $200,000. Were the plating operations to 170
operate at about 60% utilization, the operating costs for the metal 171
plating waste treatment system would be $125,000 per year according 172
to the cost data in the metal plating development document.

The washing, cleaning, and rinse waters pass separately through 174
gravity separation, dissolved air flotation, neutralization. Then 176
the washing wastewaters are combined with the metal plating
wastewaters. The combined stream is charged with the necessary 177
nutrients and then treated by biological oxidation and final 178
clarification. Sludges are vacuum filtered and disposed in a 179
suitable landfill. The estimated costs of BPCTCA for the 500,000 180
gallon per day typical facility appear in Table 16. 181

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TABLE 16

ESTIMATED COSTS OF BPCTCA

Air Transporation - Aircraft Rebuilding and Overhaul Operations

(500,000 gallon per day flow)

Investment Costs:	
Metal plating waste treatment system	$ 200,000
Gravity Separator	45,000
Dissolved air flotation unit	65,000
Neutralization tank and equipment	20,000
Biological treatment facility	300,000
Clarification system	50,000
Vacuum filter and sludge thickener	100,000
Space @ $50/SF (2,000 SF)	100,000
	$ 880,000
Annual Costs:	
Chemicals (excluding those for metal plating)	$ 25,000
Operations for treatment of metal wastes	125,000
Operation and Maintenance (excluding metals waste treatment system)	65,000
	$ 215,000
Total power	15,000
Capital	$ 70,000
Depreciation	88,000
Total (exluding power)	$ 373,000

In some instances, BPCTCA will provide sufficient treatment to achieve the BATEA effluent limitations. In others, however, the achievement of BATEA will require that the BPCTCA be supplemented by multimedia filtration and carbon adsorption prior to discharge. The incremental costs of BATEA above those fo BPCTCA have been estimated on the basis of the latter situation which is likely to be more prevalent. The estimated incremental costs of BATEA appear in Table 17.

TABLE 17

ESTIMATED INCREMENTAL COSTS OF BATEA ABOVE THOSE OF BPCTCA
Air Transporation - Aircraft Rebuilding and Overhaul Operations
(500,000 gallon per day flow)

Investment Costs:	
Multimedia filter	$ 80,000
Granular carbon filter	100,000
Total	$ 180,000
Annual Costs:	
Carbon replacement	15,000
Operation and Maintenance	20,000
Capital	9,000
Depreciation	18,000
Total	$ 62,000
Power	250

New source performance standards (NSPS) require the same level of effluent quality as BATEA.

The costs of achieving NSPS for the new typical plant would be the sum of the BPCTCA costs in Table 16 and the incremental BATEA costs in Table 17. The total cost of NSPS for the typical plant appears in Table 18.

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TABLE 18

ESTIMATED COSTS OF NSPS
Air Transporation - Aircraft Rebuilding and Overhaul Operations
(500,000 gallon per day flow)

Investment Costs:	
BPCTCA Inves. Costs (Tab. 16)	$ 880,000
BATEA Incremental Inves. Costs (Tab. 17)	180,000
Total	$ 1,060,000
Annual Costs:	
BPCTCA Annual Costs (excluding power Tab 16)	$ 220,000
BATEA Incremental Annual Costs (excluding power, Tab. 17)	62,000
	$ 282,000
Total power costs (Tab. 16 & 17)	15,250

Pretreatemnt for existing and new sources will in many cases be the equivalent of BPCTCA less the biological treatment and final clarification. The costs of pretreatment, therefore, have been estimated to be the costs presented in Table 16 less the costs of biological treatment and final clarification. The estimated costs of pretreatment appear in Table 19.

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TABLE 19

ESTIMATED COSTS OF PRETREATMENT FOR EXISTING AND NEW SOURCES
Air Transporation - Aircraft Overhaul and Rebuilding Operations

Investment Costs:	
BPCTCA Inves. Cost (Tab. 16)	$ 880,000
Less cost of biological treatment	- 300,000
Less cost of final clarification	- 30,000
Less 1/2 cost of vacuum filter	- 50,000
Total	$ 500,000
Annual Costs:	
Capital	$ 40,000
Depreciation	50,000
Operations of metal waste treatment system	65,000
Operation and Maintenance (excluding metal waste treatment)	35,000
Chemicals (excluding those for metal waste treatment)	20,000
Power	11,000
Total	$ 221,000

Aircraft Maintenance

Aircraft maintenance facilities conducting routine maintenance operations may or may not include the washing of aircraft. The wastewater flow and characteristics will differ between the facility that includes washing and the one that doesn't. In recognition of these differences, cost estimates have been developed accordingly.

Routine Maintenance

For the purposes of cost estimation it has been assumed that the typical routine maintenance shop services no more than two aircraft per day. The wastewater flow from servicing two aircraft is assumed to be 4,000 gallons. BPCTCA for controlling these wastewaters is flow equalization, neutralization and gravity separation. The estimated costs of achieving BPCTCA for typical routine maintenance operations appear in Table 20.

