United States
Environmental Protection
Agency

Economic Analysis for Final Effluent Limitation Guidelines and Standards for the Airport Deicing Category

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CHAPTER 1
INTRODUCTION

1.1 Scope and Purpose

The U.S. Environmental Protection Agency (EPA) proposes and promulgates technology-based effluent discharge requirements (effluent limitations guidelines and standards) for industrial sectors. This Economic Analysis document (EA) assesses the costs and economic impacts of the regulatory options EPA evaluated for the final regulation for the Airport Deicing Category.

1.2 Report Organization

This Economic Analysis (EA) document is organized as follows:

- Chapter 2—Profile of the Air Transportation Industry
  Provides background information on the industry sectors affected by this regulation.

- Chapter 3—Economic Impact Methodology
  Summarizes the economic methodology by which EPA examines incremental pollution control costs and their associated impacts on industry.

- Chapter 4—Pollution Control Options
  Presents short descriptions of the regulatory options considered by EPA. More detail is provided in the Technical Development Document (U.S. EPA, 2009).

- Chapter 5—Economic Impact Analysis Results
  Using the methodology described in Chapter 3, EPA presents the annualized costs associated with control of airfield and aircraft deicing fluid (ADF)-contaminated discharge, using the technologies outlined in Chapter 4. EPA then summarizes the projected economic impacts generated by the regulatory costs, including impacts on airports and co-permittee airlines. In other words, this chapter presents the findings on which EPA based its proposed determination of economic achievability under the CWA.

- Chapter 6—Impacts on Small Entities
  Pursuant to the Regulatory Flexibility Act, as amended by the Small Business Regulatory Enforcement Fairness Act, EPA examines whether the regulatory options will have a significant adverse impact on a substantial number of small entities.

1.3 References

U.S. EPA. 2009. Technical Development Document for Proposed Effluent Limitation Guidelines and Standards for the Airport Deicing Category. EPA-821-R-09-004.

CHAPTER 2
PROFILE OF THE AIR TRANSPORTATION INDUSTRY

Airport deicing/anti-icing operations are performed by airlines, airports, or contracted out to fixed base operators (i.e., contract service providers). Typically, airlines and fixed base operators are responsible for aircraft deicing/anti-icing operations, while airports are responsible for the deicing/anti-icing operations of airfield pavement. Compliance with environmental regulations may be shared between airlines and airports as co-permittees.

This chapter presents a profile of the significant economic and financial aspects of the air transportation industry as it relates to airport/aircraft deicing operations. The demand for deicing operations is a derived demand; that is, deicing operations are performed solely to provide the service of safely transporting passengers and cargo by air. Thus, the economic conditions underlying airport/aircraft deicing operations are those of the air transportation industry itself.

A variety of data sources were used in the preparation of this analysis. Many profile statistics were obtained from the U.S. Department of Transportation (DOT) Bureau of Transportation Statistics (BTS) Air Carrier Financial Reports (Form 41 Financial Data), Air Carrier Statistics (Form 41 Traffic), and Air Carrier Summary Data (Form 41 and 298C Summary Data) databases and the Federal Aviation Administration (FAA) Form 5100-127 (Airport Operating and Financial Summary). EPA has also included relevant data collected from its questionnaires, which were sent to a sample of airports and airlines regarding their operations and finances. Additionally, many literature sources were consulted in the development of this profile. These references are provided in Section 2.10.

The structure of this chapter is as follows: Section 2.1 provides a brief overview of air transportation in the context of the U.S. economy, and summarizes some key points from the detailed industry profile that follows. Sections 2.2 and 2.3 introduce the airport and airline sectors respectively, presenting important definitions as well as the types and numbers of potentially affected entities. Although the air transportation industry has been largely deregulated for 30 years, to understand the current industry structure it is helpful to know how those tumultuous years since the onset of economic deregulation shaped the industry. Thus, Section 2.4 briefly reviews industry trends over the past 30 years. Section 2.5 describes EPA's airport questionnaire. Sections 2.6 and 2.7 discuss the nature of the economic environment in which airports and airlines operate, as well as current financial conditions. Section 2.8 considers how airports interact financially with their airline customers, particularly how costs might be a passed from one entity to another. Finally, the nature of air transportation in Alaska differs considerably from the lower 48 contiguous states; Section 2.9 presents information on Alaskan airports and airlines.

2.1 Industry Overview

The U.S. commercial aviation industry plays an integral role in the nation's economy; in 2004, the industry (including commercial air transportation and support services) was responsible for 5.8 percent of U.S. gross output, 5.0 percent of personal earnings, and 8.8 percent of national employment (Campbell-Hill 2006).

For the purpose of these effluent limitation guidelines (ELG), EPA has narrowed the definition of the air transportation industry to include only airports and airlines. The following list highlights some of the major current issues that may affect industry response to the costs imposed by the ELG.

- Approximately 60 large airports are responsible for the vast majority of air traffic in the U.S., as will be described in Section 2.2.

- A shift in aircraft fleet composition has occurred with more use of regional jets, and retirement of older, less efficient larger planes. (See Section 2.3 for more details).

- Two very different airline business models are operating in competition—“legacy” airlines (carriers from the regulated industry days) and “low-cost” carriers, each with their own unique operational characteristics as discussed in Section 2.7.

- Low-cost carriers and passengers are increasing utilization of secondary airports to avoid larger, congested airports, where capacity is constrained. (See Section 2.4 for more details).

- Airline profits have been highly cyclical since deregulation as described in Section 2.7.

- The events of September 11, 2001, are only one factor in a series of events that have caused the years since 2001 to be some of the worst financial years in airline history.

Finally, this profile and economic impact analysis were prepared using a 2004 through 2006 analytic period with a 2004 baseline. At that time it appeared the air transportation industry was emerging from perhaps its worst economic crisis since deregulation. However, this optimism proved unfounded as events in 2007 and 2008 inflicted further financial distress on the industry. This document maintains the 2004 through 2006 analytic period used for the proposed regulation. EPA provides additional analysis extending from 2007 through 2009 in a separate document in the docket.

2.2 Airports

The applicable North American Industry Classification System (NAICS) code for airports is 488119: Other Airport Operations. The U.S. Census Bureau describes this industry as establishments primarily engaged in (1) operating international, national, or civil airports, or public flying fields or (2) supporting airport operations, such as runway maintenance services, hangar rental, and/or cargo handling services. The 2002 Economic Census provides a snapshot of the airport industry at 1,484 establishments with revenues of approximately $3.7 billion and 57,300 paid employees (Census 2005). However, the FAA and BTS provide more detailed data collection for the air transportation industry, and EPA relies on these data sources for a majority of the data provided in this section.

2.2.1 Number and Size

The United States has approximately 19,850 airports nationwide, ranging from large commercial airports to privately owned landing strips (FAA 2006). Of this number, the FAA has designated 3,431 airports (17 percent of the total) to be part of the National Plan of Integrated Airport Systems (NPIAS). NPIAS includes 67 proposed airports expected to open in the next 5 years in addition to 3,364 existing airports; only two of these proposed airports will be primary commercial service airports. The NPIAS designation identifies those airports significant to the United States’ aviation infrastructure, which makes them eligible for federal funding. FAA makes its determination for inclusion in NPIAS based on the airport’s activity level and location.

This analysis frequently uses FAA’s classification of airports, as illustrated in Figure 2-1. FAA created its classification system for apportioning Airport Improvement Program (AIP) funding, where airport classes are primarily determined by passenger activity. Although deicing operations and deicing/anti-icing fluids (also known as aircraft deicing fluids, or ADF) generation are a function of aircraft operations, not passenger activity, the two measures are highly correlated, and FAA’s classification system provides a useful indication of airport size for EPA’s purposes.

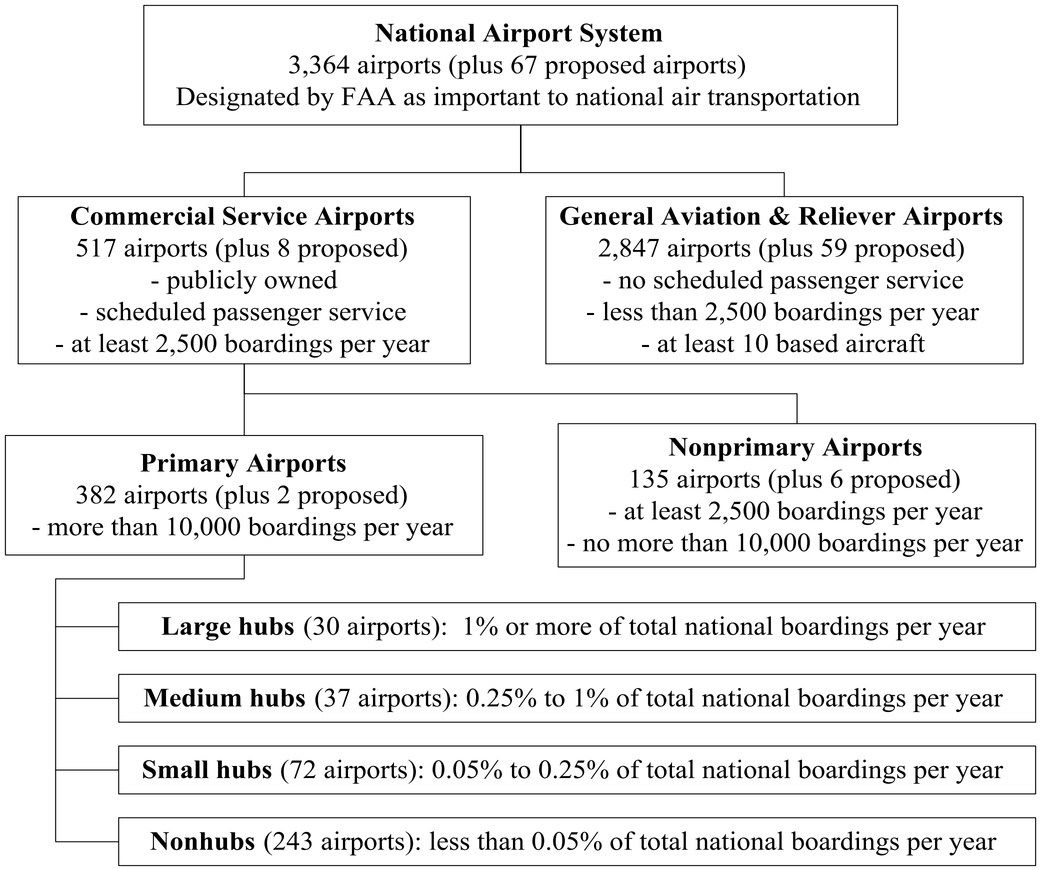

Figure 2-1. FAA Categories of Airports
Source: FAA 2006

FAA defines commercial service airports as publicly owned airports that receive scheduled passenger service and have at least 2,500 annual passenger boardings. Commercial service airports can be: primary, which have more than 10,000 annual boardings, or non-primary, which have at least 2,500 but no more than 10,000 annual boardings.[1] Primary commercial service airports are further broken out by percent of total national boardings into large hubs, medium hubs, small hubs and nonhubs.[2]

General aviation (GA) airports have no scheduled passenger service and less than 2,500 annual passenger boardings. General aviation reliever airports are located near commercial service airports and service general aviation aircraft that would normally utilize a more congested airport. Of the 2,847 existing GA airports in the NPIAS, 274 are assigned “reliever” status. FAA classifies the approximately 16,500 non-NPIAS airports as low activity landing areas. These landing areas are excluded from further discussion in this analysis since they are not significant in terms of stormwater discharges. Military airports have also

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[1] FAA defines passenger boardings as the number of revenue passenger boardings on aircraft engaged in commerce. The term “boarding” is interchangeable with the term “enplanement” (U.S. EPA 2000).
[2] Airlines may also designate certain airports as “hubs.” However, these airline designations relate to the airport’s usage to facilitate connections between airline routes. Unless otherwise noted, this analysis utilizes the FAA hub definition.

been excluded from this economic analysis because they have different operational and financial characteristics. EPA is working with the Department of Defense to determine the nature and significance of deicing/anti-icing operations at military airports.

Table 2-1 presents the number of airports in NPIAS by FAA definition, and percent of boardings and based aircraft for calendar year (CY) 2004. This table emphasizes the dominance of large hubs (those with more than 1 percent of total U.S. enplanements) in the air transportation network. The 30 large hubs accounted for almost 69 percent of all passenger boardings. Altogether the 67 large and medium hub commercial service airports account for almost 90 percent of all passenger boardings.

Table 2-1. Distribution of U.S. Airports in NPIAS (2004)

Airport Type	Number of Airports	Percentage of Enplanements	Percentage of Based Aircraft[a]
Commercial Service Large Hub	30	68.7%	1.1%
Commercial Service Medium Hub	37	20.0%	3.0%
Commercial Service Small Hub	72	8.1%	4.7%
Commercial Service Nonhub	243	3.0%	10.6%
Non-primary Commercial Service	135	0.1%	2.4%
General Aviation Relievers	274	0.0%	28.8%
General Aviation	2,573	0.0%	41.2%
Existing NPIAS Airports	**3,364**	**99.9%**	**91.8%**

[a] Based on active aircraft fleet of 214,591 aircraft in 2005.
Source: FAA 2006 [Note: Airport counts will differ depending on the source and year of data represented]

FAA's designation of hub status depends on the percent of total passenger boardings occurring at each airport, resulting in variation in the number of airports in each hub category from year to year. For its analysis, EPA utilizes the CY 2004 airport classifications, which identified 382 primary commercial service airports, 67 of which are large and medium sized hubs. EPA chose to focus the proposed rule on the commercial service airports because aircraft at general aviation airports rarely fly in weather requiring deicing and therefore are anticipated to generate relatively little ADF-contaminated stormwater. Aircraft must be approved by the FAA for flight in icing conditions, which involves a rigorous testing program, and relatively few light aircraft, which are the majority of aircraft at general aviation airports,[3] carry this approval (AOPA 2002). EPA did, however, include general aviation airports with an average of five or more cargo-only departures in the analysis because these operations tend to use jet aircraft and fly in wintry weather. EPA designated such airports as general aviation/cargo airports.

Large certificated[4] carriers must report monthly traffic statistics and quarterly financial data to BTS, which provides the data to the public. Small certificated carriers report scheduled service on a quarterly basis, and although they also report financial statistics, data are not published due to confidentiality agreements. Since the financial statistics for airlines, presented later in this section, were based on data from the BTS T-100 data and BTS Form 41 Air Carrier Financial Reports database, it is limited to large certified carriers only.

[3] In 1998, single-engine propeller aircraft comprised 70 percent of the general aviation fleet (GAO 2001).
[4] A certificated air carrier is one "holding a Certificate of Public Convenience and Necessity issued by DOT to conduct scheduled services interstate. Nonscheduled or charter operations may also be conducted by these carriers." The term "certificated air carrier" is interchangeable with "certified air carrier." (BTS 2008c). More detail is provided in Section 2.3.1.2 of this report.

Tables 2-2, 2-3, and 2-4 are based on analysis of the BTS T-100 data for commercial service airlines. As Table 2-2 illustrates, large and medium hub airports posted moderate growth in passenger aircraft departures from 2003 through 2005, but saw declines in 2006. Small hub and nonhub airports started to experience this decline in departures in 2004. Table 2-3 shows cargo-only departures are highly variable over the 2003 through 2006 time period. Table 2-4 presents passenger boardings for 2003 through 2006.

Table 2-2. Commercial Service Aircraft Departures (Passenger)

Airport Type	Number of Departures				Annual Growth Rates		
	2003	2004	2005	2006	2004	2005	2006
Large Hub	5,973,386	6,359,189	6,446,213	6,274,990	6.46%	1.37%	-2.66%
Medium Hub	1,698,917	1,769,476	1,792,848	1,762,224	4.15%	1.32%	-1.71%
Small Hub	1,041,900	1,107,831	1,103,882	1,041,607	6.32%	-0.36%	-5.64%
Nonhub	804,034	826,234	811,182	764,375	2.76%	-1.82%	-5.77%
Non-primary	76,413	75,052	69,091	72,321	-1.78%	-7.94%	4.67%
Total	**9,594,650**	**10,137,782**	**10,223,216**	**9,915,517**	**5.66%**	**0.84%**	**-3.01%**

Source: EPA analysis of BTS T-100 database

Table 2-3. Commercial Service Aircraft Departures (Cargo)

Airport Type	Number of Departures				Annual Growth Rates		
	2003	2004	2005	2006	2004	2005	2006
Large Hub	207,887	212,971	204,131	200,338	2.45%	-4.15%	-1.86%
Medium Hub	194,115	194,908	193,087	197,563	0.41%	-0.93%	2.31%
Small Hub	82,571	83,537	76,934	73,100	1.12%	-7.90%	-4.98%
Nonhub	85,519	88,645	81,067	91,393	1.37%	-8.54%	12.7%
Non-primary	8,379	8,551	7,082	7,960	2.09%	-17.2%	12.4%
Total	**578,471**	**588,612**	**562,301**	**570,354**	**1.75%**	**-4.47%**	**1.43%**

Source: EPA analysis of BTS T-100 database

Table 2-4. Commercial Service Passenger Enplanements

Airport Type	Passenger Enplanements				Annual Growth Rates		
	2003	2004	2005	2006	2004	2005	2006
Large Hub	474,573,405	514,416,974	536,384,310	539,513,169	8.40%	4.27%	0.53%
Medium Hub	117,260,549	124,964,548	130,048,827	130,207,784	6.57%	4.07%	0.12%
Small Hub	50,344,945	55,117,982	56,722,694	56,259,611	9.48%	2.91%	-0.82%
Nonhub	18,897,491	20,772,050	21,657,701	20,924,686	9.92%	4.26%	-3.38%
Non-primary	515,371	563,408	604,481	696,769	9.32%	7.29%	15.3%
Total	**661,591,761**	**715,834,962**	**745,418,013**	**747,602,019**	**8.20%**	**4.13%**	**0.29%**

Source: EPA analysis of BTS T-100 database

While boardings grew from 2003 to 2005, gains were much smaller or negative from 2005 to 2006, with the exception of double-digit growth at non-primary commercial service airports. Large hub airports posted positive growth every year since 2003. The overall growth from 2003 to 2006 for passenger boardings was 13.0 percent over four years. Although passenger boardings and passenger service aircraft departures tend to be highly correlated, airlines can increase boardings without increasing departures by using larger planes or obtaining higher load factors (the percent of available seats that are used by revenue-paying passengers). Thus, from 2005 to 2006, passenger boardings grew even though the number of departures declined.

2.2.2 Airport Location and Climate Data

Airport location as it relates to climate is important to examine because airports with high levels of snow and freezing rain are more likely to have substantial deicing operations and the volume of ADF-contaminated stormwater produced will be larger than at airports in warmer locales. EPA used weather data from the National Oceanic and Atmospheric Administration (NOAA) Climate Maps of the United States to generate the number of snow or freezing precipitation (SOFP) days[5] at airports nationwide. Figure 2-2 presents a map of primary commercial service airports by hub size and SOFP days. This information was used to stratify the airport sample frame to ensure small and nonhub airports that potentially perform significant deicing operations would be adequately represented in the survey sample. The survey and sampling plan are discussed in Section 2.5.

[5] EPA combined NOAA 30 year averages (1961 to 1990) of the number of days with snow fall exceeding one inch and the number of days with some form of freezing precipitation to create the composite snow or freezing precipitation days measure used in this analysis.

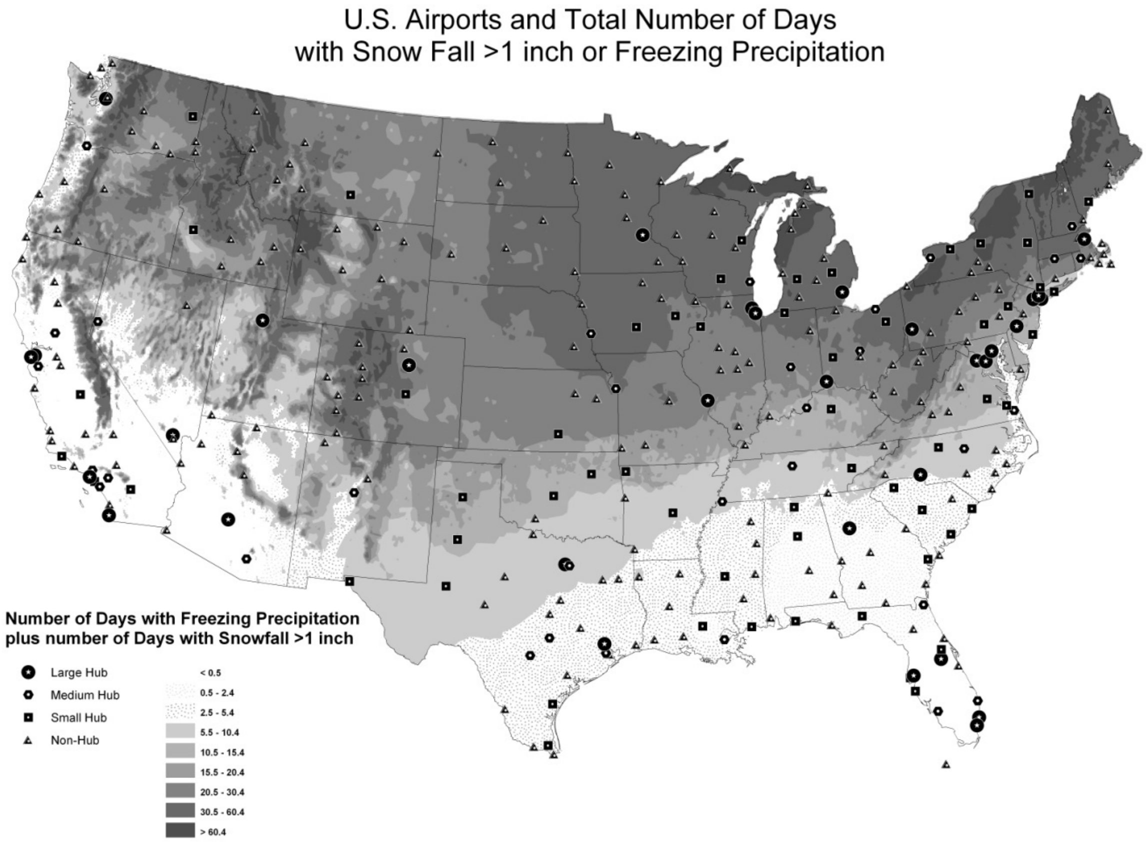

Figure 2-2. U.S. Airports and Number of SOFP Days

2.3 Airlines

The NAICS code applicable to airlines is: 481: Air Transportation, which includes air transportation of passengers and/or cargo using aircraft. The subsector distinguishes scheduled from nonscheduled air transportation. Scheduled air carriers fly regular routes on regular schedules and operate even if flights are only partially loaded. Nonscheduled carriers often operate during nonpeak time slots at more congested airports. These establishments have more flexibility with respect to choice of airport, hours of operation, load factors, and similar operational characteristics. Nonscheduled carriers provide chartered air transportation of passengers, cargo, or specialty flying services. The Census Bureau does not gather data from large certificated passenger carriers since that data is collected by BTS. Therefore this analysis relies on data collected by BTS and FAA to represent airline statistics.

