Expanded market. A major development since deregulation was the creation of hub and spoke networks. The hubs are strategically located airports used as transfer points for passengers traveling from one location to another. The hub and spoke systems were developed in order to enable airlines to serve far more markets, with the same size fleet, than the traditional direct, point-to-point service.

Deregulation also sparked marketing innovations used by most major airlines and many smaller airlines that equate to fare discounts, such as the frequent flyer program that is designed to reward repeat customers with free tickets and other benefits.

The appearance of new airlines, combined with the rapid expansion into new markets by many of the established airlines, resulted in unprecedented popularity and competition in the airline industry. In 1977, the last full year of government regulation of the airline industry, the US airlines carried 240 million passengers. By 1993 they were carrying nearly 490 million. A study by the Department of Transportation a decade after deregulation found that well over 90% of airline passengers had a choice of carriers compared to only two-thirds in 1978 (www.air-transport.org/handbk/chaptr02.htm)

III. DESCRIPTION OF OPERATIONS

This section describes the major operations and maintenance activities within the air transportation industry. The section is designed for those interested in gaining a general understanding of the industry, and for those interested in the relationship between the industrial process associated with air transportation, and the associated environmental aspects and potential impacts of the processes. This section is not exhaustive; the operations and maintenance activities discussed are intended to represent the air transportation practices and activities with potentially significant environmental impacts. These activities are presented in two categories:

(1) *Aircraft operations*, including maintenance, cleaning, fueling, and deicing; and

(2) *Airport operations*, including terminal activities, loading and off loading.

This section does not attempt to replicate published engineering information that is available for this industry. Refer to Section VIII for a list of resource materials that are available.

III.A. Aircraft Operations and Associated Environmental Aspects

III.A.1. Aircraft and Aviation-Support Vehicle Maintenance

Aircraft maintenance activities include scheduled preventive maintenance, repairs required as a result of inspections, and aircraft refurbishing. When an aircraft is built, the manufacturer creates a maintenance program for the operator of the plane. Representatives from the manufacturer, the Federal Aviation Administration (FAA), subcontractors, and the airline that purchases the aircraft form a review board that develops minimum requirements of a maintenance program. This maintenance program is then documented and followed throughout the aircraft's life.

Together, scheduled maintenance and day-to-day preventive activities are necessary to keep the aircraft safe and reliable. In general, aircraft maintenance is the function of three factors: (1) hours of flight time, (2) number of landing and take off cycles, and (3) calendar length of time from prior maintenance. Aircraft preventive maintenance starts with daily inspections of items such as tires, brakes, and fluid levels. The aircraft then continues to receive many levels of maintenance that include fluid and filter changes, detailed testing, inspections for cracks and corrosion, and after many hours of flying (usually over 100,000), complete refurbishing of the aircraft to return the plane to its original condition.

Aviation-support vehicles undergo a similar, yet less rigorous schedule of inspections, testing, and maintenance that includes oil and fluid changes, battery replacement, and repairs including metal machining.

Environmental Aspects and Potential Impacts of Aircraft Maintenance

Environmental aspects of aircraft maintenance include the use and disposal of aircraft and vehicle fluids such as:

- Wastewater from parts cleaning, metal finishing, or coating applications
- Generation of hazardous wastes consisting of flammable and metals-contaminated solvents, used hand-wipes, and sludges collected during all maintenance operations
- Hazardous air pollutant (HAP) emissions from solvent-based cleaners and coatings used in all activities.

Wastes generated as a result of aircraft and aviation-support vehicle maintenance and repair activities can include used oil, spent fluids, batteries, metal machining wastes, organic solvents, and tires. Some of these wastes can be toxic or otherwise hazardous, and uncontrolled releases can contaminate surface water, groundwater, and soils. Typical materials used in each operation and the potential impacts of use and disposal of these

materials are identified in Exhibit 11. A description of these operations and associated environmental impacts appear below.

Lubrication and Fluid Changes. Lubrication and fluid changes are part of the aircraft standard maintenance program. These activities occur at regular intervals, and as inspections indicate they are necessary. In conducting aircraft lubrication and fluid changes, these operations may generate waste oil and greases. These materials have the potential to contaminate water supplies and soil if not properly stored. By storing these materials in secure containers or tanks with secondary containment, the potential for releases to impact the environment is significantly reduced.

Operation	Activities	
Lubrication and Fluid Changes	Storage, transfer, and disposal of petroleum products	Potential to contaminate soil, groundwater, and surface waters, if spilled or allowed to enter storm drains
Battery repair and replacement	Storage of batteries containing sulfuric acid	Potential to contaminate soil, groundwater, and surface waters with hazardous material, if not contained and covered from weather
Chemical Milling Maskant Application and Chemical Milling	Use and disposal of maskants containing either toluene/xylene mixture or perchloroethylene	Air pollution from organic HAP emissions, waste maskant
Parts Cleaning	Aqueous, semi-aqueous, and solvent-based cleaner use and disposal	Water pollution from wastewater containing cleaners, waste solvents; metals, oil, and grease Air pollution from organic HAP emissions
Metal Finishing	Use and disposal of processing solutions, cyanide, heavy metal baths	Air pollution from HAP emissions; contaminated wastewater including cyanide solutions, corrosive acid and alkali solutions; heavy metal sludges
Coating Application	Primer and topcoats application and disposal	Air pollution from organic HAP emissions; waste paint; waste solvent thinner

Exhibit 11. Maintenance and Refurbishing Operations: Activities and Potential Environmental Impacts		
Operation	**Activities**	**Environmental Aspects and Potential Impacts**
Depainting	Chemical or blast depainting agents use and disposal	Contaminated sludge (stripper solution and paint residue); air contamination from VOC emissions from paints; solid waste containing paint chips and spent blasting media.
Painting	Paint use, storage, and disposal	Soil or water contamination from disposal of waste paint, thinners, solvents, resins; air contamination by VOC emissions.

Battery repair and replacement. Battery repair and replacement involve removing, repairing, and recharging aircraft and vehicle batteries. These operations have the potential to impact the environment if sulfuric acid in the batteries is released. Acid has the potential to contaminate soil and groundwater supplies, and to cause personnel injury if used batteries are not properly handled. By using proper safety equipment during handling, and storing batteries in a contained and covered area that is not exposed to rain water, batteries are less likely to cause a significant impact.

Chemical Milling Maskant Application and Chemical Milling. This operation uses etchant solutions to reduce the thickness of selected areas of metal parts in order to reduce weight. Chemical milling maskants are typically rubber- or polymeric-based coatings applied to an entire part or subassembly by brushing, dipping, spraying, or flow coating. After the chemical milling maskant is cured, it is removed from selected areas of the part where metal is to be removed during the chemical milling process.

Chemical milling maskants typically contain either a toluene/xylene mixture or perchloroethylene as solvent constituents. These chemical solvents vaporize when exposed to air, and if not stored in tightly sealed containers, become a source of hazardous air pollutants (HAPs). These organic HAP emissions also occur as the solvent evaporates as the chemical milling maskant is applied and cured.

Parts Cleaning. Aircraft components are cleaned frequently to remove contaminants such as dirt, grease, and oil. Cleaning is performed using a wide variety of cleaning materials, including aqueous, semi-aqueous, or, in some cases, solvent-based cleaners. Recently, many aircraft maintenance facilities have substituted solvent-based cleaners with water-based cleaning materials. Many components are cleaned with soap and water.

Parts cleaning operations can include immersion, flush, spray gun cleaning, or hand wiping of aircraft components. For most parts, cleaning is typically performed by a hand wiping process. However, parts that are either too large or too intricate to hand wipe are cleaned by immersion in large solvent baths or parts cleaning machines. Assemblies and parts with concealed or inaccessible areas may be cleaned by pouring the cleaning material over or into the part. The cleaning material is then drained from the part and the procedure is repeated as many times as necessary to ensure the required cleanliness.

The potential environmental impact of parts cleaning operations is dependent on the type of cleaning solution used. Halogenated, solvent-based cleaning materials potentially have the most significant impact. These solvents can generate organic HAP emissions from the evaporation of solvents during the cleaning process, including: (1) evaporation of solvent from open containers and solvent-soaked cloth and paper, and (2) emissions from storage tanks used to store cleaning solvents. In addition, solvent spills have the potential to contaminate soil, groundwater, or surface water. Contamination can be caused by hazardous constituents found in solvents themselves, as well as in metals, oils, and other potential contaminants found in the parts being cleaned. Spent hazardous solvents must be managed as hazardous wastes. Typically, they are reclaimed by a RCRA permitted hazardous waste recycler.

Facilities that use aqueous or semi-aqueous cleaning materials have a much less significant potential environmental impact because they do not generate hazardous air emissions. They do, however, generate metals, oil, and grease in the aqueous system that have the potential to contaminate water supplies. Wastewater from these cleaning processes is required to be treated onsite in accordance with the facility's wastewater discharge permit (known as a National Pollutant Discharge Elimination System or NPDES permit) or according to standards set by any local pretreatment programs.

Metal Finishing. Metal finishing processes are used to prepare the surface of a part for better adhesion, improved surface hardness, and improved corrosion resistance. Typical metal finishing operations include chemical conversion coating, anodizing, electroplating, and any operation that chemically affects the surface layer of a part. Each of these metal finishing operations has the potential to significantly impact the environment by discharging metals, cyanides, phosphates, acids, and other contaminants to waterways, soil, or groundwater.

HAP emissions and contaminated wastewater are the most significant environmental aspects of metal finishing operations. As the organic chemicals in the processing solutions evaporate, they generate hazardous vapors and emissions. Evaporation of solution also occurs from refurbished

parts as they are removed from the processing tanks. Wastewater from these operations includes cyanide solutions, corrosive acid, and alkali solutions. This water is typically treated prior to discharge, in accordance with a facility's NPDES permit or applicable pretreatment requirements. For more details on metal finishing processes and the associated environmental aspects, see EPA's Sector notebook titled *Profile Of The Fabricated Metal Products Industry* (EPA 310-R-95-007).

Coating Application. A coating is a material that is applied to the surface of a part to form a decorative or functional solid film. The most common coatings are primers and topcoats. Coatings are applied to aircraft components using several methods of application. The methods most commonly used are spraying, brushing, rolling, flow coating, and dipping. Nearly all coatings contain a mixture of organic solvents. Spray guns and other components of coating units must be cleaned when switching from one coating to another. The cleaning of spray guns involves disassembling the gun and placing the parts in a vat containing an appropriate solvent. The residual coating is brushed or wiped off the parts.

Organic HAP emissions from coating application are generated from evaporation of solvents during mixing, application, and from overspray, which is exhausted from spray booths or hangars. Coating operations also produce waste paint and waste solvent thinner that are typically drummed and shipped offsite as RCRA hazardous waste.

Depainting. Depainting involves the removal of coatings from the outer surface of aircraft. Two methods are chemical stripping and blast depainting. During chemical stripping, stripping agents are applied to the aircraft, allowed to degrade the coating, and then scraped or washed off with the coating residue. Blast depainting methods use a media such as plastic, wheat starch, carbon dioxide, or high pressure water to remove coatings by physically abrading the coatings from the surface of the aircraft. Depainting operations can produce either a liquid or solid waste stream, depending on the type of process used.

Air pollution and soil or water contamination are potential impacts from depainting. Chemical depainting generates organic HAPs from evaporation of the solvents in the stripping solution, while particulate emissions occur from the blasting media. Depainting operations can produce either a liquid or solid waste stream, depending on the type of process. Chemical depainting processes produce a liquid sludge that consists of the stripper solution and paint residue. Blast depainting processes produce a solid waste stream that consists of paint chips and spent blasting media. These wastes are required to be characterized as hazardous or nonhazardous and disposed of appropriately.

Painting. Aircraft painting generally occurs in an enclosed area to minimize potential environmental and human health impacts. High pressure, low volume, and electrostatic painting systems can reduce the amount of paint needed for a job.

Aspects of painting with potential environmental impacts include management of unused paints, spray paint booth air filters, and spent paint thinner, and emissions of volatile organic compounds (VOCs) from thinners and solvents. Spent paint filters often must be handled as hazardous waste because of the presence of wet paint or paint containing lead or chromium. Through proper training of employees and the use of high efficiency equipment, painting operations have been able to reduce paint waste, minimize air emissions, and protect the health of employees.

