US. Department
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Federal Aviation
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MANAGEMENT OF AIRPORT INDUSTRIAL WASTE

U.S. Department
of Transportatm
Federal Aviation
Administration

Advisory Circular

Subject: MANAGEMENT OF AIRPORT INDUSTRIAL WASTE

Date: 2/11/91
Initiated by: AAS-100
AC No: 150/5320-15
Change:

1. PURPOSE. This advisory circular (AC) provides basic information on the characteristics, management, and regulations of industrial wastes generated at airports.

2. CANCELLATION. This advisory circular cancels AC 150/5320-10, Environmental Enhancement at Airports - Industrial Waste Treatment, dated 4/16/73.

3. APPLICATION. The guidelines and recommendations contained in this advisory circular are recommended by the Federal Aviation Administration (FAA) for the management of airport generated wastes at civil airports.

4. RELATED READING MATERIAL. The publications listed in Appendix 1 provide further guidance and detailed information.

Leonard E. Mudd
Director, Office of Airport Safety and Standards

TABLE OF CONTENTS

CHAPTER 1. INTRODUCTION

CHAPTER 2. HAZARDS AND NUISANCES OF AIRPORT INDUSTRIAL WASTES

CHAPTER 3. TYPES OF AIRPORT INDUSTRIAL WASTE

CHAPTER 4. SURVEYS FOR AIRPORT INDUSTRIAL WASTE

CHAPTER 5. MANAGEMENT STRATEGIES FOR AIRPORT INDUSTRIAL WASTE

TABLE OF CONTENTS (CONTINUED)

Paragraph Page

CHAPTER 6. MANAGEMENT OF HAZARDOUS WASTE

CHAPTER 7. AIRPORT INDUSTRIAL WASTES CONVEYANCE AND COLLECTION

CHAPTER 8. TREATMENT TECHNIQUES FOR INDUSTRIAL WASTEWATERS;

CHAPTER 9. MANAGEMENT OF DE/ANTI-ICING CHEMICAL WASTES

CHAPTER 10. MANAGEMENT OF MAINTENANCE SHOP WASTES

TABLE OF CONTENTS (CONTINUED)

FIGURES

APPENDICES

CHAPTER 1. INTRODUCTION

1. BACKGROUND. In 1973, the Federal Aviation Administration (FAA) published advisory circular (AC) 150/5320-10 to address the subject of industrial waste management at airports. That AC, entitled "Environmental Enhancement at Airports - Industrial Waste Treatment," focused primarily on the treatment of industrial wastewaters that are generated at airports. Although the treatment technologies discussed in AC 150/5320-10 remain applicable today, new, amended, and proposed environmental regulations that are applicable to industrial wastewaters and other types of wastes generated at airports have warranted a revision of that AC. This revised AC, entitled "Management of Airport Industrial Waste," provides an updated coverage of waste management at airports and addresses the management of hazardous wastes as well as industrial wastewaters.

2. AIRPORT INDUSTRIAL WASTES. Although airports are not usually considered as industrial complexes, daily activities, such as aircraft and ground vehicle washing and cleaning, fueling operations, aircraft maintenance and repair work (including painting and metalwork), engine test cell operations; de/anti-icing operations, and ground vehicle maintenance, are all sources of airport industrial wastes. Wastes generated by these activities that are addressed by this AC are categorized as either industrial wastewaters or 'hazardous wastes.

a. Industrial Wastewaters. Industrial wastewaters are generated . during 'aircraft and ground vehicle washing, aircraft maintenance and repair work, and de/anti-icing operations. Industrial wastewaters may be discharged for treatment to onsite airport treatment systems or to an offsite publicly owned treatment work (POTW) or, for certain types of waste, discharged without treatment to surface waters. Because of their characteristics, industrial wastewaters are generally more difficult to treat than sanitary (domestic) sewage and represent a potentially significant threat to surface and ground water quality.

b. Hazardous Wastes. Hazardous wastes may be generated during ground vehicle maintenance, aircraft cleaning, fueling operations, aircraft maintenance and repair work, and engine test cell operations. Management of hazardous wastes strictly follows the stringent regulations governing treatment, storage, and disposal.

3. INDUSTRIAL WASTEWATER REGULATIONS AND WATER QUALITY STANDARDS. As provided under Section 303 of the Clean Water Act (CWA), Federal regulations require that all States develop water quality standards which have been approved by the U.S. Environmental Protection Agency (EPA). These standards, which impact airports, are reflective of the effects of various pollutants upon the ultimate uses of the receiving water and are intended to maintain water quality at a level that adequately protects public health. Numerous sections of the CWA outline provisions for other Federal regulations to ensure that State water. quality standards are achieved. Regulations that can affect airports include the National Pollutant Discharge Elimination System (NPDES) program (Section 402), Effluent Limitations (Section 301), National Standards of Performance (Section 306), and Toxic and Pretreatment Effluent Standards (Section 307). Section 403 of the CWA also outlines provisions for ocean discharge criteria. In addition to these Federal regulations, State and local regulations. may impose additional, more stringent, standards for the discharge of airport-generated industrial wastewaters. Airports are advised of the necessity to coordinate all planned airport industrial waste activities with these agencies prior to the implementation of any management programs.

4. HAZARDOUS WASTE REGULATIONS. As provided under the Resource Conservation and Recovery Act (RCRA), Federal regulations require that all generators of hazardous waste, including airport facilities and airport lessees, follow specific procedures for the treatment, storage, and disposal of hazardous wastes. Under certain circumstances; materials that would ordinarily be considered hazardous are exempt from RCRA regulations when they are present in industrial wastewater that is discharged to a POTW.

5. DE/ANTI-ICING AND STORM WATER OCCURRING WASTES.

a. Regulations. The EPA has implemented NPDES regulations for storm water discharges from transportation facilities, which specifically identify airport de/anti-icing operations. These regulations will require proper management of wastes'generated by such operations. Regulators at the State and local levels have also begun to establish more stringent limits for de/anti-icing chemicals in storm water discharges.

b. Planning Team. The regulations for proper management of airport-generated industrial waste will no doubt become more restrictive with time. In addition, other chemicals currently contained in water discharges from the airport may become subject to future regulation. Thus, it is recommended that airport operators confer with the airlines, tenants, and other involved parties to plan a comprehensive program for effective management of all current and expected future waste. Besides addressing the airport's site specific and operational needs, this approach produces a unified program benefitting all parties. It is also recommended in the planning of airport expansion or the designing of new airports, that airside drainage systems have the capability, when required, of channeling certain portions of or all airside runoff to specific locations for proper management.

CHAPTER 2. HAZARDS AND NUISANCES OF AIRPORT INDUSTRIAL WASTE

6. IGNITABILITY. Highly flammable liquids and vapors contained in some airport industrial wastes are fire and explosion hazards, particularly when discharged freely to sewers, natural bodies of water, or the ground. Vapors from volatile solvents, fuels, and oils may travel considerable distances in certain soils and form explosive concentrates in low, enclosed places. Wastes with a high solids content may cause deposits that form explosive gas during decomposition.

7. CORROSMTY. Corrosive wastes can dissolve metals and other materials or bum human skin. Wastes generated during rust removal and acid or alkaline cleaning, as well as spent lead acid, lithium, and nickel-cadmium batteries, are corrosive wastes.

8. REACTIVITY. Wastes which are reactive are unstable or undergo rapid or violent chemical reaction with water or other materials. Wastes generated from cyanide plating operations and from processes involving oxidizers, such as bleaches, are reactive wastes.

9. TOXICITY. Certain airport industrial wastes are toxic to human beings, livestock, and aquatic life, either by direct contact or through the contamination of water supplies. Pollutants contained in metal finishing wastes, such as cyanide and chromium, and certain organic compounds, such as degreasing solvents, are highly toxic at low concentrations in water. Mixed' solutions of metal wastes can be much more toxic than simple solutions of corresponding or greater concentration. The formation of sludge deposits in streams by certain airport industrial wastes can create a potential health hazard to prospective users of the stream and restrict or prohibit its use for recreational or agricultural purposes.

10. INTERFERENCE WITH WATERWAY PURIFICATION OR POTW OPERATION. The discharge of airport industrial wastes to surface waters or to a POTW may have numerous adverse consequences. The airport operator should establish measures and procedures to address situations where there would be adverse consequences due to the discharge of airport industrial wastes.

a. Waterway Self-tuuification. The self-purification of waterways depends largely on a sufficient supply of oxygen to support the life and activity of fish and other aquatic organisms. Oils and greases form mats and slicks that hinder reoxygenation of streams. Wastes with heavy organic loads utilize available oxygen and may form sludge deposits that interfere with stream self-purification' processes.

b. POTW Oneration. Increases in the organic loading to a POTW may cause the total loading to exceed its treatment capacity; thereby, decreasing the plant's effectiveness. Suspended solids increase the demand on POTW sludge handling equipment and may hinder POTW sludge digestion. Emulsified oil and grease may clog flow distribution devices and air nozzles. Toxic metals and toxic organic compounds may interfere with biological activity and may complicate sludge disposal. Acids and alkalies may corrode pipes, pumps, and treatment units and may interfere with settling and biological activity. Flammable materials may cause fires and may lead to explosions. Noxious gases present a direct danger to workers, while detergents may cause foaming in aeration basins. These consequences also need to be addressed for onsite airport treatment plants.

11. CONTAMINATION OF GROUND WATER. Disposal of airport industrial wastes by land application is limited because of the potential for ground water contamination. These practices are generally unacceptable in areas where ground water is used as a source of drinking water.

CHAPTER 3. TYPES OF AIRPORT INDUSTRIAL WASTE

12. CLASSIFICATION. Proper classification of airport-generated industrial waste will assist the airport operator to implement an effective airport waste management program. Once categorized, design alternatives for treatment, storage, and disposal can be planned in compliance with Federal, State, and local regulations. Airport industrial wastes are classified according to the pollutants they contain or the characteristics they exhibit.

a. Industrial Wastewaters. Industrial wastewaters are generally characterized in terms of conventional pollutants and priority pollutants. Conventional pollutants include oil and grease, total suspended solids (TSS), pH, and biological oxygen demand (ROD). The priority pollutant list currently comprises the 129 compounds listed in appendix 2.

b. Hazardous Wastes. A waste is considered to be hazardous if it appears on any one of the four lists of hazardous wastes contained in the RCRA regulations (40 Code of Federal Regulations (CFR) § 261), or if it has one or more of four characteristics: ignitability, corrosivity, reactivity, and toxicity. Toxicity is currently determined by the Extraction Procedure test, which is to be replaced by the Toxicity Characteristic Leaching Procedure (TCLP). Specific testing protocols contained in RCRA regulations (40 CFR § 261, Subpart C) are used to determine if an airport's waste has any of these procedurally defined characteristics. The primary responsibility for determining if a waste exhibits a hazardous characteristic lies with the waste generator.