2.3.1 Number and Size

Civil aviation can be divided into two groups: air carriers and general aviation. Air carriers are defined as companies or other organizations that carry passengers or cargo for hire or compensation. General aviation constitutes all other civil aviation. This section looks at both the number of aircraft that comprise the U.S. fleet, and the number of airlines operating in the United States.

2.3.1.1 Number of Aircraft

Aircraft utilized by air carriers are distinguished from general aviation aircraft by size, frequency, and intensity of use. At the end of 2006, the U.S. airline fleet consisted of 7,626 aircraft (FAA 2007), composed of:

- 3,886 mainline passenger aircraft (more than 90 passenger seats)
- 2,743 regional passenger aircraft
- 997 cargo aircraft

From 2005 to 2006, the mainline passenger fleet fell by 39 aircraft, with an overall loss of 576 large aircraft since 2000. In contrast, the mainline cargo fleet rose by six aircraft in 2006, with fleet size now increasing for two years in a row. In response to rapidly increasing fuel prices, airlines have been forced to reduce capacity by either grounding aircraft, or retiring larger aircraft in favor of smaller, more efficient models.

The Air Transport Association (ATA) (2008a) reports that the cost per gallon of jet fuel has increased more than 216 percent since 2000, while fuel costs as a share of total operating expenses have increased from 9.9 percent in the first quarter to 2002 to 26.5 percent in third quarter 2007. As a result, domestic airlines—including United, American, and Continental—have grounded planes, reduced schedules, and deferred or canceled future deliveries. During the first six months of 2008, American Airlines announced plans to retire up to 50 MD-80s, while U.S. Airways announced plans to cut capacity by retiring larger Boeing 757s and 737s in favor of fewer smaller planes. Other airlines have followed suit, with Delta, Continental, Northwest, and jetBlue all announcing plans to cut domestic capacity and/or accelerate plans for retirement of older, less efficient planes over the coming months (Associated Press 2008). The regional fleet has increased by nearly 470 aircraft since 2000, while turboprop and piston fleets have declined by 648 aircraft over the same time period.

As shown in Table 2-5, commercial aircraft are utilized more intensively than general aviation aircraft. Although the commercial airline fleet comprises only 4 percent of the aircraft associated with general aviation, total commercial hours flown per aircraft (on average) is almost 20 times that of a general aviation aircraft.

Table 2-5. Number of Aircraft and Flight Hours (2006)

Aircraft Type	Number of Aircraft	Total Flight Hours	Hours Per Aircraft
Commercial, Cargo and Commuter Carriers[a]			
Total (Fixed-wing)	7,149	17,846,835	2,496
Turbojet	5,916	16,095,937	2,721
% of Total	83%	90%	
Turboprop	880	1,462,290	1,662
% of Total	12%	8%	
General Aviation			
Total (Fixed-wing)	182,186	22,764,959	125
1- Engine Piston	145,036	13,975,869	96
% of Total	80%	61%	
2-Engine Turbojet	10,379	4,077,209	393
% of Total	6%	18%	
2-Engine Turboprop	5,487	1,309,643	239
% of Total	**3%**	**6%**	

[a] Not including Part 135 On-Demand Air Taxis.
Source: FAA 2007b and FAA 2007c.

2.3.1.2 Definition and Number of Air Carriers

Commercial air carriers can be divided into four categories based on FAA and U.S. Department of Transportation (DOT) requirements: large certificated carriers, small certificated carriers, commuter carriers, and air taxis. These categories are primarily determined by the combination of financial ("fitness") and safety ("operating") criteria carriers are required to meet.

Fitness criteria are set by DOT. Large and small certificated carriers require a Federal Aviation Act Section 401 fitness certificate (hence the term "certificated carrier"). Under DOT's criteria, the differences between large and small certificated carriers are: (1) aircraft size, and (2) international operations. Large certificated carriers operate aircraft that have more than 60 seats, or a payload capacity in excess of 18,000 pounds, or conduct international flights. Small certificated carriers operate aircraft that have 60 seats or less, or a payload capacity less than 18,000 pounds, and do not conduct international flights.

Commuters and air taxis do not require a fitness certificate but must register with DOT under 14 CFR Part 298. Commuter air carriers and air taxis are distinguished by the type of service provided. Air taxis primarily provide on-demand service. Commuter air carriers are defined as air taxis that also provide published scheduled service of at least five round trips per week between at least two locations.

Operating criteria are set by FAA and are based on aircraft size and type. Carriers operating aircraft carrying more than nine passengers, or more than 7,500 pounds payload, or are powered by turbojets must meet the requirements of Federal Aviation Regulation (FAR) Part 121 (14 CFR 121). FAR Part 135 operating certificates are required for aircraft that are not turbojets, and carry nine passengers or less, or have a payload less than 7,500 pounds. Table 2-6 summarizes the combination of fitness and operating requirements for each classification.

Table 2-6. Air Carrier Definitions

Air Carrier Type	Defined by Combination of Following		
	Description	Fitness Criteria	Operating Criteria
Large Certificated	Aircraft with more than 60 seats, or payload capacity greater than or equal to 18,000 pounds, or conduct international flights	DOT Section 401 Certificate	FAR Part 121[a]
Small Certificated	Aircraft with 60 seats or less, or payload capacity less than 18,000 pounds, and conduct domestic flights only	DOT Section 401 Certificate	FAR Part 121[a] or FAR Part 135[b]
Commuter	Air taxi with published scheduled service of at least five round trips per week between at least two locations	Registered under 14 CFR 298	FAR Part 121[a] or FAR Part 135[b]
Air Taxi	Primarily on-demand service	Registered under 14 CFR 298	FAR Part 121[a] or FAR Part 135[b]

[a] Aircraft carries more than nine passengers, or more than 7,500 pounds payload, or is a turbojet.
[b] Aircraft carries nine passengers or less, less than 7,500 pounds payload, and is not a turbojet.

Although the distinction between large certificated and other types of air carriers is clear-cut, the distinction between small certificated and commuter air carriers is more ambiguous. Both are able to operate the same type of aircraft and offer the same type of service. The decision to become a small certificated carrier rather than a commuter is largely at the discretion of the operator, and hinges on complex legal issues beyond the scope of this analysis (U.S. EPA 2000). Because BTS data and data availability use this distinction, EPA will present results in this form in the EA. However, these two types of air carriers can intuitively be considered very similar for understanding operational patterns and differences between their operations and larger carriers.

For the purpose of reporting air carrier statistics, BTS further characterizes large certificated carriers by annual revenue as shown below:

- Major carriers are airlines with annual operating revenues of more than $1 billion.
- National carriers are airlines with annual operating revenues of between $100 million and $1 billion.
- Regional carriers are airlines with annual operating revenues of less than $100 million. They can be further categorized into large regional carriers (revenues of $20 million to $100 million) and small regional carriers (revenues of less than $20 million).

National and regional carriers tend to focus their service in particular regions of the country. Major airlines generally provide nationwide and often worldwide service. National and regional airlines often provide “feeder” services to major airlines by carrying passengers from smaller airports not served by major airlines to the major airlines’ operational hubs. Through code-sharing agreements, the regional airlines can schedule such feeder flights under the major airline’s scheduling code. This allows the major airlines to appear to have scheduled service to more cities or more frequent flights to a city, while the regional airlines gain by having its service appear to the traveler as being provided by a major airline. Through the code-sharing agreements, major and national/regional airlines often have more complementary relationships than competitive ones.

Foreign-owned airlines have become increasingly interested in capturing a share of the U.S. air travel activity. Current legislation prohibits foreign airlines from moving passengers between points only in the United States. However, “open skies” advocates are working toward allowing foreign airlines to compete for domestic U.S. travel (Kaps 2000).

As is the case for airports, the airline industry is dominated by a small number of very large entities. Table 2-7 depicts the BTS air carrier traffic statistics for 2006.[6] Twenty major airlines account for 84.5 percent of passenger enplanements; major and national carriers combined account for over 96 percent of enplanements.

Table 2-7. Air Carrier Statistics (2006)

Carrier Type	Number (% of Total)	Passenger Enplanements (thousands)	Revenue Passenger-Miles (millions)	Available Seat-Miles (millions)	Revenue Ton-Miles (millions)	Available Ton-Miles (millions)
Major	20 (13.4%)	634,202 (84.5%)	733,936 (90.6%)	922,667 (89.8%)	100,193 (83.0%)	163,090 (81.9%)
National	32 (21.5%)	88,112 (11.7%)	64,748 (8.0%)	87,643 (8.5%)	16,821 (13.9%)	29,669 (14.9%)
Regional	35 (23.5%)	8,893 (1.2%)	5,763 (0.7%)	8,347 (0.8%)	3,166 (2.6%)	5,434 (2.7%)
Small Certificated	35 (23.5%)	4,146 (0.6%)	1,320 (0.2%)	2,060 (0.2%)	151 (0.1%)	261 (0.1%)
Commuter	27 (18.1%)	15,443 (2.1%)	4,321 (0.5%)	6,808 (0.7%)	423 (0.4%)	780 (0.4%)
Total	**149**	**750,796**	**810,098**	**1,027,525**	**120,764**	**199,234**

Source: BTS Air Carrier Summary: T1: U.S. Air Carrier Traffic and Capacity Summary by Service Class

The air transportation industry uses standard measures of unit capacity and utilization to account for differences in aircraft size and routes. For passenger service, these measures are (BTS 2008b):

- Revenue passenger-miles (RPM): number of revenue-earning passengers multiplied by the number of miles flown.

- Available seat-miles (ASM): number of aircraft seats multiplied by the number of miles flown.

Thus, ASM measures an air carrier's capacity, while RPM measures how many of those seats were filled by paying customers. Dividing RPM by ASM results in the "load factor;" the percent of available seat miles that were filled. Table 2-7 shows that flying larger aircraft over longer distances, major airlines account for about 90 percent of industry RPM and ASM.

For cargo, industry unit measures are (BTS 2008b):

- Revenue ton-miles (RTM): tons of revenue-earning cargo carried multiplied by the number of miles flown.

- Available ton-miles (ATM): cargo-carrying capacity measured in tons multiplied by the number of miles flown.[7]

Major airlines account for 83 percent of RTM and 82 percent of ATM.

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[6] Due to the use of different data sources there is a minor discrepancy in the number of total airlines included in Table 2-8 when compared with other tables in this report.
[7] Most cargo is carried on aircraft that also carry passengers, and therefore the tonnage available for cargo must be adjusted to account for the weight of the passengers carried.

2.4 Air Transportation Industry Trends

Historically, air transportation industry profitability has been highly cyclical. Recently, however, a series of largely unforeseen events this decade seriously disrupted the demand for air travel, which in turn generated an unusually pronounced dip in the air transportation industries' financial health. Even prior to the September 11, 2001 terrorist attacks, demand for air transportation, especially associated with business travel, had slowed due to the weakening economy (ATA 2001; ATA 2002). As air travel finally started to return to pre-September 11th levels in 2003, the war in Iraq and the Severe Acute Respiratory Syndrome (SARS) outbreak significantly reduced international travel, which accounts for about 25 percent of U.S. airline RPMs (ATA 2003; ATA 2004). Currently, as the industry began recovering from these events in 2005 and 2006, increasing fuel prices are weakening the upside of the financial cycle (ATA 2005; ATA 2006; ATA 2007; Heimlich 2008). This section examines how the air transportation industry has evolved since its deregulation, and how it has adjusted to innovations such as the entry of low-cost carriers and the use of secondary airports.

2.4.1 Deregulation of Airlines

Deregulation in 1978 brought many changes to the structure of the airline industry; among those were open price competition, increasingly aggressive cost and capacity control measures, and the development of the airlines' hub and spoke network system. While airlines existing during the regulated time (hereafter referred to as "legacy" airlines)[8] struggled to compete in the new free market, new entrants were able to enter the market. These new carriers often held several advantages over existing carriers:

- Low overhead and infrastructure costs
- Ability to purchase only capital equipment that was needed
- Lack of pre-existing labor contracts allowed for outsourcing

However, by the late 1980s many carriers, both new and old, exited the market through merger or bankruptcy as the industry struggled to adapt to the reality of an openly competitive market. This was a period of unusually high rates of mergers and acquisitions for the U.S. economy as a whole as well as the air transportation industry.

2.4.1.1 Development of Hub and Spoke Networks

Legacy carriers in general developed a competitive strategy organized around the concept of a "hub and spoke network," while reducing point-to-point service because they found it less profitable (Kaps 2000).[9] The concept is that airlines route passengers from many different points of origin and different destinations through a single major airport ("airline hub") and use connecting flights to send them to their various destinations. Legacy airlines also began to integrate regional carriers into carrier networks where the regional airlines act as "feeders" for the hub. The regional airlines might be independently-owned partners with, or wholly-owned subsidiaries of the major carrier.

A hub and spoke network provides several advantages to airlines, including increased service frequency and connectivity, and overall increased density of operations. Frequent service and connectivity are attractive to passengers, and increased density of operations might allow the carrier to increase its load

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[8] Although Southwest Airlines started operations prior to deregulation, it is not considered a "legacy" airline because it operates on a different business model.
[9] The "hub" of a hub and spoke network developed by an airline for its operational purposes should not be confused with the FAA definition of a hub used to allocate AIP funds.

factor and perhaps use larger aircraft with lower unit costs (Borenstein and Rose 2007; Holloway 2003). Advantage might also be gained from decreased competition at hub airports (Borenstein and Rose 2007). Conversely, hubs can result in high capital costs and poor resource utilization as the airline must equip the hub to service large numbers of aircraft in a short period of time, then sit idle while waiting for the next "bank" of flights to arrive (i.e., operational peaks associated with large numbers of aircraft arriving and departing within a short period of time; Holloway 2003).

In the context of the deicing effluent guideline, a hub has potentially significant implications for airline operations. Operational delays at a hub can ripple throughout an airline's entire network causing further delays and missed connections. Furthermore, a "bank" of aircraft might need deicing in a short period of time (Holloway 2003). Thus, collecting ADF-contaminated stormwater at an operational hub might be more difficult, and airlines might be more sensitive to the implications of deicing operations to their schedule.

2.4.1.2 Emergence of Low-Cost Carriers

In recent years, a second generation of low-cost carriers has emerged as a strong rival to the legacy airlines. Originally considered a passing trend, low-cost carriers began to enter the market better capitalized and with lower costs in direct competition with legacy airlines during the 1990s (GAO 2004). The low-cost giant Southwest Airlines, which does not utilize a hub and spoke system, is the best known example of a successful low-cost carrier, although it started operating in 1971, prior to deregulation (Belobaba 2005). Some of the major attributes of the "low cost" business model are generally considered to include: no-frills, single class service at interest fares, use of a point-to-point route structure between secondary airports, and rigorously cutting costs by using a single aircraft type and quick turn-around times, thereby reducing maintenance costs and maximizing aircraft utilization.

From 1998 to 2003, the overall market share of passenger enplanements for low-cost carriers rose from 23 percent to 33 percent, and their presence in the 5,000 largest city-pair markets (e.g., New York – Boston) increased from 32 percent to 46 percent over the same time period. Between 1999 and 2004, all existing low-cost carriers gained market share while four of the six legacy carriers lost market share (GAO 2004).

The emergence and success of low-cost carriers has caused legacy airlines to revise their business models to help them compete in a market with lower priced fares. A 2006 U.S. Government Accountability Office (GAO) analysis found that the median price for air travel has declined by almost 40 percent since 1980 after adjustment for inflation. Some legacy carriers, such as Delta and United developed their own low cost divisions (e.g., Song and Ted, respectively, both of which have been phased out), and there has been some trend away from reliance of hub and spoke route structures.

Primarily, however, legacy carriers have relentlessly cut costs, especially in the years since September 11, 2001. Although cutting costs by about 14 percent between October 2001 and December 2003, the gap between unit costs for legacy airlines and the low-cost carriers increased. GAO found that this disparity increased from 2.1 cents per available seat mile in 2000 to 3.8 cents per available seat mile in 2003 (GAO 2004). The cost difference is attributable to two main factors:

- Higher labor costs for legacy airlines due to long-standing union contracts.
- Higher asset-related costs of legacy airlines due to an older, more diverse aircraft fleet.

Since 2000, overall domestic airline capacity has grown by a modest 1.9 percent. All of the growth in capacity has occurred among low-cost carriers and regional carriers, with low-cost carriers experiencing capacity growth rates of 57 percent. This compares with a capacity loss of 20.6 percent since 2000 for large legacy carriers (FAA 2007b). Due to these cuts in capacity, legacy airlines saw revenue passenger miles (RPM) fall 10.4 percent and enplanements fall 22.3 percent over the same time period. At the same time, low-cost carriers' RPM and enplanements increased by 71.1 percent and 47.9 percent, respectively (FAA 2007b). Low-cost carriers posted operating profits of $911.6 million and net profits of $1.5 billion in 2006 (FAA 2007b).

As the industry has evolved, two distinct types of large carriers have evolved: the legacy carriers, and the low-cost carriers. The advent of low-cost carriers is seen as driving much of the recent expansion in the industry, and growth is projected to continue at a healthy rate for the next decade (assuming recent increases in fuel prices are transitory). In addition, the development of low-cost carriers has affected the pattern of airport utilization, as will be discussed in the following section.

2.4.1.3 Effect on Airports Served

Deregulation of the airline industry meant that the legacy carriers could select their own routes and drop flights to unprofitable locations (Wells 1996). Foreseeing potential financial challenges to rural and less traveled airports after deregulation, the government developed a program called the Essential Air Service to ensure communities' access to air travel. Smaller commuter airlines have replaced larger carriers in providing service to these airports. Even with subsidies, which are reflected in reduced passenger fares, these smaller commuter planes are less profitable and the GAO (2007b) found that these flights are the first flights to be eliminated during times of financial downturns.

Conversely, smaller airports have implemented new strategies to diversify and differentiate themselves. For example, low-cost airlines seek airports where delays tend to be minimal and quick turnaround is possible (Carney and Mew, 2003). Secondary airports that are located in relatively close proximity to large hub airports, or at least the large metropolitan areas served by large hub airports, are able to offer lower rates and charges, higher reliability of operations, and lower average delays than large hub airports, which makes them attractive to low-cost airlines. This is effectively creating new regional multi-airport systems (Bonnefoy and Hansman 2007).[10]

The combination of low-cost carrier and secondary airport market has made flying more cost-efficient in many markets. For example, as Southwest Airlines, considered the benchmark for the low fare carrier industry, has expanded its route structure, traffic at secondary airports it serves has often doubled or tripled, leading air industry experts to coin the phrase "the Southwest effect" to describe the phenomena (Bennett and Craun 1993). The airline's service at Manchester, NH and Providence, RI has created two attractive alternatives to Boston's Logan airport, a major hub, for air travel to and from the greater Boston metropolitan area.

2.4.2 Cyclical Nature of Air Travel Demand

The airline industry has undergone significant change since its deregulation. Passenger traffic and, with it, industry revenues, have expanded. However, expenses have grown just as fast and profits have become increasingly cyclical (GAO 2006) as seen in Figure 2-3. Immediately following deregulation, which occurred in 1978, the industry experienced a drop in profit, but by the late 1980s the industry had been in an upswing. However, by the early 1990s, the industry was once again on a downward financial trend due to a global economic recession.

[10] Although these airports are not necessarily under the same operational control and do not coordinate plans.

Although exacerbated by specific events, this profile cycle seems to be inherent in the industry (Morrison and Winston 1995; Borenstein and Rose 2007). The GAO (2006) explained one reason for the profit cyclicality of airlines is that the industry has high fixed costs for its aircraft and a costly labor structure, which makes it difficult for airlines to reduce costs when revenues drop from outside shocks, such has high fuel costs or declines in business travel. By the mid 1990s the industry was showing positive operating profits, and these are considered some of the best years for the industry (GAO 2006). However, by 2000, expenses were again higher than revenue.

In fact, prior to September 11th the industry was already forecasting losses for 2001 (Belobaba 2005). Among concerns facing the industry in early 2001 were system capacity constraints, passenger-perceived poor quality of service, and concerns about anti-competitive actions by dominant airlines against new entrants (Belobaba 2005). As will be discussed further in Section 2.7.2, there are a number of characteristics for the airline industry that create this cyclical nature.