III.A.2. Fueling

An essential part of any airport operation is the fueling of aircraft. Fueling is conducted either by tank trucks or a central underground fueling system. In both operations, fueling involves the transfer of a potentially hazardous liquid to the aircraft. Aviation fuels are broken down into two classes. The reciprocating engines use various grades of aviation gasoline, while the jet class, which includes gas turbines, utilizes jet fuels. There are grades of aviation gasoline that are readily identified by the color-coded dyes added to them. The color-coded system aids maintenance personnel in finding fuel leaks when they occur and prevents fueling mixups.

For jet fuel, there are two basic grades of jet fuel, Jet-A and Jet-B. Jet-A fuel, a narrow cut kerosene product, is the standard commercial and general aviation grade available in the United States. It usually contains no additives but may be additized with an anti-icing chemical. Jet-A1 is identical to Jet-A except that it has a lower freeze point. It is used outside the United States and is the fuel of choice for long haul flights where the fuel temperature may fall to near the freeze point. It often contains a static dissipator additive. Jet-B fuel is a wide cut kerosene with lighter gasoline-type naphtha components. It is not used by the commercial air transportation sector, however, it is used by the military.

Fuel tanks are generally located in the wings of light aircraft. However, depending on the make and model of the aircraft, it is also common to find fuel tanks in the main fuselage. Fuel lines range in diameter from 1/8 of an inch to as large as 4 inches on very large aircraft. Fuel lines of aircraft using wing tanks are located back from the leading edge of the wing. With fuselage tank model twin-engine aircraft, the fuel lines run from the fuselage tanks out through the wing structure along the wing spar into the engine compartment. On single-engine aircraft, the fuel lines are routed from the fuel tank to the firewall, and then to the engine.

Environmental Aspects and Potential Impacts of Fueling

The major environmental aspect of fueling operations is managing the fuel so that it is not released to the environment, either to the air, water, or soil. Leaking pipes or improper connections between fueling lines and the aircraft can allow fuel vapors to be released to the air, causing air contamination. Leaks, improper connections, and improperly monitored storage tanks also can lead to fuel spills. As a contingency measure, many airports and airlines employ vacuum sweeper trucks as well as hand operated sweeper units for spill response. Vacuum sweepers allow the spilled material to be removed quickly from the site while minimizing the spill's potential to impact the environment. If spills are not contained or diverted to an established

treatment system, they may end up being discharged to soil and groundwater either directly through storm drains, or as sheet runoff during rain events.

Underground fueling systems that are not maintained properly can leak into the surrounding soils and eventually contaminate groundwater. EPA regulations for underground storage tanks require tanks to be upgraded and monitored to reduce the probability of leaks to groundwater.

By conducting activities to prevent releases such as maintaining fuel tanks, lines, and fueling systems, and by assuring proper training of employees, the possibility of leaking tanks, equipment leaks, or accidental spillage is reduced substantially.

III.A.3. Aircraft Cleaning

Exterior cleaning of aircraft typically consists of washing with detergent solutions and a water rinse. Small aircraft cleaning is carried out using hand held spray nozzles, hoses and brushes. For larger aircraft, wet cleaning usually is limited to wheel wells and landing gear and is conducted to facilitate inspections. In addition, wet cleaning sometimes is performed on wing structure and flap-sequencing carriage areas for overhaul and inspection processes and on the lower aircraft fuselage for removal of accumulations of oil and grease.

Because it can be more economical (e.g., lower water costs) to dry polish aircraft fuselages rather than wash them with water and cleaning solutions, aircraft are cleaned using dry methods whenever possible.

Environmental Aspects and Potential Impacts of Cleaning

The primary environmental aspect of aircraft cleaning is the generation and disposal of wastewater from cleaning aircraft exteriors. If high pressure steam cleaners are used, water use may range from 10-20 gallons for washing small aircraft, and between 100 and 200 gallons for large aircraft.[2] Wastewater from cleaning activities may contain diluted cleaning chemicals, low concentrations of metals, oil and grease, solvents, dirt and grit, or other materials that are used as detergents, or are found in the aircraft itself. If not treated, the washwater has the potential to pollute the soil, groundwater, and surface waters.

[2] A Boeing 727 is an example of a narrow-body aircraft, while MD-11's, Boeing 747's and 767's are examples of wide-body aircraft.

To prevent such contamination, wastewater from cleaning operations usually drains to catch basins where it is mixed with other airport wastewater and discharged at an onsite treatment facility prior to discharge in accordance with the facility's NPDES permit. Prior to discharge, the wastewater may also pass through a holding tank where metals, dirt, and grit settle to the bottom, oil and grease are skimmed off the water surface, and the remaining water is discharged. If the washwater is not treated onsite, it may be discharged to a publicly owned treatment works (POTW), where it is treated prior to discharge. Washwater discharged to the POTW may be subject to pretreatment requirements established by EPA and the POTW.

III.A.4. Aircraft Deicing and Anti-Icing

As noted earlier, FAA regulations govern every aspect of airline and airport operations, including procedures and standards for aircraft maintenance and airworthiness, including aircraft deicing. Aircraft deicing and anti-icing are key components in assuring cold weather aircraft safety. Deicing and anti-icing remove from and inhibit for a period of time the formation of ice and snow on wings, fuselages, and other parts of the airplane that provide lift during takeoff. Common practice is to deice (remove accumulation) then anti-ice (protect from further accumulation) aircraft before takeoff. These processes use glycol-based materials, including ethylene glycol, diethylene glycol, or propylene glycol.

Aircraft deicing is carried out either at the departure gate area or at a central or remote facility in the vicinity of the runway to minimize the amount of time between treatment and takeoff. Central and remote deicing areas facilitate collection of deicing fluids for recycling and treatment.

Deicing is almost performed exclusively using hand held nozzles and hoses. Automatic deicer spray machines, called "deicing gantries", have been developed in recent years. However, there are some limitations on the practicality of such equipment and the associated capital investment.

Environmental Aspects and Potential Impacts of Deicing

Deicing operations generate spent deicer fluids. These fluids drain from the aircraft surfaces or from the runway surfaces to drains that direct the fluids to onsite water treatment facilities, to storm drains, or simply to paved surfaces where they may be discharged to local waterways or groundwater as sheet runoff. In some cases, deicing fluids may be released directly to the environment through runoff to surface waters or infiltration to groundwater. Glycol-based fluids deplete oxygen from the waters in which they are disposed and have toxic effects on life forms in those waters (*Aviation Week and Space Technology*, January 1995).

In general, each airport has its own distinct characteristics and drainage systems and collecting deicing fluid for reuse or recycling may not be practical. However, some airports have constructed deicing fluid collection systems that prevent discharge to storm water sewers and segregate spent deicer from other wastewater for reclamation, recycling, onsite treatment, or disposal offsite. FAA allows the reuse of deicing fluids that are reformulated and re-certified to meet appropriate aircraft deicing fluid specifications. However, at this time, the aviation industry has not recycled glycols for reuse on aircraft or runways due to cost. Some reclaimed deicing fluids may be sold in secondary markets (e.g., windshield deicers for automobiles). In compliance with Clean Water Act requirements, spent deicing fluids are treated either in the facility wastewater treatment system, discharged to publicly owned wastewater treatment plants, or discharged directly to surface waters in accordance with permit conditions.

III.A.5. General Aircraft Operational Activities

As discussed earlier, the FAA has jurisdiction over all aircraft operations and prohibits states and local governments from regulating in the areas of aircraft operations and airspace management. In addition, the exclusive jurisdiction also extends to environmental statutes as they relate to the aviation industry. For example, Section 233 of the Clean Air Act specifically prohibits states from regulating air pollution from aircraft engines.

Aircraft Operation. The mode of operation of the aircraft can be broken down into five stages: idling at gate and runway; engine power up; taxiing; takeoff and climb out; and approach and landing. Depending on the type of engine and aircraft, these activities can consume varying amounts of resources and produce various pollutants. Because fuel is the airline industry's second largest expense, increasing fuel efficiency of aircraft engines has been a top priority of U.S. airlines. Over the past two decades, U.S. airlines have increased fuel efficiency nearly 50% by lowering cruising speeds, using computers to determine optimum fuel loads and to select altitudes and routes that minimize fuel burn; and keeping aircraft exteriors trimmed (i.e., stowed) to minimize aerodynamic drag.[3]

The environmental aspects of aircraft operation are related to the use and burning of fuel. Fuel has the potential to cause varying environmental impacts depending on the type of fuel, the efficiency of burning, and the manner in which excess fuel is discarded. During aircraft operations, engines emit hydrocarbons, carbon monoxide, and nitrogen oxides (NOx). Hydrocarbon and carbon monoxide emissions result from incomplete combustion at the lower power settings for descent, or when idling or taxiing

[3] *The Airline Handbook*, Chapter 9: Airlines and the Environment from the Air Transport Association, 1997.

on the ground. NOx, the result of combustion products mixing with nitrogen in the air, is produced when engines are at their hottest, such as during takeoffs and, to a lesser extent, during cruise when jet engines also produce carbon dioxide and water vapor.

Aircraft loading and off loading. Aircraft loading and off loading includes all activities associated with the movement of materials, items, and people in and out of airplanes. Regardless of the type of airport, aircraft loading and off loading occur an infinite number of times daily throughout the U.S. Aircraft cargo loads consist of several different items, including but not limited to passengers, baggage, mail, live animals, dangerous goods (including hazardous materials), and wet cargo (e.g., fresh fish, seafood, meat, casings, etc.).

The primary loading and off loading activity with a potentially significant impact on human health and the environmental is the loading and off loading of hazardous materials. Though a rare occurrence, these loading activities have the potential to contaminate soil, groundwater, or surface water in the event of a spill or release. Facilities minimize and control these impacts through development and implementation of spill prevention control and countermeasures plans, storm water pollution prevention plants, and other emergency response programs.

If hazardous materials are transported by aircraft, the materials are subject to U.S. Department of Transportation (DOT) requirements that regulate aircraft inspections, placement of materials, packaging, and shipping papers (e.g., waybills, manifests). If hazardous materials are loaded onto an airplane, containers should be inspected for proper labeling/placarding, any signs of leakage, and compatibility with other hazardous materials. If damage or spillage of a package containing hazardous materials is observed on board an aircraft or during loading/off loading, immediate action must be taken in accordance with company or airport procedures.

Transportation of Dangerous Goods. Once hazardous materials are loaded onto aircraft, they are transported to their destination. In preparation for transport, they are stored, segregated and secured to assure safety during the transportation process. If improperly stored and secured, dangerous goods have the potential to not only impact the health of workers and passengers, but also to impact the safety of the aircraft itself.

To assure that these goods are transported in a safe manner, regulations have been established by DOT and the International Civil Aviation Organization (ICAO) Dangerous Goods Panel. These standards regulate the types of materials that can be transported, and the types of aircraft in which they can be transported. The ICAO Dangerous Goods regulations include a detailed

list of individual articles and substances specifying the United Nations classification of each article or substance, their acceptability for air transport, and the conditions for their transport.

According to the regulations, dangerous goods may be transported in one of the following ways: they may not be carried on any aircraft under any circumstances; they are forbidden under normal circumstances, but may be carried with specific approvals from the States concerned; they may be carried only on cargo aircraft; or they may be safely carried on passenger aircraft, provided certain requirements are met. It should be noted that most dangerous goods fall into the latter transport category.

The ICAO Dangerous Goods regulations also provide packing instructions for all dangerous goods acceptable for air transport with a wide range of options for inner, outer, and single packaging. In addition, all individuals involved in the preparation or transport of dangerous goods must be properly trained to carry out their responsibilities. Information on the goods must be conveyed by the pilot to air traffic services to aid in the response to any aircraft incident or accident. Finally, dangerous goods accidents or incidents must be reported, so that an investigation by the relevant authorities can establish the cause and take corrective action.

Aircraft Noise. Another type of pollution generated from the operation of aircraft is noise pollution. Noise from airports is a significant negative impact for many people in the airport vicinity. Federal noise regulations require all large aircraft to meet noise standards. FAR Part 150 regulations address the issue of aircraft noise and provide a comprehensive scheme for planning and mitigation measures funded by aviation trust funds intended to reduce noise impacts on the public (US EPA Office of Federal Activities, *Pollution Prevention/Environmental Impact Reduction Checklist for Airports*).