13. CYANIDES. Cyanides may be present in wastes generated during metal plating, steel hardening, rust prevention, and stain removal operations. The total cyanide concentration specified in ambient water quality criteria established by EPA to protect human health is 0.2 ppm. Chapters 7, 8, and 10 contain alternatives for management of wastes containing cyanides.

14. CHROMIUM COMPOUNDS 'AND TOXIC METALS. Chromium compounds may be present in wastes generated during chromium plating, bright dipping, copper stripping, and anodizing operations. Other toxic metals, such as copper, lead, and zinc, may be generated during metal plating operations. Chapters 8 and 10 contain alternatives for management of wastes containing chromium compounds and other toxic metals.

a. **Implications for POTWs.** wastes containing these compounds above certain concentrations may be toxic to micro-organisms utilized in biological treatment. Hexavalent chromium compounds generated by plating and anodizing operations are toxic to aerobic micro-organisms utilized in the biological degradation of sewage. Chromium in the trivalent form has been found to be detrimental to sludge digestion during waste treatment.

b. **Toxicity.** Toxicity of chromium salts, both trivalent and hexavalent, varies widely with the pH (acidity and alkalinity), temperature, and hardness of the receiving stream. The total chromium concentration specified in the ambient water quality criteria established by EPA to protect human health is 0.05 ppm. The National Primary Drinking Water Standards for metals established by the EPA limit total chromium to 0.050 ppm, cadmium to 0.010 ppm, and lead to 0.050 ppm. National Secondary Drinking Water Standards limit copper to 1 ppm and zinc to 5 ppm.

15. ACIDS AND ALKALIES. Acidic and alkaline wastes, generated during pickling and cleaning operations, can corrode metal and concrete sewer pipes. Acidic wastes interfere with sludge digestion and biological activity and are toxic to fish. The pH of the airport industrial wastes that are carried through sanitary sewers should be between 6.0 and 9.0. Where both acidic and alkaline wastes are involved, neutralization by mixing of the two may be sufficient to achieve a pH in this range. Preliminary investigation of the cotnpatibility of wastes should be conducted prior to mixing. Chapters 7 and 8 contain alternatives for waste management.

16. ORGANIC SOLVENTS AND PHENOLS. These wastes, generated during paint application and removal and the cleaning of aircraft and ground vehicles, can create explosion and toxicity hazards, interfere with sewage treatment, and pollute potable water. Solvents also interfere with bacterial activity in sludge digestion. Solvents and phenols, in particular, produce objectionable tastes and odors in water supplies. The concentration of phenol specified in the ambient water quality criteria for toxicity protection of human health is 3.5 ppm. The concentrations of several common industrial solvents, specified in ambient water quality criteria for carcinogenicity protection of human health, are 0.00019 ppm for methylene chloride, 0.00094 ppm for 1,2-dichloroethane, and 0.0027 ppm for trichloroethylene. Chapter 10 contains design and treatment options for organic compounds. Chapters 8 and 10 contain alternatives for waste management.

17. OIL, GREASE, AND/OR DETERGENTS. Precautionary measures should be taken in the design of waste treatment facilities or disposal strategies when wastes contain oil, grease, and/or detergents. These wastes are generated during cleaning of aircraft and ground vehicles and in vehicle maintenance shop operations. Segregation of wastes containing oil and grease helps to avoid coating carrier systems and increasing the BOD. Oil and grease coatings will also interfere with the efficiency of the precipitants used for coagulation and flocculation of industrial wastes. The mixing of dirt with cleaning wastes increases emulsions and clogs small openings in treatment units unless screened out. The pH of detergent wastes, usually ranging from 9.0 to 10.8, should be lowered by treatment. Detergents may cause partial sludge flotation through release of carbon dioxide. Chapters 7 and 8 contain alternatives for waste management.

18. BATTERIES. Spent lead acid, lithium, and nickel-cadmium batteries are generated from routine ground vehicle maintenance. The acidity and high levels in batteries may have adverse impacts on ground water if the batteries are disposed of improperly. unless recycled, spent batteries are hazardous wastes if they exhibit any of the characteristics noted in chapter 6. Chapter 6 contains guidelines on hazardous waste management.

19. DE/ANTI-ICING CHEMICAL WASTES. For most airports, aircraft de/anti-icing operations generate more waste than, pavement de/anti-icing activities. A major problem facing airport operators is the reduction in the increased BOD loading from de/anti-icing wastes to receiving waters and wastewater treatment plants. Chapter 9 contains alternatives for waste management.

CHAPTER 4. SURVEYS FOR AIRPORT INDUSTRIAL WASTE

20. OBJECTIVES OF A WASTE SURVEY. The general objective of a waste survey is to determine the sources, characteristics, and volumes of wastes that are generated. The specific aim is to assist the airport operator in establishing a sound basis for the management of these wastes, including recycling and waste minimization or elimination by process modification.

21. REQUIREMENTS OF WASTE SURVEY. Requirements of any waste survey planning include familiarity with the airport industrial processes used, operating schedules, sources of individual wastes, and, if one exists, the airport's industrial sewer system and treatment plant. In order for the survey results to be of maximum value to the airport operator, it is necessary to obtain data for a period of time which is sufficient in length to ensure that all waste-producing operations are surveyed.

22. FLOW MEASUREMENT. For continuously flowing wastewater streams, the flow rates of both individual and combined streams should be measured at representative points and expressed in standard units such as gallons per minute (gpm), gallons per hour (gph), or gallons per day (gpd). The method used by the airport operator to determine the flow rate will depend upon the magnitude of flow. Common metering devices include weirs, nozzles, flumes, and flow meters. For wastes that are generated on an intermittent basis, such as spent process baths and certain hazardous wastes, generation rates can be determined from the disposal volumes and dates.

23. SAMPLING. Accurate sampling, a necessity for correct analysis of airport industrial wastes, can be difficult because wastes are seldom homogeneous, e.g., their composition may vary widely over a period of minutes. Additionally, wastes frequently contain material in suspension as well as in solution.

a. Industrial Wastewaters. For industrial wastewaters, grab or composite samples should be taken and properly preserved before analysis. The sampling operation should be as frequent as available personnel permit or may be measured by automated water samplers with timers. Only by frequent sampling can an accurate determination of average waste concentration be made. 'A sampling interval of 10 to 15 minutes is recommended, with a maximum of one hour for streams that are not expected to vary significantly with time.

b. Hazardous Waste. For hazardous wastes, sampling to determine waste characteristics should initially be frequent (e.g., collection of several samples of wastes each time the waste is generated) and should subsequently be performed periodically (e.g., monthly, annually, or biannually) to confirm that waste characteristics have not changed.

24. ANALYSIS.

a. Industrial Wastewater. Wastewater constituents which are required to be sampled and analyzed are dictated by discharge permit limits that are applicable to the waste streams. Parameters which are typically monitored include BOD, dissolved oxygen (DO), pH, total solids (suspended and dissolved), effluent temperature, color, turbidity, oil and grease, and toxic pollutants, such as those listed in appendix 2. The recommended reference for analytical procedures for wastewaters is the latest edition of Standard Methods for the Examination of Water and Wastewater, published jointly by the American Public Health Association, the American Water Works Association, and the Water Pollution Control Federation. This reference is updated approximately every five years.

b. Hazardous Waste. Methods for analysis of hazardous waste characteristics are specified in 40 CFR § 261 Subpart C of the RCRA regulations.

CHAPTER 5. MANAGEMENT STRATEGIES FOR AIRPORT INDUSTRIAL WASTE

25. MANAGEMENT STRATEGIES. Historically, waste management at most industrial facilities has been to use end-of-pipe systems for the treatment of wastewaters and other wastes. Because of the increased costs of waste disposal, stringent regulations for hazardous waste management, and regulations that prohibit land disposal of certain wastes, recent attention has been focused on management strategies that reduce the total volume, toxicity, and/or mobility of toxic wastes. Currently, source reduction, recovery, and reuse can significantly decrease or eliminate airport waste, as well as an airport's operational costs for treatment and/or disposal. To determine the potential savings of these operational costs, a study should be made of industrial and hazardous waste management at the airport. This study should discuss various management alternatives and present recommendations for improvement. Such a study should also cover the management practices of all other types of solid waste (i.e., nonhazardous) to determine the effect, if any, that each practice has on others.

26. SOURCE REDUCTION. A waste survey (see chapter 4) is the first step an airport operator has in identifying source reduction opportunities. After determining the volume and composition of waste streams, information should be compiled on process efficiencies, disposal costs, and unaccountable material losses. Raw material substitution can reduce or eliminate the use of certain materials that are difficult or costly to treat or dispose of. Installation of more efficient equipment and improved process control, e.g., automated de/anti-icing blending equipment or involving employees, can reduce waste generation. Reduction of certain types of wastes can be achieved by installing equipment that performs the same function, e.g., the use of an apron pavement heating system in lieu of de/anti-icing chemicals.

27. RECOVERY AND REUSE. Recycling of materials that might otherwise be discharged as wastes can reduce an airport's waste treatment and disposal costs as well as the expense for raw materials. Examples of waste recovery and reuse that are particularly applicable to activities at airports are the recovery of paint solvents by distillation, the recovery of electroplating chemicals using dragout recovery tanks, and de/anti-icing chemicals for other nonairside uses or for airside use after retesting and reapproval.

28. TREATMENT. Once opportunities for source reduction and recovery and reuse are exhausted, waste treatment may be necessary to reduce the volume, toxicity, or mobility of waste prior. to discharge or disposal. Some industrial wastewater treatment technologies available to the airport operator are discussed in detail in chapters 8 and 9. Chapter 6 offers airport operators management guidelines for hazardous waste.

CHAPTER 6. MANAGEMENT OF HAZARDOUS WASTE

29. HAZARDOUS WASTES. The requirements of the hazardous waste regulations established by EPA are presented in 40 CFR § 261 through 270. Wastes that are hazardous and regulated under RCRA are classified as either listed, or characteristic wastes:

a. Listed Wastes. Listed wastes are considered to be hazardous regardless of the concentrations of hazardous chemicals contained in the waste. Listed hazardous wastes consist of wastes from nonspecific sources (F codes, 40 CFR § 261.31), from specific sources (K codes, 40 CFR § 261.32), and from commercial products (U and P codes, 40 CFR 6 261.33). The P code wastes are considered acutely hazardous and are subject to further restrictions concerning empty container storage and usage and allowable weight limits for generation and storage.

b. Characteristic Wastes. If a waste is not listed, the generator, in this case an airport facility operated by the airport itself or a lessee, should determine if a waste exhibits any of the characteristics of a hazardous waste: ignitability, corrosivity, reactivity, and toxicity.