TABLE 20

ESTIMATED COSTS OF BPCTCA
Air Transporation - Routine Maintenance Operations
(Two aircraft serviced per day, flow equal to
4,000 gallons per day)

Investment Costs:	
Equalization and neutralization tank	$ 5,000
Gravity Separator	12,000
Pipes and valves	1,000
Total	$ 18,000
Annual Costs:	
Capital	$ 1,450
Depreciation	1,800
Operation and Maintenance	1,200
Power	150
Total Annual Cost	$ 4,600

BATEA and NSPS requirements for treating wastes derived from routine maintenance operations are the same as those for BPCTCA. The incremental costs of BATEA, therefore, are zero. The total costs of NSPS are the same as the costs in Table 20.

In most cases pretreatment for existing and new sources will be equivalent to BPCTCA. Therefore, the costs of pretreatment are assumed equal to those in Table 20 for both existing and new sources. In those cases where the public system receiving the wastewaters contracts to remove a certain amount of the pollutants, then the source must remove only that remaining portion of the pollutants necessary to achieve the BPCTCA effluent limitations given the cotracted removal efficiencies of the public system.

Routine Maintenance and Washing

The aircraft maintenance installation of this type is assumed to accomodate two aircraft per day. The servicing and washing of one aircraft is assumed to generate 10,000 gallons of wastewater. The design wastewater flow from the typical installation is 20,000 gallons per day. BPCTCA consists of flow equalization, neutralization, gravity separation, and dissolved air flotation. The estimated costs of BPCTCA treatment requirements appear in Table 21.

TABLE 21

ESTIMATED COSTS OF BPCTCA
Air Transportation - Routine Maintenance and Washing Operations
(Two aircraft serviced per day, flow equal to 20,000 gallons per day)

Investment Costs:	
Equalization and neutralization tank and equipment	$ 18,000
Gravity separator	19,200
Dissolved air flotation unit	24,000
Pipes and valves	3,000
	$ 64,200
Annual Costs:	
Capital	$ 5,160
Depreciation	4,560
Operation and maintenance (excluding chemicals)	4,800
Chemicals	1,800
Power	2,040
Total Annual Cost	$ 18,360

BATEA for typical routine maintenance and washing installations consists of recirculation of wash waters and if feasible recirculation of rinse waters. For the purposes of estimating the incremental costs of achieving BATEA, it has been assumed that the effluent from the BPCTCA treatment system can be recirculated as wash waters. Since rinse waters are assumed to be fresh water, the recirculation does not eliminate the need for discharge. Recirculation of the effluent for washing requires the necessary piping, valving, pressurized storage, and precautions to insure that the recirculated water is used for washing only. It is estimated that the investment cost for the piping, valving, and pressurized storage would be about $10,000. The additional operating and maintenance costs associated with the BATEA system would be about $500 per year and the additional power requirements would be no more than $100.

NSPS requirements are the same as those for BATEA. The estimated costs for achieving NSPS are equal to the sum of the estimated costs of BPCTCA plus the incremental costs of BATEA. The estimated costs of NSPS appear in Table 22.

TABLE 22

ESTIMATED COSTS OF NSPS
Air Transporation - Routine Maintenance and Washing Operations
(Two aircraft serviced per day,
flow equal to 20,000 gallons per day)

Investments Costs:	
Investment cost of BPCTCA (Tab.21)	$64,200
Incremental cost of BATEA	10,000
Total	$74,200
Annual Costs:	
Capital	$ 6,000
Depreciation	5,400
Operation and Maintenance	5,300
Chemicals	1,800
Power	2,140
Total	$20,640

Pretreatment for existing sources consists of flow equalization, 516
neutralization, and gravity separation. Pretreatment for new sources 518
consists of the above and in addition dissolved air flotation. The 520
estimated costs of pretreatment for existing sources appear in Table
23. Pretreatemnt for new sources requires the same investment as 521
BPCTCA. The costs of pretreatment for new sources, therefore, are 522
the same as the costs of BPCTCA in Table 23. 523

TABLE 23 528
ESTIMATED COSTS OF PRETREATMENT FOR EXISTING AND NEW SOURCES 529
Air Transportation - Routine Maintenance and Washing Operations 530
(Two aircraft serviced per day, 531
flow equal to 20,000 gallons per day) 532

535

Investment Costs:		537
Equalization and neutralization tank and		539
equipment	$ 18,000	540
Gravity separator	19,200	541
Pipes and valves	2,400	542
Total	$ 39,600	543
Annual Costs:		545
Capital	$ 3,200	547
Depreciation	2,800	548
Operation and Maintenance	2,400	549
Power	200	550
Total	$ 8,600	551

553

Ground Vehicle Service and Maintenance 558

The typical ground vehicle service and maintenance installation 560
produces in general the same types of wastewaters as that from 561
aircraft maintenance installations. The major difference between the 562

two operations is that of the quantity of flow. The typical ground 563
vehicle service and maintenance shop generates about 1,000 gallons
per day of wash and cleaning wastewaters. In most instances, the 565
wastewaters from this activity could be routed directly to the two 566
treatemnt systems that would also treat aircraft maintenance wastes.
Nevertheless, costs have been estimated for a separate ground vehicle 567
service and maintenance waste treatment facility assuming that the 568
wastewaters include wash waters.