Air Pollutants from Transportation

The EPA Office of Air Quality Planning and Standards has compiled air pollutant emission factors for determining the total air emissions of priority pollutants (e.g., total hydrocarbons, SOx, NOx, CO, particulates, etc.) from many transportation sources. The Aerometric Information Retrieval System (AIRS) contains a wide range of information related to stationary sources of air pollution, including the emissions of a number of air pollutants which may be of concern within a particular industry. Exhibit 12 summarizes annual releases (from the industries for which a Sector Notebook Profile was prepared) of carbon monoxide (CO), nitrogen dioxide (NO_2), particulate matter of 10 microns or less (PM_{10}), total particulates (PT), sulfur dioxide (SO_2), and volatile organic compounds (VOCs).

Exhibit 12. Annual Air Pollutant Releases by Industry Sector (tons/year)							
Industry Sector	CO	NO_2	PM_{10}	PT	SO_2	VOC	TOTALS
Power Generation	366,208	5,986,757	140,760	464,542	13,827,511	57,384	20,843,162
Petroleum Refining	734,630	355,852	27,497	36,141	619,775	313,982	2,087,877
Iron and Steel	1,386,461	153,607	83,938	87,939	232,347	83,882	2,028,174
Pulp and Paper	566,883	358,675	35,030	111,210	493,313	127,809	1,692,920
Stone, Clay, and Concrete	105,059	340,639	192,962	662,233	308,534	34,337	1,643,764
Transportation*	**128,625**	**550,551**	**2,569**	**5,489**	**8,417**	**104,824**	**800,475**
Organic Chemicals	112,410	187,400	14,596	16,053	176,115	180,350	686,924
Inorganic Chemicals	153,294	106,522	6,703	34,664	194,153	65,427	560,763
Nonferrous Metals	214,243	31,136	10,403	24,654	253,538	11,058	545,032
Lumber and Wood Production	122,061	38,042	20,456	64,650	9,401	55,983	310,593
Metal Mining	4,670	39,849	63,541	173,566	17,690	915	300,231
Nonmetal Mining	25,922	22,881	40,199	128,661	18,000	4,002	239,665
Plastic Resins and Synthetic Fibers	16,388	41,771	2,218	7,546	67,546	74,138	209,607
Metal Casting	116,538	11,911	10,995	20,973	6,513	19,031	185,961
Rubber and Misc. Plastics	2,200	9,955	2,618	5,182	21,720	132,945	174,620
Motor Vehicles, Bodies, Parts and Accessories	15,109	27,355	1,048	3,699	20,378	96,338	163,927
Textiles	8,177	34,523	2,028	9,479	43,050	27,768	125,025
Printing	8,755	3,542	405	1,198	1,684	103,018	118,602
Fabricated Metals	4,925	11,104	1,019	2,790	3,169	86,472	109,479
Pharmaceuticals	6,586	19,088	1,576	4,425	21,311	37,214	90,200
Furniture and Fixtures	2,754	1,872	2,502	4,827	1,538	67,604	81,097
Ship Building and Repair	105	862	638	943	3,051	3,967	9,566
Electronics and Computers	356	1,501	224	385	741	4,866	8,073
Dry Cleaning	102	184	3	27	155	7,441	7,912

* "Transportation" includes air, water, railroad, trucking, and pipeline categories and SIC codes, and as such, represents a very broad range of industries. This represents stationary source air emissions only, not mobile sources.

Source: U.S. EPA Office of Air and Radiation, AIRS Database, 1997.

III.B. Airport Operations

Airport operations include all activities related to operating and maintaining the airport. These activities include operation and maintenance of runways, control towers, maintenance facilities, aircraft gates, baggage handling facilities, and general airport operations. This section focuses on two of these activities: runway deicing and general operations.

III.B.1. Runway Deicing

Airport runways, taxiways, and gate areas are sprayed with deicer and anti-icer to remove and prevent the buildup of ice and snow that would inhibit taxing, takeoff, and landing. Pavement deicing/anti-icing breaks the bond holding ice and compacted snow to the surfaces of runways and taxiways, facilitating mechanical ice and snow removal, and allowing aircraft to maintain adequate friction between aircraft tires and the runway. Runway and ramp deicing is usually done with one or more substances (e.g., glycol, urea, sodium formate, and/or potassium acetate). Sand is usually reserved to prevent slippage at the gate area, but not on taxiways and runways due to potential engine ingestion hazards.

Environmental Aspects and Potential Impacts of Runway Deicing

Deicing mixtures have the potential to contaminate groundwater and surface water supplies as they flow from airport runways to storm drains or to waterways as sheet runoff. Sand has the potential to clog storm water drains and contaminate water bodies through increased erosion and sediment buildup. Deicing chemicals that mix with storm water discharges must be managed according to the facility's NPDES storm water permit. In an effort to control water contamination, many facilities direct storm water to an onsite treatment facility prior to discharge.

III.B.2. General Airport Operations

General airport operations encompass many activities including passenger and vehicle traffic, ticketing, baggage handling, passenger security, and concessions and food services. Airports, like other administrative offices, can generate large quantities of waste paper and consume large amounts of energy from lighting, heating and cooling systems, and computers. Concession shops and food service operations can generate significant quantities of solid waste, such as corrugated cardboard, paperboard, office paper, newspapers, magazines, wooden pallets, aluminum, plastic, and glass containers, as well as leftover food. Groundskeeping and landscaping activities can generate waste pesticides and herbicides. Airport traffic congestion can generate significant air emissions.

Environmental Aspects and Potential Impacts of General Operations

The operation of airports can have a variety of impacts on the environment. These impacts include erosion, sedimentation, soil compaction, noise pollution, chemical pollution resulting from aircraft maintenance and deicing, aircraft emissions, contaminated runway and grounds runoff, generation of waste construction materials, and litter and other debris from administrative and food service operations.

In regards to wildlife, there is typically no significant destruction of wildlife habitat. FAA is, however, aware of the problem that certain species (e.g., large waterfowl, birds that flock, deer) cause aviation. As a result, FAA encourages, and in some cases requires, airport sponsors to work with wildlife agencies to manage the habitat attracting these species. Such measures are needed to reduce the number of collisions between these species and aircraft to protect human and wildlife populations.

IV. POLLUTION PREVENTION OPPORTUNITIES

The best way to reduce pollution is to prevent it in the first place. Some companies have creatively implemented pollution prevention techniques that improve efficiency and increase profits while at the same time minimizing environmental impacts. Airlines and airports are reducing material inputs, re-engineering processes to reuse by-products, improving management practices, and employing substitution of toxic chemicals. Some operations are able to actually get below regulatory thresholds just by reducing pollutant releases through aggressive pollution prevention policies. ***While implementing pollution prevention techniques, it is important that the facility assure that the techniques are conducted in accordance with FAA safety regulations and airworthiness requirements***. ***FAA's Advisory Circular entitled, "Management of Airport Industrial Waste"(AC#150/5320-15), provides guidance on managing industrial wastes that airport operations generate.***

The Pollution Prevention Act of 1990 established a national policy of managing waste through source reduction, which means preventing the generation of waste. The Pollution Prevention Act also established as national policy a hierarchy of waste management options for situations in which source reduction cannot be implemented feasibly. In the waste management hierarchy, if source reduction is not feasible, the next alternative is recycling of wastes, followed by energy recovery, and as a last alternative, waste treatment.

In order to encourage these approaches, this section provides both general and company-specific descriptions of some pollution prevention advances that have been implemented within the air transportation industry. While the list is not exhaustive, it does provide core information that can be used as the starting point for facilities interested in beginning their own pollution prevention projects. This section provides summary information from activities that may be or are being implemented by this sector. When possible, information is provided that gives the context in which the technique can be used effectively.

Please note that the activities described in this section do not necessarily apply to all facilities that fall within this sector. Facility-specific conditions must be considered carefully when pollution prevention options are evaluated, and the full impacts of each option must be evaluated for its effects on air, land, and water pollutant releases.

Waste minimization generally encompasses any source reduction or recycling that results in either the reduction of total volume or the toxicity of hazardous waste. Source reduction is a reduction of waste generation at the source, usually within a process. Source reduction can include process

modifications, feedstock (raw material) substitution, housekeeping and management processes, and increases in efficiency of machinery and equipment. Source reduction includes any activity that reduces the amount of waste that exits a process. Recycling refers to the use or reuse of a waste as an effective substitute for a commercial product or as an ingredient or feedstock in an industrial process.

IV.A. Air Transportation Operations

Pollution prevention/waste minimization opportunities in the air transportation industry are available for many operations including aircraft and vehicle maintenance and repair, washing and cleaning, deicing, fueling, aircraft modification, and airport layout and operations. These areas are addressed in the following sections.

IV.A.1. Maintenance and Refurbishing Operations

Aircraft maintenance activities generate wastes that are of great environmental concern to the air transportation industry. The major wastestreams from aircraft maintenance and refurbishing are lubricants, batteries, scrap metal, parts cleaning wastes (e.g., solvents), depainting wastes (e.g., chemical paint stripping wastes, abrasive blast and surface preparation wastes), and painting/painting equipment cleaning wastes. Source reduction is the best pollution prevention approach for reducing the amount of wastes produced. Source reduction can be achieved through material substitution, process or equipment modification, recycling, or better operating practices. ***Note: Such modifications must be made in accordance with FAA requirements, as well as the extraordinarily specific maintenance practices recommended by airframe and engine manufacturers.*** The following material presents pollution prevention/waste minimization opportunities for each type of waste.

Used Oil and Lubricants. Most airline maintenance facilities recycle used oil. Recycling used oil requires equipment like a drip table with a used oil collection bucket to collect oil dripping off parts. Drip pans can be placed under aviation-support vehicles awaiting repairs in case they are leaking fluids. Some facilities use absorbent materials (e.g., "pigs" or "quick dry") to catch drips or spills during activities where oil drips may occur. While absorbents prevent oil from impacting the environment, they actually create more solid and potentially hazardous waste in the form of contaminated absorbent materials. Preventing small spills in the first place, using drip pans, or cleaning spills with rags, soap and water can prevent the generation of additional waste. Recycling used oil by sending it to a commercial recycling facility saves money and protects the environment.

To encourage recycling, the publication *How To Set Up A Local Program To Recycle Used Oil* is available at no cost from the RCRA/Superfund Hotline at 1-800-424-9346 or (703) 412-9810.

Spent petroleum-based fluids and solids should be sent to a recycling center whenever possible. Solvents that are hazardous waste must not be mixed with used oil. If they are mixed, the entire mixture may be considered hazardous waste, and thus subject to more stringent regulation. Non-listed hazardous wastes will be mixed with waste oil, and as long as the resulting mixture is not hazardous, can be handled as waste oil. All used drip pans and containers should be labeled properly.

Fluids. Aircraft and aviation-support vehicles require regular changing of fluids, including oil, coolant, and others. To minimize releases to the environment, these fluids should be drained and replaced in areas where there are no connections to storm drains or municipal sewers. Minor spills should be cleaned prior to reaching drains. Used fluid should be collected and stored in separate containers. Fluids can often be recycled. For example, brake fluid, transmission gear, and gear oil are recyclable. Some liquids are able to be legally mixed with used motor oil which, in turn, can be reclaimed.

During the process of engine maintenance, spills of fluids are likely to occur. The "dry shop" principle encourages spills to be cleaned immediately, without waiting for the spilled fluids to evaporate into the air, to transmit to land, or to contaminate other surfaces. The following techniques help prevent spills:

✓ Collect leaking or dripping fluids in designated drip pans or containers. Keep all fluids separated so they may be properly recycled.

✓ Keep a designated drip pan under the vehicle while unclipping hoses, unscrewing filters, or removing other parts. The drip pan prevents splattering of fluids and keeps chemicals from penetrating the shop floor or outside area where the maintenance is occurring.

✓ Immediately transfer used fluids to proper containers. Never leave drip pans or other open containers unattended.

Radiator fluids from aviation-support vehicles are often acceptable to antifreeze recyclers. This includes fluids used to flush out radiators during cleaning. Reusing the flushing fluid minimizes waste discharges. If a licensed recycler does not accept the spent flushing fluids, consider changing to another brand of fluid that can be recycled. Many maintenance facilities

have purchased antifreeze recycling systems that connect directly to a vehicle so that the antifreeze is taken from the vehicle, cleaned, and then put back into the same vehicle.

If the maintenance facility services air conditioners in aviation-support vehicles, special equipment must be used to collect the freon or other refrigerant because it is not permissible to vent the refrigerant to the atmosphere. Air conditioner maintenance activities require employee training, specifically for handling refrigerants. Reusing refrigerants onsite is less costly than the only other legal alternative, sending the refrigerant to an offsite recycler.