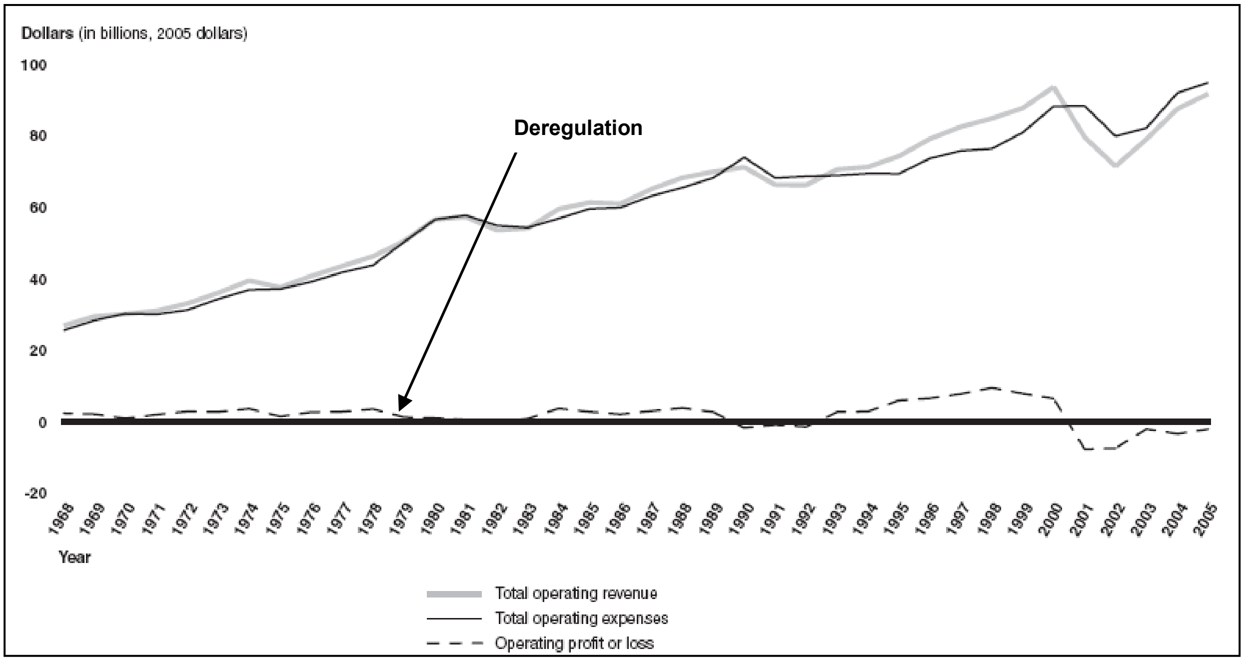

Figure 2-3. Cyclical Nature of Airline Operating Profits Since Deregulation
Source: GAP 2006

Although airports generate a large portion of revenue from the airlines through landing fees and passenger facility charges, there is a growing trend to generate more revenue through non-airline sources such as parking and concessions. The more revenue an airport generates through non-airline sources, the more attractive the airport is to airlines (as fees to airlines tend to be lower), and the more stable the airport's revenue stream will be (Kwan 2008). More discussion about airport revenues is provided in Section 2.6.2.

2.4.3 Growth in Air Travel

Between 2000 and 2006, total domestic airline capacity (i.e., available seats) increased by only 1.9 percent, but enplanements (i.e., filled seats) increased by 6.2 percent (FAA 2007b). The FAA forecasts growth in enplanements through 2020 at an average annual rate of 3.5 percent.

2.4.3.1 Airport Capacity Constraint

A growing issue for airports is airport congestion. While congestion is caused primarily by an increase in flight operations, it is exacerbated by a concurrent change in demand composition (Carney and Mew, 2003). As airlines continue to differentiate themselves by increasing flight frequency on existing routes as well as by creating new routes (primarily of the point-to-point service variety serviced by regional jets), airports are struggling to keep pace. Airlines have more flexibility in adjusting their operational frequency and equipment mix than airports, which must work with an infrastructure that is largely fixed in the short term. This results in a disconnect between airline and airport operations and operational inefficiencies in the air transportation system. For example, the number of flights at John F. Kennedy Airport in New York City increased 41 percent from March 2006 to August 2007 without a corresponding increase in runways or resources available to handle increased operations (McCartney 2007).

Adding capacity requires physical space, which many of the nation's airports simply do not have. Another barrier is that many airports are built near environmentally sensitive areas, such as waterways, that would make expansion costly and, in many cases, prohibited. New, large capacity airports could also be constructed to address the demand issue, but environmental and space constraints make this option unlikely to be the primary solution (Bonnefoy and Hansman 2007). As discussed in Section 2.4.1, secondary airports have developed as viable alternatives for passengers willing to drive in order to avoid flying out of more congested hubs.

2.4.3.2 Change in Airline Service

Given the current constraints of the airport system, a plausible solution might be the use of larger aircraft by airlines. The larger aircraft could carry more passengers while using approximately the same airport resources as a smaller aircraft. The historical trend, however, is for airlines to use smaller aircraft. The contradiction stems from increased competition among airlines post-deregulation, which has generated a greater demand for increased flight frequency under the hub and spoke network. Thus airlines are utilizing smaller aircraft to meet demand when more frequent flights are offered.

Additionally, for the airlines an empty seat is a lost revenue opportunity. Even if the airline offers a discounted fare on a flight that is not completely full, it still increases its revenue more than the additional cost of flying that passenger. Average load factor, which is the percentage of available seats filled by revenue passengers, have been rising as shown in Table 2-8. The data shows that airlines are experiencing more activity by increasing the number of passengers per departures. By the third quarter of 2007, the average passenger load factor was 82.3 percent (DOT 2007).

Table 2-8. Operational Highlights of the U.S. Scheduled Service Airline Industry (in millions except as noted)

Financial Statistics	2001	2002	2003	2004	2005	2006	% Change 2001 to 2006
Aircraft Departures (thousands)	8,888	9,275	10,848	11,401	11,558	11,264	26.7%
Passengers Enplaned	622.1	614.1	646.5	703.0	738.3	744.2	19.6%
Revenue Passenger Miles (RPMs)	651,700	642,242	656,938	733,680	778,563	796,795	22.3%
Available Seat Miles (ASMs)	930,511	894,217	893,941	971,466	1,002,735	1,005,534	8.1%
Passenger Load Factor (percent)	70	71.8	73.5	75.5	77.6	79.2	9.2 pts.

Source: ATA 2007a

2.4.3.3 Introduction of Regional Jets

An increase in the number of flights available has led to a concurrent increase in the number of nonstop flights. According to Borenstein and Rose (2007), the number of markets that had nonstop service rose nearly 70 percent between 1984 and 2005. This increase in nonstop service coincided with the introduction of regional jets emerging in 1992 to replace older narrow-body jets and turboprops. Regional jets are defined as aircraft that have capacities of less than 100 passengers; these smaller planes are often more efficient than either small turboprops or larger jets on short-haul nonstop flights. Many features of these new aircraft made them popular with airlines. They have shorter flight times with faster turnaround and increased flight frequency of service than turboprop aircraft (Mozdzanowska et al 2003).

EPA's analysis of BTS data, as provided in Table 2-9, shows an overall growth trend in regional jet departures from 2000 to 2006 for passenger flights, and during this period, the reliance on regional jets relative to turboprops has increased significantly. In 2000, departures from turboprops were about 1.5 times as common as regional jet departures; however, in 2006, regional jet departures were approximately 2.5 times more common than turboprop departures.

Overall the FAA (2007 forecast) has seen a trend for legacy airlines to decrease aircraft size while regional carriers have been increasing aircraft size. Regional carriers have been adjusting aircraft size to provide capacity that complements market demand.[11]

Increased prevalence of regional jets may affect ADF usage since the aircraft has improved the financial viability of operating from smaller airports. Therefore air traffic at these airports is increasing. The highest growth in regional jet departures occurred before 2004, the year of EPA's deicing survey, so EPA believes that the information reviewed for this analysis has been captured to reflect the changing aircraft fleet composition.

[11] Another type of jet that has recently been introduced to the market is the Very Light Jet (VLJ). According to FAA (2006), the VLJ is a light weight, twin jet aircraft with a maximum take-off weight below 10,000 pounds. While currently they do not make up a significant portion of the fleet, the GAO (2007c) estimates a fleet of 3,016 to 7,649 VLJ will be in the airways between 2016 and 2025. VLJs may become significant in the air taxi market segment, and the FAA is currently deliberating the possibility of allowing VLJs to operate on scheduled services.

Table 2-9. Regional Jet Versus Turboprop Departures (Passenger Data)

Year	Regional Jets		Turboprops	
	Number of Departures	% Change from Previous Year	Number of Departures	% Change from Previous Year
2000	752,359	NA	1,183,591	NA
2001	899,258	19.5%	1,058,617	-10.6%
2002	1,392,161	54.8%	1,133,799	7.1%
2003	2,435,860	75.0%	1,752,518	54.6%
2004	3,001,216	23.2%	1,602,674	-8.6%
2005	3,347,156	11.5%	1,414,656	-11.7%
2006	3,260,910	-2.6%	1,332,470	-5.8%

Source: BTS T-100 database

2.5 Airport Survey

This section focuses on the airport questionnaire, which collected information on ownership structure, financial relationships with airlines, and funding sources for capital expenditures. The detailed profile of airports is presented in sections 2.6 and 2.7 based on information collected in the questionnaire as well as publicly available data from BTS (available at www.transtats.bts.gov), the National Flight Data Center Database (available at www.faa.gov/airports_airtraffic/airports/airport_safety/airportdata_5010), and FAA financial data (available at cats.airports.faa.gov/reports/reports.cfm).

EPA used its authority under Section 308 of the Clean Water Act to collect information from a sample of airports potentially affected by the rule of operational and economic data that was not otherwise available. EPA used these detailed data to improve its understanding of the air transportation industry, and in models to project the impacts of the ELG. The rulemaking docket provides copies of the survey instruments (DCNs AD00354 and AD00355) and detailed information regarding implementation of the surveys.

EPA developed a sample frame design for the airport survey based on airport size and climate. Although deicing operations are prevalent at colder climate airports, EPA needed to determine the extent that airports in warmer climates also have anti-icing operations. For example, flights that originate at these airports may land in airports with wintry weather conditions. Additionally, dry-weather deicing may also be performed on some types of aircraft whose fuel tanks become super-cooled during high-altitude flight, resulting in ice formation at lower altitudes and after landing. Therefore all airports classified by FAA as large and medium hubs, regardless of climate, were sampled with certainty. These large and medium hubs account for 80 percent of commercial departures and enplanements. Five general aviation airports with at least five cargo departures on average per day were also surveyed as a judgment sample to better understand deicing/anti-icing operations at small airports with significant cargo-only service.

EPA also selected all small and nonhub airports (excluding Alaskan airports) with at least 30,000 annual jet departures. The remaining airports were stratified by the number of significant snow or freezing precipitation days (SOFP) as determined by the NOAA data (see Figure 2-1). EPA selected 14.5 SOFP days for stratification, and oversampled those airports with more than 14.5 SOFP days per year.

One medium hub airport in Alaska was sampled with certainty. EPA then selected a judgment sample of small and nonhub Alaskan airports to better understand their deicing/anti-icing operations and economic profile as a judgment sample. EPA chose airports based on activity that would capture the major climate zones in Alaska (e.g., coastal). Due to its operational and financial structures, EPA analyzed the data separately, which is discussed in Section 2.9.

The questionnaire was sent to a total of 152 airports,[12] which included all large and medium hub airports, all five airports designated by EPA as general aviation/cargo airports, as well as a sample survey of all small and nonhub airports. EPA also included judgment sample airports with specific treatment technologies and Alaskan airports. The response rate for the Airport Questionnaire was 98 percent. Table 2-10 shows the distribution of surveyed airports by size class.

Table 2-10. Airport Survey Sample Stratification

Airport Category[b]	SOFP Days	Total Population	Total # Sampled
Large Hub	NA	33	33
Medium Hub	NA	35	35
Small Hub with ≥ 30,000 Jet Departures	NA	6	6
Small Hub < 30,000 Jet Departures	< 14.5	38	6
	≥ 14.5	24	9
Nonhub	< 14.5	99	13
	≥ 14.5	134	31
Judgment Sample			
General Aviation/Cargo	NA	5	4
Alaska[a]	NA	85	11
Specific Treatment Technologies	NA	NA	4
Total		**459**	**152**

[a] Airports included one medium, two small hubs, seven nonhubs, and one non-primary commercial service, from a total population of 85 commercial service airports.
[b] Airport classifications may change from year-to-year because they are based on the number or percent of passenger boardings at each airport. The number of airports by category differs in this table from Figure 2-1 and Table 2-2 because they are based on classification at the time of stratification; the numbers in the previous table represent the most current airport counts.

2.6 Airport Management

This section discusses in more detail the structure of airport ownership and financial management. It also presents data showing the financial characteristics of different airport types.

2.6.1 Airport Ownership and Management

Commercial airports in the United States generally fall under one of two main forms of ownership: quasi-governmental authorities (single purpose airport authorities or multipurpose port authorities) or multipurpose governments (e.g., cities, counties, states). This section examines the distribution of ownership types at airports throughout the United States.

The Transportation Research Board's analysis (2007) of the ownership structures of the nation's top 100 airports in 2005 (as determined by annual enplanements) is shown in Figure 2-4 below. Figure 2-4 also compares ownership answers provided by the Section 308 survey data based on 2004 data. Both data sets indicate that local governments (made up of city, regional, county and state governments) account for 58 percent of airport ownership. Authorities, which are quasi-local or regional governmental organizations,

[12] One hundred and fifty three airports were surveyed. However, one general aviation/cargo airport was located on a military airport and therefore determined to be out of scope for this analysis.

own approximately 40 percent of airports. Airport authorities tend to be independent entities in which a government official selects the group of commissioners that govern the airport.

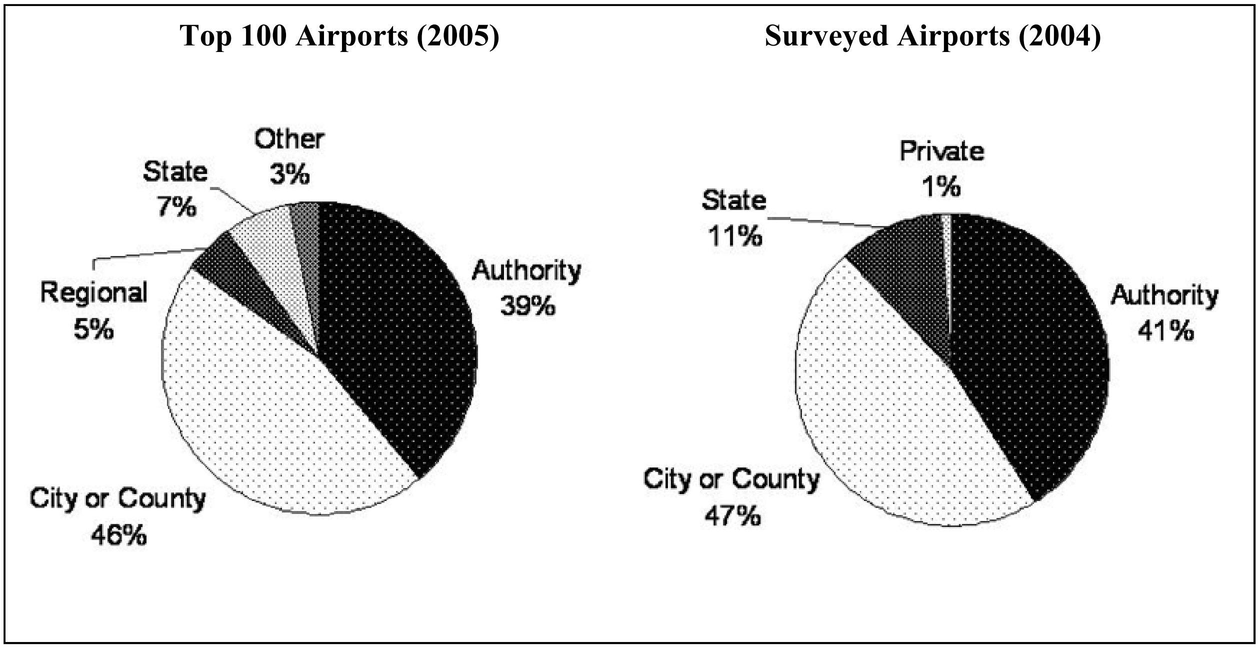

Figure 2-4. Airport Ownership
Source for Top 100 Airports: TRB 2007; Source for Surveyed: EPA Deicing Survey

As airline business models change, airport ownership structures may change as well. There is currently a movement toward an increasingly commercial mindset in airport operations with growing interest in allowing private ownership of commercial service airports. Currently, FAA regulations stipulate that airport revenues cannot be used to fund off-airport projects. This law prohibits private owners from making a profit for its shareholders, which is a major disincentive for private investors. In 1997, Congress established a pilot program to allow FAA to explore privatization as a means to generate access to private capital for airport improvement and development. Under the program, private companies may own, manage, lease, and develop public airports. These entities would be allowed to divert revenue from the airport (e.g., profit) and still qualify for federal financial assistance.

Aside from current restrictions, another issue working against private ownership is lack of access to low-cost capital. Publicly owned airports can impose PFCs, apply for AIP grants,[13] and issue tax-free municipal bonds; privately owned airports do not have access to these funding sources. More discussion about these funding sources is provided in the next section.

Stewart International Airport in New York privatized under the pilot program, but in 2005, the airport was withdrawn from the program. During the same time period, several other airports also applied, but ultimately withdrew their applications. FAA believed that airport owners proposed privatization as a means to generate development capital rather than use available tax-exempt financing. During its review of the program, FAA (2004a) found that all the airports that had applied for the pilot program were

[13] The FAA-managed AIP provides grants to public agencies and, in rare cases to private entities, for the planning and development of public-use airports.

operating with losses, which may have impaired its access to low cost financing. Currently, the City of Chicago has applied for Midway International Airport's participation in the pilot program.

While the anticipated trend toward full-scale privatization of airport operations has certainly stalled, it does not mean that airports are shunning privatization altogether. Carney and Mew (2003) suggest that airports are developing different arrangements, such as outsourcing certain operations to private firms, such as concessions or parking, but the overall management of the airport remains in the public sector.

2.6.2 Airport Financial Management

This section provides a look at airport financial management, including the various components of airport revenue streams, typical accounting practices and how they may factor into EPA's impact analysis, and finally how estimates of net operating revenues (operating revenues less operating expenditures) may inform EPA's impacts analysis.

2.6.2.1 Funding Methods

The financial and operational relationship between airlines and airport is defined in the airport use agreement. This document specifies how the risks and responsibilities of running the airport will be shared, how rates for using facilities and services are calculated, and how frequently these rates and charges may be adjusted.

Airport financial management is fundamentally different from most other business enterprises, because many airports have traditionally used a *residual-cost* approach to finances. Under this approach, the airlines assume the financial risk of running the airport by agreeing to pay any costs of running the airport not paid by non-airside sources of revenue. This approach became the standard before deregulation and is still used by the majority of large commercial airports (Wells 1996). Since the airlines are assuming part of the risk, they often enact "majority-in-interest" clauses, which requires the airport to consult and receive approval by the airlines before undertaking capital expenditures. GAO (2001) found that majority-in-interest clauses provide dominant airlines at an airport "veto" power, in effect, over large capital projects that could increase capacity. A survey conducted in 1998, found that 84 percent of airport/airline residual use and lease agreements include a majority-in-interest clause (FAA and OST 1999).

Under the alternative *compensatory* approach, the airport assumes the financial risk; airlines pay rates set equal to their estimated cost of using the facility. Using the compensatory approach, there is no guarantee the airport will cover costs; however, the airport can keep any surplus revenue over cost and accumulate capital for future development. Only 20 percent of the airports surveyed in 1998 with a compensatory use and lease agreement had a majority-in-interest clause in their agreements (FAA and OST 1999).

Many airports use a mixed approach of residual and compensatory funding, with some rates and charges and some airline buy-in. Of the 213 weighted responses to this question from the EPA deicing survey, a smaller percentage are using a pure residual cost method than a compensatory or mixed approach as illustrated in Table 2-11.

Table 2-11. Airport Funding Methods (2004)

Funding Method	Number of Weighted Respondents	Percent of Weighted Respondents[a]
Residual	41	18.8%
Compensatory	78	35.8%
Mixed	73	33.5%
Other	21	9.6%

[a]Percentages do not add to 100 because 5 weighted respondents did not answer this question.
Source: EPA Airport Deicing Questionnaire

Determining the financial risk of an airport depends on the number of carriers it hosts; those with one primary carrier are more vulnerable to an unstable economy than those with competing airlines and diversified market shares. Airports with smaller and fewer air carriers are even more vulnerable than primary airports because their operations are more likely to be reduced in the case of an economic downturn. As a result of the downturn in air transportation after September 11, 2001, airports that host large carriers were seeing with increasing frequency a reduction in carrier hub presence and the breaking of long-term lease agreements (DOT 2003).

Recently airports have been working to become more financially stable through reducing costs to carriers and increasing their revenue. According to the U.S. DOT, they have taken part in various efforts to reach this goal by: refinancing debt at lower interest rates, redirecting passenger facility charge (PFC) revenues to reduce airline charges, reducing expenditures on non-essential operations, raising revenue by applying for reimbursement on security costs, and increasing non-airside rates. The airports have also engaged in adjusting income-sharing to increase the airlines' share and offering benefits to airlines by allowing them additional time to repay underpayments (DOT 2003).

Airport operating statements often break down the operating revenues and expenditures for key cost centers. Typical cost centers might be:

- Airfield operations (e.g., runways, taxiways, aprons).
- Terminal area concessions (e.g., food and beverage services, car rentals, specialty shops, personal services, amusements, advertising, ground transportation, hotels).
- Airline leased areas (e.g., ground equipment rentals, offices, ticket counters, cargo terminals, hangers, operations and maintenance areas).
- Other leased areas (e.g., fixed base operators (FBO), freight forwarders, government offices, businesses in airport industrial parks, equipment and cargo terminals rented by non-airline users).

Table 2-12 shows that of the 73 weighted respondents using a mixed approach, the majority (84.9 percent) use the residual-cost approach to determine airline fees for airfield operations based on the actual cost of running these areas, while a much larger percentage of airports use a compensatory approach for terminal concessions.