BPTCA for the typical treatment facility consists of gravity 570
separation in a manually cleaned sump-separator. These sump-separator 572
units can be installed for a cost of $5,000 in the typical ground 573
vehicle maintenance shops. Maintenance cost for such a unit are 574
negligible. There are no power costs associated with operation of 575
the separator.

BATEA and NSPS requirements are the same as those of BPCTCA. The 579
incremental costs of BATEA above those of BPCTCA are zero and the 580
cost of NSPS are the same as the costs of BPCTCA.

Pretreatment for existing sources is a sump to settle out grit 582
and contain any spills that might occur. If an existing maintenance 584
shop did not already have such a sump, one could be installed for 585
less than $750. Pretreatment for new sources requires the same level 586
of control as BPCTCA and the same expenditure of funds to install the 587
appropriate sump-separator.

Fuel Storage Centers

No wastewaters of any consequence originate from these areas. No collection or treatment system is required. The cost of control for all levels of regulation are zero.

Terminal and Auxiliary Facilities

The wastewaters from these facilities fall under the category of sanitary and domestic wastes. The sources of wastewaters are primarily restaurants and lavatories in the terminal. The appropriate controls for the treatment of these wastewaters are determined by the secondary treatment requirements for municipal and domestic wastes. Costs for these controls ought to be attributed to the costs of cleaning up municipal wastes in general and should not be combined with the costs of cleaning up the process wastewaters associated with air transportation.

SECTION IX

BEST PRACTICABLE CONTROL TECHNOLOGY CURRENTLY AVAILABLE EFFLUENT GUIDELINES AND LIMITATIONS

Introduction

The best practicable control technology currently available (BPCTCA) includes both source control and treatment technology. BPCTCA source control technology is that within the process itself which should be normal practice within the industry. BPCTCA end-of-pipe treatment technology is based on the wastewater treatment processes currently used. The extent to which treatment technology is applied depends on the magnitude and the scope of the operations conducted at each airport complex.

Waste treatment technology for air transporation industry of wastes does not require highly sophisticated treatment methods. More efficient results of the treatment methods presently employed could be attained through proper maintenance and control, and in some instances, modification of the equipment now in operation. Good management, good housekeeping practices, waste segregation and control of water used can play a key part in lessening the waste loads and volumes requiring treatment.

In-plant controls available to accomplish such measures include, but are not limited to the following:

1. provide high standards of good housekeeping in maintenance and operation;

2. separation of contaminated low-volume wastewaters from other plant waters, such as wash waters;

3. separation of oils, greases, jet fuel, and solvents from other plant wastewaters;

4. employ electrostatic painting to materially reduce the pollutional load generated when refinishing aircraft surfaces;

5. use non-phenolic paint strippers wherever possible;

6. reduce water usage to eliminate excess flows;

7. segregate nontoxic and toxic wastewaters;

8. use granular materials to soak up liquid spills;

9. prevent leaks, overflows, and spills;

10. provide impoundments for any leaks, overflows, and spills that occur.

Waste Treatment Methods

A desirable and economical way to treat industrial wastes generated at airports is to combine them with sanitary sewage for treatment in the same plant. Generally, however, the industrial wastes must be pretreated to keep acids, alkalis, toxic metals, oils, and greases from damaging treatment units and interfering with biological treatment practices.

Consideration should always be given to grouping certain types of industrial wastes because of the operating economies involved (e.g. acid wastes with alkaline wastes, small volume wastes having high BOD values with similar wastes with lesser values). By doing this, the industrial wastes can be brought into the range of biological treatment used in treating sanitary sewage, thereby permitting combined treatment.

Oil - Water Wastes

BPCTCA end-of-pipe treatment for removing free oil, fuels, hydrocarbon solvents, lubricating oils and similar materials is based on existing wastewater treatment processes. Such methods employ:

1. Storm water diversion to minimize waste flows;
2. gravity-type oil-water separators (such as those approved by the API) or baffle plate separators;
3. skimming and sludge draw off equipment for removal of floating and settled oily materials;
4. filtration - by vacuum, sand or dual media filters.

These methods are satisfactory when free oily wastes are present and there is sufficient difference in specific gravity or density for separation. Gravity separators will not prevent the escape of all emulsified oil.

Successful emulsion breaking requires the addition of chemical flocculating materials followed by air flotation, sedimentation, filtration, and/or biological treatment. Other methods that are effective include heating, distillation, centrifuging, or precoat filtration.