Batteries. Facilities have many battery disposal options: recycling onsite, recycling through a supplier, or direct disposal. Facilities should explore all options to find one that is right for the facility. Many waste batteries must be handled as hazardous waste. Lead acid batteries are not considered hazardous waste as long as they are recycled. In general, recycling batteries may reduce the amount of hazardous waste stored at a facility, and thus the facility's responsibilities under RCRA. The following best management practices are recommended when sorting used batteries:

- ✓ Place on pallets in a contained area, and label by battery type (e.g., lead-acid, nickel, and cadmium).
- ✓ Protect them from the weather with a tarp, roof, or other means.
- ✓ Store them on an open rack or in a watertight, secondary containment unit to prevent leaks.
- ✓ Inspect them for cracks and leaks as they are removed from the vehicle or aircraft. If a battery is dropped, treat it as if it is cracked. Acid residue from cracked or leaking batteries is likely to be hazardous waste under RCRA because it is likely to exhibit the characteristic of corrosivity, and may contain lead and other metals.
- ✓ Avoid skin contact with leaking or damaged batteries.
- ✓ Neutralize acid spills and dispose of the resulting waste as hazardous if it still exhibits a characteristic of a hazardous waste.

Machine Shop Wastes. The major hazardous wastes from metal machining are waste cutting oils, spent machine coolant, and degreasing solvents. However, scrap metal also can be a component of hazardous waste produced

at a machine shop. Material substitution and recycling are the two best means to reduce the volume of these wastes.

The preferred method of reducing the amount of waste cutting oils and degreasing solvents is to substitute them with water-soluble cutting oils. Recycling of waste cutting oils also is possible if nonwater-soluble oils must be used. Machine coolant can be recycled, and a number of proprietary systems are available to recycle the coolant. Coolant recycling is implemented most easily when a standardized type of coolant is used throughout the shop. Reuse and recycling of solvents also are achieved easily, as mentioned above. Most shops collect scrap metals from machining operations and sell these to metal recyclers. Metal chips which have been removed from the coolant by filtration should be drained and included in the scrap metal collection. Wastes should be segregated carefully to facilitate reuse and recycling.

Small Parts Cleaning. Solvents are commonly used for small parts cleaning. Spent solvents are often toxic and/or hazardous and should be disposed of in an environmentally safe manner. Spent solvent, if hazardous, must be treated and disposed of as hazardous waste, unless recycled properly. There are several options for reducing the amount and/or toxicity of spent solvents:

- ***Switch to non-hazardous substances.*** Switch from hazardous, organic-based to non-hazardous, aqueous-based solvents. In addition, certain aqueous parts washers can use detergents instead of solvents. While water-based parts washers may be more expensive than solvent-based parts washers (costs range from $1,000 to $3,000 for water-based washers capable of washing small parts), the cost of the parts washer can be quickly recovered as the cost of disposing or recycling of hazardous solvent as well as the cost of any required training for workers handling the solvent are eliminated. This will reduce the amount of hazardous waste generated from cleaning operations.

- ***Keep lids closed when not in use.*** For solvents that contain volatile organic compounds, keeping containers closed except when parts actually are being cleaned reduces solvent emissions to the atmosphere, improves worker safety, and allows the solvent to be used longer, rather than simply to evaporate.

- ***Reuse.*** Solvents can be reused if quality requirements are met and until their effectiveness is compromised, and then they can be recovered and recycled.

- ***Recycle.*** Solvent recycling also can decrease hazardous waste production from small parts cleaning. Spent solvents can be cleaned and recycled with a solvent still. Processes for recycling solvents are well established and widely used in many industrial sectors. Solvents should not be poured down sewer drains, mixed with used oil, or stored in open containers to allow them to evaporate. Solvent stills (e.g., distillation units) may only be installed in appropriately fire rated areas.

- ***Use good housekeeping practices.*** To minimize solvent waste generation, facilities should use good housekeeping practices including labeling of all chemicals and wastes to avoid misuse and potential injury or contamination; keeping containers of hazardous solvents closed to prevent air emissions; providing storage area leak control and containment; and making improvements in drum location, product transfer leak collection, and drum transport procedures. If solvents are used, care should be taken to wear protective safety gear and follow good housekeeping practices.

Depainting

Chemical Stripping Wastes. Chemical stripping operations must be conducted according to the appropriate and relevant requirements associated with the original equipment manufacturers' specifications. Chemical stripping wastes consist primarily of stripping agent and paint sludges. Methylene chloride is the most commonly used paint stripping agent, although the industry increasingly is using less toxic agents such as dibasic esters, semi-aqueous, terpene-based products, aqueous solutions of caustic soda, and detergent-based strippers that currently are available on the market. In order to reduce compliance costs, many facilities are replacing methylene chloride with nonhalogenated strippers.

The Aerospace National Emission Standards for Hazardous Air Pollutants (NESHAP) (effective September 1998) places stringent limitations on the use of chemical strippers containing hazardous air pollutants. (See discussion in Section V.C Pending and Proposed Regulatory Requirements.)

Storing and reusing or recycling used strippers also are effective waste minimization techniques. Solvent strippers, particularly stripping baths, generally can be reused several times before their effectiveness is diminished. Both spent caustic and organic stripping solutions can be treated to remove contaminants. Segregating the spent stripping wastes from other waste streams will help facilitate cost-efficient reuse and recycling of contaminated strippers.

Abrasive Blasting and Surface Preparation Wastes. Abrasive blasting is being used as an alternative for chemical paint stripping. Although blasting does not require disposal of chemical strippers, it does create a large amount of water runoff and air pollution, and the presence of paint chips containing hazardous metals and organometallic biocides can make abrasive blasting wastes potentially hazardous. Research and testing are underway on a number of innovative alternative paint removal and surface preparation techniques including: plastic media blasting, steel shot slingers, water jet stripping, thermal stripping, dry ice pellets, laser paint stripping, and cryogenic stripping. However, an alternative as economically viable and easy as chemical paint stripping has not been found.

- Plastic media blasting has had mixed results. The same types and quantities of solid wastes are generated as with grit blasting, but the plastic media tend to be more easily recyclable through the use of pneumatic media classifiers that are part of the stripping equipment. The abrasion eventually turns the plastic media to dust, making the waste paint the main waste to be disposed. However, it will not work on epoxy or urethane paints. In addition, the blasting equipment is more expensive and requires more highly trained operators.

- Cavitating water jet stripping systems remove most paints, separate the paint chips from the water, and treat the water to eliminate dissolved toxic materials. Although relatively little hazardous waste is generated by this process, it is not as efficient as grit blasting, and the equipment has higher capital and operating costs.

- The thermal stripping process softens the paint so it can be peeled relatively easily. Although it generates only one waste stream (waste paint), it is more labor-intensive than other stripping methods and can only be used on non-heat-sensitive surfaces.

- Carbon dioxide pellets can be used as a blast medium leaving only paint chips that can be swept up and placed in containers for disposal (the dry ice evaporates). However, the cost of the dry ice, storage, and handling equipment can be substantial.

- A pulsed carbon dioxide laser controlled by an industrial robot to remove paint produces no residue. However, the method is complex, capital intensive, and requires highly skilled operators.

- Cryogenic stripping using liquid nitrogen baths followed by gentle abrasion or plastic shot blasting is useful for small parts or objects, but requires special equipment for handling the liquid nitrogen.

Blasting cannot be used as a paint stripping method on certain substrate because the abrasive media will cause damage, especially to composite materials.

Painting and Painting Equipment Cleanup Wastes. Methods for minimizing paint and painting equipment cleanup wastes include tight inventory control, material substitution, and minimization of fugitive oversprays. Tight inventory control techniques such as monitoring employee operations or limiting access to raw materials storage areas force employees to stretch the use of the raw materials. Use of less toxic types of paints can reduce the amount of hazardous paint waste as well as painting equipment cleanup waste (i.e., solvent wastes). Also, the use of powder coatings based on finely pulverized plastics that are baked on at 400°F has been tried as a substitute for paint for some industrial applications.

Minimizing overspray has benefits in terms of both inventory control and elimination of surface water runoff. For inventory control, overspray can be minimized by using air-assisted, airless, high volume, low pressure turbine, air-atomized electrostatic, and airless electrostatic application techniques. In addition, overspray can be minimized by maintaining a fixed distance from the surface while triggering the paint gun, and releasing the trigger when the gun is not aimed at the target. Overspray control for minimizing runoff can be achieved by using plastic sheeting under and around the aircraft being painted, or using a paint booth for smaller parts.

To reduce the amount of wastes created by painting operations, all paint should be used until containers are completely empty. Containers that are considered empty under the Resource Conservation and Recovery Act (RCRA) may be disposed of as solid waste (40 CFR 265). However, they may face requirements under DOT regulations depending on the amount of hazardous waste remaining in the container. Used containers of paint may need to be disposed of as hazardous wastes if they are not completely empty. Also, paint may be purchased in recyclable and/or returnable containers to reduce disposal costs.

IV.A.2. Fueling

Pollution prevention opportunities for aircraft and vehicle refueling operations primarily focus on the prevention of fuel spillage and the associated air, water, and hazardous waste pollution. Fuel tank monitoring and automatic shutoff devices are key spill prevention measures. Although not permitted for jet fuel, using color-coded dyes to identify fuel grades of aviation fuel is commonly used to prevent mixtures of fuel and to find fuel leaks. One technique to prevent fuel spills is to install catchment basins, including containment at hydrant pits. All leaking pipe joints, nozzle

connections, and any damage to the fueling hose (e.g., kinks, crushing, breaks in the carcass, bulges, blistering, soft spots at the coupling, deep cracks or cuts, spots wet with fuel, or excessive wear) should be reported immediately to reduce their potential impact on the environment. Using dry cleanup methods for the fuel area reduces water runoff and associated contamination of groundwater and surface water supplies.

Pollution prevention techniques for aircraft fueling include:

- ✓ Inspect fueling equipment daily to ensure that all components are in satisfactory condition.
- ✓ Employ proper grounding and bonding techniques for a safe fueling operation.
- ✓ If fueling of an airplane occurs at night, assure it is carried out it in well lit areas.
- ✓ Where possible, avoid fueling an aircraft during aircraft maintenance activities that might provide a source of ignition to fuel vapors. Similarly, assure that all radio and radar equipment is off during the refueling process.
- ✓ While fueling, check for leaks and assuring that the fueling operator has a clear view of control panel.
- ✓ Never leave the nozzle unattended during overwing fueling, or wedge or tie the nozzle trigger in the open position.
- ✓ Discourage topping off of fuel tanks, except when required for compliance with FAA safety regulations.
- ✓ Sump of hydrant pits.

Vehicle fueling. Self-locking fueling nozzles minimize the risk of both fuel spillage and air pollution by ensuring a secure seal between the fuel source and tank.

Fuel in vehicle operations. Use of battery-operated or alternative fuel vehicles provides two ways to reduce emissions from aviation-support vehicles. Natural gas vehicles, for example, are a viable alternative to gasoline- and diesel-powered transportation. Almost any gasoline-powered vehicle can be converted to run on natural gas by installing a natural gas fuel system and storage tanks without removing any existing equipment. Diesel

conversions are somewhat more complicated because they also involve reducing compression and adding a sparked-ignition system. Other fuels suitable for vehicles include methanol, ethanol, and propane.

In 1997, there were alternative fuel vehicle programs at virtually every major airport in the United States. The alternative vehicle usage at airports runs the gamut from taxis, shuttle buses, passenger busses, transport busses, minivans, trucks, cars, tugs, tractors, belt loaders, and ground power units, to catering vehicles. The use of natural gas vehicles is being driven by both cost effectiveness and regulation. Many states require companies with fleets of twenty or more vehicles to phase in alternative fuel vehicles. The 1990 Clean Air Act also contains incentives to encourage the use of alternative fuels. Federal (and in some areas, State) tax deductions for "alternative fuel vehicles" and related refueling equipment are available. The maximum tax deductions range from $2,000 to $50,000 for each alternative fuel vehicle and up to $100,000 on refueling stations.

IV.A.3. Aircraft and Vehicle Exterior Cleaning

Pollution prevention opportunities for aircraft and aviation-support vehicle cleaning focus on the reduction of wastewater discharges.