Table 2-12. Portions of Revenue Collection Using Residual-Cost Approach When Airport Uses Mixed Approach Overall

Method	Number of Respondents	Percent of Respondents
Airfield operations	62	84.9%
Terminal area concessions	15	20.5%
Airline leased areas	22	30.1%
Other leased areas	16	21.9%

Source: EPA Airport Deicing Questionnaire

2.6.2.2 Revenue Categories and Operating Profit

Commercial service airports are required to annually file standardized financial statements with FAA (Form F-127). This section takes a closer look at the airport operating revenues and expenditures as reported to the FAA. These statements request revenue data for the following categories:

Aeronautical Operating Revenue

- Landing fees
- Terminal/International arrival area rental or other charges
- Apron charges/tie-downs
- FBO revenue (contract or sponsor-operated)
- Cargo and hangar rentals
- Aviation fuel tax retained for airport use
- Fuel sales net profit/loss or fuel flowage fees
- Security reimbursement
- Miscellaneous
- Other

Non-aeronautical Operating Revenue

- Land and non-terminal facilities
- Terminal – food and beverage
- Terminal – retail stores
- Terminal – other
- Rental cars
- Parking
- Miscellaneous
- Other

As discussed earlier, airline payments to the airport (e.g., landing fee, terminal rentals) are often established in airport use agreements. The most common financial mechanisms include a square footage charge for rented space and a landing fee based on aircraft weight. Signatory airlines are committed to leasing airport resources for a fixed period of time.

Table 2-13 lists eight general categories of revenue generation. Large hubs generate the largest portion of their revenue from landing fees (22.7 percent) and terminal rentals (24.5 percent). As hub size decreases, the proportion of revenue generation from these two sources steadily decreases down to 10.2 percent for landing fees and 11.9 percent for terminal revenues for nonhubs. The top revenue generator for medium and small hubs is parking (25.8 and 22.9 percent of total revenue generated, respectively). Nonhubs generate the largest proportion of their total revenue from ground/land rentals (15.2 percent) and "other aviation" fees (29.4 percent). Significant proportions of the "other aviation" revenue for nonhubs comes from FBOs (5.4 percent), cargo and hangar rentals (7.8 percent), and fuel sales and flowage fees (10.2 percent). "Other aviation" fees and ground/land rentals are relatively small revenue generators for larger hubs.

Table 2-13. Airside and Non-airside Operating Revenues and as a Percent of Total Revenues

Revenue Categories	Total Revenue by Hub Size (millions)				Percent Revenue by Hub Size			
	Large	**Medium**	**Small**	**Non**	**Large**	**Medium**	**Small**	**Non**
Landing Fees	$1,865.5	$451.0	$149.0	$54.4	22.7%	19.2%	14.3%	10.2%
Terminal Rentals	$2,016.4	$511.5	$191.1	$63.5	24.5%	21.8%	18.3%	11.9%
Other Aviation	$753.7	$213.9	$130.1	$157.2	9.2%	9.1%	12.5%	29.4%
Ground/Land Rentals	$257.6	$81.3	$91.8	$81.5	3.1%	3.5%	8.8%	15.2%
In Terminal Concessions	$875.0	$159.2	$60.0	$18.8	10.6%	6.8%	5.7%	3.5%
Rental Cars	$623.8	$274.4	$151.2	$63.1	7.6%	11.7%	14.5%	11.8%
Parking	$1,318.0	$603.8	$238.9	$65.4	16.0%	25.8%	22.9%	12.2%
Other	$515.1	$49.4	$32.2	$31.3	6.3%	2.1%	3.1%	5.8%
Total	**$8,225.0**	**$2,344.5**	**$1,044.3**	**$535.1**	**100.0**	**100.0%**	**100.0**	**100.0**

Source: FAA AAS-400 CATS Report 127 by Hub Size for Year 2004

EPA further explored the revenue differences among airport hub sizes in Table 2-14. Average operating revenues at medium hubs are 23.2 percent of those at large hubs; for small and nonhubs those figures are 7.2 percent and 1.1 percent respectively. Similarly, the revenue generation by airports through landing fees is on par with operating revenues with average landing fees at medium hubs 20.0 percent of those at large hubs; for small and nonhubs those figures are 4.8 percent and 0.7 percent respectively. The difference among airport sizes is significant to this analysis in at least two ways. First, rates and charges (e.g., landing fees) tend to be a key means for airports to pass compliance costs through to airlines. Second, landing fees might also be indicative of an airport's market power when negotiating with airlines. More discussion about the ability to pass the rule's compliance costs on is found in Section 2.8.2.

Table 2-14. Average Revenues and Expenditures by Hub Size, 2002-2006

	Large Hubs	Medium Hubs	Small Hubs	Nonhubs
Airport Count	33	35	25	54
Total Operating Revenues	$259,059,243	$60,033,358	$18,778,255	$2,789,776
As Percent of Large Hub Average	--	*23.2%*	*7.2%*	*1.1%*
Landing Fees	$57,985,445	$11,600,777	$2,809,179	$387,957
As Percent of Large Hub Average	--	*20.0%*	*4.8%*	*0.7%*
Concessions Revenues	$40,486,606	$10,496,019	$3,115,883	$383,742
As Percent of Large Hub Average	--	*25.9%*	*7.7%*	*0.9%*
Parking Revenues	$42,276,451	$15,605,612	$4,825,623	$495,553
As Percent of Large Hub Average	--	*36.9%*	*11.4%*	*1.2%*
Total Operating Expenses	$165,811,794	$37,771,069	$12,321,288	$2,722,125
As Percent of Large Hub Average	--	*22.8%*	*7.4%*	*1.6%*
Net Operating Revenues	$93,247,449	$22,262,289	$6,456,967	$85,835
As Percent of Large Hub Average	**--**	***23.9%***	***6.9%***	***0.1%***

Source: EPA analysis of FAA Form 127 airport financial data. Surveyed airports only.

Finally, more than 75 percent of the airports sampled in the EPA Deicing Questionnaire indicated that they received no direct operating subsidies from state, city, or county governments in 2004.

2.6.2.3 Cost Trends

For airports, much of the direct impacts from the events of September 11, 2001 are reflected in changes in protocol and safety measures. FAA (2004b) found that airports experienced a decline in financial health due to increased security costs combined with reduced revenue from decreased air travel. These airports had substantial fixed costs that provided few options for quick reduction of operating costs. EPA conducted a literature review, but found limited information regarding the direct financial impacts on airports with the exception of changes to security procedures. Much of the literature discussed the significant impacts to the airlines, which results in an indirect effect on airports (e.g., reduced collection of landing fees and other passenger-based charges).

2.6.2.4 Capital Financing

If an airport implements enhanced deicing/anti-icing pads and other storm water environmental mitigation projects, it will likely pay for the new infrastructure as a capital expenditure. The primary capital funding sources available to airports (e.g., bonds, AIP grants, PFCs, state/local contributions) are discussed in the following subsections.

2.6.2.4.1 Airport Bonds

As publicly owned entities, airports do not access private equity markets and instead issue debt through the municipal bond market. There are four principal types of bonds generally issued by airports to fund capital expenditures (TRB 2007):

- General obligation (GO) bonds
- General airport revenue bonds (GARBs)

- PFC-backed bonds
- Special facility bonds

GO bonds have been the primary capital financing tool in recent years for the nation's smaller airports; GARBs, however, are most commonly used overall for financing airport infrastructure improvements (TRB 2007). As most of the bonds issued by airports are municipal bonds, they are usually tax-exempt for the purchasers. While many airlines have defaulted on their debt issuances, no airports have defaulted (DOT 2003, Kaps 2000). Because revenue to pay the bond debt is based on airlines serving that airport, bond investors recognize the connection between airline health and airport revenues (Schoenberger 2003).

2.6.2.4.2 AIP grants

Airport Improvement Program (AIP) grants are administered by the FAA and funded through aviation user taxes. AIP grants are not equally available to all airports; in fact, there are at least six mechanisms for granting AIP funds to airports:

- Entitlement funds
- Small airport funds
- "Set aside" funds
- State apportionments
- Non-primary apportionments
- Discretionary funds

Prior to applying for AIP grants, airports must meet the eligibility requirements. The airport must be included in the NPIAS and meet one of the following criteria:

- Publicly owned
- Privately owned but classified by FAA as a reliever airport
- Privately owned with a minimum of 2,500 annual enplanements

AIP funded projects must be directly related to the safety and construction or rehabilitation of airstrip-related areas and activities. Aesthetic improvements to the grounds, hangars, offices, parking lots, or the terminals are not eligible. For large and medium primary hub airports, AIP funds can cover up to 75 percent of costs (80 percent for noise reduction projects), and for small primary, reliever, and general aviation airports, they can cover up to 95 percent of costs.

In FAA Order 5100.38C, *Airport Improvement Program Handbook* (effective June 28, 2005) FAA includes aircraft ground deicing and anti-icing systems as eligible safety projects (FAA 2005b). Section 547(d) states:

> At commercial service airports, construction or reconstruction of aircraft deicing, anti-icing, and ice inspection facilities on the ground, including pavement, drainage, fluid collection, and environmental mitigation to reduce storm water discharge contamination, is eligible when designed in accordance with Advisory Circular 150/5300-14 [i.e., FAA design standards].

During fiscal year (FY) 2007, the FAA issued 2,022 AIP grants totaling more than $3.3 billion. EPA reviewed grants made in 2005 and 2006 for aircraft deicing containment facility construction or rehabilitation. Table 2-15 depicts those airports receiving grants specifically related to deicing containment.

Because demand for AIP grants is greater than AIP funds (GAO 2007) and airport sponsors must apply for project-specific grants, a process that is time consuming and costly, EPA does not assume airports will be able to use AIP grants to pay for projects to meet effluent guidelines.

Table 2-15. AIP Grants Awarded for Aircraft Deicing Related Projects

Airport	2005 Grant	2006 Grant
Akron-Canton Regional	$5,000,000	$5,000,000
Bandette International	$553,932	
Bangor International	$1,384,222	
Buffalo-Niagara International		$816,891
Denver International	$13,211,130	$3,450,000
Detroit Metropolitan	$2,950,000	
Kansas City International	$7,464,005	$4,463,462
Morgantown Municipal	$1,018,589	
Scott Air Force Base/Midamerica	$709,672	
Toledo Express	$746,767	$861,735
Pittsburgh International[a]		$2,663,274

[a] For the design and permitting for environmental mitigation in conjunction with existing deicing treatment plant.
Source: EPA analysis of FAA 2007d and 2008b

2.6.2.4.3 PFCs

Since the early 1990s, most of the nation's passenger service airports have been able to fund capital development projects using a passenger facility charge (PFC). Approved airports are allowed to collect PFC fees of up to $4.50[14] for every enplaned passenger. The FAA manages the program and is authorized to approve an airport's application to participate and the specific projects for which the collected money will be used. Eligible PFC-funded projects include those that:

- Enhance safety or security of the national air transportation system.
- Reduce airport noise.
- Facilitate competition between or among air carriers.

Airlines collect the PFCs when tickets are purchased and forward the funds to the airports. PFC revenues, which totaled more than $2.4 billion in 2006, can be applied to projects two ways: (1) "pay-as-you-go", in which the revenues and interest are directly spent on capital projects, or (2) leveraged to repay debt (TRB 2007). Table 2-16 provides a break down of the PFC as a percent of the total operating revenue by hub size.

[14] There have been legislative efforts recently to increase the PFC (GAO 2007).

Table 2-16. PFCs as Percent of Total Operating Revenues (2003-2006) and Total Value (2006)

FAA Hub Size	PFCs as % of Total Operating Revenues				Total Value of PFCs	% of Total PFC Revenue in 2006
	2003	2004	2005	2006	2006	
Large	17.7%	18.9%	19.4%	19.4%	$1,814,337,475	74%
Medium	15.7%	16.8%	16.5%	17.0%	$388,841,623	16%
Small	13.1%	14.6%	15.4%	15.7%	$178,209,216	7%
Nonhub	6.6%	7.1%	7.4%	7.0%	$62,144,102	3%

Source: EPA calculations on BTS Form 127 Airport Financial Data

The GAO found that large and medium hub airports participate at a higher rate than small airports for various reasons. Of the total PFC funding, large airports receive the most benefit since the fee is based on enplanements. As seen in Table 2-16, large airports received 74 percent of total PFC revenues. For the small airports, revenues from the PFCs may be too low (i.e., too few enplanements) to offset the expected costs of applying and administering the program. In an effort to combat this inequity, $0.50 of every dollar up to 50 percent of the annual revenues collected by large airports is transferred to FAA to be added to the general PFC fund. These PFCs are awarded to other commercial service airports to fund capital investment projects (FAA 2007b).

As of May 1, 2008, the FAA had approved 372 airports to collect PFCs. Of these, 280 (75 percent) were approved to collect at the maximum level of $4.50. Total approved PFC collections were approximately $62.1 billion as of May 1, 2008, although actual collected amounts are less (FAA 2008d). These data indicate that since most airports currently approved to collect PFCs are already doing so at the maximum rate, the ability of PFC revenues to cover additional increased capital expenditures (whether directly or as the revenue stream to cover bond issues) is questionable.

2.6.2.4.4 State and Local Contributions

The GAO (2007d) examined state and local government contributions to airports and found that they contribute $0.7 billion of total annual airport capital funding of $13 billion annually (or 4 percent of the total). The same GAO report also provides information on the distribution of the grant funds to various airport categories as presented in Table 2-17. A majority of the state and local funding (57 percent) is directed toward general aviation reliever airports.

Table 2-17. Distribution of State Funding

Airport Category	Percent of State Grants Received[a]
Large Hub	7%
Medium Hub	7%
Small Hub	7%
Nonhub	7%
Non-primary CS	2%
General Aviation/Reliever	57%

[a] The report does not document the distribution of the remaining 13 percent of grants.
Source: GAO (2007d)

2.6.2.4.5 Overview of Capital Funding

Annual capital expenditures by the nation's airports are substantial, and a variety of funding sources exist to cover these expenditures. The GAO estimated the source of airport capital funding as listed in Table 2-18. The report further stated that large and medium hub airports accounted for 72 percent of all capital expenditure ($9.4 billion annually). Their finding that grants and state/local contributions make up a smaller proportion of funding is consistent with EPA's survey responses.

Table 2-18. Sources of Airport Funding (2001-2005)

Funding Source	Average Funding (billion, 2006 $)	Percent of Total Funding
Airport bonds	$6.5	50%
AIP grants	$3.6	29%
PFCs	$2.2	17%
State and local contributions	$0.7	4%
Total	**$13**	**100%**

Source: GAO 2007d

For a more detailed look at this information by hub size, EPA examined the responses to its Airport Deicing Questionnaire.[15] The answers provided by surveyed airports were slightly different than what is reported in aggregate in the GAO report. Table 2-19 below provides a breakdown of weighted responses to the question of airport capital financing.

Table 2-19. Capital Expenditure Financing (2001-2005)

	Grants		"Pay As You Go" Financed By:			
Hub Size	AIP	Other	PFCs	Rates and Charges	Other	Airport Bonds
Large Hubs	13.7%	3.7%	16.2%	8.0%	18.0%	46.8%
Medium Hubs	34.4%	5.7%	18.3%	11.1%	10.9%	44.8%
Small Hubs	55.7%	2.9%	20.1%	9.5%	9.6%	20.8%
Nonhubs	70.9%	8.4%	7.2%	5.5%	21.3%	12.4%

Source: EPA's Airport Deicing Questionnaire

In EPA's survey responses, between 12 percent and 47 percent of respondents of capital expenditures were financed with bonds in the previous five years, compared with GAO's estimate of 50 percent. Airport bonds were the largest source of funds for large and medium hubs. The largest source of capital funding reported by small hubs and non hubs were grants, the majority of which were AIP grants.

As shown in Figure 2-5, the GAO (2007d) found that airport projects planned for 2007-2011 exceed past funding levels by approximately $1 billion annually. Although some of these projects are ineligible for AIP grants ($5.8 billion), a total of $8.2 billion of AIP eligible projects is larger than the historical AIP funding of the five year period 2001-2005 at $3.6 billion. Some of difference is funded by other sources, such as PFC ($2.2 billion) and airport bonds ($6.5 billion).

[15] The specific question: "Using readily available information, characterize the percentage of capital expenditures at this airport of the last five years accounted for by [the categories shown in part in the first column of Table 2-18]."

As Figure 2-6 shows, the GAO (2007d) found that average annual planned development at larger airports for 2007-2011 exceeds the average annual funding from 2001-2005 by approximately $600 million. From 2001-2005, larger airports collected an average of $9.4 billion each year while they plan to spend $10 billion each year from 2007-2011. Of the $10 billion in planned development costs, $5.7 billion (57 percent) is planned to go towards AIP ineligible projects. Funding through PFCs ($2.0 billion) and airport bonds ($5.9 billion) will help fund the majority of these development projects.

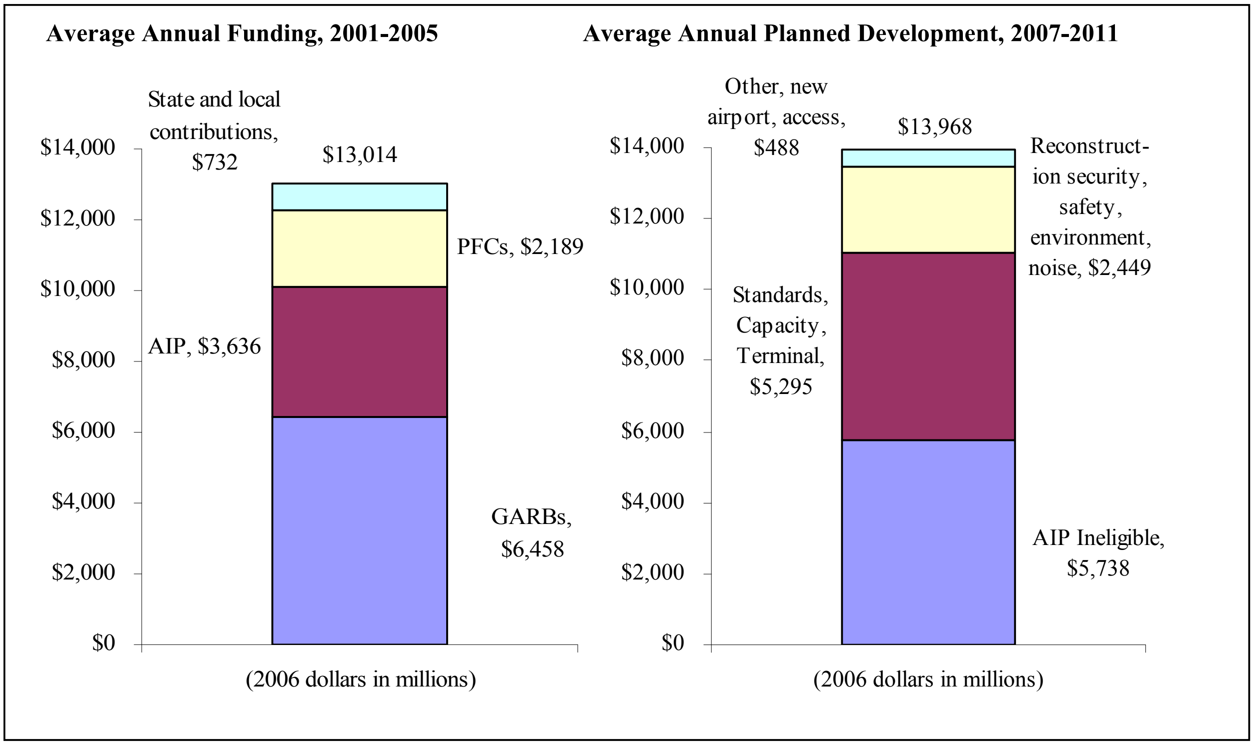

Figure 2-5. Comparison of Past Airport Funding to Future Development Costs
Source: GAO 2007d

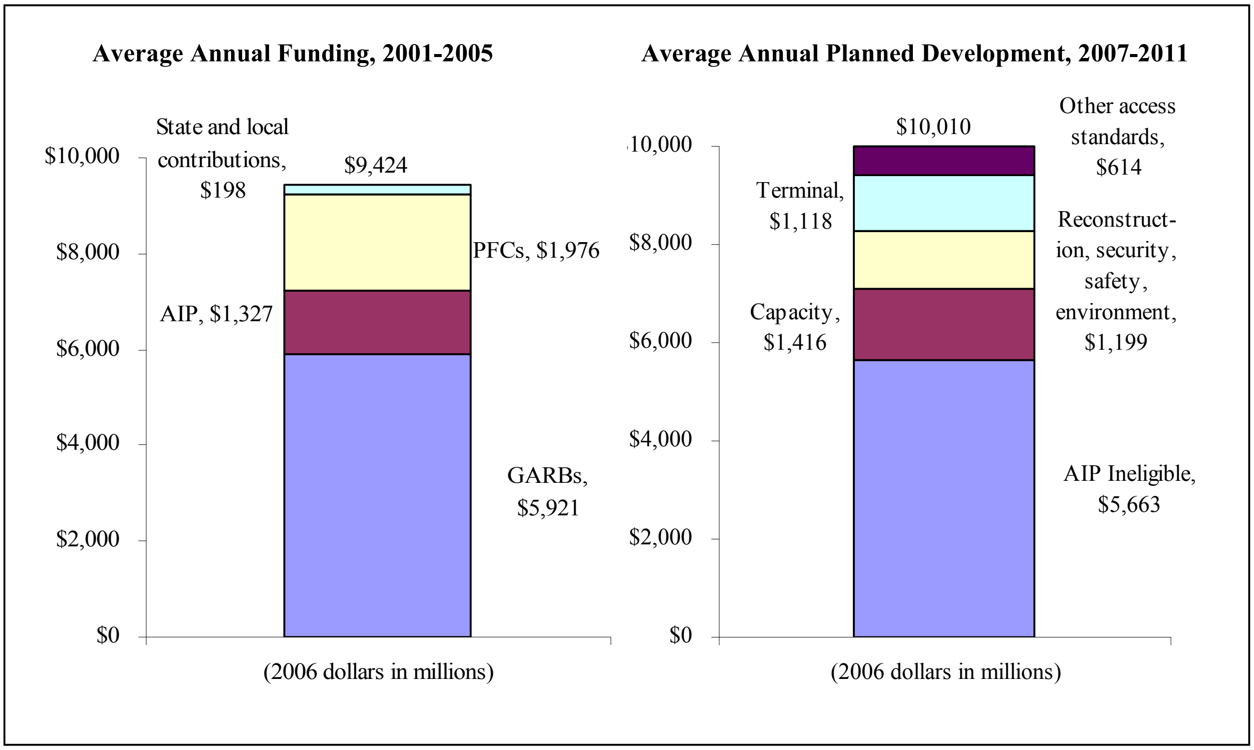

Figure 2-6. Comparison of Larger Airports' Past Funding to Future Development Costs
Source: GAO 2007d

2.6.2.5 Net Operating Revenues

The FAA reported that airports have recovered financially from the difficulties of the early 2000s (Shaffer 2007). However, they also found a direct relationship between the size of the airport (measured by passenger enplanements) and the net operating revenues of the airport. Large and medium-sized airports consistently earn positive net revenues. FAA's review found them financially stable in large part because of their ability to tap into funding sources beyond federal grants, such as GARBs and PFCs. However, it goes beyond this; the ability of large and medium-sized airports to tap into bond markets is at least partially a function of their ability to earn positive net revenues, that is, to earn revenues over and above costs that can be used to pay for the bonds.