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Phenolic Wastes

Concentrated phenol wastes resulting from the cleaning of aircraft parts and the stripping of paint, are partially removable by air flotation and the addition of flocculating chemicals, such as alum or activated silica.

Phenols in low concentrations can be treated in biological oxidation processes such as trickling filters, the activated sludge process, or a combination of both.

Where phenols present a significant wastewater problem, carbon adsorption will provide the best results.

Metal Plating Wastes

BPCTCA for metal plating operations is the use of chemicals to treat wastewater at the end of the process combined with the best practical in-process control technology to conserve rinse water and reduce the amount of treated wastewater discharged.

For essentially all of the parameters, BPCTCA involves precipitation which includes coagulation, sedimentation, flotation and finally filtration.

Chemical oxidation or electrolytic decomposition of cyanides and chemical reduction of chromium are required as part of the treatment process. Such heavy metals as cadmium, copper, zinc, iron,

manganese, nickel, and chromium +3 can be readily and inexpensively 141
precipitated as hydroxides by lime treatment.

Neutralization and co-precipitation of these heavy metals along 143
with settling and clarification are generally employed to remove 144
suspended solids before combining with other non-plating wastes. 145

This technology has been widely practiced by the plating industry 147
for over 25 years. However, it cannot achieve zero discharge of 149
heavy metals because of the finite solubility of the metal salts. In 151
addition, it is not practicable to achieve 100% clarification and
some small amount of metal is contained in the suspended solids. 152

Since metal plating operations in the airline industry are 154
basically the same as those employed in the overall metal plating 155
industry, the treatment technology used by the latter industry is 156
applicable for processing metal plating wastes originating from 157
aircraft maintenance facilities. The state-of-the-art for dealing 159
with metal plating operations is described in detail in the 160
Development Document for Effluent Limitations Guidelines for the 161
Electroplating Industry as developed by EPA in August 1973.

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Best Practical Control Treatment Currently Available for Industry Categories

Aircraft Ramp Service

The wastes discharged from this activity are infrequent. Large spills are removed immediately with residuals flushed to sewer system or evaporated. Standard treatment should consist of gravity sump or separator units installed on sewer systems for collection of solids and floatable materials washed from specific service areas where a high potential exists for waste discharges. Normal surface runoff should be eliminated from treatment systems.

Aircraft Rebuilding and Overhaul

Treatment requirements are based on wastes resulting from the rebuilding and overhauling of aircraft engines, air frames and other components. The wastes are derived from materials used and removed during the cleaning, metal plating and painting processes.

BPCTCA emphasizes source control to reduce waste volume and separate treatment of oily, solvent, detergent and paint stripping wastes from metal plating wastes. BPCTCA treatment for non-metal plating wastes requires physical-chemical methods equivalent to screening, gravity separation, equalization for acid-alkaline materials, chemical treatment for breaking of emulsions, coagulation, dissolved air flotation and sedimentation. The need for biological treatment is required where satisfactory BOD, COD, and phenol reductions have not been attained through the above described physical-chemical treatment methods alone for direct discharge to receiving streams. Treatment technology to accomplish this includes the use of oxidation ponds, trickling filters, activated sludge systems, polishing lagoons or combinations of these followed by final clarification. Other techniques are described in "Manual on Disposal of Refinery Wastes, Volume on Liquid Wastes," American Petroleum Institute, 1969.

BPCTCA treatment for metal plating wastes requires physical-chemical measures equivalent to methods of equalization, pH adjustment, oxidation or reduction, chemical precipitation, clarification and filtration. Removal of cyanides requires destruction by electrolytic decomposition or chemical oxidation processes.

Aircraft Maintenance

Routine

Treatment requirements are based on wastes resulting from maintenance and minor repair of aircraft engines, air frames and components, cleaning aircraft interiors, replacing aircraft engines, lubricant replacement, and floor cleaning.

BPTCA includes source control over the waste materials produced and physical treatment using screens and gravity-type oil-water separators to remove settleable solids, floatable oils, grease, and other substances. Where emulsified oily wastes are present, gravity separation should be followed by treatment equivalent to chemical emulsion breaking, air flotation and clarification.

Washing

Water that has been used to clean aircraft contains a mixture of detergents, oil, fuel, carbon, metal oxides and other solids.

Best practicable control technology for treatment of these wastes requires physical-chemical systems employing screening and gravity separation for removal of settleable solids and floatable oils, grease and other substances. In addition, treatment requirements include equalization for any acid-alkaline detergents and chemical treatment for breaking emulsified oils, greases and cleaning solvents followed by dissolved air flotation, and clarification

Ground Vehicle Service and Maintenance

Wastewaters from this source are largely from oily materials, solvent and detergent cleaning wastes, painting wastes, and vehicle and floor wash waters.

Best practicable control technology requires source control to prevent or reduce the wastes generated and physical treatment consisting of screening and gravity oil-water separators for removal of settleable solids, floatable oils, grease and other materials.