- ***Aircraft Cleaning.*** For washing aircraft, it is best to utilize a designated cleaning area, recycle washwater (if possible), and use phosphate-free detergents. Washwater should be contained and an oil/water separator should be used. Washwater can be captured, filtered, and reused in aircraft washing and other activities. If the washwater is reused for washing aircraft, ***it must meet the manufacturer's specifications for washwater***. Washwaters containing contaminants can result in corrosion of potentially critical aircraft parts.
  Another water reduction tool, a flow restrictor, can be used to control the amount of water being used to wash aircraft. A reduction in water usage will translate into a reduction in the volume of generated wastewaters. (Note that technologies for water reduction are only suggestions and should be evaluated individually to address the circumstances appropriate to each site.)

  Note: Air worthiness requirements may dictate the quantity of water used in certain cleaning operations.

- ***Vehicle Washing.*** Vehicle washing has become a major environmental compliance issue for most companies that operate a fleet of vehicles. While pollutants from vehicle washing are generally controlled by routing the water through an oil and water separator,

many techniques are available that prevent the water from being generated at all. The following pollution prevention activities will help ensure that a facility is addressing potential sources of pollution:

- ✓ Wastewater discharge can be prevented by dry washing vehicles using a chemical cleaning and waxing agent, rather than detergent and water. The dry washing chemical is sprayed on and wiped off with rags. No wastewater is generated. Dry washing is labor intensive and creates solid waste that must be disposed of properly.

- ✓ Wastewater can be contained by washing at a low point of the facility, blocking drains from the facility using a containment dike or blanket, or washing on a built-in or portable containment pad.

- ✓ Wastewater can be disposed of by evaporation from a containment area, or by discharging the wastewater to a sanitary sewer system. Permission must be obtained from the POTW before washwater can be drained, pumped, or vacuumed to a sanitary sewer connection.

IV.A.4. Aircraft Deicing

As noted earlier, FAA regulations and advisory circulars govern in detail virtually every aspect of airline and airport operations, particularly with respect to procedures and standards for aircraft maintenance and airworthiness, including aircraft deicing. Potential pollution prevention opportunities for aircraft deicing operations include (1) providing the appropriate training on the use of glycol products to ensure they are efficiently applied to reduce polluting airport runoff and (2) collecting deicing fluid to prevent direct discharges to surrounding surface water and groundwater along with facility storm water. Appropriate liquid aircraft deicers include ethylene glycol, propylene glycol, and di-ethylene glycol.

Recycling deicing fluid. In general, the reuse of deicier fluid *on aircraft* is problematic and usually prohibited due to quality control and the cost issues associated with storage and treatment. However, recycling deicing fluid is a method employed by some airports and airlines as recycled deicing fluid can be used for *nonaircraft applications*. There are two main processes used to recycle deicing fluid. The first process involves filtering collected fluid, demineralizing it, removing salts, and then evaporating the water to leave a higher glycol concentration.

The second process uses reverse osmosis membrane technology to recover glycol by preconcentrating dilute runoff prior to distillation. In order to make recycling practical and economically feasible, it is necessary to collect concentrations that contain more than 10% glycol. Traditionally to allow recycling, only one type of chemical glycol (ethylene or propylene) could be used at an airport. However, newer methods are available to handle mixtures. The benefits of recycling fluids include recovery of the cost of glycol, recovery of the utility cost for water, and reduced disposal cost for spent glycol.

The most widespread collection method involves the collection of deicer through separate drainage areas around aircraft deicing operations, which minimizes the mixing of storm water and deicing fluid. The collection systems can be located either at the gate area or at a remote deicing area. Deicer fluid at gate area surfaces can be collected using vacuum sweeping machines, sponge rollers, and pumps.

Alternative deicing methods. Additional technology-based, alternative deicing methods currently are being developed by industry. While some of these have yet to be proven cost effective, they do present viable alternatives as technology is improved.

- FAA has approved site-specific procedures for infra-red equipment designed to de-ice aircraft.

- Deicing truck with a cab. This type of enclosure for the operator reduces overspray since the operator can get closer to the job. However, minimum safe distances must be maintained to avoid accidents and damage to aircraft or personnel. Customers of such a system have reported up to 30% reductions in consumption of glycol-based and other anti-deicing fluids.

- More advanced computerized ice detection protection systems. For example, a system that takes electronic measurements from a wing-mounted sensor disc to identify the type and thickness of ice contamination has been developed. The system also can tell when the deicing fluid is in a transition stage and about to fail as a protective coat. Such a mechanism would be useful in determining when and where the aircraft needs to be deiced.

Segregation of Wastestreams. Wastewater segregation can be an effective technique that often does not require significant process or equipment modifications. In some cases, wastewater streams can be treated more effectively and economically if they are segregated from other streams which do not require the same degree of treatment. Highly contaminated

wastewater streams, oily wastewater streams, and wastewater streams containing contaminants requiring a specific treatment method (e.g., metals removal) can be segregated to reduce the volume of wastewater receiving certain treatment steps. Wastewater treatment can also be improved by adding stages to existing wastewater treatment systems. Additional stages, such as biological treatment, chemical precipitation, filtration, ion exchange, and sludge dewatering, improve system effectiveness and treatment costs through reduced sludge generation, recovery of metals for resale, and replacement of more costly treatment stages. By segregating wastestreams, facilities can provide the appropriate treatment to each wastewater stream. (Note: Wastestream segregation should be considered as a preferred alternative at a new or existing facility when it can be accomplished at a reasonable cost.)

IV.A.5. General Aircraft Operations

Modifications. Pollution prevention opportunities for aircraft modification primarily focus on improving the efficiency of the engine. Engine manufacturers are being encouraged or required to research and develop cleaner, quieter, and more fuel-efficient aircraft. Air pollution is a function of both the type of aircraft engine and the mode of operation of the aircraft, which can be broken down into the following stages: idling at gate and runway; engine power up; taxiing; takeoff and climb out; and approach and landing. With respect to the type of engine, one mechanism that can improve air quality in and around airports is for airlines and associated personnel to encourage and support aviation research that would reduce aircraft emissions. In the meantime, airlines have the option of buying and leasing aircraft that meet or exceed the strictest requirements while retiring, replacing, or retrofitting older equipment as rapidly as possible to reduce both the amount of air and noise pollution.

Operations. Pollution prevention opportunities for aircraft operations at the airport include the following:

✓ Utilize more efficient aircraft. By operating more efficient aircraft, airlines have been able to reduce fuel consumption and decrease the cost of operations. Since 1976, the introduction of more fuel efficient aircraft has reduced fuel consumption per passenger mile by approximately 50%.[4]

[4] *Airline Fuel Consumption*, The Boeing Company, 1997.

✓ Retrofit gate facilities to centralized ground power in order to reduce aircraft engine running and prevent extraneous air emissions associated with engine and auxiliary power unit usage.

✓ Reduce holdover time from deicing to takeoff to eliminate the need for a plane to require deicing more than once.

✓ Checking cargo prior to loading for leaking or otherwise damaged shipments will prevent the leakage of wastes. This is of particular importance for loading dangerous goods, wet cargo, live animals, or other cargo prone to leakage. After unloading, it is useful to check the cargo compartments to ensure that all of the load for a given station has been removed. Inspecting any traces of leakage at once will enable the operator to establish the source of such leakage.

IV.B. Airport Operations

IV.B.1. Runway Deicing

In addition to collection and recycling of deicing fluids, pollution prevention opportunities include the use of alternative, less polluting deicers such as magnesium acetate and potassium acetate. These fluids have been approved by FAA on both safety and environmental grounds, and have no significant impact on water quality. It should be noted that although they have received FAA approval, magnesium acetate and potassium acetate have caused safety problems by damaging aircraft lighting systems. As in all cases where alternative technologies are used to minimize environmental impacts, aircraft safety is a major concern and must be addressed.

IV.B.2. General Airport Operations

Pollution prevention opportunities for airports focus primarily on alleviating air and noise pollution by implementing layout modifications and changes in airport operations. These improved practices can reduce the amount of air and noise pollution generated by aircraft and associated airport activities.

- For existing airports, engage in comprehensive noise mitigation planning and implement feasible measures to reduce noise impacts on densely populated regions. For new airports, if possible, choose an optimal site for the airport that is away from large communities.

- Use proper land use planning, which is a local government responsibility, for the areas affected by airport noise. For examples, airports may choose to purchase land surrounding the airport for airport use or acquire land as aviation easements. Airports may also

work with local zoning boards and encourage them to zone land near airports for airport compatible uses. In particular, FAA is concerned about sanitary landfill locations near airports because landfills attract certain bird species that are hazards to aviation due to their size and/or flocking behavior.

Additional Airport Activities Impacting Air Quality. Air pollution resulting from airport operations is dependent on both mobile sources of pollution such as airplanes, ground-service vehicles, and automobiles accessing the airport as well as point sources of pollution such as power plants, fueling systems, fuel storage facilities, aircraft maintenance facilities, and deicing facilities.

Airport Traffic. Air quality in and around the airport vicinity is related not only to aircraft using the airport but to travelers and employees accessing the airport and maintenance vehicles that service the airport. Automobiles and busses used by motorists that enter and leave airports create a large source of air pollution through automobile exhaust. To reduce emissions from private vehicles, airports can link or improve public transport access, provide express bus services, and institute bus/high occupancy vehicle lanes on access roads.

Employee Programs. Initiating employee programs can reduce air pollution in and around the airport. For instance, modifying airport employee work weeks to a revised schedule that limits trips made by employees will decrease air emission (e.g., an airport may implement a 9 day/80 hour two-week schedule). Other options are voluntary employee Rideshare Programs or day care services to prevent employees from having to travel unnecessary miles, which in turn reduces the quantity of auto emissions associated with airport operations.

Recycling solid waste. Recycling all paper, cardboard, plastics, metal, and airport-specific items such as wood and film plastic will prevent pollution. In addition, distributing recycling literature and educational materials to employees and travelers will encourage more recycling of these materials.

Pest Management. Food waste from the large number of concessionaires at major airports create pest management problems at airports. Various pesticides, fumigants, and other pest management techniques are used at airports to control pests.

Landscaping. Airport erosion control projects should use environmentally and economically beneficial landscaping methods. Any plantings near runways should avoid attracting hazardous wildlife (e.g., geese, gulls, large mammals, or prey species that attract large mammals). However, careful

planting can reduce the use of pesticides, herbicides insecticides, and rodenticides; control erosion; reduce water usage; reduce energy usage; reduce runoff and air emissions from mowers; and associated exposure to workers and the public.

V. SUMMARY OF FEDERAL STATUTES AND REGULATIONS

This section discusses the Federal regulations that may apply to this sector. The purpose of this section is to highlight and briefly describe the applicable Federal requirements, and to provide citations for more detailed information. The three following sections are included:

- Section V.A. contains a general overview of major statutes
- Section V.B. contains a list of regulations specific to this industry
- Section V.C. contains a list of pending and proposed regulations

The descriptions within Section V are intended solely for general information. Depending upon the nature or scope of the activities at a particular facility, these summaries may or may not necessarily describe all applicable environmental requirements. Moreover, they do not constitute formal interpretations or clarifications of the statutes and regulations. For further information, readers should consult the Code of Federal Regulations and other state or local regulatory agencies. EPA Hotline contacts are also provided for each major statute.

V.A. General Description of Major Statutes

Resource Conservation and Recovery Act

The Resource Conservation And Recovery Act (RCRA) of 1976 which amended the Solid Waste Disposal Act, addresses solid (Subtitle D) and hazardous (Subtitle C) waste management activities. The Hazardous and Solid Waste Amendments (HSWA) of 1984 strengthened RCRA's waste management provisions and added Subtitle I, which governs underground storage tanks (USTs).

Regulations promulgated pursuant to Subtitle C of RCRA (40 CFR Parts 260-299) establish a "cradle-to-grave" system governing hazardous waste from the point of generation to disposal. RCRA hazardous wastes include the specific materials listed in the regulations (commercial chemical products, designated with the code "P" or "U"; hazardous wastes from specific industries/sources, designated with the code "K"; or hazardous wastes from non-specific sources, designated with the code "F") or materials which exhibit a hazardous waste characteristic (ignitability, corrosivity, reactivity, or toxicity, and designated with the code "D").

Regulated entities that generate hazardous waste are subject to waste accumulation, manifesting, and recordkeeping standards. Facilities must generally obtain a permit either from EPA or from a State agency which EPA has authorized to implement the permitting program if they store hazardous wastes for more than 90 days (or 180 or 270 days depending on the amount

of waste generated and the distance the waste will be transported) before treatment or disposal. Facilities may treat hazardous wastes stored in less-than-ninety-day tanks or containers without a permit. Subtitle C permits contain general facility standards such as contingency plans, emergency procedures, recordkeeping and reporting requirements, financial assurance mechanisms, and unit-specific standards. RCRA also contains provisions (40 CFR Part 264 Subpart S and §264.101) for conducting corrective actions which govern the cleanup of releases of hazardous waste or constituents from solid waste management units at RCRA treatment, storage, and disposal facilities.