Although small hub and nonhub primary airports have returned to the financial health levels of the late 1990s, these airports are not as financially stable as their larger counterparts. FAA found that even with the option to collect PFCs, many of these airports continue to rely on federal AIP grants for major capital improvements (Shaffer 2007).[16]

2.6.3 Airport Finance and the Economic Impact Analysis

There are a number of distinguishing features of this industry that make the analysis different from the type of analysis EPA would perform for a more traditional for-profit manufacturing industry. Almost all potentially affected airports are publicly owned and operated by local, county, or state governments, or by quasi-governmental authorities created to operate the airport. As governmental or quasi-governmental entities, airports do not earn a profit or loss in the traditional financial sense; in fact, many airports have been operated with the expectation that they will break even financially, with airline customers legally required to cover expenditures in excess of costs.

In addition, airport capacity is constrained, especially in the short run, and the demand for large capital expenditures necessary to maintain and expand U.S. airport network significantly exceeds supply. Although airports have access to federal, state, and local government grants, and PFCs, it is not clear these funds are available to meet capital expenditures associated with meeting effluent guidelines. Airports will likely have to rely on the bond market and airline rates and charges. As the preceding analysis shows, these are not equally available to all types of airports.

2.7 Airline Financial Management

2.7.1 Historical Overview of Airline Profitability

The year 2006 represented the first profitable year for the airline industry since 2000. Increased revenues were attributed to "solid growth in passenger, cargo and ancillary revenues, and against a backdrop of 3.3 percent growth in real U.S. gross domestic product (GDP)" (ATA 2007b). Passenger revenues in 2006 were 0.75 percent of U.S. GDP, still well below the pre-September 11, 2001, share of 0.95 percent (ATA 2007b). While revenues increased in 2006, so did operational expenses. The increase in operational expenses of 3.6 percent is largely attributed to higher fuel prices (which is discussed in Section 2.7.2.4).

Following September 11, 2001, major airlines cut the number of flights by 20 percent or more, and one carrier ceased operations entirely (GAO 2001). As a result of decreased airline traffic, many airlines grounded part of their existing fleet and delayed delivery of new aircraft that had been on order (FAA 2007). The largest effect on airlines following September 11, 2001, was an increase in operating costs. This increase occurred for several reasons:

- Unit costs increased due to lower aircraft utilization, brought about by schedule reductions.
- Increased security requirements and associated delays decreased airline productivity.
- Both aircraft insurance and liability insurance costs increased substantially.

In addition to the costs above, airlines were also faced with the implementation of the Aviation Security Infrastructure Fee (ASIF) to cover Transportation Security Administration screening costs (Belobaba 2005). The fee is directly passed to passengers at an amount of $2.50 added to the fare for the first two legs of a flight in each direction (TSA 2004) (i.e., a maximum charge of $10 roundtrip).

[16] This may be related to the variance in year-to-year passenger enplanements at these airports. Passenger enplanements at smaller airports appears to vary more (relative to their average) than at larger airports. Thus, the stream of revenues from PFCs may be too uncertain to be used to guarantee sufficient backing for a bond issue.

In 2003, the airline industry suffered another sharp decrease in demand for flights, particularly to the Asian market, due to the SARS crisis. Since SARS is spread through inhalation of airborne droplets, primarily in areas of close contact with many people, it was of particular concern to airlines and airline passengers. United Airlines saw scheduled revenue passenger miles decrease by about 6 percent in March, 2003 compared with one year earlier; the airline's passenger load factor declined from 78 percent in March 2002 to 74 percent in March 2003. US Airways also saw declines in revenue passenger miles (down 16 percent in March 2003 over March 2002) (Gola 2003).

Between 2001 and 2005, the airline industry incurred operating losses of nearly $28 billion (GAO 2006). Table 2-20 lists various financial statistics for domestic operations only, by airline type over the five-year period from 2002 through 2006. The majority of airlines posted negative operating profit and net income.[17] On average, only national, commuter and domestic cargo carriers earned positive operating profits and only regional and domestic cargo carriers posted average positive net income from 2002 to 2006.

Table 2-20. Five-Year Average Financials for Domestic Operations by Airline Type (2002-2006)

Airline Type	Five-Year (2002-2006) Average Financials (in thousands)			
	Operating Revenue	Operating Expenses	Operating Profit	Net Income
Major Carrier	$6,188,971	$6,404,253	-$215,282	-$622,568
National Carrier	$416,058	$398,878	$17,180	-$13,490
Regional Carrier	$46,735	$47,228	-$493	$82
Medium Regional Carrier	$12,968	$15,042	-$2,074	-$2,603
Commuter Carrier	$31,488	$26,916	$4,571	-$2,969
Small Certified Carrier	$4,981	$5,066	-$85	-$163
Domestic Only All Cargo	$544,950	$528,641	$16,310	$24,073

Source: BTS Air Carrier Financial Reports (Form 41), Schedules P-11 and P-12.

By 2006, however, there were gains in all operating revenue categories, with the exception of the charter market. Table 2-21 presents summary financial statistics for U.S. airlines, 2005-2006. Both operating and net profit margins improved, with net profit becoming positive. Particularly important to the industry are that the unit measurements of revenue per passenger mile (RPM), revenue per available seat mile (ASM), and revenue per cargo ton mile all increased significantly, with gains of 5.7, 7.9, and 4.6 percent respectively.

[17] Operating profit represents the profit (loss) from air transportation-related activities only and does not include non-operating income (expenses), nonrecurring items or income taxes. Net income represents the total profit (loss) and includes operating profit (loss), non-operating income (expenses), nonrecurring items and income taxes.

Table 2-21. Financial Highlights of the Airline Industry (U.S. Airlines, scheduled service, in millions except as noted)

	2005	2006	Change (%)
Operating Revenues	$151,255	$163,824	8.3
Passenger[a]	93,500	101,208	8.2
Cargo[a]	20,704	22,544	8.9
Charter	6,074	5,562	-8.4
Other	30,976	34,510	11.4
Operating Expenses	150,828	156,279	3.6
Operating Profit (Loss)	427	7,545	1,668.1
Net Profit (Loss) [b]	-$5,782	$3,045	-
Revenue per Passenger-Mile (¢/RPM)[a]	12.00	12.69	5.7
Revenue per Seat-Miles (¢/ASM)[a]	9.32	10.06	7.9
Revenue per Cargo Ton-Mile (¢/RTM)[a]	73.58	76.99	4.6
Operating Profit Margin (%)	0.3	4.6	4.3 pts.
Net Profit Margin (%)	-3.8	1.9	5.7 pts.

[a] Scheduled service only.
[b] Excludes bankruptcy-related charges (reorganization expenses and fresh-start accounting gains).
Source: ATA 2007b

Table 2-22 highlights overall changes in domestic operating profit and net income for large certificated air carriers by type between 2002 and 2006. Although five-year average operating profits were negative (see Table 2-20), most air carriers experienced growth in operating profit; only medium regional and small certified carriers showed declining operating profit. Changes in net income from 2002 to 2006 were more mixed; major, national, commuter and domestic cargo carriers posted improved net income (although net income was still negative for major and national airlines), while regional, medium regional and small certified carriers showed declining net income.

Despite the improved 2006 financial picture, in 2007, the Air Transport Association (ATA) reported that because of the industry's high level of debt, airlines will continue to be extremely vulnerable to market fluctuations, such as fuel prices and economic recession. During 2006, the higher jet fuel prices are estimated to have added $8.9 billion to the industry's operating costs, virtually negating any cost saving efforts that carriers made in reducing non-fuel related expenses during the year (Heimlich 2007).

Table 2-22. Changes in Domestic Operating Profit and Net Income, 2002 to 2006

Airline Type	Operating Profit (in thousands)			Net Income (in thousands)		
	2002	2006	Change	2002	2006	Change
Major Carrier	-$574,711	$239,115	$813,827	-$696,493	-$320,645	$375,847
National Carrier	$1,747	$23,074	$21,328	-$7,572	-$4,041	$3,532
Regional Carrier	-$1,959	$1,340	$3,299	$1,645	$205	-$1,440
Medium Regional Carrier	-$1,199	-$8,426	-$7,227	-$2,361	-$9,083	-$6,722
Commuter Carrier	-$9,173	$0	$9,173	-$35,761	$0	$35,761
Small Certified Carrier	$0	-$423	-$423	$0	-$815	-$815
Domestic Only All Cargo	$0	$42,785	$42,785	$0	$90,054	$90,054

Source: BTS Air Carrier Financial Reports (Form 41), Schedules P-11 and P-12.

2.7.2 Factors in Airline Profitability

2.7.2.1 Industry Characteristics Affecting Profitability

Air transport is an intermediate product; that is, it is a product consumed so that another good (e.g., business meeting, leisure travel) can be obtained. Thus, the demand for air transport services is dependent on demand for the underlying product (Holloway 2003). As an intermediate good, the airline industry exhibits fixed capacity, sells a perishable product, and faces demand levels that vary both predictably and stochastically (Borenstein and Rose, 2007).

While the industry itself has been deregulated, the majority of the infrastructure for air transportation remains controlled by the government (Borenstein and Rose, 2007). Holloway (2003) believes this creates an unusual dynamic between the publicly controlled airspace and airports and privately controlled airlines. Holloway (2003) found air transport demand is:

- Heavily influenced by output supply.
- Prone to market fluctuation impacts in the long run.
- Subject to imbalances in volume or timing of traffic flows.

Holloway (2003) suggested that approximately 80 percent of a scheduled carrier's costs can be considered fixed in the short run. This translates into airlines not being able to quickly adjust to market changes. Indeed, airline profits have exhibited greater fluctuations since deregulation, but Borenstein and Rose (2007) believe this is due to both price inflation and the size of the industry. The observed fluctuations in net income, however, are no more severe than during regulation. The volatility inherent in the airline industry may be largely explained by two factors (Borenstein and Rose 2007; Morrison and Winston 1995):

- Fundamentals of the industry: quick and dramatic fluctuations in profit are driven by highly volatile demand, high levels of fixed costs, and slow adjustment of supply;

- Strategic errors: changes in airline capacity can take years to implement (e.g., new aircraft orders, expansion of airport facilities), thus the industry relies heavily on economic forecasts, which means that their most important business decisions are based on the imperfect science of economic forecasting done by each airline individually.

2.7.2.2 Factors Controlled by the Airlines

Many factors within the airline's control can affect profits. The major determinants of profitability are:

- Operating costs (e.g., employee compensation, fuel prices, maintenance expenses)
- Fares
- Network and operating characteristics
- Managerial characteristics

Operating costs have an inverse relationship to profits. An airline trade group, ATA publishes a quarterly airline cost index based on the data provided to U.S. DOT on Form 41. As illustrated in Figure 2-7, the highest percent of operating costs are labor and fuel, based on the most recent data available (ATA 2007b).

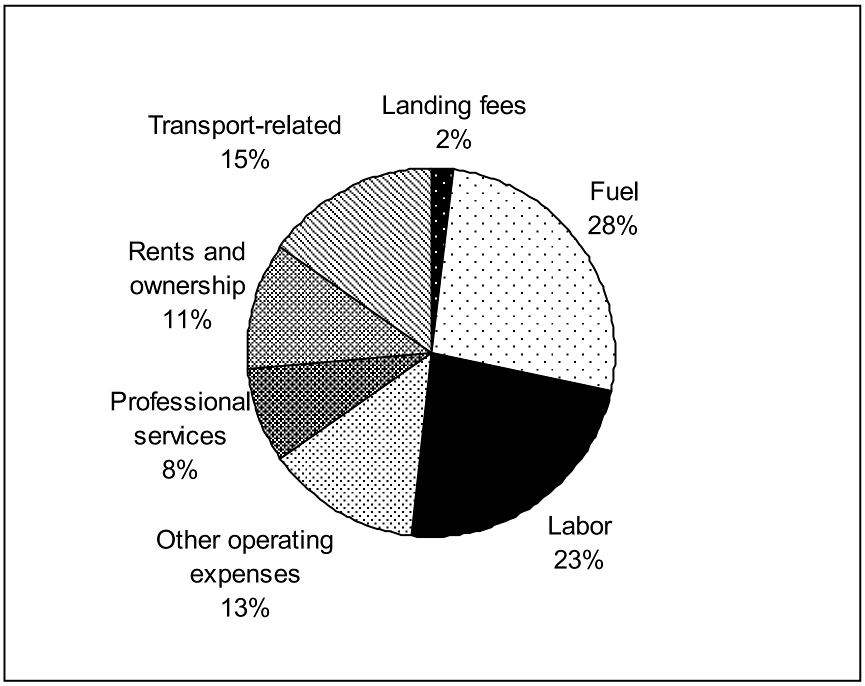

Figure 2-7. Airline Operating Costs as Percentage of Total (2007)
Source: EPA analysis of ATA 2007b.

2.7.2.3 Labor Costs

Unions represent at least part of the labor force at all major U.S. airlines (GAO 2003). Contracts between airlines and their unionized employees are conducted in accordance with the requirements of the Railway Labor Act of 1936. Airline labor contracts do not expire, but instead have a date upon which parties can request revised terms for a new contract. Labor costs accounted for over 40 percent of the unit cost difference between legacy airlines and low cost airlines in 2003 (GAO 2004). Legacy airlines' high labor costs are the result of a more senior workforce, higher pension costs, and work rules that differ from their low-cost carriers. Union contracts can also make it more difficult for airlines to adjust labor costs to changing market conditions. Legacy airlines that file for bankruptcy have been renegotiating union contracts to reduce labor cost. Even with its younger staff and lower pay, labor costs are still a significant portion of the low-cost carriers' operating expenses.

2.7.2.4 Fuel Costs

The U.S. airline industry consumes approximately 19.5 billion gallons of jet fuel per year (ATA 2008a). Fuel now exists as the largest contributor to airline costs, surpassing labor for the first time in 2006 (Heimlich 2007). As of May 2008, the ATA reported that almost 40 percent of the price of an airline ticket goes to pay for fuel costs, as opposed to roughly 15 percent in 2000 (Maxon 2008). In terms of the reduction in fuel related costs, efforts have been made to reduce consumption across the commercial side of the industry with a 1.9 percent decrease in consumption from 2005 to 2006. Airlines have been cutting costs through reduction of plane weight and drag. For example, airlines have reduced reserve fuel carried by aircraft to reduce weight. Cutting heavy items from plane interiors, such as beverage carts, seats, ovens, and extra potable water, has proven to save thousands of gallons of fuel annually (Heimlich 2007).

In FAA's forecast of air transportation (2007), they found that if the price of oil increased to more than $100 per barrel, then the industry will experience major disruptions likely resulting in less capacity and passenger demand, along with reduced market competition. In February 2008, Merrill Lynch, a global financial management and advisory company, projected that if oil was available at $75 per barrel, then all 12 airlines analyzed would have a profitable year (Reed 2008). The company further suggested that oil priced at $95 per barrel, would result in only five profitable airlines and a total industry loss of $322 million. At $110 per barrel, only two airlines would be profitable and industry losses would be $3.3 billion. The Energy Information Administration stated that in 2007, the average price for oil was $72 per barrel in 2007 and their June 10, 2008 short-term forecast projected an average of $122 per barrel in 2008 and $126 per barrel in 2009 (EIA 2008).[18]

2.7.2.5 Landing Fees

In the third quarter of 2007 landing fees composed 1.9 percent ($653 million of $33.9 billion) of operating costs, and since 1990, landing fees have composed of between 1.8 and 2.4 percent of operating costs (ATA 2008a). Absolute costs have increased at a slow but steady rate increase from $1.25 billion in 1990 to $2.51 billion in 2006.

An FAA rule issued in 1996 set some guidelines for the structuring of landing fees (FAA 1996). Airports had traditionally structured many of their landing fees based on weight of the aircraft, and the 1996 rule did nothing to alter that. However, it did require that all landing fees must be offset by costs of completed construction projects (not future or current projects) to avoid large revenue accumulation based on the landing fees. The rule also allowed for a "peak pricing" system (as long as it is not discriminatory) in which congested airports could charge carriers higher landing fees at the busiest times.

There is a growing move to use "peak pricing" to encourage airport customers to use alternative airports, alter their flight schedules, or fly larger aircraft (GAO 2001). A proposed FAA rule issued in January 2008 (FAA 2008c) clarifies that airports did have the authority "to establish a two-part landing fee structure consisting of both an operation charge and a weight-based charge, in lieu of the standard weight-based charge." Additionally, the proposed rule allows airport managers the ability to offset a proportion of the landing fees with current (in addition to already constructed) construction projects, and the ability to offset their revenue from landing fees with construction costs of any other underutilized airports they may own.

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[18] Prediction based on West Texas Intermediate crude oil market, which is slightly higher quality crude oil than the OPEC basket (but typically no more than $2 per barrel higher). The price of jet fuel is primarily based on the underlying price of crude oil (with additional costs imputed from the jet fuel crack spread), so as crude prices rise, so do jet fuel prices (Heimlich 2006).

In EPA's airport questionnaire, EPA asked airports to identify the landing fees for commercial air carriers for 2004. Table 2-23 lists the weighted average of the responses according to hub size across five categories. A signatory airline is an air carrier that has signed a long term commitment with the airport. As shown in Table 2-23, signatory airlines often are provided with a reduced landing fee as a benefit of the agreement.[19] EPA found that landing fees for the nonhubs airports are much higher than the other hub sizes.

Table 2-23. Landing Fees by Hub ($/1000 lb landed weight)

Hub Size	Passenger Air Carrier Signatory	Passenger Air Carrier Non-Signatory	Cargo Air Carrier Signatory	Cargo Air Carrier Non-Signatory	Commuter/ Small Commercial Airlines
Large	2.30	2.61	2.31	2.65	2.66
Medium	1.80	2.27	1.89	2.25	2.00
Small	2.34	3.09	2.43	2.80	2.24
Nonhub	4.25	5.19	3.86	4.94	4.16

Source: EPA Deicing Questionnaire

EPA anticipates that airport costs associated with the deicing effluent guideline may be passed through to the airlines in the form of higher landing fees.

2.7.3 Industry Concentration

Despite many of the legacy air carriers ceasing operations in the years following deregulation, the largest carriers have retained market dominance. In 2005, with a combined market share of 66 percent, 9 of the original 23 legacy carriers continue to serve the U.S. market (Borenstein and Rose 2007). Since 2005, and the success of the US Airways and America West merger, there are continued rumors about proposed legacy airline mergers due to overcapacity (Bailey 2006; Blanton 2008). In theory, these mergers would consolidate overlapping operations on routes and airports, along with corporate overhead, in order to reduce operating costs. The decline in the number of traditional carriers through bankruptcy or merger has raised concerns among some observers that increasing market concentration might provide surviving airlines with market power.

2.7.3.1 Market Power

Economists typically measure industry competitiveness by market share accounted by the largest four or eight largest companies or an index such as Herfindahl that measures the number of "effective competitors." Using such measures, the competitiveness of the airline industry has declined since deregulation due to mergers. However, airlines do not really compete at the national level, but at the route level. As Morrison and Winston (1995) pointed out:

> Four effective competitors at the national level can operate in two very different ways: with each having a monopoly share on one-quarter of the routes or each having a one-quarter share on all routes. Although the number of airlines is the same either way, the second situation is obviously more competitive because more airlines serve each route. Thus fewer effective

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[19] The 1996 FAA rule mentioned above (FAA 1996) states that it is not considered a discriminatory process to charge different rates for signatory and non-signatory airlines, "The prohibition on unjust discrimination does not prevent an airport proprietor from making reasonable distinctions among aeronautical users (such as signatory and non-signatory carriers) and assessing higher fees on certain categories of aeronautical users based on those distinctions (such as higher fees for non-signatory carriers, as compared to signatory carriers)."

competitors at the national level does not necessarily mean that the industry is less competitive.

Entry into a given route market is determined by existing competition on the route and how the route has been integrated into both the entering carrier's and existing carriers' networks (Morrison and Winston 1995). Carriers are discouraged from entering a new route market if one of their competitors has a hub at either the origin or destination of that route (Morrison and Winston 1995), therefore, reducing competition on certain routes.

Many airline markets tend to exhibit oligopolistic behavior in that price changes initiated by any one of the small number of competitors on a route are likely to bring a reaction in pricing by the other carriers (Holloway 2003). This aspect of air carrier behavior has been readily observable in the last two or three years as airlines struggle to cover increasing fuel costs. A carrier might announce a fare increase, then watch to see if competitors follow the increase; if not, the initiating airline often quietly reduces its fares to their previous level a few days later (see, for example: Grant, 2008; IHT, 2007; Reuters, 2007).

Holloway (2003) also noted that additional airline costs can feed into passenger fares through changes in total fares (after all taxes and fees) even though base fares (advertised fares) might remain constant. An example of this strategy is fuel surcharges after oil price spikes; the addition of a fuel surcharge increases the total passenger fare. Thus airlines are able to increase revenues by increasing the total amount paid for a ticket without actually increasing base fares.