30. GENERATOR STATUS. According to the 'Hazardous and Solid Waste Amendments (HSWA) of 1984, generators are organized into three tiers based on the total quantity of nonacutely hazardous waste generated in any calendar month.

a. Conditionallv Exempt Small Quantity Generators (CESQG). CESQGs generate less than 100 kg of hazardous waste and no more than 1 kg of acutely hazardous waste in any calendar month. Most airport facilities fall into this category the majority of the time.

b. Small Quantitv Generators (SQG). SQGs generate between 100 and 1000 kg of hazardous waste and no more than 1 kg of acutely hazardous waste in any calendar month. Some airport facilities fall into this category.

c. Large Quantity Generators (LQG). LQGs generate 1000 kg or more of hazardous waste and no more than 1 kg of acutely hazardous waste in any calendar month. Airport facilities that operate aircraft maintenance and repair shops and engine test cell operations may meet this criteria.

d. Monthlv Variation in Status. The status of an airport facility can change on a monthly basis if the total quantity of waste generated changes. If the generator status changes, the airport facility is subject to all of the applicable hazardous waste regulations pertaining to the new generator status. Airport facilities that anticipate process changes or that experience fluctuations in waste generation, storage, or accumulation need to be aware of their new responsibilities if their generator status changes.

31. GENERATOR IDENTIFICATION NUMBER. Only SQG and LQG airport facilities are required to obtain an EPA Identification Number for the transportation of hazardous waste. However, many hazardous waste transporters will not handle waste from an airport facility that does not have an Identification Number, regardless of their generator status. Also, because the status of a generator can change based upon monthly hazardous waste generation, it is advisable for CESQG airport facilities to obtain an EPA Identification Number.

32. ACCUMULATION TIME: Time and quantity limits are set for the accumulation and storage of hazardous wastes to minimize the amount of waste routinely accumulated onsite. The time and quantity limits have been set, however, so that facilities such as airports may accumulate enough hazardous waste to economically ship it offsite for treatment or disposal.

a. Accumulation bv CESQG Airport Facilities. There is no time limit applicable to the accumulation of hazardous waste by a CESQG. If a CESQG airport facility accumulates 1000 kg or more of hazardous waste onsite; however, the generator loses the CESQG exclusion and all of the accumulated waste is subject to full regulation under 40 CFR § 262.34(d) and must be sent to a designated facility within 180 days (270 days for transport over 200 miles).

b. Accumulation bv SQG Airport Facilities. An SQG airport facility may accumulate hazardous waste onsite without a permit or interim status for up to 180 days (or 270 days if the waste must be transported over 200 miles), provided that the following conditions are met: 1) the generator does not accumulate 6000 kg or more of hazardous waste; 2) the waste is only accumulated in either containers or tanks, and 3) the generator complies with the requirements for personnel training, emergency procedures, preparedness and prevention, and the technical standards for accumulation units according to 40 CFR § 26234(d).

c. Accumulation by LQG Airport Facilities. An LQG airport facility may accumulate any quantity of waste onsite for up to 90 days without a permit or interim status provided the following conditions from 40 CFR § 262.34 are met: 1) storage occurs only in tanks or containers (no impoundments); 2) tanks or containers comply with 40 CFR § 265, 'Subpart I, Standards for Containers, and Subpart J, Standards for Tanks; 3) the generator does not accept shipments of hazardous waste generated from offsite sources; 4) waste is sent to a designated facility within 90 days unless the waste is treated and rendered nonhazardous within 90 days; and 5) the generator complies with the requirements for Preparedness and Prevention and Contingency Plan and Emergency Procedures of 40 CFR § 265.

d. Exceeding Time or Quantity Limits. If SQG or LQG airport facilities exceed the time or quantity limits noted above, then they are considered to be storage facilities and must obtain a storage permit (as discussed below) and meet all of the RCRA storage requirements according to 40 CFR § 264, § 265, and § 270.

33. ACCUMULATION UNITS. Airport facilities are required to designate areas within its facilities where hazardous wastes are stored prior to disposal. Containers in this area should be clearly marked. The requirements for containers in which hazardous wastes are accumulated are as follows:

a. Accumulation Requirements for CESQG Airport Facilities. CESQG airport facilities are not subject to storage or accumulation requirements unless they change generator status due to the amount of waste accumulated onsite. Nevertheless, following the rules for LQGs and SQGs should minimize potential risks to both human health and the environment.

b. Accumulation Requirements for SQG Airport Facilities. SQG airport facilities accumulating hazardous waste in containers must comply with Subpart I of 40 CFR § 265, except for § 265.176, which requires ignitable (§ 261.21) and reactive (§ 261.23) wastes to be placed at least 50 feet inside the facility's property line.

c. Accumulation Requirements for LQG Airport Facilities. LQG airport facilities accumulating hazardous wastes in containers must comply with Subpart I of 40 CFR § 265. The date when accumulation begins, as well as the words "HAZARDOUS WASTE," must be clearly labeled on each accumulation unit. Tanks in which hazardous wastes are accumulated must be in compliance with the provisions of Subpart J of 40 CFR § 265, except § 265.197(c) and § 265.200, including: 1) a one-time assessment of the tank system, including integrity test results; 2) installation standards for new tank systems; 3) design standards, including an assessment of corrosion potential; 4) secondary containment phasein provisions; 5) periodic leak testing if the tank system does not have secondary containment; 6) closure; and 7) response requirements regarding leaks, including reporting to the EPA Regional Administrator the extent of any release and requirements for repairing or replacing leaking tanks.

d. Tank Accumulation Requirements for LQG and SQG Airport Facilities.

(1) Tank Systems. LQG and SQG airport facilities accumulating hazardous waste in a tank must comply with the following requirements pertaining to tank systems: 1) treatment must not generate any extreme heat, explosions, fire, fumes, mists, dusts, or gases, damage the structural integrity of the tank, or threaten human health or the environment in any way; 2) hazardous wastes or reagents that may cause corrosion, erosion, or structural failure must not be placed in a tank; 3) at least 2 feet of freeboard must be maintained in an uncovered tank unless sufficient overfill containment capacity is supplied; 4) the containment system must have the capacity to contain 10 percent of the volume of containers (if they are, grouped together) or of the largest (or sole) container, whichever is greatest; 5) continuously fed tanks must have a waste-feed cutoff or bypass system; and 6) ignitable, reactive, or incompatible wastes must not be placed into a tank unless these wastes are first rendered nonignitable, nonreactive, or nonflammable.

(2) Inspection Timetables. The waste-feed cutoff and bypass systems, monitoring equipment data, and waste level must be inspected at least once each operating day. The construction materials and the surrounding area of the tank system must be inspected for visible signs of erosion or leakage at least weekly. At closure of the generating facility, all hazardous wastes must be removed from the tanks, containment systems, and discharge control systems. Owners or operators of 90-day accumulation tanks are not required to prepare closure or postclosure plans, contingent closure or postclosure plans, maintain financial responsibility, or conduct waste analysis and trial tests.

e. Satellite Accumulation. A generator may accumulate a total of 55 gallons (1 barrel) of hazardous waste or 1 quart of acutely hazardous waste at or near any initial generation point. As soon as the 55-gallon or l-quart limit is attained, the generator has up to three days to move that container to the regular storage area. As soon as the container is at the regular storage area, the applicable time limit starts. Satellite accumulation containers must be marked with the words "HAZARDOUS WASTE" or with other words that identify the contents of the containers (40 CFR § 262.34(c)).

34. ONSITE TREATMENT AND DISPOSAL. Treatment in a tank or container without a permit or interim status is permissible provided that the airport facility maintains compliance with 40 CFR § 262.34. Treatment occurs within the storage time limit for each type of generator status. An airport facility may not dispose of hazardous waste onsite unless a disposal permit has been obtained. Any airport facility desiring to store, treat, or dispose of hazardous waste in any manner not consistent with allowable methods previously described needs a permit as described in 40 CFR § 270. Obtaining a permit to store, treat, or dispose of hazardous wastes on site can be both costly and time consuming. The operator of such an airport facility can obtain a permit by: 1) notifying EPA or the appropriate State agency of hazardous waste activity; 2) completing Part A of the permit application; 3) complying with the interim status standards described in 40 CFR § 265; 4) completing Part B of the permit application; and 5) complying with the standards described in 40 CFR § 264 and § 266.

35. MANIFESTS.

a. LQG Airport Facilitv Reuuirements. An LQG airport facility transporting hazardous waste offsite or offering it for transportation must use the Uniform Hazardous Waste Manifest.

(1) General Procedure. The manifest must accompany the waste wherever it travels. Each individual involved in a shipment must sign and keep one copy. When the waste reaches its final destination, the owner or operator of the designated and permitted treatment, storage, and disposal (TSD) facility signs the manifest and returns a copy to the airport facility operator to confirm receipt. A designated TSD facility must have interim status or a permit. The designated TSD facility signing the manifest accepts responsibility for that shipment and cannot ship the waste back to the airport facility or any other facility unless that facility is also classified as a designated facility. Although a facility may accept responsibility for a shipment, the airport facility operator retains liability under 40 CFR § 107 of Superfund.

(2) Follow Up. Each person involved in the movement, storage, or receipt of hazardous waste requiring a manifest must retain a copy of that manifest for at least three years. If an airport facility operator does not receive a copy of the signed manifest from the designated TSD facility within 35 days after the initial transporter accepted the waste, the airport facility operator must contact the designated facility to determine the status of the waste. If the airport facility operator has not received a signed manifest within 45 days, an exception report, which consists of a copy of the original manifest and a letter explaining the efforts taken to locate the waste and the results of those efforts, must be filed with EPA

b. SQG Airport Facilitv Reuuirements. An SQG airport facility must use the Uniform Hazardous Waste Manifest and retain copies of manifests for at least three years. There is an exclusion to the requirement, the "Safety Kleen Amendment," in which an SQG airport facility does not have to use a manifest provided the waste is reclaimed under a contractual agreement and: 1) the type of waste and the frequency of shipments are specified in the agreement; 2) the vehicle used to transport the hazardous waste to the recycling facility and to deliver regenerated material back to the generator is owned or operated by the. reclaimer of the waste; and 3) the generator maintains a copy of the reclamation agreement in the facility's files for a period of at least three years after termination of the agreement.

c. CESQG Airport Facilitv Reuuirements. An CESQG airport facility is no.t legally required to utilize a manifest for hazardous waste; however, many transporters will not handle waste from such facilities. Since airport facilities can change status based upon monthly changes in hazardous waste generation, it is advisable to recommend CESQG airport facilities to utilize manifests and retain copies.

d. Designating Storage. Treatment. or Disposal Facilities. Any type of storage, treatment, or disposal facility that an airport facility designates to receive hazardous waste must be either: 1) permitted or have interim status under § 270 of RCRA; 2) authorized to manage hazardous waste by a State with an authorized program under § 271 of RCRA; 3) permitted, licensed, or registered by a State to manage municipal or industrial hazardous waste; 4) a permitted facility that beneficially uses, reuses, or legitimately recycles or reclaims the hazardous waste; or 5) a permitted facility that treats the waste prior to beneficial use or reuse or conducts legitimate recycling or reclamation.