Where gravity separation alone is not sufficient to eliminate emulsified oils, detergents or other waste constituents, further physical-chemical treatment equivalent to emulsion-breaking techniques, coagulation, air flotation and clarification must be used.

Fuel Storage Centers

Normally there is no waste discharge from fuel storage centers. Being a potential source of fire or explosion, close control is maintained over the areas. Installation of waste treatment systems for this source is not proposed.

Terminal and Auxiliary Facilities

Sanitary wastes originating from such facilities are covered by treatment requirements for domestic systems operated by municipalities or individual airports.

Effluent Limitation Guidelines

Proposed effluent limitation guidelines for the air transporation industry are listed in Table 1 in Section II - Recommendations. These limits are based on a reasonable flow per unit and concentration limits attainable by best practicable treatment. Rationale for determining concentration limits for applicable waste constituents have been developed in Section VII. Further rationale and the establishing of concentration limits is presented in the

following text. The limitations are for point sources discharging 268
directly into streams and not to municipal or other industrial 269
systems which may treat the wastes.

Oil should be limited to an average of not more than 10 mg/l as 271
hexane extractables with an absolute limit of 20 mg/l. These limits 273
have been practicably and consistently attained in well-designed and
well-operated oil separation plants. 274

Suspended solids can be effectively removed in good oil- 276
separation facilities and by liming clarification systems. The 278
effluent concentration should be limited to an average of 25 mg/l and 279
a maximum of 50 mg/l.

There is no practicable way to remove dissolved solids from waste 281
streams and treatment systems themselves usually increase them. 282
Effluent limits should be determined by receiving water quality 283
standards.

Biochemical oxygen demand (BOD) is normally removed by over 60% 285
through oil separation and air flotation treatment systems. Further 287
reduction to acceptable limits is attainable by biological oxidation 288
means. BOD(5) should be limited to an average of 25 mg/l and a 289
maximum of 50 mg/l for any one day. If COD is substituted as a 290
parameter, it should be limited to 125 mg/l average and 250 mg/l
maximum for any one day. 291

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Phenols are removable in facilities having multiple treatment sequences such as air flotation, biological treatment, and filtration. Effluent concentrations should be limited to an average of 1.0 mg/l and a maximum of 2.0 mg/l.

Heavy metals are effectively removed by chemical treatment followed by precipitation and filtration. Concentration limits for the metals of concern in this industry are:

Cadmium	0.15 mg/l
Total chrome	0.50 mg/l
Copper	0.5 mg/l
Lead	0.10 mg/l
Nickel	1.0 mg/l
Zinc	1.0 mg/l

Cyanide should be limited to a concentration of 0.1 mg/l in the effluent. This is readily accomplished by cyanide destruction and post chlorination.

Temperature is not normally significant, and effluent limits need not be set. The pH in the effluent should be within the range of 6.0 to 9.0 units.

NOTICE

These are tentative recommendations based upon information in this report and are subject to change based upon comments received and further internal review by EPA.

Pretreatment Standards for Existing Sources 325

Pretreatment of airport industrial wastes for acceptance in 328
publicly owned systems should be considered wherever possible. Many 330
airport industry discharges now go to municipal systems.

A minimum level of pretreatment must be given to airport 332
facilities which discharge wastewater to publicly owned treatment 333
works. In addition, potential pollutants which will inhibit or upset 335
the performance of publicly owned treatment works must be eliminated 336
from such discharges.

Pretreatment for airport industrial wastewaters for existing 338
sources as a minimum should include gravity separation of oils and 339
solids and the use of an equalization and neutralization basin to 340
prevent shock loadings of these materials and acidic or alkalines 341
wastes.

With respect to metal plating operations, a potential toxicity 343
problem exists if heavy metals, cyanides and phenolic materials are 344
discharged. This will require control of non-compatible pollutants 345
to conform to the most restrictive of: (1) local ordinances for 346
discharge to a publicly owned treatment works; (2) the pretreatment 347
provisions of Section 304(f) of the FWPC Act (40 CFR 128); (3) the 348
provision of Section 307(a) with respect to toxic substances; or (4) 349
effluent limitations as described in this section - Best Practicable 350
Control Technology Currently Available.

Sludge Disposal

Sludges generated by waste treatment must be disposed of in a manner which will not degrade the environment. Relatively innocuous materials such as inorganic silt, sewage type sludge and tightly bound metals may be disposed of in carefully managed landfills. Organic materials such as may be derived from jet engine and air frame overhaul, aircraft washing, and painting activities may necessitate incineration or recycling into useful materials. Landfill should not be viewed as first choice disposal for most of these materials or for oily sludges.

Oil skimmed from gravity separators can often be reprocessed or used as heating fuel. Oily sludges should also be examined for oil recovery. If this is not practicable, they should be disposed of in an environmentally acceptable manner.

Monitoring Requirements

Monitoring requirements should be relatively straightforward for most airport industrial discharges. However, for metal plating, jet engine and air frame overhaul, and paint stripping activities, the permittor should be guided by information on the various organic and inorganic materials used in the activities performed. The monitoring requirements will then be related to the complexity of operations.