In light of the unprecedented increases in jet fuel costs in 2008, airlines have increasingly made use of surcharges to generate additional revenues without raising base fares. These include: fuel surcharges, fees for checking a pet on board, making a phone reservation, checking a second piece of luggage, snacks and meals, and the opportunity to select a window or aisle seat (Chen and Prada 2008; Hamman, 2008). American Airlines has even added a new charge for checking the first piece of luggage; other airlines have not made this move yet, but are considering it for the near future (Chen and Prada 2008).

In a 2005 report, GAO found that since 2000, the airline industry's excess capacity has greatly diminished their pricing power. Profitability, therefore, depends on which airlines can most effectively compete on cost, which relates back to the increased market share of low-cost carriers. With the changing landscape of the airline industry, it suggests any legacy carrier exiting the industry would be replaced by a new low-cost entrant, thus resulting in an overall lowering of fares. On the other hand, the exit of the major low-cost carrier in the nation, Southwest Airlines, while it would affect a small percentage of overall passenger traffic, would send overall fares upward (Morrison and Winston 1995).

2.7.3.2 Barriers to Exit

Bankruptcy has been a common occurrence in the U.S. airline industry. Borenstein and Rose (2007) report that five of the top seven U.S. airlines (each having at least five percent of domestic market share) have filed for Chapter 11 bankruptcy at least once. These airlines are Continental, US Airways, Delta, United, and Northwest; all except Continental have filed for Chapter 11 since September 11, 2001 (ATA 2008b). The only two top-tier airlines that have yet to declare bankruptcy are American and Southwest (Borenstein and Rose 2007).

Chapter 11 bankruptcy allows a company to continue to operate while the company is protected from its creditors and allowed to reorganize in an attempt to once again become a financially viable company after its fresh start. Reorganization typically involves renegotiation of contractual (including union) and debt obligations; creditors and others, such as a unionized labor force, have incentive to agree to reorganization in the hopes that the reorganized company will be worth more than they would receive if the company was shut down and its assets sold to repay creditors.

Many in the airline industry have argued that continued operation of insolvent airlines is at least partially responsible for the financial instability of the industry as a whole (e.g., Crandall 1995, Kaps 2000, Holloway 2003). The primary issue here is that Chapter 11 bankruptcy provisions act as a “barrier to exit,” allowing otherwise financially nonviable airlines to remain in operation to the detriment of the industry as a whole.

The issue can largely be traced to the economics of operating an industry with high fixed costs (e.g., aircraft ownership and/or leases, infrastructure) and low marginal cost. Given that an airline is already committed to undertaking a flight from one city to another, the marginal—or incremental cost of filling an empty seat on that aircraft is relatively low (primarily the incremental fuel burn). This creates incentive for airlines to reduce prices; as long as the ticket price exceeds marginal cost, the airline will make more money—or lose less money—by filling that seat even if the ticket does not cover the allocated full costs of providing that flight. This is exacerbated by the perishable nature of the product—the potential revenue represented by an empty seat on flight can never be recovered by selling it at a later date.

Crandall (1995) aggressively states the case for the problems caused by a bankrupt airline remaining in operation. Airlines operating under bankruptcy protection are able to operate at artificially low cost due to restructured debt, renegotiated labor contracts, and other reduced obligations. Thus such airlines receive a cost advantage over other airlines, and are able to offer even lower fares. Non-bankrupt airlines are faced with an unpalatable choice between matching the lower fares, which are probably below that airline’s full costs, or maintaining fares that will cover costs but lose passengers. As discussed in the previous paragraph, their incentive would be to follow the competition and reduce fares as well. Crandall concludes that bankruptcy protection has resulted in ruinous fare wars, huge losses, high debt-to-equity ratios, and low-grade investment securities for U.S. airlines.

Not all agree with this doomsday assessment of airline bankruptcy. According to Borenstein and Rose (2007), very little happens to the market when a large player files for bankruptcy. Typically, an airline will reduce fares immediately prior to filing bankruptcy. Competitors with healthier financial outlooks, however, do not tend to follow suit with the price decrease and therefore the fare decrease is usually temporary. Despite there being a lot of media attention paid to airline bankruptcy filings, it appears that there is little impact on competitors or consumers (Borenstein and Rose 2007).

Crandall’s discussion of the implications of barriers to exit and bankruptcy on the industry intuitively makes sense. However, one can take the same logic that appears to be inherent in the nature of the airline industry and argue that the problem of bankruptcy protection might be overstated. The incentive to fill aircraft seats even at fares below fully allocated cost exists whether the carrier is bankrupt or not. Because aircraft seats are a perishable product and the marginal cost of filling those seats is low, there will always tend to be downward pressure on air fares as long as the market is competitive.

Furthermore, the value of an airline, even if bankrupt, is far greater than the value of its components: “the value of an airline’s assets—individual aircraft, buildings, ground leases, etc.--is substantially less than the stream of cash flow which can be produced by using those assets in concert” (Crandall 1995). Thus, whether an airline is protected by the courts or not, there are strong incentives for creditors (and employees) to reach agreement to keep a vulnerable airline in operation.

Finally, Crandall points out that renegotiated labor contracts give bankrupt airlines lower labor costs than the non-bankrupt competition. However, since deregulation, the industry has seen a stream of low cost start-ups, of which a majority do not have union labor, and all of which have lower labor costs (e.g., they do not have pilots, mechanics, and other employees with 20 or more years of seniority because the airline hasn't been in existence that long). Thus, low labor cost competition is not resulting solely from bankrupt airlines.

In conclusion, the economics of the industry appear to be such that there is inherently downward pressure on prices. With high fixed costs and low marginal costs, this provides incentive for airlines to offer fares below fully allocated costs. Because many of an airline's costs may be associated with aircraft leases and other long term financial commitments, there are incentives for those airlines to remain in operation for long periods of time even if they cannot meet their full costs. Thus, although the importance of Chapter 11 bankruptcy provisions might be overstated in the financial performance of the industry, the underlying economic fundamentals suggest there are inherent factors in operation that will always make the airline industry a difficult financial environment.

2.8 Airport-Airline Interactions

2.8.1 Effect of Airline Bankruptcies on Airports

With financial instability being an inherent trait of the airline industry, it bears mentioning the impact such instability has on airports. Borenstein and Rose (2007) found that while carriers do tend to reduce service levels during bankruptcy, there are always other airlines willing to meet market demand. They also found that in both small and large airports there is no statistically significant service effect when a carrier at those airports declares bankruptcy. There is a small statistically significant effect at medium airports, but "total service to the airport declines by less than half the number of flights that the filing carrier offered before bankruptcy" (Borenstein and Rose, 2007:19).

2.8.2 Airport-Airline Cost Pass-Through Analysis

The ability of a supplier to pass through costs to the purchaser depends on the fundamentals of supply and demand. The demand for aircraft deicing services–as well as the demand for airport services in general–is derived from consumers' demand to travel from one place to another or to ship their cargo from one place to another. In short, it is due to consumers' demand for air transportation that airlines demand services from airports, such as landing slots and access to the terminal, apron, and hanger space necessary to support their flight operations. Determining cost pass-through for deicing services thus involves not one, but two pass-throughs: from airport to airline and from airline to passenger.

In perfectly competitive markets–with many small sellers and many small purchasers–the relative price elasticities of supply and demand essentially determine cost pass-through. However, neither the market for airport services nor the market for airline services can be described as perfectly competitive. Both airports and airlines appear to have some ability to set prices, although this pricing power probably varies with the type and location of the airport, and the size, type, and route structure of the airline. In the air transportation industry, although cost pass-through might depend on market fundamentals in the long run, in the short run it is subject to negotiation. Section 2.8.2.1 and Section 2.8.2.2 describe some of the attributes that affect the determination of cost pass-through between airports and airlines and between airlines and customers, respectively.

2.8.2.1 Airports to Airlines

Historically, it has been something of a truism that all airport costs are eventually paid for by airlines and airline customers. Airlines pay for airport operating costs through rates and charges. They also pay for airport capital expansion either through aviation user taxes that formed the basis for AIP grants or by providing the revenue stream to finance bond issues. These costs are then generally passed on to their customers. In addition, airline passengers directly pay for airport costs through the airport revenue streams from concessions, parking, and car rentals. In addition, much capital expenditure is now funded through PFCs (which are added to ticket prices).[20] Although these recent trends have modified airport finance, the overall impression is still that in the long-run, a large percentage of airport costs are passed through to airlines and airline passengers in the form of increased fees. However, in the short-run, cost pass-through (CPT) from airports to airlines might be significantly smaller than 100 percent.

Although sparse, and more suggestive than definitive, available literature indicates that airports are able to pass on costs to airlines. But there is a delicate balance to maintain, especially in the short run:

> "A major consideration to be made by airport personnel at airline-served airports in forecasting their projected revenues is that of how to charge the airport's major tenants, the airlines. Because such charges impact heavily on the airport's revenue stream, it is important to be fair to the tenants as well as to gain sufficient revenue to operate the airport and make related major purchases" (Kaps 2000).

An analysis by the DOT supports this claim. DOT examined how the severe airline financial distress following September 11, 2001, affected airports and looked at actions taken by airports to ensure their own financial viability. Among the actions taken were the following:

> "Reducing or refunding the effective rates that air carriers pay for airport facilities by suspending or reducing airline rates and charges, under-recovering certain costs allowable under airline agreements, contributing discretionary cash flow to reduce airline charges, adjusting the income-sharing formula to enlarge the airline share, offering airlines additional time to repay any underpayments of prior rates and charges, and consolidating unspent construction fund amounts to refund airlines" (DOT 2003).

This indicates that the reality of the airlines' financial situation impeded pass-through of airport capital expenditures to airlines.

In addition, the ability of airports to increase fees is dependent on the nature of the particular airport and its relationship with the tenant airline(s). For example, airports with only one major airline are more financially vulnerable and may be less willing to pass on capital costs to the airline if the airline is in financial distress. Also, secondary airports are more vulnerable than primary airports because the services at secondary airports are more readily suspended during times of financial difficulty for the airlines. Increased competition at airports will lessen the likelihood that an airport will be dominated by a single airline in the future (DOT 2003). In addition, airports compete among themselves to attract and retain airline tenants by creating favorable working environments for the airlines. Anecdotally, some airports in relatively close proximity to other significant airports have indicated to EPA that they are reluctant to increase airline rates and charges for fear of losing traffic to competitors.

The DOT report also finds that airports turn to alternative revenue sources when trying to reduce costs on airlines. Such alternatives may include altering staffing levels and benefits, reducing non-essential business operations expenditures, and increasing parking rates. In strong financial markets when interest rates are low, airports may also seek to refinance their outstanding debt, redirect PFC revenues to pay for outstanding debt and/or reduce some airline rates and charges (DOT 2003).

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[20] To the extent that PFCs increase the cost of air transportation, and therefore decrease the quantity of air transportation purchased by consumer, airlines indirectly pay some cost of PFCs in the form of forgone revenues (see Section 2.8.2.2).

In summary, the impression from analyzing the industry and its financial and market structure and reviewing the literature, is that most airport costs, both capital and operating, will eventually be passed through to airlines and/or their customers. However, this represents a long-run trend. In the short-run, airports might face significant resistance to increased costs, especially when the airlines are in financial distress. The years since the events of September 11, 2001, have largely been a period of financial distress for airlines. As the price of oil continues to rise, it is not clear how much this financial stress on airlines has eased. Thus, while costs might conceptually be passed through, it is not clear how much scope is available for cost pass-through at this point in time.

Finally, cost pass-through from airports to airlines cannot be discussed without consideration of the complexity of the airport sector. Airports vary considerably not only in their ability to pass through costs, but their need to pass through costs as well. These differences appear to be systematically related to airport size. Large airports have significant financial resources on which to draw, both from ability to accumulate operating surpluses as well as their access to various capital funding programs. Smaller airports have much more limited financial resources. It is difficult for them to generate operating surpluses, and they appear to be much more dependent on various grant programs to fund capital projects. These two issues: financial resources generated through operations, and through participation in government programs, are discussed in detail in the following two sections.

2.8.2.1.1 Review of Operational and Financial Characteristics of Airports

If an airport is constrained in its ability to pass through costs to airlines, then its ability to implement a regulatory option will largely be a function of its financial resources in the absence of significant additional revenues. These resources include the ability of an airport to access capital markets to fund the initial capital expenditure; if costs can be passed through, capital markets should be easier to access since a revenue stream is available to fund the incurred debt.

The potential for airports to pass through costs to airlines is at least partially a function of the financial resources the airport can call upon. The difference in the scale of operations, and hence their access to financial resources is significant. Table 2-24 compares average operational data by airport hub size. The implications of this table are clear; even medium hub airports, the second largest category of airports after large hubs, operate at a fraction of the scale at which large hubs operate:

- Average departures at a medium hub are less than 30 percent and enplanements are less than 24 percent of the average large hub figure.
- For small hubs, departures are less than 12 percent and enplanements less than 7 percent of the average large hub figure.
- For nonhubs, departures are less than 4 percent and enplanements less than 1 percent of the average large hub figure.

Table 2-24. Average Departures and Enplanements by Hub Size, 2002-2006

	Large Hubs	Medium Hubs	Small Hubs	Nonhubs
Airport Count	33	35	25	54
Departures	190,093	56,313	21,849	6,244
As Percent of Large Hub Average	--	29.6%	11.5%	3.3%
Enplanements	15,285,072	3,589,355	1,023,525	118,173
As Percent of Large Hub Average	--	23.5%	6.7%	0.8%

Source: EPA analysis of BTS T-100 airport operations data. Surveyed airports only.

The consequences of the difference in operational scale are reflected in average airport revenues and expenditures. Average operating revenues at medium hubs are 23.2 percent of those at large hubs; for small and nonhubs those figures are 7.2 percent and 1.1 percent respectively (see Table 2-15, Section 2.6.2.).

The differences between airport size classes in landing fees are significant in at least two ways. First, rates and charges (e.g., landing fees) tend to be a key means for airports to pass-through compliance costs to airlines. Second, landing fees might also be indicative of an airport's market power when negotiating with airlines.

- Average landing fees at medium hubs are 20.0 percent of those at large hubs; for small and nonhubs those figures are 4.8 percent and 0.7 percent respectively.

- Landing fees at these airports are smaller relative to large hub landing fees than are departures; for example, medium hub departures are 29.6 percent of those at large hubs but landing fees are only 20.0 percent of those at large hubs. This most likely reflects the weaker passenger demand at these airports in two ways:

    - Airlines tend to fly smaller aircraft into smaller airports (e.g., regional jets rather than Boeing 737s), and
    - Airlines may be more willing to reduce or withdraw services at these airports if fees become too large, thus constraining an airport's ability to raise fees.

In addition, airports are often able to accumulate reserves for capital expenditure programs through concession and parking revenues, which are also related to the scale of passenger service at the airport. Table 2-14 also shows that revenues from these sources are relatively small at smaller airports, particularly nonhubs. These revenue sources can be particularly valuable to an airport because airlines have less influence on rate setting for concessionaires and how those revenues will be used than they do over landing fees and terminal and gate rents.

Finally, capital expenditures can be funded out of net operating revenues. To the extent that operating revenues exceed operating expenditures, airports can accumulate the difference in its capital accounts. EPA compared operating revenues with operating expenses by airport type over five years to determine airports' ability to accumulate reserves for capital projects out of operating surpluses. These results are presented in Table 2-25. Large, medium and small hub airports appear to have the ability to accumulate reserves. Nonhub airports, however, spend more than they take in from operating revenues, meaning they may have to find alternative funding sources just to finance their day-to-day operations. It appears clear that nonhubs do not have significant internal financial resources to draw on to support capital projects.

Furthermore, this limits their access to bond markets, as GARBs typically require that net revenues exceed annual debt service by at least 25 percent.

Table 2-25. Ratio of Airport Operating Expense to Revenues, 5-Year Average (2002-2006)

FAA Classification	Ratio of Operating Expenses to Operating Revenues
Large Hubs	0.65
Medium Hubs	0.64
Small Hubs	0.76
Nonhubs	1.42

Source: FAA Form 127 data as compiled by EPA.

2.8.2.1.2 Airport Capital Improvement Programs and Financing Sources

Average capital expenditures and significant sources of funding for capital expenditures are summarized in Table 2-26. On average, capital improvement programs at smaller airports tend to be relatively small scale, on the order of $5 million for nonhubs to $15 million for small hubs. It should be noted that these capital programs must cover replacement of current capital stocks such as fire-fighting equipment, radar, lighting, communications and other equipment, resurfacing of runways, and similar projects; they do not necessarily represent expansion programs.

Table 2-26. Average Capital Expenditure and Financing by Hub Size, 2002-2006

	Large Hubs	Medium Hubs	Small Hubs	Nonhubs
Airport Count	33	35	25	54
Total Project Expenditures	$177,874,771	$39,616,089	$14,705,868	$4,956,860
As Percent of Large Hub Average	--	*22.3%*	*8.3%*	*2.8%*
PFC Revenues	$48,059,002	$9,561,662	$3,012,540	$334,152
As Percent of Large Hub Average	--	*19.9%*	*6.3%*	*0.7%*
Grant Receipts	$22,809,305	$10,716,828	$7,010,565	$3,679,966
As Percent of Large Hub Average	--	*47.0%*	*30.7%*	*16.1%*
Bond Indebtedness	$1,335,074,774	$253,756,033	$57,327,526	$2,631,704
As Percent of Large Hub Average	--	*19.0%*	*4.3%*	*0.2%*
Total Indebtedness	$1,418,440,732	$268,293,030	$59,921,343	$4,223,407
As Percent of Large Hub Average	--	*18.9%*	*4.2%*	*0.3%*

Source: EPA analysis of FAA Form 127 airport financial data. Surveyed airports only.

Table 2-26 demonstrates that nonhub airports in particular do not rely on debt financing of capital programs. This is largely an implication of the operating income figures discussed above; these airports do not have the revenue streams necessary to support large amounts of debt. Furthermore, PFCs are not a large source of funds for these airports; they do not have the passenger flow that will generate significant PFC revenues.

Smaller airports are much more heavily dependent on grants to fund capital expenditures than are large hubs. For example, departures, enplanements, operating revenues and expenditures, capital expenditures, indebtedness, and PFC revenues for nonhubs are all less than about 3 percent of the same figures at large hubs. The single exception to that rule is grant receipts; grant receipts at nonhubs are 16 percent of grant receipts at large hubs. In fact, grant receipts comprise 74 percent of capital project expenditures at nonhubs, 48 percent at small hubs, 27 percent at medium hubs, and about 13 percent at large hubs. Clearly, smaller airports are highly dependent on grants to pay for capital expenditures. These grants must fund replacement of necessary existing capital plant, not just new capital expenditures. Since funding of grants, especially AIP grants, is low relative to the demand for those grants, only the highest priority projects tend to get funded at smaller airports.

In summary, it appears that in the short run, at least, the largest airports have the most ability–or leverage–to pass through costs to airlines. They also have the best access to other means of funding capital construction programs. Small airports are the most vulnerable to changes in airline service, and thus have little market power to enable them to pass through costs to airlines. In addition, the smallest group of potentially affected airports, small hubs and nonhubs, has the fewest alternatives for funding capital programs; nonhubs in particular appear to be almost entirely dependent on AIP grants for capital expenditures.

2.8.2.2 Airlines to Passengers

The ability of airlines to pass through costs to passengers in the form of higher ticket prices depends largely on market specific factors such as the desirability of an airport as a final destination, whether a trip to that final destination is for business or pleasure, and whether other airports with acceptable standards of airline service are close to that destination. If an airport serves a highly desirable final destination, with a high percentage of business travel, and there are no alternative airports nearby, airlines might be able to pass through significant costs to their passengers. Conversely, if customers are flying to airports primarily as a means to get elsewhere (e.g., connecting flights), if multiple airlines serve that airport, or if there are other airports just as suitable for that purpose, customers will be less willing to pay higher ticket prices, and airlines will thus be less able to pass through costs on flights using that airport.[21]

Very few studies examine or try to estimate the intensity of demand for services at specific airports. A number of studies have measured the intensity of demand for airline services in general. EPA used two papers (FAA 1995, Button 2005) that contained extensive literature reviews of studies of the price elasticity of demand for air transportation. The price elasticity of demand evaluates the responsiveness of consumers to changes in product price and is defined as the percentage change in quantity demanded (in this case, air travel) caused by a given percentage change in price (in this case, airfare).

Although details may vary, the price elasticity of demand for business travel is generally less elastic than for non-business travel (e.g., vacation travel). That is, there will be a relatively small reduction in business travel compared to non-business travel in response to any given change in fares. If a business person has to be at a certain location on a certain date, those travel plans are unlikely to change if fares increase. Conversely, a person traveling for vacation has no need to be at a specific location on a specific date; a vacation traveler might respond to fare increases by changing destination, mode of travel, or perhaps even choosing not to travel. Second, the price elasticity of demand is less elastic for long trips than short trips.

[21] In another context, the importance of these factors is recognized when airports issue bonds. Airports perform analyses of these underlying demand fundaments, which become important components in determining bond ratings and prices.

The reasoning is similar to that for business travel: if fares increase, short trips might be feasible by car or train, while those alternatives will be less attractive for long trips.

Econometric studies have estimated price elasticities of demand for air travel ranging from -0.26 for long-haul business travel (a 10 percent increase in fare reduces travel by 2.6 percent), to about -4.5 for short-haul non-business travel (a 10 percent increase in fare reduces travel by 45 percent) (FAA 1995, Button 2005). Analysts frequently use values of about -0.9 for business travel, and from -1.5 to -2.0 for non-business travel (FAA 1995, Button 2005).