36. PERSONNEL TRAINING. PREPAREDNESS AND PREVENTION. AND CONTINGENCY PLANS AND EMERGENCY PROCEDURES. As specified in 40 CFR § 26234, a generator of hazardous waste is required to comply with the requirements of 40 CFR § 265.16 (personnel training) and of Subparts C (preparedness and prevention) and D (contingency plan and emergency procedures) of 40 CFR § 265.

a. Personnel Training for LOG Airport Facilities. LQG airport facilities must establish a training program for appropriate facility personnel designed to reduce the potential for errors that might threaten human health or the environment. This program must also include training to ensure facility compliance with all applicable regulations. Both initial training and annual updates are required. Either on-the-job or formal classroom instruction is allowable; however, the content, schedule, and techniques used for on-the-job training must be detailed in the training records maintained at the facility.

b. Personnel Training for SQG Airport Facilities. SQG airport facilities must ensure that all involved employees are thoroughly familiar with proper waste handling and emergency procedures relevant to their responsibilities during normal facility operations and emergencies via generator-sponsored instruction. The training requirement is minimal compared to the more comprehensive instruction required for LQG airport facilities.

c. Personnel Training for CESQG Airport Facilities. CESQG airport facilities are not legally required to provide personnel training; however, it may be advisable to provide, at a minimum, the type of training required for SQGs, particularly given that generator status could change.

d. Preparedness and Prevention. According to Subpart C of 40 CFR § 265, a facility must be operated and maintained in order to minimize the possibility of any fire, explosion, or unplanned sudden or nonsudden release. Required equipment includes an alarm system, a communication device to contact emergency personnel (e.g., telephone), portable fire extinguishers, fire control equipment, and an adequate firefighting water supply system in the form of hoses or an auto-sprinkler system. All equipment must be routinely tested and maintained in proper working order. Facilities must make prior arrangements with local emergency organizations and personnel for an emergency response. Arrangements should include notification of the types of waste handled, a detailed layout of the facility, a listing of facility contacts, and specific agreements with the necessary State and local emergency response organizations.

e. Contingency Plan and Emergency Procedures. Both LQG and SQG airport facilities must have a contingency plan, as outlined in Subpart D of 40 CFR § 265, that is designed to minimize hazards in the case of a sudden or nonsudden release, fire, explosion, or similar emergency.

(1) Plan Requirements. Such a plan must contain a description of actions that will be undertaken by facility personnel, a detailed list and location of emergency equipment, and evacuation procedures. Airport facility operators who have previously prepared a Spill Prevention, Control, and Countermeasure Plan (SPCC) in accordance with either 40 CFR § 112 or § 300, or some other emergency or contingency plan, need only to amend that plan to incorporate hazardous waste management provisions.

(2) Personnel Requirements. There must be at least one employee either on the premises or on call (i.e., available to respond to an emergency at the facility within a short time) at all times with the responsibility of coordinating all emergency response measures (the emergency coordinator). The emergency coordinator, in responding to any emergencies that may arise, should institute the following emergency procedures, if appropriate: 1) contact the fire department and/or attempt to extinguish any fire; 2) contain any flow and commence cleanup wherever possible; and 3) notify the National Response Center of any fire, explosion, or release that meets a Superfund reportable quantity (40 CFR § 302) or a release that threatens human health or the environment. The airport facility must post the name and telephone number of the designated emergency coordinator, the telephone numbers of the fire department and appropriate emergency response organizations, and the locations of fire extinguishers, spill control equipment, and fire alarms next to facility telephones.

37. EMERGENCY PLANNING AND COMMUNITY RIGHT-TO-KNOW. In the fall of 1986, congress passed the Emergency Planning and Community Right-To-Know Act (EPCRA). This law, which is Title III of the Superfund Amendments and Reauthorization Act (SARA), directs States, communities, and industry (e.g., airport facilities) to work together in order to plan for chemical accidents, develop inventories of hazardous substances, track toxicchemical releases, and provide public access to information relating to hazardous substances. Airport facilities that handle or use any of a list of extremely hazardous chemicals over certain quantities must notify public agencies that they are covered by the emergency planning provisions of Title III and must appoint representatives to provide detailed information to State commissions and local committees that will be used to prepare emergency preparedness plans. Both airport facilities and aircraft are treated as facilities under Section 40 CFR § 304 (42 U.S.C. 11001), only for the purpose of emergency notification, owners or operators of facilities must also notify the State's emergency response commission immediately after an accidental release of an extremely hazardous substance that is over the reportable quantity established for that substance, as well as follow-up written reports for the release. Title III also requires facilities that make, store, or use certain chemicals to file reports with the State commission and local committees if the chemicals are present above certain thresholds. Facilities that are required to maintain material safety data sheets (MSDSs) under OSHA's Hazard Communication (HC) Standard must submit the MSDSs or a list of MSDSs to State and local authorities. Annual chemical inventory forms must also be supplied.

CHAPTER 7. AIRPORT INDUSTRIAL WASTES CONVEYANCE AND COLLECTION

38. CONVEYANCE SYSTEMS. Airport industrial wastes containing appreciable amounts of certain materials, such as heavy metals, solvents, sludges, oils, greases, acids, or alkalies, are typically segregated and treated prior to discharge to sanitary sewers or receiving waters. Several types of collection systems are available to airport operators.

a. Open. Open ditches and canals may be used to carry wastes if concrete linings are provided to minimize the percolation of waste liquids into the soil. These conveyances are not suitable, however, for the collection of wastes that pose potential fire or explosion hazards or release nuisance odors. In general, open collection systems are not desirable because of unsightly appearance and hazard to the public.

b. Closed. Closed systems are commonly used for wastes and sanitary sewage. Separate conveyance systems are required for sanitary wastes and airport industrial wastes that require pretreatment.

c. **Special.** Special provisions, such as the use of holding tanks or ponds, need to be made for some incompatible wastes which cannot be discharged to sewers without danger of fire, explosion, or damage to the materials used to construct the sewer.

d. **Security.** Installation of proximity fencing helps to preclude the inadvertent entry of persons or animals onto an airport's waste treatment plant and its facilities.

39. SEWER MATERIALS. In most cases, the materials used to construct sewers to convey airport industrial wastes are the same as those used for sanitary sewers. These materials include metal, plastic, and concrete. Acid wastes are particularly corrosive to these materials. Cooling of wastes with temperatures above **180°** F **(82°** C), prior to discharge to the sewer, helps to prevent possible damage to sewer joints. In the selection of piping and pumps, consideration during design should be given to the corrosive and other damaging effects of many wastes on concrete and metal. In many applications, plastic pipe is less vulnerable to attack and is thus often used in place of metal pipe.

40. COLLECTION SYSTEMS. Concentrated waste materials can be segregated in holding tanks or ponds prior to pretreatment. This is often the **case** when the quantities involved are large enough to cause operational difficulties' if combined with the general waste flow. Materials for which collection systems are often used include: concentrated acids, concentrated alkaline solutions, cleaners, solvents, plating solutions, stripping solutions, cyanide wastes, phenolic compounds, and de/anti-icing chemicals. Wastes are released from the collection systems for treatment at times and rates most favorable to the 'airport's or community's treatment system operation. Earlier release by using an aeration system is one means of reducing the generation of obnoxious odors. Avoiding, if possible, construction of new sewage ponds reduces the likelihood of creating new wildlife problems.

CHAPTER 8. TREATMENT TECHNIQUES FOR INDUSTRIAL WASTEWATERS

41. GENERAL. The most desirable and economical method of treating industrial wastewaters is by combination with sanitary sewage for treatment in a single treatment plant. Pretreatment, however, is generally necessary to prevent the deleterious effects of acids, alkalies, oils, and greases on treatment units and on micro-organisms utilized in biological treatment. The techniques used for treatment of industrial wastewaters may involve various physical, chemical, and biological unit operations, tertiary treatment, and other treatment technologies. The operator of any treatment facility should furnish operator manuals and basic employee training in the proper operation of the treatment facility.

42. PHYSICAL UNIT OPERATIONS. Techniques used for the physical treatment of industrial wastewaters include equalization, screening, grit removal, sedimentation, and flotation.

a. Equalization. Equalization is typically one of the first operations in a treatment system and is used to reduce the temporal variation in wastewater flow or concentration. An equalization basin consists of an agitated tank, which has a total volume generally in the range of 10 to 25 percent of the airport's total daily wastewater flow. Agitation is accomplished by mechanical mixing devices or by diffused air aeration.

b. Screening. Bar racks (also called bar screens) with relatively wide spacing of 1 to 1.5 inches are often used at treatment plants for protecting pumps and treatment units from damage and clogging by large solids, rags, and other debris carried by sewage or wastewater. Revolving drum or disk screens with 1/16-inch to 1/4-inch openings may be suited for preliminary treatment of wastes containing coarse solids.

c. Comminution. Comminutors are devices that are used to cut up solids contained in wastewater. The cut up of solids into a smaller, more uniform size improves downstream operations and processes and eliminates other operational problems.

d. Grit Removal. Wastes from maintenance and repair operations are likely to contain considerable amounts of grit as well as dirt and grease. Washing and steam cleaning are major sources of these waste components. Grit is objectionable because it can clog sewers and cause rapid wear on pumps and sludge removal equipment. It is also harmful when treatment systems include sludge digestion because it can accumulate in the digester and clog drawoff piping. Wastes containing an excessive amount of grit should be segregated and subjected to grit removal and treatment by means of a grit chamber prior to discharge to sewer systems, pumping stations, or waste treatment systems. A grit chamber is an enlarged channel or long tank placed at the influent end of the treatment plant. A properly designed cross section will retard the flow velocity just enough to promote the gravitational settling of heavier solids prior to their removal.

e. Sedimentation. Sedimentation, with or without chemical pretreatment, is used in connection with the treatment of most industrial wastes because it produces a substantial reduction in the suspended solids content. Sedimentation basins similar to those used for sanitary sewage treatment are used for the treatment of industrial wastes. Normally, mechanical sludge and scum removal equipment is utilized during the process.

f. Flotation. Suspended material, such as oil, grease, and other substances with a specific gravity less than that of water, tends to separate from water by floating. Fine particles and some flocculent material with a specific gravity greater than that of water tend to settle, but at a very slow rate. Flotation may be employed to remove these materials and may be accomplished in simple gravity separators or in dissolved air flotation units.

(1) Gravity Separators. Gravity oil-water separators are good processors for the treatment of wastewaters generated by activities producing large amounts of oily wastes. The American Petroleum Institute (API) Separator is an example of a gravity separator of proven usefulness for oil removal. It consists of a long, narrow, relatively shallow, baffled basin equipped with a continuous skimming and scraping mechanism. Generally, free-floating dispersed oil, which will coalesce rapidly, is readily separated from industrial wastewater in this type of basin. Emulsified oil that coalesces slowly, however, is not reduced appreciably and needs to be chemically treated to break the emulsion.

(2) Dissolved-air Flotation. This method is used to remove oil and grease from airport industrial wastes and involves the production of many small air bubbles within the waste. These bubbles attach themselves to the suspended particles, causing them to float to the surface and be skimmed by mechanical means. The clarified water is removed from the

flotation tank through submerged outlets. The efficiency of the process may be improved by the addition of flocculating chemicals, such as alum, activated silica, and polymers.