Effluent flow and pH should be continuously monitored for all treatment systems where best practicable control technology requires treatment beyond simple gravity oil separation and in any case where average flow is greater than 50,000 gallons per day. For lesser volumes, pH and flow rate should be measured at the time of sampling.

If only limited routine maintenance facilities are located on an airport, the frequency of samples and analysis required will depend on airport activity. At least one effluent grab sample should be collected per week for chemical analysis. On the other hand, if major overhaul and maintenance base facilities are present, the airport should be required to obtain and analyze a 24-hour composite effluent sample once per week. The composite should be comprised of a minimum of three equally spaced (in time) grab samples taken over a 24-hour period.

Non-Water Quality Environmental Impact

No satisfactory evidence exists that disposing of sludge wastes on land has a direct impact on soil systems, but underground disposal is not recommended because ground water may become contaminated from leaching, percolation, or infiltration.

The employing of waste treatment methods based on BPCTCA is not expected to have any air pollution impact.

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SECTION X 5

$%Best Available Technology Economically Achievable$% 7
$%Guidelines and Limitations$% 8

$%Industry Category Covered$% 13

The prime source categories discharging waste contaminants have 15
been identified as originating from facilities involved in: (1) 17
Aircraft Rebuilding and Overhaul; (2) Aircraft Maintenance; and (3) 18
Ground Vehicle Service and Maintenance.

$%Identification of Best Available Technology$% 21
$%Economically Achievable$% 23

For the prime waste sources cited, the best available control 28
technology currently available to be applied consists of those
measures described in Section IX under BPCTCA and the in-plant source 29
controls defined. In addition BATEA includes control measures 30
designed to eliminate to the extent economically achievable, the 31
discharge of industrial waste waters from airport facilities.

Such in-plant source control practices applicable in limiting 33
water requirements and waste discharges include: 34

1. Use of air-cooled rather than water-cooled equipment; 36

2. Use of wastewater treatment plant effluents for cooling and 39
washing purposes where applicable;

3. Recycle water used for washing; 41

NOTICE
These are tentative recommendations based upon information in this report and are subject to change based upon comments received and further internal review by EPA.

4. Use of mechanized floor cleaning equipment in lieu of direct water flushing operations.

It is emphasized that metal plating wastes originating from aircraft rebuilding and overhaul facilities are generally the same as those produced by the metal plating industry itself. The BATEA treatment technology defined for this industry would be applicable to similar operations conducted in aircraft rebuilding and overhaul.

The BATEA for metal plating operations has been determined to be the use of a combination of in-process and end-of-process control and treatment to remove pollutants from process wastewater discharges. This can be accomplished by employing BPCTCA techniques combined with deep bed or multi media filtration.

In addition, a further reduction in heavy metals concentrations from metal plating wastes is supported by treated effluent data tabulated on metal plating industries in the development document for metal plating effluent limitation guidelines. The results are representative of chemical treatment from approximately 50% of the industry plants where data were obtained. There is no reason to believe otherwise that these same levels cannot be applied and attained by airline plating shops. For BATEA requirements, further reduction in concentration levels for the parameters BOD, COD, and suspended solids are based on providing good operation and control of treatment systems, limiting waste sources, and filtration. Further reduction of phenols is attainable through methods equivalent to chemical oxidation or carbon adsorption.

Effluent Limitation Guidelines

For meeting BATEA requirements the following effluent limitation concentrations have been established for applicable waste constituents.

BOD	15 mg/l
COD	75 mg/l
Suspended Solids	15 mg/l
Oil and Grease	10 mg/l
Phenols	0.1 mg/l
Cyanide	0.025mg/l
Cadmium	0.10 mg/l
Total Chrome	0.30 mg/l
Copper	0.20 mg/l
Lead	0.10 mg/l
Nickel	0.50 mg/l
Zinc	0.30 mg/l

The proposed effluent loading limitation guidelines are listed in Table 2 in Section II - Recommendations. They are based on the above reduction concentrations resulting from control and operation measures previously described.

Pretreatment Standards, Sludge Disposal and Monitoring

Requirements for BATEA are the same as discussed in Section IX - BPCTCA.

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SECTION XI 6

$%New Source Performance and Pretreatment Standards$% 8

$%New Source Performance Standards$% 11

Performance standards to be achieved by new sources within the 13
airline segment of the transportation industry are based on the 14
application of the Best Available Control Technology Economically 15
Achievable as discussed in Section X.

The operation and maintenance of fixed facilities and services 17
related to air transportation do not call for major innovations in 18
waste treatment technology. Basically, this technology consists of 19
employing the methods which are being used, possibly with a few
modifications.

However, a major design criterion for development of new 21
facilities is reuse and recycling of water streams to the greatest 22
extent possible, in order to minimize discharges to other wastewater
treatment systems or to water courses. 23

The recommended guidelines for the application of standards of 25
performance for new sources discharging to navigable waters are the 26
same as those presented in Section X.