Price elasticities of demand are of more than academic interest; they have significant implications for supplier income when prices change. If demand is inelastic (that is, if the price elasticity of demand lies between 0.0 and -1.0), then a fare increase will increase supplier revenues; the percentage reduction in demand is smaller than the percentage increase in fare, thus overall supplier revenues increase. If demand is elastic (that is, if the price elasticity of demand is from -1.0 to -∞), then a fare increase will trigger such a large reduction in demand that supplier revenues decrease. Vacation travel appears to account for a larger share of passengers than business travel (with the exception of certain destinations and times of the year), suggesting that if airlines try to pass through costs to their customers, revenues will decline.

The exact impact of a fare increase on airlines will depend on airline specific factors such as flight destinations, overall route structure, frequency of departures, and a number of other factors that lead customers to choose one airline over another. The impact will also depend on other supply characteristics. If supply is very inelastic (e.g., in a supply-demand diagram, the supply curve is very steep or vertical), airlines will not change the number of seats offered for sale in the short run if the costs of offering those seats for travel increases. In this case, cost pass-through will be zero; there will be no increase in fare and no decrease in passengers carried, but cost per seat will increase and operating profit will fall by the same amount. Conversely, if supply is elastic (e.g., in a supply-demand diagram, the supply curve is very flat or horizontal), airlines will pass through 100 percent of costs. This will cause passengers to reduce the number of seats purchased, and revenues will fall.

Data on the price elasticity of supply of airline seats are not readily available. However, at least in the short run, supply appears to be very inelastic. Airline tickets have become something of a commodity, where passengers largely base their choice on ticket price. This acts to drive prices down to a low level. The incentives for airline behavior driving this result were discussed in detail under “Barriers to Exit” (see Section 2.7.3.2). The results of this price competition might be observed in the recent behavior of airlines in reaction to rising fuel costs. With airline fuel costs projected to increase by 50 to 70 percent in 2008, airlines have found it difficult to raise fares, at least in the short run. Announced fare increases by one airline have not been followed by others, forcing the airline raising its fares to return them to their initial level. While airlines have recently started charging or increasing fees for checked bags, phone reservations, and in-flight meals and snacks, these fees are expected to cover only a fraction of increased fuel costs. Thus, it appears that at least in the short run, it is difficult in today’s business climate for airlines to pass through a significant percentage of costs to their passengers.

2.9 Alaska

Aviation in Alaska is significantly different from aviation in the other 48 states in the continental United States. Approximately 90 percent of the State of Alaska is not serviced by roads, so aviation is important to the State’s infrastructure and basic way of life. Alaska has six times as many pilots per capita and 16 times as many aircraft per capita compared with the rest of the United States (State of Alaska 2008a). With the exception of Juneau International Airport, the State of Alaska owns all the airports, which are divided into two distinct systems:

- The Alaska International Airport System—Ted Stevens Anchorage International Airport (only medium hub in Alaska) and Fairbanks International Airport (small hub).

- The Alaska Rural Airport System (RAS)—256 rural airports scattered throughout the State.

Juneau International Airport (small hub) is owned by the City and Borough of Juneau, and operated as a major enterprise fund of the local government. As such, it is considered to be a self-sufficient component of the City/Borough of Juneau (City and Borough of Juneau, 2004).

Table 2-27 shows the number of departures of commercial services leaving Alaska from 2002-2006. After a large 15 percent increase in departures in 2003, there was a small but steady decline in total departures for the following three years with the exception of Ted Stevens Anchorage. Despite decreasing number of departures from 2004 to 2006, passenger enplanements increased during that time as shown in Table 2-28. This data correlates with the increased number of passengers per departure—9.3 in 2003 to 11.1 in 2006 (Table 2-29).

Another indication of how different Alaska aviation is from the rest of the United States is that Alaska has many small airlines that operate only in Alaska. Based on analysis of BTS T100 data, there are 37 airline carriers which have at least 97 percent of their total flights depart from Alaskan airports; furthermore, 32 of these 37 carriers operate exclusively within the state (i.e., 100 percent of their departures are within Alaska). While some of these 37 airlines have very few departures per year (i.e., eight airlines have fewer than 525 departures per year), 14 of these 37 airlines had more than 10,000 departures from Alaska in 2006. The top three airlines in terms of Alaskan departures include:

- Hageland Aviation Service (76,522 Alaskan departures [99.99 percent of the airline's total departures]).

- Grant Aviation (46,217 Alaskan departures [100 percent of airline's total departures]).

- Peninsula Airways (42,690 Alaskan departures [99.96 percent of the airline's total departures]).

In addition, these 37 airlines tend to be more reliant on propeller-driven aircraft; at least 83 percent of these airlines' departing aircraft are propeller driven and most rely on a much higher percentage. Even national carriers tend to use propeller planes for their Alaskan departures. Delta, Continental, and United Airlines all had between 700 and 1,000 departures from Alaska, all of which were propeller-powered aircraft. This reliance on propeller-driven aircraft illustrates just some of the differences of air transportation in Alaska: smaller aircraft, frequent short hops, frequent bad weather, and dirt runways with little ground support at many airports (see, for example Carey, 2007). However, the key feature of air transportation in Alaska is that it provides the primary outside access to many towns and villages that cannot be reached by road.

Table 2-27. Commercial Service Aircraft Departures (Alaska)

Airport Type	Number of Hubs	Number of Departures					Annual Growth Rates			
		2002	2003	2004	2005	2006	2003	2004	2005	2006
Large Hub	0	0	0	0	0	0	NA	NA	NA	NA
Medium Hub	1	74,838	83,211	90,641	95,607	99,607	11.19%	8.93%	5.48%	4.18%
Small Hub	2	43,080	50,870	51,169	44,232	41,204	18.08%	0.59%	-13.56%	-6.85%
Nonhub	23	146,443	170,748	163,656	169,212	167,229	16.60%	-4.15%	3.39%	-1.17%
Non-primary	61	158,134	180,129	169,440	157,323	153,038	13.91%	-5.93%	-7.15%	-2.72%
Total	**87**	**422,495**	**484,958**	**474,906**	**466,374**	**461,078**	**14.78%**	**-2.07%**	**-1.80%**	**-1.14%**

Source: EPA analysis of BTS T-100 data

Table 2-28. Commercial Service Passenger Enplanements (Alaska)

Airport Type	Number of Hubs	Passenger Enplanements					Annual Growth Rates			
		2002	2003	2004	2005	2006	2003	2004	2005	2006
Large Hub	0	0	0	0	0	0	NA	NA	NA	NA
Medium Hub	1	2,431,444	2,305,462	2,489,946	2,640,210	2,598,569	-5.18%	8.00%	6.03%	-1.58%
Small Hub	2	762,589	777,376	821,885	828,461	834,338	1.94%	5.73%	0.80%	0.71%
Nonhub	23	1,087,004	1,104,889	1,172,959	1,203,034	1,227,718	1.65%	6.16%	2.56%	2.05%
Non-primary	61	389,962	409,063	424,615	426,115	435,003	4.90%	3.80%	0.35%	2.09%
Total	**87**	**4,670,999**	**4,596,790**	**4,909,405**	**5,097,820**	**5,095,628**	**-1.59%**	**6.80%**	**3.84%**	**-0.04%**

Source: EPA analysis of BTS T-100 data

Table 2-29. Commercial Service Aircraft Passengers per Departure (Alaska)

Airport Type	Number of Hubs	Passengers per Departure					Annual Growth Rates			
		2002	2003	2004	2005	2006	2003	2004	2005	2006
Large Hub	0	0	0	0	0	0	NA	NA	NA	NA
Medium Hub	1	32.5	27.7	27.5	27.6	26.1	-14.72%	-0.85%	0.53%	-5.53%
Small Hub	2	17.7	15.3	16.1	18.7	20.2	-13.67%	5.11%	16.61%	8.11%
Nonhub	23	7.4	6.5	7.2	7.1	7.3	-12.82%	10.76%	-0.80%	3.26%
Non-primary	61	2.5	2.3	2.5	2.7	2.8	-7.91%	10.35%	8.08%	4.94%
Total	**87**	**11.1**	**9.5**	**10.3**	**10.9**	**11.1**	**-14.26%**	**9.06%**	**5.74%**	**1.11%**

Source: EPA analysis of BTS T-100 data

2.9.1 Alaska International Airport System

The State operates the Alaska International Airport System as a separate major enterprise. It is considered a self-sufficient component of the State government, which can issue its own debt in the form of revenue bonds. Thus the two airports: Ted Stevens Anchorage International Airport and Fairbanks International Airport operate similar to the other state government-run airports in the United States.

2.9.2 Alaska Rural Airport System

The RAS is the other major component of the Alaskan aviation system, but it operates much differently from the International Airport System. The 256 airports of the RAS range from small municipal airports to simple dirt landing strips. The RAS is not a self-sufficient government unit, and the rural airports actually lose money every year. However, due to the nature of transportation in the State of Alaska, it is vital that these airports remain in operation despite being unprofitable.

The Alaska Department of Transportation and Public Facilities (DOT&PF), as well as local or tribal governments are responsible for operating RAS airports. According to the DOT&PF, airports in the state are funded through a combination of user fees, state, local, or tribal funds, and federal funds. RAS airports have limited opportunities for generating revenue. In fact, these airports have found it difficult to finance the increased federal security mandates since September 11, 2001. The DOT&PF has limited funds to perform additional O&M at many of the state's RAS airports.

2.9.2.1 RAS Airport Funding

According to Roger Maggard, Statewide Airport Development Manager for the RAS, almost every RAS capital project is funded through AIP grants. As the RAS loses money each year, they do not (and would not be able to) issue any bonds and therefore do not carry debt. Instead, to ensure continued operation, the RAS is heavily subsidized by the State government and local sponsors. Maggard estimated that the State of Alaska provides $23 to $24 million annually to cover RAS operating costs. These airports only generate between $3 and $4 million in revenues. These revenues are not received from typical sources, as there are no passenger facility charges and rarely any concessions or even building space to rent. The revenues are primarily comprised from land leases for aviation or non-aviation purposes (Maggard 2008).

The RAS does receive approximately $1 to $2 million per year from the State Legislature for various projects. However, because this funding is spread over the 256 rural airports, it does not cover the total capital costs of necessary projects. Although there is the possibility of the Legislature approving appropriations from the General Fund to finance projects in the RAS, this appears highly unlikely and the RAS cannot assume that any money will be available through this avenue (Maggard 2008).

2.9.2.2 AIP Spending

Since most capital projects within the RAS are funded through the AIP, EPA examined the number and type of projects being funded over the past couple of fiscal years. Table 2-30 shows overall project counts and dollar amounts for AIP-funded projects at primary and non-primary airports within the RAS.

Table 2-30. Alaska Rural Airports AIP Spending Plan

	FY 2006		FY 2007		FY 2008	
	Number of Projects	Funding Amount	Number of Projects	Funding Amount	Number of Projects	Funding Amount
Primary Airports	19	$80,899,778	20	$40,714,125	30	$75,394,000
Non-Primary Airports	27	$66,100,891	27	$81,020,189	37	$143,814,950
Total	46	$147,000,669	47	$121,734,314	67	$219,208,950

As of December 12, 2007. Spending plan figures contain entitlement and discretionary funded AIP projects.
Source: EPA calculations based on State of Alaska 2007

The majority of projects and money spent (or planned for) in 2007 and 2008 are at non-primary airports within the RAS. Four primary categories of projects are included in the AIP spending plan:

- Airfield projects
- Buildings
- Equipment
- Airport Planning

A breakdown of AIP spending by project type, combined for primary and non-primary airports is provided in Table 2-31. The majority of AIP funded projects in the RAS, in terms of dollars spent, are airfield projects. These included runway and apron improvements and construction, runway surfacing, and general airfield upgrades. Most projects fall into the equipment category, though the amount spent is relatively small compared with airfield projects. Equipment projects include the purchase of new and replacement equipment such as snow blowers, deicing vehicles, plows, and other heavy machinery. Airport planning and buildings costs round out the projects funded through the AIP.

Table 2-31. Total AIP Spending by Project Type - Alaska Rural Airport System

	FY 2006		
	Number of Projects	**Funding Amount**	**Percent of Total Project Funding**
Airfield Projects	16	$129,502,657	88.1%
Buildings	3	$6,076,086	4.1%
Equipment	19	$6,394,670	4.4%
Airport Planning	8	$5,027,256	3.4%
	FY 2007		
	Number of Projects	**Funding Amount**	**Percent of Total Project Funding**
Airfield Projects	15	$98,548,553	81.0%
Buildings	2	$7,990,066	6.6%
Equipment	16	$4,985,520	4.1%
Airport Planning	14	$10,210,175	8.4%
	FY 2008		
	Number of Projects	**Funding Amount**	**Percent of Total Project Funding**
Airfield Projects	25	$195,584,250	89.2%
Buildings	6	$10,480,000	4.8%
Equipment	28	$8,618,000	3.9%
Airport Planning	8	$4,526,700	2.1%

Source: EPA calculations based on State of Alaska 2007.

All AIP-funded projects require state and local sponsors provide 6.25 percent of funding, of which the state covers half and local or tribal governments contribute the remaining. The figures in Tables 2-30 and 2-31 above represent total project costs.

2.9.2.3 Other Funding Issues

As mentioned above, the RAS is heavily subsidized by the State of Alaska. However, detailed information on the State's funding of the RAS has been difficult to obtain since it is not a specific line item in DOT&PF's budget, as seen in Table 2-32, which represents the publicly available budget.

Table 2-32. FY 2001 Capital & Operating Budget for the AK DOT&PF

Budget Category		Amount (in thousands)	Percent of Total Budget
Measurement Standards		$3,350.90	0.30%
Planning/D&C		$4,982.80	0.50%
Administration		$11,697.00	1.10%
State Equipment Fleet		$21,742.30	2.10%
International Airports		$41,465.20	4%
Marine Highways		$103,086.70	10%
Maintenance & Ops		$87,081.40	8.40%
Capital Budget		$756,130.40	73.60%
	- Federal	$643.2	
	- General Fund	$60.2	
	- Hwy Working Capital Fund	$11.8	
	- Int'l Airport Revenue Fund	$22.5	
	- AHFC Fund	$5.9	
	- Capital Improvement Program	$1.5	
	Designated Receipts	$9.1	
	Investment Loss Trust Fund	$1.9	

Source: DOT&PF 2000

2.9.2.4 Operation and Maintenance

The daily O&M at rural airports is handled in different ways, depending on the size of the airports. For the larger airports, O&M tasks are handled by staff from the DOT&PF; for other airports along the major highway system, these tasks are handled by the same crews that tend to the highways. For smaller rural airports, maintenance jobs (such as snowplowing) are generally contracted out to local residents (DOTPF 2000). Routine maintenance needs for the entire Alaskan airport system (both International and Rural) is estimated at $39 million per year, and the budget available to cover these costs for the airport system has not kept pace with inflation.

2.9.3 Alaska and the Economic Impact Analysis

Since the majority of Alaskan airports are operated as part of a RAS, EPA has reviewed them separately in Chapter 5.

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CHAPTER 3
ECONOMIC IMPACT METHODOLOGY

This chapter presents the methodology EPA used to analyze and estimate the economic impacts of an effluent limitations guidelines and standards (ELGs) for discharges associated with deicing operations. The unusual aspect of this ELG is that the airport is likely to purchase and install treatment systems or implement best management practices to control aircraft deicing discharges, but airport tenants, that is, the airlines using the airport, generate the ADF-contaminated stormwater.

Section 3.1 reviews funding sources available to airports to finance capital improvements, and describes how EPA chose to model airport capital finance and annualization of compliance costs. Section 3.2 presents the methodology EPA used to project economic and financial impacts to airports as a result of those compliance costs. Section 3.3 provides the method by which the cost of supplying air transportation services to an airport is estimated. Section 3.4 describes how compliance costs projected for the 2004 baseline are extrapolated to analyze additional years. Section 3.5 discusses EPA's approach to analyzing the more complex situation where an airport and airlines are co-permittees on the airport's National Pollutant Discharge Elimination System (NPDES) permit; this makes the co-permittee airlines directly subject to the requirements of the effluent limitation guidelines (ELG), and thus potentially impacted by the rule. Finally, Section 3.6 lists cited references.

3.1 Compliance Cost Annualization

In this section, EPA discusses how airports might finance capital programs and its implications for the annualization of capital costs. Selection of the appropriate rate for discounting future costs and benefits depends on the perspective taken in the analysis. Different elements of society have different preferences for future consumption (of both products and environmental "goods"), and this difference is represented in the interest rate.

EPA has determined that overall societal preferences for future consumption are best represented by a 3 percent real interest rate (EPA, 2010). EPA's role is to take a societal perspective in evaluating the costs and benefits of this effluent guideline. Therefore, EPA uses a 3 percent real interest rate to project the national level costs and benefits of the rule from a societal perspective.

However, airports that would incur cost to comply with the ELG must access financial markets to meet the requirements of the rule. Even if they do not need to borrow to finance capital expenditures, they forgo the opportunity to use that money for alternative purposes, the "opportunity cost of capital." Economic impacts to airports depend on the actual costs incurred by airports, and therefore, to determine those costs and subsequent impacts, it is appropriate to use an interest rate that represents the airports' opportunity cost of capital. Thus, EPA uses two different real interest rates to evaluate this effluent guideline. The first is the 3 percent real interest rate used to project aggregate national level compliance costs. Sections 3.1.1 through 3.1.3 below discuss EPA's determination of the appropriate interest rate to use for airports for the purposes of evaluating economic impacts, and some of the implications of that determination.

Section 3.1.1 reviews alternative means of airport financing of capital expenditures. Section 3.1.2 outlines EPA's method for estimating the annualized cost of capital expenditures. Section 3.1.3 compares how financial impacts to might differ depending on the means used to fund capital expenditures.

3.1.1 Airport Financing Methods for Capital Expenditures

Projected airport compliance costs are of two distinct types: operating and maintenance (O&M), and capital; the ELG will result in most affected airports incurring a combination of the two. A number of funding sources exist for airports to finance capital expenditures. EPA expects that many airports will finance capital expenditures associated with this rule using tax-exempt General Airport Revenue Bonds (GARB). According to the Air Transport Association (ATA), 95 percent of all airport debt issued since 1982 has been in the form of GARB (ATA, 2005a). Other funding sources exist for airports, such as Airport Improvement Program (AIP) grants from Federal Aviation Administration (FAA), state grants, Passenger Facility Charges (PFC), commercial paper, "pay-as-you-go" supported by airport rates and charges, or (assuming the capital expenditures are not too large) the airport's capital improvement fund (CIF).

The alternative with the lowest cost to the airport is clearly AIP or other grants. However:

- Demand for AIP grants exceeds availability, and airports may already have committed anticipated AIP grants well into the future.
- Switching AIP grants from an existing program to pay for deicing-related capital expenditures would require FAA approval, and entail additional work and expense. Also, FAA may be reluctant to permit such changes, since many AIP grants are for high priority safety and capacity-related projects.
- State and other grants appear to be a relatively small source of capital funding.

While it is more likely that PFCs may be used to fund capital expenditures than AIP grants, it cannot be generally assumed that airports will use those either because:

- PFCs require FAA approval on a project-specific basis, and, like AIP grants, tend to be committed well into the future.
- There is a maximum PFC that an airport may charge ($4.50); as of May 1, 2008, 280 of the 372 airports (75 percent) approved by FAA to collect PFCs were charging the maximum rate (FAA 2008).

Furthermore, PFCs can be used as the revenue source to support a GARB issue. In such a case, if a capital program is economically achievable using rates and charges to support GARB, it should also be affordable if the GARB can be supported using PFC revenues.

One of the primary drawbacks to funding capital expenditures through short-term commercial paper or pay-as-you-go is practical. It is more difficult to manage a project with uncertain revenue streams; a bond issue smoothes expenditure and revenue streams. In fact, commercial paper may commonly be used in the short run to fund a project until it can be rolled into a larger bond issue (Taylor, 2005). Pay-as-you-go has the advantage that it does not increase airport debt, and may therefore be used when an airport may be close to a debt ceiling or similar constraint that would make it reluctant to issue new debt.

The primary advantage of using GARB over alternative sources of finance is that because they are a form of municipal bond, income to bond holders is tax exempt. This has been estimated to result in effective interest rates two percentage points lower than alternative non-tax exempt capital sources to bond issuers (CBO 1999). Although airports ostensibly do not pay interest if capital projects can be funded through grants instead of issuing bonds, airports do incur an opportunity cost: using an AIP grant to finance deicing-related capital expenditures means the AIP grant cannot be used for funding other capital programs. Thus, regardless of the funding source for financing capital expenditures associated with the capture and control of ADF-contaminated stormwater, the airport incurs an opportunity cost, which is best represented by the market interest rate associated with issuing bonds.

In its economic analysis of the proposed rule, EPA assumed capital expenditures would be financed through the issuing of GARB, using an airport-specific interest rate equal to the rate each airport realized on its most recent GARB issue. For the economic analysis of the final rule, EPA has modified its approach, applying a real 7 percent interest rate to all capital expenditures. This change to the analytic approach is in response to comments on the proposed rule that many smaller airports do not have access to bond markets. Therefore their finance costs will exceed that used to annualize capital expenditures, and their compliance costs will be larger than those used in the economic impact analysis. By using a 7 percent real interest rate in the final rule analysis, EPA ensures that airport compliance costs will be lower than estimated to the extent they can use alternative means of financing the capital expenditure.

3.1.2 Compliance Cost Annualization

Capital costs often vary substantially over the course of a project life; some years an airport may expend millions of dollars purchasing and installing equipment to collect and treat ADF-contaminated stormwater, while in most years these capital expenditures will be zero. Capital cost annualization takes a series of unequal capital expenditures over the project life, and converts them into a series of equal annual payments with a total value, after accounting for the time value of money, identical to original stream of expenditures, essentially the same way the initial purchase price of a house is converted into a series of equal monthly mortgage payments.[22]

To annualize capital costs, EPA first calculates the interested present value (PV) of capital expenditures over an anticipated 20 year project life, incorporating equipment replacement as necessary. Future capital expenditures are discounted using a 7 percent real rate to determine their value at project start (year 1). EPA then calculates the annualized cost of these capital expenditures as a stream of 20 equal annual payments with a discounted present value identical to that of the stream of unequal expenditures.