43. CHEMICAL UNIT OPERATIONS. Chemicals are added to industrial wastewaters to achieve pH neutralization, break up oil and grease emulsions, coagulate suspended or colloidal solids, oxidize cyanides, reduce chromium, and precipitate heavy metals.

a. Neutralization. Concentrated acidic or alkaline wastes normally require pH neutralization prior to discharge. When both types of wastes are available, mixing the two is advantageous, since only the excess acid or alkali requires further neutralization. Reactivity of the 'combined wastes should be evaluated prior to mixing waste streams.

(1) Pickling Acids. Acid wastes from metal pickling and finishing operations usually present the greatest problems. The various acids used in the pickling process are sulfuric, nitric, hydrochloric, and phosphoric, with sulfuric acid being the most commonly used. Quick lime and hydrated lime are the alkaline neutralizing agents most commonly used.

(2) Treatment Modes. Neutralization may be accomplished by either continuous or batch treatment methods (see figures 8-l and 8-2). Neutralization is carried out by feeding lime slurry to the spent pickle liquor in a tank equipped with an agitator. Lime requirements are obtained from the "acid value" of the pickle liquor and the "alkaline value" of the lime as determined by chemical analysis. The sludge formed in the process is disposed of in a sanitary landfill or as a hazardous waste if its heavy metal content is too high. Hazardous waste management is discussed in chapter 6.

b. Breakup of Oil and Grease Emulsions. Emulsions can be broken by acidification, the addition of alum or iron salts, or the use of emulsion-breaking polymers. The disadvantage of adding alum or iron is the large quantities of volume generated. The breaking of emulsions is a complex art and often requires treatability testing prior to developing a final process design.

c. Coagulation and Flocculation. Coagulation and flocculation are. employed to remove suspended or colloidal materials from wastewater. Chemicals commonly used for coagulation include alum, ferric salts, and polymers. Equipment used for coagulation and flocculation often consists of a rapid-mix tank, in which chemicals and wastewater are mixed, and a flocculation basin, in which rotating paddles promote particle aggregation. The flocculated mixture is settled in conventional settling tanks.

d. Oxidation, Reduction, and Precipitation. At most airport facilities, oxidation of cyanides, reduction of chromium, and precipitation of heavy metals are treatment processes normally associated with electroplating operations. These technologies are addressed in chapter 10.

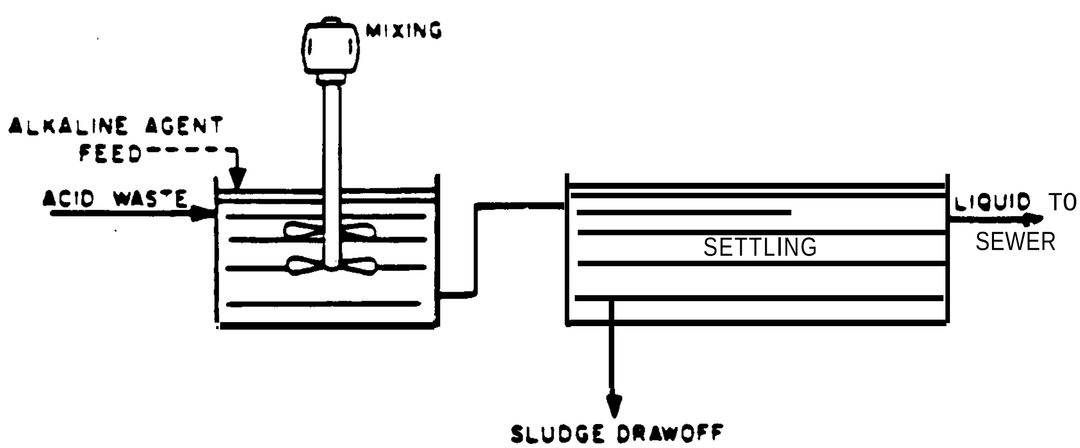

Figure 8-1. Neutralization (continuous method)

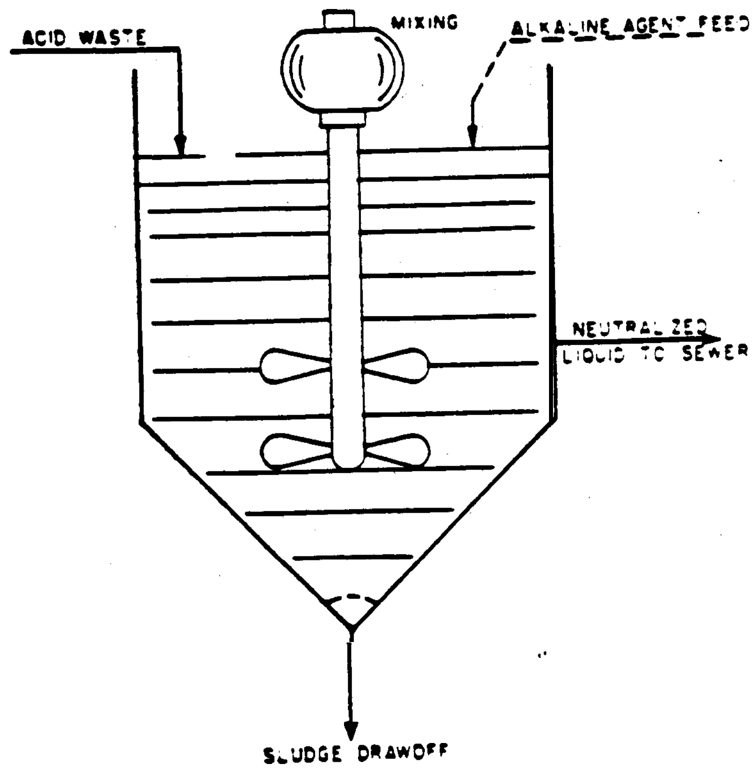

Figure 8-2. Neutralization (batch method)

44. BIOLOGICAL UNIT OPERATIONS. The destruction of the organic component of many industrial wastes may be accomplished by biological degradation. Wastes which exhibit a biochemical oxygen demand are potentially amenable to biological treatment. Biological processes are usually employed after a substantial proportion of suspended matter has been removed.

a. Trickling Filters. Trickling filters, similar to those employed for domestic sewage, generally provide effective treatment of organic industrial wastes. Both standard and high-rate trickling filters with recirculation can be used. Trickling filters are reliable treatment devices which are relatively easy and inexpensive to operate and, in general, provide the best type of biological treatment for industrial wastes or for combined sanitary and industrial wastes.

b. Activated Sludee. The activated sludge process is useful for treating airport industrial wastes where the organic loading is relatively uniform or homogeneous. This method is sensitive to heterogeneous or shock loads and toxic substances and requires careful operating controls.

45. TERTIARY AND OTHER TREATMENT TECHNOLOGIES. Technologies used for tertiary treatment of industrial wastewater include: ion exchange, electrolytic recovery, air stripping, and adsorption.

a. Ion Exchange. In the ion exchange process, charged ions in the influent industrial wastewater are electrostatically attracted to ion-exchange resins to produce an effluent in which certain elements have been exchanged for others. The resins themselves are not altered chemically and can readily be regenerated, depending on the resin, by the use of a salt, base, or acid. This method is used to remove cyanides and chromates from rinse water, remove impurities from chromic acid plating and anodizing solutions, and produce demineralized water from raw water.

b. Electrolvtic Recoverv. In electrolytic recovery, industrial wastewater is subjected to a direct electrical current to achieve specific oxidation and reduction reactions in a manner similar to that employed in electroplating. By this method, heavy metals. are removed from industrial wastewater by plating them onto electrodes. Cyanide oxidation can also be accomplished by this technique. A major advantage to airport operators in using the electrolytic recovery technology' for metal removal as compared to conventional treatment technologies, such as precipitation, is that little or no sludge generated by this method requires disposal as a hazardous waste.

c. Air Stripping and Adsorption. Air stripping and activated carbon adsorption are technologies commonly used for the removal of solvents and other toxic organic compounds from industrial wastewater. In air stripping, water is contacted with air in a countercurrent flow stripping tower which effects the partitioning of the organic compound from the water into the air. In activated carbon adsorption, wastewater is passed through a column packed with granular activated carbon. Organic compounds in the industrial wastewater are removed by adsorption onto the activated carbon. In some cases, bacterial growth within the pores of the activated carbon allows for biological degradation of organic compounds which extends the adsorption capacity of the activated carbon. Once its adsorption capacity is exhausted, the carbon is disposed of or regenerated in a furnace. The use of these technologies will probably increase in the future when more stringent discharge standards for toxic organics are developed and enforced.

46. TREATABILITY STUDIES. There is no standard method for treating industrial wastes, as each airport's industrial plant effluent presents a special treatment problem. Laboratory and pilot-plant studies may be required to determine the type of treatment required for a particular waste. Depending on waste characteristics, combinations of these basic procedures may be implemented to provide the required degree of treatment.

47. SLUDGE HANDLING. With the exception of sludges that are either listed or characteristic hazardous wastes (e.g., sludges from electroplating that contain certain heavy metals or cyanides), organic sludge resulting from industrial waste treatment is dried and disposed of in the same manner as sanitary sewage sludge. Organic sludge may be handled by the digestion methods used in sanitary sewage plants. Sludge drying may be accomplished on open beds 'or vacuum filters. Industrial wastes containing large quantities of chemical coagulants generally produce a large volume of sludge that ordinarily does not dry as rapidly as sanitary sewage sludge.

CHAPTER 9. MANAGEMENT OF DE/ANTI-ICING CHEMICAL WASTES

48. DE/ANTI-ICING CHEMICALS. In general, the de/anti-icing chemicals used by airlines in both North America and Europe primarily contain glycols and water. Glycols are the dominant chemical agents because of their good performance as a freezing point depressant (FPD). A mixture prevents refreezing of melted snow or ice by reducing the temperature at which water freezes. Theoretically, when mixed with water, the freezing point of the mixture is lowered in direct relation to the amount of glycol present until a minimum freezing point, the eutectic point, is reached. For example, the eutectic point for ethylene glycol is reached at a 58/42 mixture of glycol/water which gives a minimum freezing point of -56.7" F (-49.3" C).