NOTICE

These are tentative recommendations based upon information in this report and are subject to change based upon comments received and further internal review by EPA.

$%Pretreatment Standards for New Sources$%

Pretreatment Standards for new sources are the same as those described for existing sources in Section IX.

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SECTION XII

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SECTION XIV

GLOSSARY AND ABBREVIATIONS

$%Glossary$%

Airports and Flying Fields

Establishments primarily engaged in the operation and maintenance of airports and flying fields and/or the servicing, repairing, overhauling, and storing of aircraft at such airports.

Airport Terminal Services

Establishments primarily engaged in furnishing coordinated handling services for air freight or passengers at airports. Establishments furnishing aircraft services directly associated with aircraft repair, maintenance, and storage, either exclusively or in conjunction with other terminal airport services.

$%Air Transportation, Certificated Carriers$%

Establishments of companies holding certificates of public convenience and necessity under the Civil Aeronautics Act, operating over fixed routes on fixed schedules, or in the case of certificated Alaskan carriers over fixed or irregular routes. These companies may be primarily engaged in the transportation of revenue passengers or in the transportation of cargo or freight.

$%Air Transportation, Noncertificated Carriers$%

Establishments of companies permitted to operate without a showing of public convenience and necessity under the Civil Aeronautics Act, including noncertificated irregular and supplemental air carriers.

$%Best Available Technology Economically Achievable (BATEA)$%

Treatment required by July 1, 1983, for industrial discharge to surface waters as defined by Section 301 (b) (2) (A) of the Act.

$%Best Practicable Control Technology Currently Achievable (BPCTCA)$%

Treatment required by July 1, 1977, for industrial discharge to surface waters as defined by Section 301 (b) (1) (A) of the Act.

$%Best Available Demonstrated Technology (BADT)$%

Treatment required for new sources as defined by Section 306 of the Act.

$%Biochemical Oxygen Demand$%

Oxygen used by bacteria in consuming a waste substance.

$%Chemical Oxygen Demand$%

Oxygen consumed through chemical oxidation of a waste.

$%Clarification$%

The process of removing undissolved materials from a liquid. Specifically, removal of solids either by settling or filtration.

$%Cleaner$%

Usually an alkaline solution pretreatment to remove surface soil such as oils, greases, and substrates chemically unrelated to the basis material.

$%Compatible Pollutants$%

Those pollutants which can be adequately treated in publicly owned treatment works without harm to such works.

$%Continuous Treatment$%

Chemical waste treatment operating uninterruptedly as opposed to batch treatment; sometimes referred to as flow through treatment.

$%Dragout$%

The solution that adheres to the objects removed from a bath. More precisely defined as that solution which is carried past the edge of the tank.

$%Effluent$%

The waste water discharged from a point source to navigable waters.

$%Effluent Limitation$%

A maximum amount per unit of production of each specific constituent of the effluent that is subject to limitation in the discharge from a point source.

$%Electrolytic Decomposition$%

An electrochemical treatment used for the oxidation of cyanides. The method is practical and economical when applied to concentrated solutions such as contaminated baths, cyanide dips, stripping solutions, and concentrated rinses. Electrolysis is carried out at a current density of 35 amp/sq ft at the anode and 70 amp/sq ft at the cathode. Metal is deposited at the cathode and can be reclaimed.

$%Electroplating$%

The electrodeposition of an adherent metallic coating upon the basis metal or material for the purpose of securing a surface with properties or dimensions different from those of the basis metal or material.

$%Electroplating Process$%

An electroplating process includes a succession of operations starting with cleaning in alkaline solutions, acid dipping to neutralize or acidify the wet surface of the parts, followed by electroplating rinsing to remove the processing solution from the workpieces, and drying.

$%Emulsion$%

A liquid system in which one liquid is finely dispersed in another liquid in such a manner that the two will not separate through the action of gravity alone.

$%End-of-Pipe Treatment$%

Treatment of overall wastes, as distinguished from treatment at individual processing units.

$%Filtration$%

Removal of solid particles or liquids from other liquids or gas streams by passing the liquid stream through a filter media.

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$%Industrial Waste$%

All wastes streams within a plant. Included are contact and non-contact waters. Not included are wastes typically considered to be sanitary wastes.

$%Hangar$%

A garage facility used for housing and servicing aircraft.

$%Incompatible Pollutants$%

Those pollutants which would cause harm to, adversely affect the performance of, or be inadequately treated in publicly owned treatment works.

$%Joint Treatment$%

Treatment in publicly owned treatment works of combined municipal wastewaters of domestic origin and wastewaters from other sources.

$%New Source$%

Any building, structure, facility, or installation from which there is or may be a discharge of pollutants and whose construction is commenced after the publication of the proposed regulations.

$%New Source Performance Standards$%

Performance standards for the industry and applicable new sources as defined by Section 306 of the Act.