Although RCRA is a Federal statute, many States implement the RCRA program. Currently, EPA has delegated its authority to implement various provisions of RCRA to 47 of the 50 States and two U.S. territories. Delegation has not been given to Alaska, Hawaii, or Iowa.

Most RCRA requirements are not industry specific but apply to any company that generates, transports, treats, stores, or disposes of hazardous waste. Here are some important RCRA regulatory requirements:

- **Identification of Solid and Hazardous Wastes** (40 CFR Part 261 and 262) provides definitions and lays out the procedure every generator must follow to determine whether the material in question is considered a hazardous waste or solid waste, or is exempted from regulation.

- **Standards for Generators of Hazardous Waste** (40 CFR Part 262) establish the responsibilities of hazardous waste generators including obtaining an EPA ID number, preparing a manifest, ensuring proper packaging and labeling, meeting standards for waste accumulation units, and recordkeeping and reporting requirements. Providing they meet additional requirements described in 40 CFR 262.34, generators may accumulate hazardous waste for up to 90 days (or 180 or 270 days depending on the amount of waste generated and the distance the waste will be transported) without obtaining a permit.

- **Land Disposal Restrictions** (LDRs) (40 CFR Part 268) are regulations prohibiting the disposal of hazardous waste on land without prior treatment. Under the LDRs program, materials must meet LDR treatment standards prior to placement in a RCRA land disposal unit (landfill, land treatment unit, waste pile, or surface impoundment). Virtually all hazardous wastes are subject to LDR requirements. Generators of waste subject to the LDRs must provide notification of such to the designated treatment, storage, and disposal facility to ensure proper treatment prior to disposal.

- **Used Oil Management Standards** (40 CFR Part 279) impose management requirements affecting the storage, transportation, burning, processing, and re-refining of the used oil. For parties that merely generate used oil, regulations establish storage standards. For a party considered a used oil processor, re-refiner, burner, or marketer (one who generates and sells off-specification used oil directly to a used oil burner), additional tracking and paperwork requirements must be satisfied.

- RCRA contains unit-specific standards for all units used to store, treat, or dispose of hazardous waste, including **Tanks and Containers**. Tanks and containers used to store hazardous waste with a high volatile organic concentration must meet emission standards under RCRA. Regulations (40 CFR Part 264-265, Subpart CC) require generators to test the waste to determine the concentration of the waste, to satisfy tank and container emissions standards, and to inspect and monitor regulated units. These regulations apply to all facilities that store such waste, including large quantity generators accumulating waste prior to shipment off-site.

- **Underground Storage Tanks** (USTs) containing petroleum and hazardous substances are regulated under Subtitle I of RCRA. Subtitle I regulations (40 CFR Part 280) contain tank design and release detection requirements, as well as financial responsibility and corrective action standards for USTs. The UST program also includes upgrade requirements for existing tanks that must be met by December 22, 1998.

- **Boilers and Industrial Furnaces** (BIFs) that use or burn fuel containing hazardous waste must comply with design and operating standards. BIF regulations (40 CFR Part 266, Subpart H) address unit design, provide performance standards, require emissions monitoring, and restrict the type of waste that may be burned.

EPA's RCRA, Superfund and EPCRA Hotline *at 1-800-424-9346 responds to questions and distributes guidance regarding all RCRA regulations. The RCRA Hotline operates weekdays from 9:00 a.m. to 6:00 p.m., EST, excluding Federal holidays.*

Comprehensive Environmental Response, Compensation, and Liability Act

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), a 1980 law known commonly as Superfund, authorizes EPA to respond to releases, or threatened releases, of hazardous substances that

may endanger public health, welfare, or the environment. CERCLA also enables EPA to force parties responsible for environmental contamination to clean it up or to reimburse the Superfund for response costs (including remediation costs) incurred by EPA. The Superfund Amendments and Reauthorization Act (SARA) of 1986 revised various sections of CERCLA, extended the taxing authority for the Superfund, and created a free-standing law, SARA Title III, also known as the Emergency Planning and Community Right-to-Know Act (EPCRA).

The CERCLA hazardous substance release reporting regulations (40 CFR Part 302) direct the person in charge of a facility to report to the National Response Center (NRC) any environmental release of a hazardous substance which equals or exceeds a reportable quantity. Reportable quantities are listed in 40 CFR §302.4. A release report may trigger a response by EPA, or by one or more Federal or State emergency response authorities.

EPA implements hazardous substance responses according to procedures outlined in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 CFR Part 300). The NCP includes provisions for permanent cleanups, known as remedial actions, and other cleanups referred to as removals. EPA generally takes remedial actions only at sites on the National Priorities List (NPL), which currently includes approximately 1300 sites. Both EPA and states can act at sites; however, EPA provides responsible parties the opportunity to conduct removal and remedial actions and encourages community involvement throughout the Superfund response process.

EPA's RCRA, Superfund and EPCRA Hotline *at 1-800-424-9346 answers questions and references guidance pertaining to the Superfund program. The CERCLA Hotline operates weekdays from 9:00 a.m. to 6:00 p.m., EST, excluding Federal holidays.*

Emergency Planning And Community Right-To-Know Act

The Superfund Amendments and Reauthorization Act (SARA) of 1986 created the Emergency Planning and Community Right-to-Know Act (EPCRA, also known as SARA Title III), a statute designed to improve community access to information about chemical hazards and to facilitate the development of chemical emergency response plans by State and local governments. EPCRA required the establishment of State emergency response commissions (SERCs), responsible for coordinating certain emergency response activities and for appointing local emergency planning committees (LEPCs).

EPCRA and the EPCRA regulations (40 CFR Parts 350-372) establish four types of reporting obligations for facilities which store or manage specified chemicals:

- **EPCRA §302** requires facilities to notify the SERC and LEPC of the presence of any extremely hazardous substance (the list of such substances is in 40 CFR Part 355, Appendices A and B) if it has such substance in excess of the substance's threshold planning quantity, and directs the facility to appoint an emergency response coordinator.

- **EPCRA §304** requires the facility to notify the SERC and the LEPC in the event of a release equal to or exceeding the reportable quantity of a CERCLA hazardous substance or an EPCRA extremely hazardous substance.

- **EPCRA §311 and §312** require a facility at which a hazardous chemical, as defined by the Occupational Safety and Health Act, is present in an amount exceeding a specified threshold to submit to the SERC, LEPC and local fire department material safety data sheets (MSDSs) or lists of MSDSs and hazardous chemical inventory forms (also known as Tier I and II forms). This information helps the local government respond in the event of a spill or release of the chemical.

- **EPCRA §313** requires manufacturing facilities included in SIC codes 20 through 39, which have ten or more employees, and which manufacture, process, or use specified chemicals in amounts greater than threshold quantities, to submit an annual toxic chemical release report. This report, known commonly as the Form R, covers releases and transfers of toxic chemicals to various facilities and environmental media, and allows EPA to compile the national Toxic Release Inventory (TRI) database.

All information submitted pursuant to EPCRA regulations is publicly accessible, unless protected by a trade secret claim.

EPA's RCRA, Superfund and EPCRA Hotline *at 1-800-424-9346 answers questions and distributes guidance regarding the emergency planning and community right-to-know regulations. The EPCRA Hotline operates weekdays from 9:00 a.m. to 6:00 p.m., EST, excluding Federal holidays.*

Clean Water Act

The primary objective of the Federal Water Pollution Control Act, commonly referred to as the Clean Water Act (CWA), is to restore and maintain the chemical, physical, and biological integrity of the nation's surface waters.

Pollutants regulated under the CWA include "priority" pollutants, including various toxic pollutants; "conventional" pollutants, such as biochemical oxygen demand (BOD), total suspended solids (TSS), fecal coliform, oil and grease, and pH; and "non-conventional" pollutants, including any pollutant not identified as either conventional or priority.

The CWA regulates both direct and indirect discharges. The National Pollutant Discharge Elimination System (NPDES) program (CWA §502) controls direct discharges into navigable waters. Direct discharges or "point source" discharges are from sources such as pipes and sewers. NPDES permits, issued by either EPA or an authorized State (EPA has authorized 42 States to administer the NPDES program), contain industry-specific, technology-based and/or water quality-based limits, and establish pollutant monitoring requirements. A facility that intends to discharge into the nation's waters must obtain a permit prior to initiating its discharge. A permit applicant must provide quantitative analytical data identifying the types of pollutants present in the facility's effluent. The permit will then set the conditions and effluent limitations on the facility discharges.

A NPDES permit may also include discharge limits based on Federal or State water quality criteria or standards, that were designed to protect designated uses of surface waters, such as supporting aquatic life or recreation. These standards, unlike the technological standards, generally do not take into account technological feasibility or costs. Water quality criteria and standards vary from State to State, and site to site, depending on the use classification of the receiving body of water. Most States follow EPA guidelines which propose aquatic life and human health criteria for many of the 126 priority pollutants.

Storm Water Discharges

In 1987 the CWA was amended to require EPA to establish a program to address storm water discharges. In response, EPA promulgated the NPDES storm water permit application regulations. These regulations require that facilities with the following storm water discharges apply for an NPDES permit: (1) a discharge associated with industrial activity; (2) a discharge from a large or medium municipal storm sewer system; or (3) a discharge which EPA or the State determines to contribute to a violation of a water quality standard or is a significant contributor of pollutants to waters of the United States.

The term "storm water discharge associated with industrial activity" means a storm water discharge from one of 11 categories of industrial activity defined at 40 CFR 122.26. Six of the categories are defined by SIC codes while the other five are identified through narrative descriptions of the regulated industrial activity. If the primary SIC code of the facility is one of

those identified in the regulations, the facility is subject to the storm water permit application requirements. If any activity at a facility is covered by one of the five narrative categories, storm water discharges from those areas where the activities occur are subject to storm water discharge permit application requirements.

Those facilities/activities that are subject to storm water discharge permit application requirements are identified below. To determine whether a particular facility falls within one of these categories, consult the regulation.

Category I: Facilities subject to storm water effluent guidelines, new source performance standards, or toxic pollutant effluent standards.

Category ii: Facilities classified as SIC 24-lumber and wood products (except wood kitchen cabinets); SIC 26-paper and allied products (except paperboard containers and products); SIC 28-chemicals and allied products (except drugs and paints); SIC 291-petroleum refining; SIC 311-leather tanning and finishing; SIC 32 (except 323)-stone, clay, glass and concrete; SIC 33-primary metals; SIC 3441-fabricated structural metal; and SIC 373-ship and boat building and repairing.

Category iii: Facilities classified as SIC 10-metal mining; SIC 12-coal mining; SIC 13-oil and gas extraction; and SIC 14-nonmetallic mineral mining.

Category iv: Hazardous waste treatment, storage, or disposal facilities.

Category v: Landfills, land application sites, and open dumps that receive or have received industrial wastes.

Category vi: Facilities classified as SIC 5015-used motor vehicle parts; and SIC 5093-automotive scrap and waste material recycling facilities.

Category vii: Steam electric power generating facilities.

Category viii: Facilities classified as SIC 40-railroad transportation; SIC 41-local passenger transportation; SIC 42-trucking and warehousing (except public warehousing and storage); SIC 43-U.S. Postal Service; SIC 44-water transportation; SIC 45-transportation by air; and SIC 5171-petroleum bulk storage stations and terminals.

Category ix: Sewage treatment works.

Category x: Construction activities except operations that result in the disturbance of less than five acres of total land area.

Category xi: Facilities classified as SIC 20-food and kindred products; SIC 21-tobacco products; SIC 22-textile mill products; SIC 23-apparel related products; SIC 2434-wood kitchen cabinets manufacturing; SIC 25-furniture and fixtures; SIC 265-paperboard containers and boxes; SIC 267-converted paper and paperboard products; SIC 27-printing, publishing, and allied industries; SIC 283-drugs; SIC 285-paints, varnishes, lacquer, enamels, and allied products; SIC 30-rubber and plastics; SIC 31-leather and leather products (except leather tanning and finishing); SIC 323-glass products; SIC 34-fabricated metal products (except fabricated structural metal); SIC 35-industrial and commercial machinery and computer equipment; SIC 36-electronic and other electrical equipment and components; SIC 37-transportation equipment (except ship and boat building and repairing); SIC 38-measuring, analyzing, and controlling instruments; SIC 39-miscellaneous manufacturing industries; and SIC 4221-4225-public warehousing and storage.