49. TREATMENT AND DISPOSAL OF DE/ANTI-ICING CHEMICAL WASTES. Location of de/anti-icing operations could directly prescribe the appropriate method for managing de/anti-icing chemical waste. The most common location currently used at airports is along the apron areas where specially designed, mobile deicing vehicles operate from gate to gate. Other airports operate away from the gate areas by employing a "centralized system" that utilizes a stationary dispensing system or employing holding aprons supported by mobile vehicles. Future airport planning should consider the possibility of nongate deicing operations. There are several alternatives for management of waste generated by either system, the selection of which is dependent upon site-specific factors such as the magnitude and frequency of waste flow. Whichever of the following options is utilized at the airport, it should ensure proper and effective remove of de/anti-icing chemicals:

a. Disposal to Sanitary Sewage Facility. Because glycols are readily biodegradable, their runoff could feasibly be treated with sanitary sewage, if the treatment plant has the capacity to handle the hydraulic load and the additional BOD associated with glycols. Measurements have shown the average oxygen demand for glycols is between 400,000 and 600,000 mg O_2/L, even if diluted per fluid manufacturer's specifications. To lessen the load affects of glycols on treatment plants, onsite interception basins may be used not only to better control the rate of flow during peak flight hours, but also to stabilize the waste. Also, the use of airport wastewater treatment facilities to lower the BOD load could result in an effluent acceptable to most local treatment plants. The treatment of glycol waste in an onsite sewage treatment facility is a widely accepted practice which has been demonstrated at American and European airports.

b. Biological Treatment. An onsite biological treatment plant using extended aeration, contact stabilization, or trickling filters alone would not be practical for only glycol-based FPD fluids given the seasonal nature of their usage. In addition, glycols do not provide nutrients, such as nitrogen and phosphorous, for microbial growth other than an organic carbon source. Nutrient addition can be achieved by channelling flow to the facility's sanitary sewage treatment plant from airplane lavatory cleaning and/or airport restroom facilities.

c. Lagoons and Retention Ponds. Conversion of suitable unused airport land into lagoons or retention ponds permits collection of large volumes of glycol-based fluid waste from pavement surface runoff.

(1) Capacity. The minimum design capacity handles at least the surface runoffs for winter months because microbial activity needed for biodegradation decreases during the winter season, plus incorporate additional capacity for the thawing periods. Required oxygen could be provided by mechanical aeration or photosynthesis, although there. would also be a decrease in algal growth during cold weather. Capacity requirements can be reduced by continuous aeration that allows for faster biodegradation and, thus, earlier release of glycol-based fluid waste. Additionally, lagoons of this type could also stabilize and pre-treat glycol-based fluid waste prior to discharge to a wastewater treatment plant.

(2) Configuration. An acceptable configuration for any retention basin is one that is easily defensible from a wildlife standpoint. Square or circular retention basins are not recommended as they are attractive to birds, and waterfowl will seek the safety of a pond's center to escape harassment activities. Hence, linear retention basins are recommended since they facilitate wildlife harassment and, if necessary, permit easier covering of the basin. As concentrated glycol is toxic to wildlife, covering may be necessary to prohibit any wildlife. use. Fencing is recommended whenever potentially hazardous compounds are stored in open areas.

d. Land Disposal. Where glycol-based FPDs use is small, runoff glycol wastes can be collected with absorbent material and, where permissible, disposed of in a landfill. However, since glycols are readily biodegradable, this method of disposal would be highly inefficient because of absorbent material and transportation costs. An alternative to this would be land treatment, if permitted, in which the waste is applied to the soil to allow native micro-organisms the opportunity to degrade the glycols. At some locations, some runway and apron de/anti-icing runoff is discharged directly to the soil. This type of disposal can become a concern if groundwater supplies are affected. In addition, frozen ground may not readily absorb viscous de/anti-icing wastes (depending on their temperature when they reach the soil),

e. Surface Water Disposal. In some cases, de/anti-icing wastes can be discharged with little or no pretreatment to surface waters. Factors which impact the feasibility of this management alternative include the proximity of the airport to a suitable body of surface water, the size (i.e., volume or flow rate) of the surface water, the magnitude and frequency of waste flow, and State and local regulations pertaining to surface water discharge. Section 403 of the CWA outlines provisions for ocean discharge criteria.

f. Recycling. Rather than seeking to treat the glycol-based fluid waste, methods of physical separation might be applied in order to recover a reusable product. In this case, the primary sewer discharge would be water with very little glycol-based fluid waste. Recycling provides the airport operator and users a chemical cost savings since the recaptured glycol could be sold or reused for other nonairside applications. Recaptured glycol-based fluids may also be reused on the airside if they meet the appropriate glycol-based fluid specification. Prior to their reuse, airport and airline operation. managers and private aircraft operators should be notified.

g. Reduction in Chemical Usaee Throueh New Technologies. The advent of new technologies to reduce the quantities of de/anti-icing chemical usage is becoming available to airport operators. Some possible benefits to airport operators derived from the following systems are: controlling or eliminating glycol runoff by confining deicing operations at defined areas or eliminate spraying pavements; reducing the quantities of glycol usage; recapturing and/or recycling glycols for other uses; and decreasing the melting of snowbanks containing glycols into the ground during thawing periods.

(1) Aircraft Surfaces. Computerized spraying systems for aircraft de/anti-icing operations are in use today. The basic system consists of a dedicated pad for the de/anti-icing operations, fluid bleeding equipment with or without computerized spray nozzles, a recovery system for spilled waste, and other support items unique to the system. Because it is more efficient, the de/anti-icing operation reduces the quantities of glycol-based fluids applied to aircraft surfaces; thereby minimizing the waste management task These systems are also capable of recycling spent fluids for other nonairside uses (see precautions in Subparagraph 49(f), Recycling). Improvements to airport capacity and safety may be possible by the placement of such "centralized/remote facilities" away from the gate areas. The location of such systems must satisfy the design standards of AC 150/5300-13, Airport Design.

(2) Pavement Surfaces. In-pavement circulating tubing carrying a heated fluid/gas medium to heat apron and taxiway pavement surfaces is in use today (electrical systems are available at higher operating costs). This technology can reduce the quantities of de/anti-icing chemicals applied to pavement surfaces. Two aspects of a pavement surface heating system that require reasonable accuracy in their determination are:

(i) Pavement Surface Heat. The minimum amount of pavement surface heat is one that maintains a snow and ice-free pavement surface under the specified weather conditions. This can. be determined as a function of the ambient conditions and the behavioral properties of the thermal distribution system installed. The thermal distribution system consists of the thermal resistance between the pavement surface to a variety of typical ambient environments, the resistance of the in-pavement system, and the transient behavior of the actively heated pavement.

(ii) Annual Energy Requirements. The amount of energy needed to be expended annually by the pavement heating system to perform its intended function needs to be determined. Energy consumption depends on the severity of the airport's winter climate, on the number of anticipated times and duration the heating system is to' be activated, and the energy source(s). Climate design parameters include air and pavement temperatures, humidity, wind speed, and the amount of snowfall. Also, during the winter months, energy consumption varies from month to month.

CHAPTER 10. MANAGEMENT OF MAINTENANCE SHOP WASTES

50. GENERAL. The operations conducted at aircraft maintenance shops include cleaning, reconditioning, and overhauling. The principal wastes produced, in addition to those discussed under Chapter 11, Aircraft Wash Wastes and Similar Wastes, are metal cleaning, treating, and plating solutions. This chapter describes treatment facilities for these major airport industrial wastes, including specific systems for the treatment of chromates and other heavy metals, phenols, and cyanides.

51. PLATING ROOM WASTES. Plating room wastes, which are mainly inorganic, consist of acids, cyanides, and heavy metals such as zinc, copper, lead, and chromium. The chief plating room operations contributing to the generation of these wastes are:

a. **Stripping**. The use of acidic or alkaline baths to remove undesirable films or coating on the metal to be plated.

b. Cleaning. The removal of oil, grease, dirt, and corrosion through the use of acidic and alkaline cleaners.

c. Plating., The process of using a direct electrical current to deposit metal on the material being plated, produces metal and cyanide wastes.

52. SOURCES AND 'CHARACTERISTICS OF WASTES. The chief sources of wastes in plating room operations are: dragout losses (solutions carried out of the bath and into overflow rinses on the part being plated); spray losses (chiefly in chrome plating where the gas produced causes a fine spray); and the dumping of spent solutions. The characteristics of plating wastes vary considerably. They may be either acidic or alkaline, depending on the baths used. Chromate baths produce highly acidic wastes while alkaline cleaning baths and cyanides produce alkaline wastes. In general, plating wastes are highly toxic and corrosive.

53. PLATING WASTE REDUCTION. Dragout losses may be reduced by providing adequate drainage of the metal being plated and the use of a dragout recovery tank. Spray losses may be reduced by the installation of an exhaust system to recover finely divided spray for return to the solution' tank The use of series rather than parallel rinse tanks reduces water consumption. Finally, good housekeeping and supervision decrease wastes, prevent improper dumping, and improve the segregation and collection of waste.

54. CHROMIC ACID RECOVERY. Streams containing chromates may be treated separately to remove contaminating metals from chrome plating and anodizing solutions. The contaminants are iron, trivalent chromium, copper in plating solutions, and aluminum in anodizing solutions. A flow diagram of a chromic acid recovery system is shown in figure 10-l.

a. Waste Storaee Tank. Spent chrome plating solutions from process tanks are collected in a storage or holding tank for dilution to a suitable chromic acid content. Anodizing solutions may be sufficiently low in chromic acid concentration and require no dilution. Dilution of plating solutions is necessary to avoid damage to the equipment used in the next step, ion exchange.

b. Ion Exchange Eauinment. A sulfonic cation exchange resin bed in the hydrogen form is used to exchange the contaminating metals in the solution with hydrogen ions in the resin bed. The purified solutions are then passed to an evaporator. When the accumulated impurities from the plating solutions inhibit the ability of the resin in the exchanger to continue purification, the exchanger is removed from service and the resin is regenerated with sulfuric acid. In the regeneration process, the sulfuric acid removes the contaminating metal ions and restores the exchanger resin to the hydrogen form. The sulfuric acid regenerant waste is treated by neutralization and precipitation.

c. Evaporator. The chrome plating solutions, which are diluted before passing through the cation exchanger to avoid excessive decomposition of the exchanger resin, are brought back to original concentrations by evaporation before return to the plating process tanks.

d. Chromic Acid Storaee Tank The purified and concentrated chromic acid is stored and returned to the plating process tanks as required.