$%ORP Recorders$%

Oxidation-reduction potential recorders.

$%Oxidizable Cyanide

Cyanide amenable to oxidation by chlorine according to standard analytical methods.

$%pH$%

A unit for measuring acidity or alkalinity of water, based on hydrogen ion concentrations. A pH of 7 indicates a "neutral" water or solution. At pH lower than 7, a solution is acidic. At pH higher than 7, a solution is alkaline.

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$%Phenol$%

Class of cyclic organic derivatives with basic formula C(6)H(5)OH.

$%Pickling$%

The removal of oxides or other compounds related to the basis metal from its surface by immersion in a pickle.

$%Point Source$%

A single source of water discharge such as an individual plant.

$%Pretreatment$%

Treatment performed in wastewaters from any source prior to introduction for joint treatment in publicly owned treatment works.

$%Raw

Untreated or unprocessed.

$%Rectifier$%

A device which converts ac into dc by virtue of a characteristic permitting appreciable flow of current in only one direction.

$%Rinse$%

Water for removal of dragout by dipping, spraying, fogging, etc.

$%Runway$%

A strip of leveled ground, generally paved, for use by aircraft in landing and taking off operations.

$%Secondary Treatment$%

Biological treatment provided beyond primary clarification.

$%Sludge$%

The settled solids from a thickener or clarifier. Generally, almost any flocculated settled mass.

$%Standard of Performance$% 316

A maximum weight discharged per unit of production for each 319
constituent that is subject to limitation and applicable to new 320
sources as opposed to existing sources which are subject to effluent
limitations. 321

$%Supernatant$% 324

The layer floating above the surface of a layer of solids. 327

$%Surface Waters$% 330

Navigable waters. The waters of the United States, including the 334
territorial seas.

$%Tank$% 337

Term for vessel that contains the solution and auxiliary equipment 340
for carrying out the electroplating or other operational step. 341

$%Thickeners$% 344

A large tank for continuous settling and removal of sludge from a 347
process stream.

$%Total Chromium$% 350

Total chromium (CrT) is the sum of chromium in all valences. 353

$%Total Cyanide$% 356

The total content of cyanide expressed as the radical CN-, or alkali 359
cyanide whether present as simple or complex ions. The sum of both 361
the combined and free cyanide content of a plating solution. In 362
analytical terminology, total cyanide is the sum of cyanide amenable
to oxidation by chlorine and that which is not according to standard 363
analytical methods.

$%Total Metal$% 366

Total metal is the sum of the metal content in both soluble and 369
insoluble form.

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$%Total Suspended Solids (TSS)$% 372

Any solids found in waste water or in the stream which in most cases 375
can be removed by filtration. The origin of suspended matter may be 376
man-made wastes or natural sources such as silt from erosion.

$%Waste Discharged$% 379

The amount (usually expressed as weight) of some residual substance 382
which is suspended or dissolved in the plant effluent after treatment 383
if any.

$%Waste Generated$% 386

The amount (usually expressed as weight) of some residual substance 389
generated by a plant process or the plant as a whole and which is 390
suspended or dissolved in water. This quantity is measured before 391
treatment.

$%Waste Loading$% 394

Total amount of pollutant substance, generally expressed as pounds 397
per day.

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CONVERSION TABLE

Multiply (English Units)		by	to Obtain (metric Units)	
English Unit	Abbreviation	Conversion	Abbreviation	Metric Unit
acre	ac	0.405	ha	hectares
acre - feet	ac ft	1,233.5	cu m	cubic meters
British Thermal Unit	BTU	0.252	kg cal	kilogram-calories
British Thermal Unit/pound	BTU/lb	0.555	kg cal/kg	kilogram calories/ kilogram
cubic feet/minute	cfm	0.028	cu m/min	cubic meters/minute
cubic feet/second	cfs	1.7	cu m/min	cubic meters/minute
cubic feet	cu ft	0.028	cu m	cubic meters
cubic feet	cu ft	28.32	l	liters
cubic inches	cu in	16.39	cu cm	cubic centimeters
degree Fahrenheit	F°	0.555(°F-32)[1]	°C	degree Centigrade
feet	ft	0.3048	m	meters
gallon	gal	3.785	l	liters
gallon/minute	gpm	0.0631	l/sec	liters/second
horsepower	hp	0.7457	kw	killowatts
inches	in	2.54	cm	centimeters
inches of mercury	in Hg	0.03342	atm	atmospheres
pounds	lb	0.454	kg	kilograms
million gallons/day	mgd	3,785	cu m/day	cubic meters/day
mile	mi	1.609	km	kilometer
pound/square inch (gauge)	psig	(0.06805 psig +1)[1]	atm	atmospheres(absolute)
square feet	sq ft	0.0929	sq m	square meters
square inches	sq in	6.452	sq cm	square centimeters
tons (short)	ton	0.907	kkg	metric tons (1,000) kilograms
yard	yd	0.9144	m	meters

1 Actual conversion, not a multiplier

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