Pretreatment Program

Another type of discharge that is regulated by the CWA is one that goes to a publicly owned treatment works (POTWs). The national pretreatment program (CWA §307(b)) controls the indirect discharge of pollutants to POTWs by "industrial users." Facilities regulated under §307(b) must meet certain pretreatment standards. The goal of the pretreatment program is to protect municipal wastewater treatment plants from damage that may occur when hazardous, toxic, or other wastes are discharged into a sewer system and to protect the quality of sludge generated by these plants. Discharges to a POTW are regulated primarily by the POTW itself, rather than the State or EPA.

EPA has developed technology-based standards for industrial users of POTWs. Different standards apply to existing and new sources within each category. "Categorical" pretreatment standards applicable to an industry on a nationwide basis are developed by EPA. In addition, another kind of pretreatment standard, "local limits," are developed by the POTW in order to assist the POTW in achieving the effluent limitations in its NPDES permit.

Regardless of whether a State is authorized to implement either the NPDES or the pretreatment program, if the State develops its own program, it may enforce requirements more stringent than Federal standards.

Spill Prevention Control and Countermeasure Plans

The 1990 Oil Pollution Act requires that facilities that could reasonably be expected to discharge oil in harmful quantities prepare and implement more

rigorous Spill Prevention Control and Countermeasure (SPCC) Plan required under the CWA (40 CFR §112.7). There are also criminal and civil penalties for deliberate or negligent spills of oil. Regulations covering response to oil discharges and contingency plans (40 CFR Part 300), and Facility Response Plans to oil discharges (40 CFR §112.20) and for polychlorinated biphenyl (PCB) transformers and PCB-containing items were revised and finalized in 1995.

EPA's Office of Water, at (202) 260-5700, will direct callers with questions about the CWA to the appropriate EPA office. EPA also maintains a bibliographic database of Office of Water publications which can be accessed through the Groundwater and Drinking Water Resource Center, at (202) 260-7786.

Safe Drinking Water Act

The Safe Drinking Water Act (SDWA) mandates that EPA establish regulations to protect human health from contaminants in drinking water. The law authorizes EPA to develop national drinking water standards and to create a joint Federal-State system to ensure compliance with these standards. The SDWA also directs EPA to protect underground sources of drinking water through the control of underground injection of liquid wastes.

EPA has developed primary and secondary drinking water standards under its SDWA authority. EPA and authorized States enforce the primary drinking water standards, which are, contaminant-specific concentration limits that apply to certain public drinking water supplies. Primary drinking water standards consist of maximum contaminant level goals (MCLGs), which are non-enforceable, health-based goals, and maximum contaminant levels (MCLs), which are enforceable limits set as close to MCLGs as possible, considering cost and feasibility of attainment.

The SDWA Underground Injection Control (UIC) program (40 CFR Parts 144-148) is a permit program which protects underground sources of drinking water by regulating five classes of injection wells. UIC permits include design, operating, inspection, and monitoring requirements. Wells used to inject hazardous wastes must also comply with RCRA corrective action standards in order to be granted a RCRA permit, and must meet applicable RCRA land disposal restrictions standards. The UIC permit program is primarily State-enforced, since EPA has authorized all but a few States to administer the program.

The SDWA also provides for a Federally-implemented Sole Source Aquifer program, which prohibits Federal funds from being expended on projects that may contaminate the sole or principal source of drinking water for a given

area, and for a State-implemented Wellhead Protection program, designed to protect drinking water wells and drinking water recharge areas.

EPA's Safe Drinking Water Hotline, at 1-800-426-4791, answers questions and distributes guidance pertaining to SDWA standards. The Hotline operates from 9:00 a.m. through 5:30 p.m., EST, excluding Federal holidays.

Toxic Substances Control Act

The Toxic Substances Control Act (TSCA) granted EPA authority to create a regulatory framework to collect data on chemicals in order to evaluate, assess, mitigate, and control risks which may be posed by their manufacture, processing, and use. TSCA provides a variety of control methods to prevent chemicals from posing unreasonable risk.

TSCA standards may apply at any point during a chemical's life cycle. Under TSCA §5, EPA has established an inventory of chemical substances. If a chemical is not already on the inventory, and has not been excluded by TSCA, a premanufacture notice (PMN) must be submitted to EPA prior to manufacture or import. The PMN must identify the chemical and provide available information on health and environmental effects. If available data are not sufficient to evaluate the chemicals effects, EPA can impose restrictions pending the development of information on its health and environmental effects. EPA can also restrict significant new uses of chemicals based upon factors such as the projected volume and use of the chemical.

Under TSCA §6, EPA can ban the manufacture or distribution in commerce, limit the use, require labeling, or place other restrictions on chemicals that pose unreasonable risks. Among the chemicals EPA regulates under §6 authority are asbestos, chlorofluorocarbons (CFCs), and PCBs.

EPA's TSCA Assistance Information Service, at (202) 554-1404, answers questions and distributes guidance pertaining to Toxic Substances Control Act standards. The Service operates from 8:30 a.m. through 4:30 p.m., EST, excluding Federal holidays.

Clean Air Act

The Clean Air Act (CAA) and its amendments, including the Clean Air Act Amendments (CAAA) of 1990, are designed to "protect and enhance the nation's air resources so as to promote the public health and welfare and the productive capacity of the population." The CAA consists of six sections, known as Titles, which direct EPA to establish national standards for ambient air quality and for EPA and the States to implement, maintain, and enforce these standards through a variety of mechanisms.

Under the CAAA, many facilities will be required to obtain permits for the first time. State and local governments oversee, manage, and enforce many of the requirements of the CAAA. CAA regulations appear at 40 CFR Parts 50-99.

Pursuant to Title I of the CAA, EPA has established national ambient air quality standards (NAAQSs) to limit levels of "criteria pollutants," including carbon monoxide, lead, nitrogen dioxide, particulate matter, ozone, sulfur dioxide, and volatile organic compounds (VOCs). Geographic areas that meet NAAQSs for a given pollutant are classified as attainment areas; those that do not meet NAAQSs are classified as non-attainment areas. Under Section 110 of the CAA, each State must develop a State Implementation Plan (SIP) to identify sources of air pollution and to determine what reductions are required to meet Federal air quality standards. Revised NAAQSs for particulates and ozone were proposed in 1996 and may go into effect as early as late 1997.

Title I also authorizes EPA to establish New Source Performance Standards (NSPSs), which are nationally uniform emission standards for new stationary sources falling within particular industrial categories. NSPSs are based on the pollution control technology available to that category of industrial source.

Under Title III, EPA establishes and enforces National Emission Standards for Hazardous Air Pollutants (NESHAPs), nationally uniform standards oriented towards controlling particular hazardous air pollutants (HAPs). Title I, section 112(c) of the CAA further directed EPA to develop a list of sources that emit any of 189 HAPs, and to develop regulations for these categories of sources. To date EPA has listed 174 categories and developed a schedule for the establishment of emission standards. The emission standards will be developed for both new and existing sources based on "maximum achievable control technology" (MACT). The MACT is defined as the control technology achieving the maximum degree of reduction in the emission of the HAPs, taking into account cost and other factors.

Title II of the CAA pertains to mobile sources, such as cars, trucks, buses, and planes. Reformulated gasoline, automobile pollution control devices, and vapor recovery nozzles on gas pumps are a few of the mechanisms EPA uses to regulate mobile air emission sources.

Title IV of the CAA establishes a sulfur dioxide and nitrogen oxide emissions program designed to reduce the formation of acid rain. Reduction of sulfur dioxide releases will be obtained by granting to certain sources limited emissions allowances, which, beginning in 1995, will be set below previous levels of sulfur dioxide releases.

Title V of the CAA of 1990 created a permit program for all "major sources" (and certain other sources) regulated under the CAA. One purpose of the operating permit is to include in a single document all air emissions requirements that apply to a given facility. States are developing the permit programs in accordance with guidance and regulations from EPA. Once a State program is approved by EPA, permits will be issued and monitored by that State.

Title VI of the CAA is intended to protect stratospheric ozone by phasing out the manufacture of ozone-depleting chemicals and restrict their use and distribution. Production of Class I substances, including 15 kinds of chlorofluorocarbons (CFCs) and chloroform, were phased out (except for essential uses) in 1996.

EPA's Clean Air Technology Center, at (919) 541-0800, provides general assistance and information on CAA standards. The Stratospheric Ozone Information Hotline, at 1-800-296-1996, provides general information about regulations promulgated under Title VI of the CAA, and EPA's EPCRA Hotline, at 1-800-535-0202, answers questions about accidental release prevention under CAA §112(r). In addition, the Clean Air Technology Center' s website includes recent CAA rules, EPA guidance documents, and updates of EPA activities (www.epa.gov/ttn then select Directory and then CATC).

V.B. Industry Specific Requirements

As noted earlier, several government entities regulate specific transportation sectors. The air transportation industry is regulated by several different Federal, State, and local agencies. The air transportation industry is regulated by DOT's largest agency—the Federal Aviation Administration (FAA). The DOT has traditionally established national standards that are not affected by local or State laws.

EPA has traditionally relied on delegation to States to meet environmental standards, in many cases without regard to the methods used to achieve certain performance standards. This has resulted in States with more stringent air, water, and hazardous waste requirements than the Federal minimum requirements. This document does not attempt to discuss State standards, but rather highlights relevant Federal laws and proposals that affect the air transportation industry.

Clean Water Act

NPDES Requirements. Wastewater from air transportation facilities discharging to surface waters is regulated under the Federal Water Pollution Control Act (FWPCA). National Pollutant Discharge Elimination System (NPDES) permits must be obtained to discharge wastewater into navigable waters. The airport is usually considered the "discharger" for regulatory control and permitting purposes, and the individual tenants may not hold specific discharge permits. However, in some cases, the airport is the permittee and the tenants are the co-permittees. In the event of a discharge problem, a tenant who is a co-permittee contributing wastewater to an airport's discharge may be subject to action on the part of the airport or regulators (EEA, 1996).

As mandated by Section 304(m) of CWA, EPA is developing effluent limitation guidelines for certain industrial wastewater discharges from operations. At this time, there are no effluent limitation guidelines established specifically for aviation operations, however, other wastewater discharge restrictions may apply. For example, existing categorical guidelines for metal finishing currently apply to certain discharges from this industry sector. In addition, EPA is in the process of establishing effluent limitation guidelines for the transportation equipment cleaning, which will include operations such as exterior cleaning. These guidelines are scheduled to be promulgated in 2000. (Contact: Gina Matthews or Jan Goodwin, Office of Water, (202) 260-6036 and (202) 260-7152, respectively).

Storm Water Requirements. As discussed under the general description of the Clean Water Act, EPA published storm water regulations on November 16, 1990, which require certain dischargers of storm water to waters of the U.S. to apply for NPDES permits. According to the final rule, facilities with a "storm water discharge associated with industrial activities" are required to apply for a storm water permit. The rule states that transportation facilities classified in SIC 40 through 45, and 5171 which have vehicle maintenance shops, equipment cleaning operations, or airport deicing operations are considered to have a storm water discharge associated with industrial activity. However, only those portions of the facility that are either involved in vehicle maintenance (including vehicle refurbishing, mechanical repairs, painting, fueling, and lubrication), equipment cleaning operations, airport deicing operations, or which are otherwise identified under paragraphs (b)(14)(I)-(xi) of Section 122.26 are considered to be associated with industrial activity. It is also important to that co-permittee permitting is available if appropriate to a specific tenant/airport relationship for covering storm water run off.

Facilities covered by this rule must submit one of the following permit applications:

- Individual permit application.
- Group permit application. A group permit application can be filed by facilities with like operations and discharges. In 1991, a group storm water permit application that covered airports was filed by the American Association of Airport Executives and the Airport Research and Development Foundation. On the application, airports were identified as the permittee and all tenants as co-permittees (EEA, 1996).
- Notice of Intent for general permit coverage.

SPCC. The CWA requires facilities to develop Spill Prevention Control and Countermeasure (SPCC) plans for petroleum products, such as oil or any substance, that cause a sheen on water, if they are stored in large quantities at a particular site. The SPCC program requires reporting spills to navigable waters and the development of contingency plans that must be kept onsite. SPCC plans document the location of storage vessels, types of containment, dangers associated with a major release of material from the tanks, types of emergency equipment available at each site, and procedures for notifying the appropriate regulatory and emergency agencies. No SPCC plan is considered complete until it has been reviewed and certified by a registered Professional Engineer.