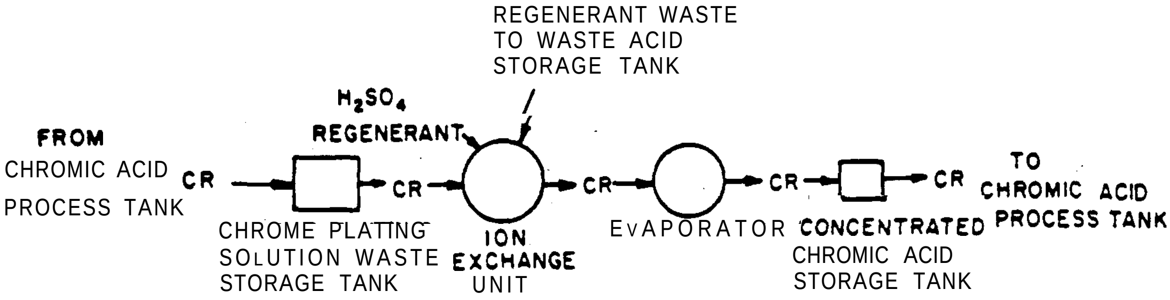

Figure 10-l. Chromic acid recovery

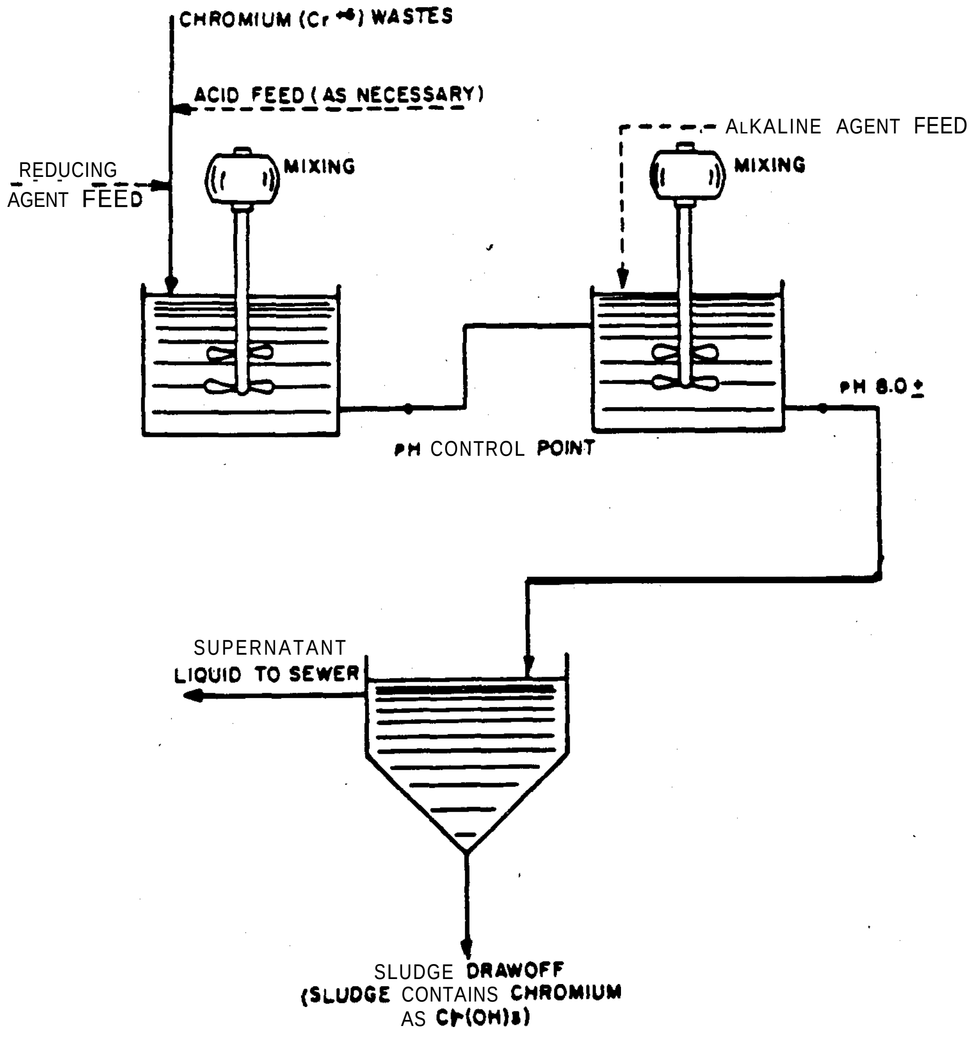

Figure 10-2. Chemical treatment of chromium wastes

55. CHROMIUM REDUCTION. Another method of treating chromate wastes is by the reduction of the chromate ion through the addition of ferrous sulfate, followed by neutralization with lime to precipitate heavy metals (see figure 10-2). Normally, batch treatment is used. The waste is discharged to acid-resistant tanks equipped with mixing devices, skimmers, baffled decanting outlets, and sludge withdrawal ports. Chemical doses for waste treatment are approximately twice the theoretical amount of either ferrous sulfur dioxide or barium. Following thorough mixing and a standing period of approximately one hour, oil and grease are skimmed from the top. Milk of lime is then added until the pH of the mixture is approximately 8.0. This mixture is then agitated and allowed to settle for a period of approximately 12 hours. The supematant liquor is then decanted and the sludge removed.

56. PHENOLIC WASTES. Concentrated phenol and cresol wastes result from the cleaning of aircraft parts and require separate treatment. Biological treatment in sewage plants of wastes containing phenols and cresols has been used in some cases where the quantity of sewage is sufficient to dilute the phenols to a concentration of not more than 20 ppm. Pretreatment of phenol wastes for oils and suspended solids removal can be accomplished by the air flotation method previously described in paragraph 50.

a. Chemical Oxidation. Figure 10-3 shows a flow diagram of the system used for chemical treatment of phenolic wastes. Concentrated phenol and cresol wastes are collected in a receiving tank with a capacity sufficient to hold at least the daily flow of these wastes. The tank contents are then transferred to the phenol oxidation tank where the pH of the phenol bearing wastes is raised by the addition of lime. Chemicals, such as alum or ferrous sulfate, are added to assist in coagulating the solids in the waste. The entire contents of the tank are then mixed and -allowed to stand for a time to permit sludge and scum to separate out of the liquid. After separation, the scum and sludge are removed by oil skimming and sludge scraping mechanisms in the tank. Chlorine is added and the tank contents thoroughly mixed to ensure complete oxidation of the phenols.

b. Biological Treatment. Phenols at low concentrations (not greater than 20 ppm) can be treated by biological treatment processes such as trickling filters, the activated sludge process, or a combination of both. In these processes, the wastes, after neutralization with an alkali such as lime, flow to a primary sedimentation tank. The tank effluent flows through a two-stage trickling filter which removes a large part of the BOD and phenol content. The effluent from the trickling filter is passed through aeration tanks in which further reduction of phenol content takes place. The effluent flow continues through secondary sedimentation units to remove biological flocs and other suspended materials. If necessary, the effluent flows to a holding pond for further retention before discharge to a stream.

57. CYANIDE WASTES. Cyanide wastes are normally treated by the alkaline chlorination method. While either batch or continuous treatment may be used, batch treatment facilities are best for small and medium-sire plants.

a. Batch Treatment. In terms of waste management, batch treatment offers the advantage of positive control of effluent quality, since no wastes need be discharged until analysis reveals complete cyanide destruction. Cyanide wastes are alternately collected in one of two holding tanks, each having one day's capacity of waste flow. While one tank is filling, the contents of the other are being treated (see figure 10-4). Lime or caustic soda is added to raise the pH of the wastes above 8.5 and the pH is then continually maintained at this point by the addition of lime. A minimum pH of 8.5 is required to prevent formation of the toxic gas cyanogen chloride. After a thorough, vigorous mixing, chlorine is added for cyanide destruction. For small-scale operations, the chlorine is often applied in hypochlorite form. The approximate ratio, by weight, of the caustic and chlorine required to treat the cyanide is 10:1, with a minimum exposure period of one hour. Completion of reactions is assured by the application of a slight excess of chlorine.

b. Waste Release. After destruction of the cyanide, the alkaline waste water may be mixed with other waste streams and used in neutralizing acid wastes.

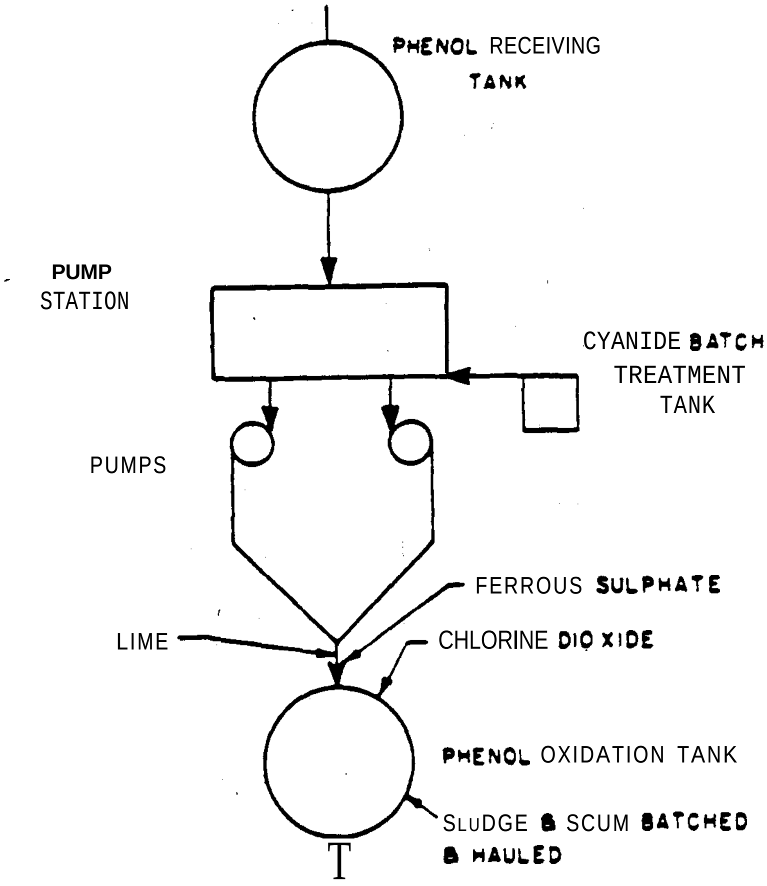

Figure 10-3. Chemical oxidation of phenols

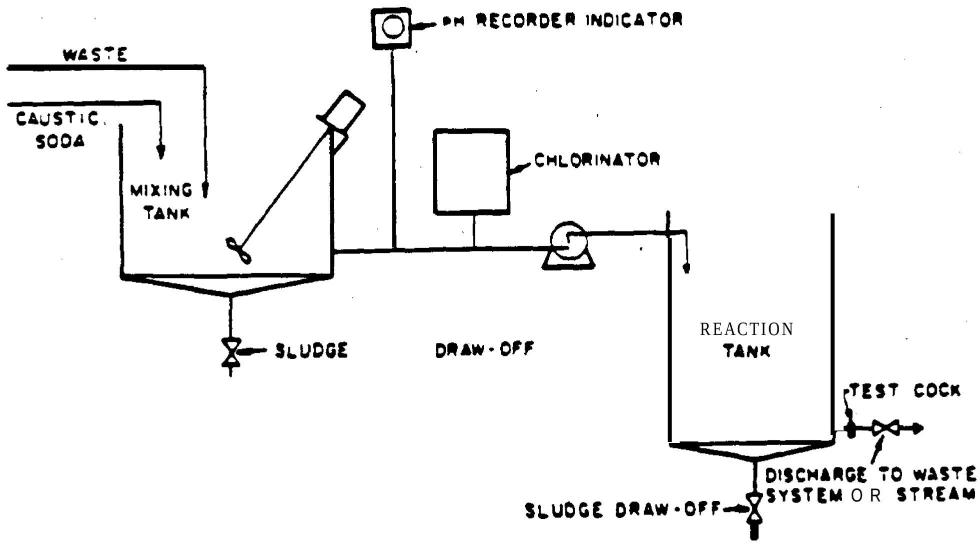

Figure 10-4. Cyanide treatment

CHAPTER 11. MANAGEMENT OF AIRCRAFT WASHES AND SIMILAR WASTES

58. GENERAL. Discussion in this chapter involves the collection and treatment of wastes from aircraft wash racks, motor vehicle service areas, engine tests cells, engine repair shops, and other activities contributing large quantities of oil, grease, and emulsified wastes.