Resource Conservation and Recovery Act

Air transportation facilities generate a variety of RCRA-regulated wastes in the course of normal operations and utilize underground storage tanks for fuel storage. However, underground airport hydrant fuel systems have been deferred from the bulk of federal UST requirements pursuant to an exclusion set forth in 40 CFR §280.10. Aircraft refurbishing and maintenance operations generate hazardous wastes such as certain spent solvents and caustics, and paints and paint sludges. Additional common materials from aviation maintenance facilities that may be hazardous include:

- Rechargeable nickel-cadmium batteries and lead-acid motor vehicle batteries
- Vehicle maintenance fluids
- Fluorescent light bulbs
- Scraps of metals (cadmium, chromium, lead, mercury, selenium, and silver) and materials containing these metals (e.g., high-grade stainless steel or paint waste) (exempt if recycled)
- Waste solvents
- Near-empty paint cans and spray cans
- Paint stripping residue.

Note that petroleum products and petroleum-containing wastes (e.g., waste oil, contaminated fuel, or fuel spill clean-up wastes) are specifically

exempted from RCRA regulations, unless they exhibit any of the hazardous waste characteristics (EEA, 1996). Many air transportation facilities qualify as hazardous waste generators under RCRA law. Under RCRA, it is the facility's responsibility to determine whether a waste is hazardous. A list of EPA hazardous wastes can be found in 40 CFR §§261.31-261.33. Wastes are also hazardous if they exhibit a characteristic described in 40 CFR §§261.21-261.24. RCRA wastes are subject to the hazardous waste regulations of 40 CFR Parts 124, 261-266, 270-273, and 302. Used oil and USTs are subject to different rules.

Oil Pollution Act

The 1990 Oil Pollution Act (OPA) establishes strict, joint and several liability against facilities that discharge oil or which pose a substantial threat of discharging oil to navigable waterways. OPA imposes contingency planning and readiness requirements on certain facilities that may include vehicle maintenance shops. These requirements may affect some air transportation maintenance establishments. Regulations covering response to oil discharges and contingency plans (40 CFR Part 300), and facility response plans to oil discharges (40 CFR Part 112) were revised and finalized in 1994.

Comprehensive Environmental Response, Compensation, and Liability Act

A number of wastes generated from the air transportation refurbishing and maintenance processes contain CERCLA hazardous substances. Therefore, past spills and on-site releases of such substances may require remedial clean-up actions under Superfund.

Emergency Planning and Community Right-to-Know Act

CERCLA/EPCRA Emergency Release Notification. Any person in charge of a facility is required to immediately notify the LEPCs and SERCs likely to be affected if there is a release into the environment f a hazardous substance that exceeds the reportable quantity for that substance. Substances subject to this requirement include those on the list of "extremely hazardous substances" (40 CFR Part 355) as well as more than 700 hazardous substances subject to the emergency notification requirements under CERCLA Section 103(a) (40 CFR Section 302.4).

Many materials commonly used in the aviation industry fall into this category of CERCLA hazardous substances, including many solvents, ethylene glycol, methanol, methylene chloride, and 1,1,1-trichloroethane. With regard to the obligation to report releases of ethylene glycol being used for aircraft deicing at airports, the "facility" may include the truck applying the deicer, the aircraft to which the deicer is applied, or the entire airport. The person in

charge of the "facility" must report a release into the environment of 5,000 pounds or more of ethylene glycol in any 24-hour period (EPA, 1996).

Federally Permitted Release Exemption. CERCLA Section 103(a) exempts those persons in charge of facilities from reporting releases that are federally permitted. On February 4, 1992, EPA issued OSWER Directive 9360.4-12 regarding *CERCLA Reporting Requirements for Releases of Ethylene Glycol From Airplane Deicing Operations*. This Interpretative Memorandum and OSWER Directive allows the airline industry to classify releases of the ethylene glycol as nonreportable (or exempt) discharges if a facility (1) has an NPDES permit covering ethylene glycol, (2) has applied for an NPDES permit, or (3) discharges to a publicly-owned treatment works (POTW) meeting the applicable pretreatment standards. Since most if not all fluid discharges resulting from aircraft deicing operations usually fit into one of the permitted release exemptions found in CERCLA Section 101(10), most water discharges of ethylene glycol-based deicing fluids will not result in a reporting requirement. (EPA, 1992)

Emergency Planning. Under EPCRA, a facility must notify authorities if it has onsite at any time a listed hazardous substance in an amount over the substance's threshold planning quantity. Extremely hazardous substances that may be present in aviation-related facilities include nitric acid, sulfuric acid, phenol and ammonia (EEA, 1996).

Clean Air Act

Sections 231-234 of the Clean Air Act gives exclusive jurisdiction to the federal government and preempts any state or local regulation with respect to emissions of any air pollutant from any aircraft or engine.

Air Quality Standards - Ozone Non-Attainment Areas. The most important pollutant affected by air quality standards is ozone. In attainment areas, a major source emits or has the potential to emit more than 100 tons per year of any criteria pollutant or 10 tons per year of any hazardous air pollutant or 25 tons per year of any combination of hazardous air pollutants (emission thresholds differ for various categories of nonattainment areas). Large aircraft maintenance facilities performing aircraft painting or using large amounts of solvents may exceed these limits. Emission rates are dependent on the types of chemicals and methods used and the types of air emission control equipment used. Some regulations apply to substances (e.g., solvent degreasers) regardless of the size of the source. These regulations are designed to reduce emissions from solvent evaporation (EEA, 1996).

To assist State and local agencies in establishing regulations that reduce VOC emissions from the air transportation industry, EPA developed a control

technique guideline. This guideline offers an incentive of reduced recordkeeping requirements for facilities that use only approved cleaning agents, and requires vapor pressure limits for non-listed cleaning agents. Additionally, the guideline requires unused cleaning agent and solvent-laden rags to be stored in containers to prevent evaporation. (EEA, 1996) Airports located in ozone non-attainment areas may be subject to restrictions applicable to motor vehicles. These restrictions may affect the type and use of both airside and landside vehicles.

NESHAPs/MACT Standard. National emission standards for hazardous air pollutants (NESHAP) attempt to control several hundred compounds, the most notable for airports being asbestos. Airports must comply with the NESHAP requirements for asbestos when demolishing, or significantly remodeling, a building containing asbestos. Asbestos is commonly found in ceiling tile, floor tile, boiler room insulation, and sprayed-on insulation installed more than 20 years ago.

As stated earlier, MACT is the control technology achieving the maximum reduction in the emission of the hazardous air pollutants, taking into account cost and other factors. A MACT standard for coating operations conducted by aerospace manufacturing and reworking facilities was finalized by EPA in 1996. The emission limit from primers is 2.9 pounds per gallon and the topcoat emission limit is 3.5 pounds per gallon. Generally, HAP emissions are not permitted during paint removal operations (except during spot stripping and decal removal) (EEA, 1996). However, a number of exceptions may apply which permit such emissions under circumstances addressed in the NESHAP. According to the aerospace NESHAP, the provisions restricting HAP emissions during paint removal do not apply to the removal of paint from parts or units normally removed from the plane.

New Source Performance Standards (NSPS). Some facilities subject to NSPS may be found at airports, including industrial and utility boilers, vehicle maintenance facilities, and fuel storage and delivery facilities.

State Implementation Plans (SIPs). SIPs regulate stationary sources, such as buildings and other permanent installations, and mobile sources, such as automobiles. Typical airport facilities and activities which may be subject to stationary source regulations include heating and refrigeration plants; fueling systems; fuel storage facilities; aircraft maintenance facilities; deicing; roadways, garages, and parking lots; landside development; building demolition; and building construction. SIPs may also control mobile sources such as fleet vehicles and other vehicles using the airport. Airports are large parking areas for automobiles, trucks, and aircraft. SIPs may have to limit motor vehicle emissions through "transportation control measures." These measures are designed to reduce congestion and the number of vehicle miles

traveled in a region. Measures which affect airports include improved public transit, measures to encourage uses of buses and other high occupancy vehicles, mandatory trip reduction, and traffic flow improvements.

Where applicable, SIPs must address the requirements of general air conformity (40 CFR Part 93). In addition, FAA is required to ensure compliance with general air conformity requirements for federal airport actions planned for nonattainment or maintenance areas.

Ozone-Depleting Substances. The amended CAA is phasing out the production and restricting the use and distribution of ozone-depleting chemicals. One ozone-depleting chemical widely used in the air transportation industry for fire suppression is halon. Halon production has ceased and future purchases must be from recycled stock. For consistency with these regulations, FAA has revised its policy and no longer requires halon use during firefighting drills conducted under FAR 121.417 and FAR 135.331 (EEA, 1996).

Additionally, EPA has established requirements for servicing and disposal of air conditioning and refrigeration equipment containing regulated ozone-depleting refrigerants. Certified, self-contained recovery equipment must be available during refrigeration equipment servicing. Additional recordkeeping and reporting requirements apply for appliance owners/operators and technicians. Facilities with refrigeration equipment containing ozone-depleting chemicals must comply with 40 CFR Part 82 (EEA, 1996).

Federal Insecticide, Fungicide, and Rodenticide Act

FIFRA regulations are applicable to air transportation facilities and operations where herbicides are used to control weeds and brush, or when pesticides and rodenticides are used for pest control in buildings. Air transportation operations should only apply herbicides, both general and restricted use, according to label instructions. Certification is required for use of restricted use herbicides.

V.C. Pending and Proposed Regulatory Requirements

Clean Water Act

Presently, there are no effluent limitations guidelines specific to the air transportation industry. Effluent guidelines are currently being developed for tank interior cleaning, including aircraft cleaning, by the Office of Water. These guidelines are to be proposed in January 1998 and issued in final by February 2000 (Contact: Gina Matthews or Jan Goodwin, Office of Water, (202) 260-6036 and (202) 260-7152, respectively).

On January 31, 1997, EPA proposed a package of negotiated amendments, including deadline extensions, to the effluent guidelines plan set forth in a 1992 Consent Decree. For metal products and machinery industry guidelines, which are applicable to certain maintenance and refurbishing activities, the proposed modifications would allow EPA to combine the current two-phase guideline development process into one streamlined effluent guideline procedure. The new combined rule is scheduled to be finalized by December 2002.

The modified consent decree also targets airport deicing operations. The consent decree allowed EPA to remove deicing discharges from the scope of the categorical rulemaking, and instead initiate a study of water pollution problems associated with airport deicing operations and storm water runoff. Recently issued FAA guidelines on aircraft deicing and the recent EPA storm water rules are likely to have a significant effect on airport deicing operations.

In addition, the EPA Office of Water will also work with the Department of Defense to study deicing operations at military installations. Depending on the results of this study, guidelines specific to deicing at military installations may be developed.

EPA's five-year-old baseline general permit for industrial storm water dischargers expired on September 30, 1997. EPA suggests that industries covered by the baseline permit should explore their permit options. Most State five-year industrial permits expired along with the EPA Baseline General Permit on September 30, 1997. Most permits contain a provision stating that the expired permit remains effective and enforceable until replaced. However, the permits also contain a provision requiring permittees to submit a new Notice of Intent (NOI) prior to permit expiration to remain covered. Once an airport is without a permit, it generally cannot reapply for coverage under the expired permit.

Emergency Planning and Community Right-to-Know Act

Under EPCRA 313, Toxic Release Inventory (TRI) reporting is required by manufacturing and certain other facilities. Air transportation facilities are currently not subject to TRI reporting requirements. EPA recently expanded the TRI program and did not include airports (62 FR 23834), however, they may be added in the future.

Clean Air Act

EPA has completed its final amendments to the Aerospace NESHAP under the CAA which will be implemented September 1, 1998. The Aerospace

NESHAP establishes work practice, equipment, and pollution control standards for maintenance procedures.

EPA will issue its final Control Techniques Guidelines document for the aerospace industry addressing reasonably available control technology (RACT) for volatile organic compounds (VOC) emissions, which will address the maintenance issues discussed in the document.

EPA's Clean Air Technology Center, at (919) 541-0800, provides general assistance and information on CAA standards. In addition, the Clean Air Technology Center' s website includes recent CAA rules and EPA guidance documents (www.epa.gov/ttn then select Directory and then CATC).