59. WASTE CONTRIBUTORS.

a. Aircraft Washing. In general, aircraft washing involves the following: 1) pressure spraying the entire aircraft surface with cleaning agents to loosen accumulated oil film, dirt, and oxides; 2) brushing the surfaces with an alkaline water-base cleaner to help loosen foreign matter; and 3) hosing down the surfaces with hot or cold water for thorough removal of emulsified oil, grease, and dirt from the aircraft.

b. Vehicle Service Areas. Vehicle maintenance wastes result from washing operations and the disposal of used grease and oil.

c. Engine Repair. Engine repair shop wastes result from cleaning engines and parts with alkaline cleaners.

d. Engine Test. Engine test cell wastes result from engine and floor cleaning operations and generally contain oil, grease, and emulsified materials.

60. AIRCRAFT WASH WASTES TREATMENT. When large quantities of oil, grease, and emulsified wastes are being discharged, it may be necessary to use specifically designed treatment plants. A typical treatment plant consisting of a holding tank and air compression, chemical induction, and flotation units, is shown in figure 11-l and described as follows:

a. Primary Treatment. Raw industrial wastes are piped to a combination holding tank and grit chamber. The tank is provided with devices for the removal of grit, free oil, and free solvent. Usually suitable stirring and mixing devices are installed to keep wastes from stratifying.

b. Secondary Treatment. The secondary treatment system consists of a continuous operation of flocculation and flotation by air under compression. The components of the system are: inflow pumps, a chemical mixing tank, and mechanical sludge collection equipment for removing floated sludge from the liquid surface in the flotation tank to the sludge trough or hopper. Automatic controls are required for starting and stopping the operation of the inflow pumps at preset liquid levels in the surge tank.

61. SLUDGE DISPOSAL. Usually the sludge volume is approximately 10 percent of, the total flow when motor vehicle maintenance, engine test cell, and other wastes are included. Wet sludge is transferred to a storage basin where a three-phase separation occurs; the heavier sludge settles to the bottom, the lighter floating material forms a scum layer on the surface, and relatively clear water exists between the two layers. Sluice valves placed at various levels in the basin outlet structures may be selectively opened to draw off the clearest water for recirculation through the system. The accumulated sludge is periodically trucked away for proper treatment.

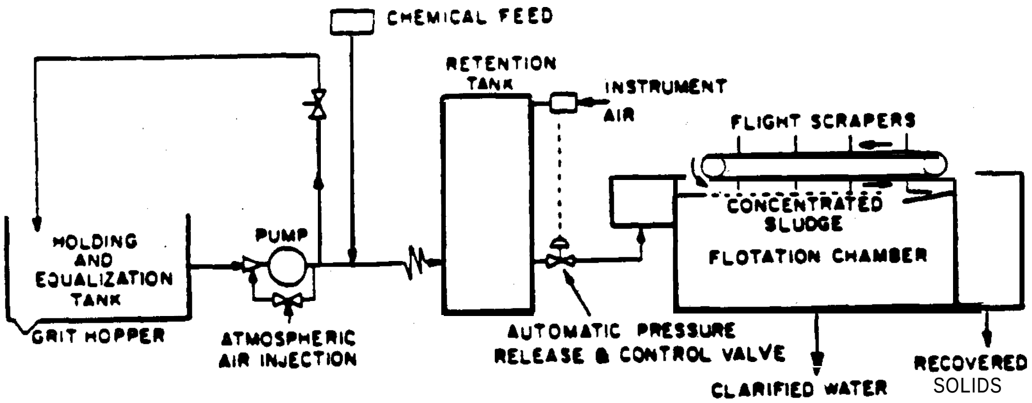

Figure 11-l. Air flotation treatment system

APPENDIX 1. RELATED READING MATERIAL

1. Environmental Enhancement at Airports - Industrial Waste Treatment, Advisory Circular 150/5320-10, April 16, 1973, U.S. Department of Transportation, Federal Aviation Administration, Washington, D.C.

2. Standard Methods for the Examination of Water, Sewage. and Industrial Wastes, American Public Health Association (latest edition), Washington, D.C.

3. Hazardous Materials Emergency Planning Guide, DOT P 5800.4, September 1, 1987, U.S. Department of Transportation, Office of Hazardous Materials Transportation.

4. Campbell, M.E. and W.M. Glenn, Profit from Pollution Prevention, Pollution Probe Foundation (1982), Toronto, Ontario, Canada.

5. Patterson, J.W., Industrial Wastewater Treatment Technology, 2nd Edition, Buttetworths (1985), Boston, Massachusetts.

6. Metcalf & Eddy, Inc., Wastewater Engineering: Treatment/Disposal/Reuse, 2nd Edition, McGraw-Hill (1979), New York, New York.

7. Eckenfelder, W.W., Jr., Industrial Water Pollution Control, 2nd Edition, McGraw-Hill (1989), New York, New York.

8. Code of Federal Regulations, Title 40 - Protection of Environment.

APPENDIX 2. PRIORITY POLLUTANT LIST

1. acenaphthene
2. acrolein
3. acrylonitrile
4. benzene
5. benzidine
6. carbon tetrachloride (tetrachlorom,ethane)

chlorinated benzenes (other than dichlorobenzenes):

7. chlorobenzene
8. 1,2,4-trichlorobenzene
9. hexachlorobenzene

chlorinated ethanes (including 1,2-dichloroethane, l,l,l-trichloroethane and hexachloroethane):

10. 1,2-dichloroethane
11. l,l,l-trichloroethane
12. hexachloroethane
13. l,l-dichloroethane
14. 1,1,2-trichloroethane
15. 1,1,2,2-tetrachloroethane
16. chloroethane

chloroalkyl ethers (chloromethyl, chloroethyl and mixed others):

‘17. bis (chloromethyl) ether
18. bis (2-chloroethyl) ether
19. 2-chloroethyl vinyl ether (mixed)

chlorinated naphthalene:

20. 2-chloronaphthalene

chlorinated phenols (other than those listed elsewhere; includes trichlorophenols and chlorinated cresols):

21. 2,4,6-trichlorophenol
22. parachlorometa cresol
23. chloroform (trichloromethane)
24. 2-chlorophenol

dichlorobenzenes:

25. 1,2-dichlorobenzene
26. 1,3-dichlorobenzene
27. 1,4-dichlorobenzene
28. 3,3-dichlorobenzidine

dichloroethylenes (l,l-dichloroethylene and 1,2-dichloroethylene):

29. 1,1-dichloroethylene
30. 1,2-trans-dichloroethylene
31. 2,4-dichlorophenol

dkhloropropane and dichloropropene:

32. 1,2-dichloropropane
33. 1,2-dichloropropylene (1,3-dichloropropene)
34. 2,4-dimethylphenol

dinitrotoluene:

35. 2,4-dinitrotoluene
36. 2,6-dinitrotoluene
37. 1,2-diphenylhydrazine
38. ethylbenzene
39. fluoranthene

haloethers (other than those listed elsewhere):

40. 4-chlorophenyl phenyl ether
41. 4-bromophenyl phenyl ether
42. bis (2-chloroisopropyl) ether
43. bis (2-chloroethoxy) methane

halomethanes (other than those listed elsewhere):

44. methylene chloride (dichloromethane)
45. methyl chloride (chloromethane)
46. methyl bromide (bromomethane)
47. bromoform (tribromomethane)
48. dichlorobromomethane
49. trichlorofluoromethane
50. dichlorodifluoromethane
51. chlorodibromomethane
52. hexachlorobutadiene
53. hexachlorocyclopentadiene
54. isophorone
55. naphthalene
56. nitrobenzene

nitrophenols (including 2,3-dinitrophenol and dinitrocresol):

57. 2-nitrophenol
58. 4-nitrophenol
59. 2,4-dinitrophenol
60. 4,6-dinitro-o-cresol

* Reference 40 CFR § 403(b).

nitrosamines:
61. n-nitrosodimethylamine
62. n-nitrosodiphenylamine
63. n-nitrosodi-n-propylamine
64. pentachlorophenol
65. phenol

phthalate esters:
66. bis (2-ethylhexyl) phthalate
67 butyl benzyl phthalate
68. di-n-butyl phthalate
69. di-n-octyl phthalate
70. diethyl phthalate
71. dimethyl phthalate

polynuclear aromatic hydrocarbons:
72. benzo(a)anthracene (1,2-benzanthracene)
73. benzo(a)pyrene (3,4-benzopyrene)
74. 3,4-benzofluoranthene
75. benzo(k)fluoranthene (11,12-benzoflouranthene)
76. chrysene
77. acenaphthylene
78. anthracene
79. benzo(ghi)perylene (1,2-benzoperylene)
so. phenanthrene
81. fluorene
82. dibenzo(a,h)anthracene (1,2,5,6-dibenzanthracene)
83. indeno(1,2,3-cd)pyrene (2,3-o-phenylenepyrene)
84. pyrene
85. tetrachloroethylene
86. toluene
87. trichloroethylene
88. vinyl chloride (chloroethylene)

pesticides and metabolites:
89. aldrin
90. dieldrin
91. chlordane (technical mixture and metabolites)

DDT and metabolites:
92. 4,4'-DDT
93. 4,4'-DDE (p.p'-DDX)
94. 4,4'-DDD (p.p'-TDE)

endosulfan and metabolites:
95. a-endosulfan-Alpha
96. b-endosulfan-Beta
97. endosulfan sulfate

endrin and metabolitesl
98. endrin
99. endrin aldehyde

heptachlor and metabolites:
100. heptachlor
101. heptachlor epozide

hexachlorocyclohexane (all isomers):
102. a-BHC-Alpha
103. b-BHC-Beta
104. r-BHC (Lindane)-Gamma
105. g-BHC-Delta

polychlorinated biphenyls (PCBs):
106. PCB-1242 (Arochlor 1242)
107. PCB-1254 (Arochlor 1254)
108. PCB-1221 (Arochlor 1221)
109. PCB-1232 (Arochlor 1232)
110. PCB-1248 (Arochlor 1248)
111. PCB-1260 (Arochlor 1260)
112. PCB-1016 (Arochlor 1016)

113. **toxaphene**
114. antimony (total)
115. arsenic (total)
116. asbestos (fibrous)
117. beryllium (total)
118. cadmium (total)
119. chromium (total)
120. copper (total)
121. cyanide (total)
122. lead (total)
123. mercury (total)
124. nickel (total)
125. selenium (total)
126. silver (total)
127. thallium (total)
128. zinc (total)
129. **2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)**

* Reference 40 CFR 8 403(b).