For example, EPA expects that glycol collection vehicles (GCVs) have a service life of 10 years. Thus, if an airport is modeled as purchasing a GCV, capital costs are incurred in year 1, and again in year 11 to replace the original GCV. The first year's capital expenditures are equal to their nominal value, but the capital costs in year 11 are multiplied by 1/(1 + 0.07)10 to calculate their value in year 1. Piping and storage tank components have an expected service life of 20 years and those capital costs are only incurred in year 1. The PV of this stream of capital expenditures from year 1 through year 20 is calculated as:

$$Present\ Value\ of\ Capital\ Costs = \sum_{t=1}^{20} \frac{(Capital\ Costs)_t}{(1+r)^{t-1}}$$

Where t is the project period (1 through 20) and r is the real interest rate (7 percent). In this example, capital costs are zero for all years except year 1 and year 11. After calculating the PV of these capital costs, they are annualized:

[22] Cost annualization covers cases where after the initial capital expenditure, all expenditures in subsequent periods are equal to zero, such as the mortgage on a house, or where additional nonzero expenditures are incurred in subsequent periods, such as this effluent guideline.

$$Annualized\ Capital\ Costs = PV * \frac{r*(1+r)^n}{(1+r)^n - 1}$$

Where n is the project life (20 years). In all cases, the PV of capital costs are annualized over 20 years to allow direct comparison between options despite differing service lives. EPA chose a 20 year project life because it represents the longest expected lifetime of any of the equipment that comprise the technology bases for the final regulation. EPA examined the expected service life of various equipment components of the technology bases for the final deicing rule. The components are described in more detail in the TDD. During development of this rule, EPA examined three different technological bases for ADF capture: (1) GCVs, (2) plug and pump (combined with GCVs), and (3) deicing pads (see Section 4, and the Technical Development Document for further details)[23] and found:

- GCVs have expected service lives of approximately 10 years.
- Plug and pump technologies have expected service lives of approximately 10 years.
- Deicing pads have expected service lives of approximately 20 to 30 years.
- Equipment to spread potassium acetate instead of urea for airfield deicing has an expected service life of approximately 10 years.

Additional costs requiring annualization are associated with the following major components:

- Holding tanks and associated piping have expected service lives of approximately 20 years.
- Anaerobic fluidized bed (AFB) treatment has an expected service life of approximately 20 years.
- Permitting costs, such as engineering and monitoring costs to demonstrate that the airport's ADF stormwater collection system meets the Collection Percentage Standard are incurred every 5 years.

Of the component and requirements listed above, all are incurred as first year costs in the annualized cost calculation. Components with an expected service life of 20 years or more only incur those initial costs; components with an expected service life of 10 years incur replacement costs in year 11. Finally, those requirements that must be met every 5 years impose recurring costs in years 6, 11 and 16.

In addition to annualized capital payments (the annualized PV of capital expenditures), each airport also incurs annual O&M costs. Each component specified under an option has O&M costs associated with it in addition to its capital cost. Also, certain airports are expected to incur costs annually because of the requirement to switch from using urea to the more costly potassium acetate for airfield deicing. An airport's annual O&M costs under each option are therefore the sum of O&M costs for each component specified under that option.

[23] The economic impacts of meeting a 60 percent ADF collection and treatment requirement, for which deicing pads were considered a possible treatment technology, were analyzed for the proposed rule, but are not further analyzed here for the final rule.

The cost basis for the economic and financial impact analyses described below consists of:

- Annual debt payments estimated as the annualized NPV of capital costs (including replacement of capital equipment if necessary), which will be used to determine if the airport can continue to service its debt after the proposed rule is promulgated (see Section 3.2.2).

- Annual operating costs estimated as the sum of the annual O&M costs associated with each component specified under an option, which will also be used to determine if the airport can continue to service its debt after the proposed rule is promulgated (see Section 3.2.2).

- Total annualized costs estimated as the sum of annual debt payments plus annual operating costs, which will be used to project airport revenues based on the revenue test (see Section 3.2.1).

3.1.3 Comparison of Impacts under GARB, AIP Grants and PFCs

EPA chose to modify the underlying assumptions for projecting annualized capital costs as incurred by airports; these are now calculated to use a standard 7 percent real interest rate. EPA assumes airports will use a lower cost method of financing these costs if such an opportunity is available. However, the use of such alternative financing has implications for airport financial health that extend beyond merely reducing impacts by lowering the annualized cost of the rule. In this section, EPA examines how different methods of financing might affect projected airport impacts.

For the proposed rule, EPA used the nominal coupon rate from the airport's most recent bond issue obtained from its Comprehensive Annual Financial Report (CAFR) to annualize capital costs. EPA found that nominal coupon rates range from 2.04 to 9.37 percent, with a median of 5.25 percent and an average of 5.26 percent. When deflated using the average Consumer Price Index (CPI) from 2002 through 2006 (2.31 percent), real interest rates range from 0.0 to 6.9 percent, with a median of 2.87 percent and an average of 2.89 percent. These low effective real rates reflect the significance of the tax-exempt nature of GARB. Thus, the revised cost annualization assumptions result in the use of a significantly higher real interest rate to annualize costs for the final rule analysis. EPA expects many airports will be able to use GARB for this purpose; at a minimum, these airports are likely to incur lower costs and associated economic impacts will be smaller than reflected in this analysis.

In addition to differences in the cost of capital implicit in assumptions concerning how such expenditures are financed, there are different implications for economic impacts associated with how an airport chooses to pay the stream of annualized capital costs regardless of how they are financed. The simplest assumption, and seemingly the most likely, is that airports will pay the stream of annualized capital costs over time by increasing rates and charges to airlines that utilize the airport. However, should an airport choose to use AIP or PFC funds to finance capital expenditures, these costs are unlikely to enter an airport's rates and charges, and projected economic impacts will differ subtly from those outlined in Chapter 5 below.

Airport Improvement Program funds come in the form of a grant. The primary effect of using an AIP grant to pay for deicing-related infrastructure improvements would likely be the delay in an alternative project for which the AIP grant was originally slated. Thus, there is an opportunity cost to using AIP grants, which is measured by the cost of capital. However, there is no direct effect on rates and charges, and therefore the capital component of compliance costs would not to be passed on to airlines or their passengers. However, as mentioned above, AIP grants tend to be accounted for well into the future and it would be highly speculative to assume the FAA would authorize whole-scale changes in the use of these grants to meet the requirements of this effluent guideline. EPA assumes AIP grants are not available for effluent guideline-related capital projects; if they become available, the cost of the proposed regulation should be lower than projected by EPA.

In the case of PFCs, the availability of funding is less clear cut than AIP grants. Not all airports eligible for PFCs use them, and not all airports that use PFCs charge the maximum allowable rate. Many airports designate PFCs as the dedicated revenue stream to secure GARB.

Funding capital expenditures with PFCs should result in lower impacts to airports than directly using rates and charges to support GARB. Servicing the debt associated with capital expenditures does not directly enter the airport's rates and charges using PFCs. While costs of the rule might be passed on to airlines and their customers whether financed through rates and charges or PFCs, the impacts of the two funding mechanisms will differ. If capital improvements are funded through rates and charges, then airlines directly incur increased operating costs, some (or all) of which may be passed through to passengers in the form of increased ticket prices. To the extent that passengers react to increased ticket prices by flying less, airlines may also incur decreased revenues depending on the price elasticity of demand for travel to that airport.

However, should an airport use PFCs to finance capital expenditures, while the passenger cost of air transportation directly increases, airline operating costs are unchanged. PFCs are added directly to ticket prices, collected by the airline, and transferred to the airport. Although the PFC charge is listed on the ticket separately from the fare, there is no evidence that passengers differentiate the PFC component in the total cost of purchasing the ticket when making their travel decisions. Presumably an increase in the total cost of purchasing a ticket attributable to an increased PFC will affect their travel decision in the same way as an identical increase in the total cost of purchasing a ticket attributable to increased landing fees. In such a case, passenger response, and the impact on airline revenues should be identical under both funding mechanisms. However, PFCs do not directly increase airline operating costs as would an increase in airport rates and charges.

Thus, EPA's method of analyzing the potential economic impacts of increased airport capital expenditures is conservative in multiple ways:

- The cost of capital is significantly higher than if airports use GARB.
- AIP grants do not enter airport rates and charges, and are not directly passed on to airlines and their passengers.
- PFC do not enter airport rates and charges, although they are perceived by passengers as an increase in ticket prices. As such, they may affect airline revenues through their impact on the demand for air transportation services, but do not directly increase airline operating costs.

To the extent that airports are able to use GARB, AIP grants or PFC to finance capital expenditures associated with this rule, economic impacts are likely to be smaller than projected in this analysis.

3.2 Economic Impact Analysis of Airports

As discussed in the Industry Profile, airports are generally non-profit government or quasi-government (e.g., port authorities) enterprise funds. Thus, the impact of effluent guideline-related compliance costs on airport income is not equivalent to that of a for-profit private sector business, nor can it be analyzed in the same manner using the same benchmarks.

EPA has identified two measures to judge the economic achievability of the rule on affected airports:

- Ratio of annualized compliance costs to operating revenues
- Debt service coverage ratio

The number (and/or percent) of entities incurring annualized compliance costs exceeding 1 percent and 3 percent of operating revenues are frequently used standards of judging economic achievability. EPA uses them for small business impact analyses, impact analyses where cash flow or net income measures are not available, and screening analyses. It is also a measure often used by other agencies for impact analyses.

Based on public comments on the proposed rule, EPA has also chosen to examine impacts using two additional measures:

- Ratio of annualized compliance costs to aeronautical revenues
- Annualized compliance costs per enplaned passenger.

These measures will be described in Section 3.2.2 and 3.2.3 below. Because there are no hard and fast rules for using these measures as determinants of economic achievability, EPA presents the results of these additional tests as sensitivity analyses.

3.2.1 Ratio of Annualized Compliance Costs to Operating Revenues

EPA's Guidelines for Preparing Economic Analyses (2010) specifically presents the "revenue test," that is, the ratio of annualized compliance costs to operating revenues, as the relevant method to measure impacts of programs that directly affect government and not-for-profit entities. The airports potentially affected by this rule are owned directly by the government (e.g., city, county, or state), or by a quasi-governmental not-for-profit port authority.[24] Thus, this is an appropriate measure of impacts for airports affected by the deicing effluent guideline.

EPA therefore compared the ratio of total annualized compliance costs (costs) to total operating revenues (revenues) for each airport to determine the impact of the selected options on airport revenues. By EPA guidance (EPA 2010),[25] when:

- 0 percent < (estimated annualized compliance costs/revenues) ≤ 1 percent: the option is generally considered affordable for an entity.

- 3 percent < (estimated annualized compliance costs/revenues): the option is considered to be placing a heavy burden on an entity.

To apply the revenue test to airports, EPA used the sum of 2004 aeronautical and non-aeronautical operating revenues reported by airports on FAA Form F-127 (Operating and Financial Summary) as the

[24] One surveyed airport, Airborne Airpark, is privately owned and is a private use facility; the revenue test would not be appropriate for this airport. However, Airborne Airpark is not expected to be affected by the proposed regulation.
[25] The EPA guidance cited here was developed from EPA's small business regulatory flexibility guidance. However, in this guidance (i.e., EPA 2000b), the guidelines apply to all affected entities, not just small entities.

measure of airport operating revenue for this analysis. The estimation of annualized compliance costs was described in Section 3.1.3, above, and the Technical Development Document (EPA 2011).

Industry comments on the proposed rule pointed out that many airports use residual-cost approach to determine rates and charges for the airside cost center (see Section 2.6.2 for details on rate setting methodologies). EPA examined deicing questionnaire data and found that approximately 50 percent of respondents use a residual approach to setting airside rates and charges. If airports use a residual cost approach, then commenters argue that due to airport use agreements, airports are legally required to cover airside costs with airside revenues, and therefore compliance costs must be covered by aeronautical revenues. In this view, EPA should use the ratio of compliance costs to aeronautical revenues as the relevant measure of impacts to airport finances instead of the ratio of compliance costs to total airport operating revenues.

EPA, however, concludes that the ratio of compliance costs to total operating revenues is the more appropriate measure of airport impacts. First, the sole purpose of an airport is to provide a base for air transportation services. Landside revenues, for example, raised through parking, retail, and food concessions are not designed to provide a revenue stream to support the provision of a different service or product, but instead allow airports to accumulate capital from non-airline sources. Thus the intent of these revenue streams is also to support the provision of air transportation services and is therefore a component of an airport's resources relevant to determining the continued economic viability of the airport if it is required to implement this ELG. Second, airports have discretion in choosing what costs are passed-through to airlines, especially in the short run (see Section 2.8.2). Third, if airports use a hybrid approach and operate the landside on a compensatory basis, then airports may have an agreement with signatory airlines that revenues in excess of operating costs will be shared with the airlines. Fourth, there is evidence of airports choosing to close a revenue gap by increasing landside rates and charges (on parking, for example) rather than increase rates and charges on airlines.

3.2.2 Annualized Compliance Cost per Enplaned Passenger

Airline cost per enplaned passenger (or simply cost per enplaned passenger; CPEP) is a measure commonly used in the air transportation industry to determine whether an airport is attractive to airlines, or if the airport is becoming too costly for airlines to use (Page, 2005). CPEP is calculated for each airport as revenues earned from airlines divided by enplaned passengers. EPA chose two measures based on CPEP for use in the determination of economic impacts:

- Incremental cost per enplaned passenger, and
- Percent Increase in CPEP.

Industry comments on the proposed rule specifically recommended the second measure for use in this analysis. However, EPA found two problems with that approach: (1) baseline CPEP is not available for all airports, and (2) interpretation of baseline CPEP, as well as incremental changes to it, is problematic. When reviewing the recommended approach, EPA found that the measure of incremental CPEP has value in its own right as an indicator of what costs might be passed through per passenger to cover compliance costs. Hence both measures are included as a sensitivity analysis.

EPA measured incremental CPEP for each airport as:

$$Incrementd\ CPEP = \frac{Average\,Annualized\,Compliance\,Costs}{Enplaned\,Passengers}$$

Average annualized costs are calculated as described in Section 3.1 above. Enplaned passengers for each airport are published by FAA (2010).

EPA calculated the percent increase in CPEP as:

$$Percent\ Increase\ in\ CPEP = \frac{Incremental\ CPEP}{Baseline\ CPEP}$$

Where baseline airport-specific CPEP (where available) was obtained through an internet search of publicly available sources.

EPA found baseline 2004 CPEP data for 86 of 198 in-scope airports, including 26 of the 46 airports projected to incur compliance costs under this ELG. Among these airports:

- CPEP ranges from about $2.00 to $18.00 for all airports.
- By airport hub size:
  - Large hubs have an average CPEP of $8.10 with a range of $2.00 to $18.00; 10 of 27 large hubs have CPEP exceeding $10.00.
  - Medium hubs have an average CPEP of $6.20 with a range of $2.00 to $12.00; 4 of 30 medium hubs have CPEP exceeding $10.00.
  - Small hubs have an average CPEP of $6.00 with a range of $3.00 to $12.00; 1 of 25 small hubs has CPEP exceeding $10.00.
  - CPEP was publicly available for a single non-hub airport ($8.00).

Clearly larger airports tend to have a higher CPEP, and are more likely to have a CPEP exceeding $10. However, even within airport size classes, a broad range of CPEP is evident, which makes the use of CPEP to determine economic achievability problematic.[26] Again, there is no "bright line" for determining when cost per enplaned passenger becomes too high for airlines to continue service to that airport, or what relative differential in CPEP will induce an airline to switch service from one to another. In recommending this measure to EPA, industry stated there are no clear thresholds for CPEP to determine economic achievability (see comment EPA-HQ-OW-2004-0038-1240.1 – 134).

Based on industry preference for an industry-specific measure, EPA chose CPEP as another yardstick to determine if compliance costs are in some sense large enough to make the rule economically unachievable. However, EPA found it more useful to measure whether compliance costs per enplaned passenger might be prohibitive, rather than the relative change in CPEP between airports.

3.2.3 Debt Service Coverage Ratio

Although EPA no longer assumes that airports will issue debt in the form of GARB to finance capital expenditures, it seems likely that debt financing will be used by many or most airports (see Section 2.6.2). Furthermore, even if an airport does not resort to debt-financing, airport income is affected by increased airport operating costs. In either case, an airport must maintain good financial standing to avoid defaulting on existing debt. Indeed, airports operated by quasi- governmental port authorities have financial

[26] At least some differences in CPEP are likely associated with airport specific attributes. For example, two otherwise similar airports may have significantly different CPEP if one is closer to an airport that might be considered a competitor, or if one has a higher percentage of "origin and destination" traffic. Thus, there is no single level of CPEP that can be considered economically sustainable.

requirements written into the controlling documents that establishing and governing the authority. These generally include limitations on the airport's debt service coverage ratio (DSCR); if the DSCR does not remain above a certain threshold, the authority will be default on its debt. Although this threshold might vary in general, the applicable standard among airports affected by the rule is that the DSCR must remain above 1.25.

EPA therefore examined the impact of the rule on each affected airport's DSCR. The DSCR is defined as:

$$DSCR_{pre} = \frac{Net\ Revenues_{pre}}{Debt\ Service_{pre}}$$

Analysis of airport financial data presented on FAA Form 127 demonstrated that an airport's DSCR could not, in general, be estimated from this information. Therefore, EPA requested the airport's current debt service coverage ratio, and the net revenues and debt service used to calculate that ratio on the survey. EPA also verified that all airports projected as incurring capital costs under the proposed option do use bonds to finance capital expenditures.

EPA estimated post-regulatory DSCR in two ways: assuming 100 percent of costs are passed through to airlines in the form of higher rates and charges, and assuming zero percent of costs are passed through to airlines.

Assuming 100 percent cost pass-through, post-regulatory DSCR is calculated as:

$$DSCR_{post} = \frac{Net\ Revenues_{pre}}{Debt\ Service_{pre} + Annualized\ \ Bond\ Payment}$$

Assuming zero cost pass-through, post-regulatory DSCR is calculated as:

$$DSCR_{post} = \frac{Net\ Revenues_{pre} - Incremental\ Operating\ Cost}{Debt\ Service_{pre} + Annualized\ Bond\ Payment}$$

The DSCR threshold that an airport must meet is specified in the statute creating the airport authority, or the standard that otherwise applies to the relevant airport owner, such as the county or municipal government. For all affected airports for which EPA was able to document the DSCR, the standard is 1.25. Thus, an airport will be evaluated as impacted if its pre-regulatory DSCR is greater than 1.25 and its post-regulatory DSCR is less than 1.25.

An airport will not necessarily default on its debt should the airport's post-regulatory DSCR as measured in this analysis fall below the 1.25 threshold. Rather, this should be taken as an indication that the airport will potentially be in serious financial distress if it issues additional debt but does nothing to strengthen its financial condition. This is essentially a warning sign that the airport must undertake action to avoid default: rates and charges could be raised by a larger amount, debt might be restructured, and airports may have opportunities to pay for capital expenditures without incurring debt (e.g., "pay-as-you-go" funded through rates and charges or passenger facility charges (PFC)). This may help a marginal airport stay within its financial limitations. However, exceeding this threshold would constitute a potentially significant financial impact, and the economic achievability of the rule might be questionable for that airport.

3.3 Analysis of Potential Impacts to Air Service

EPA's effluent limitation guidelines are imposed on airports, while airlines are the tenants or "customers" of those airports. Because airlines are the airport customers, any costs passed through from airport to airlines are secondary impacts of the rule. Historically, EPA determines the economic achievability of a rule based on primary or direct impacts (i.e., impacts to a NPDES permit holder), and does not consider secondary impacts. However, airports might be impacted by a reduction in flights even if an airport's compliance costs do not exceed 3 percent of total operating revenues. EPA therefore examined the increase in airline operating costs at each airport, and thus the potential decrease in supply of air transportation services, if deicing compliance costs are passed-through to airlines.

The airline industry's basic measure of the supply of airline passenger transportation services is available seat-miles (ASM). A single ASM is equal to one passenger seat (empty or filled) flown one mile, thus a carrier's ASM are calculated by multiplying the number of seats flown on a route by route distance, then aggregating ASM over all routes flown.

For each airport affected by the rule, EPA estimated the increased unit cost of providing transportation services from that airport as:

$$Incremental\ Cost\ per\ ASM = \frac{Annualized\ Compliance\ Costs}{Total\ Available\ Seat\ Miles}$$

where airport-specific ASM are obtained from BTS (2010).

In addition, EPA compared the airport-specific incremental cost per ASM with the national passenger airline average cost per ASM:

$$Percent\ Increase\ in\ Overall\ Cost\ per\ ASM = \frac{Incremental\ Cost\ per\ ASM}{National\ Average\ Cost\ per\ ASM}$$

EPA estimated the U.S. national average cost per ASM using BTS data on system-wide ASM and operating costs for all passenger airlines with data available.[27] Airlines with both operating costs and ASM data available accounted for almost 95 percent of total ASM flown in the U.S. This measure can be interpreted as the decrease in supply of airline services attributable to the effluent guideline.

3.4 Extrapolation of 2004 Compliance Costs to Analyze Additional Years

EPA estimated compliance costs using the *Airport Deicing Questionnaire*, which covers the 2002-2003, 2003-2004 and 2004-2005 deicing seasons. Thus the baseline for estimating each airport's equipment and operating needs to meet the effluent guideline are those conditions that existed in the 2004-2005 deicing season. EPA used equipment prices and operational costs from 2006 to project deicing compliance costs for the 2004 baseline. Therefore, to perform the economic impact analysis, EPA deflated costs in 2006 dollars to 2004 using the Producer Price Index for Airport Operations (BLS, 2010), and compared projected airport compliance costs with 2004 airport financial data.

[27] BTS does not have data to estimate cost per ASM on anything but a system-wide basis, nor were airlines able to provide more granular data on the questionnaire.

EPA extrapolated 2004 average annualized compliance costs to extend the analysis beyond the 2004-2005 deicing season. In this extrapolation, capital costs were treated differently from O&M costs. EPA held annualized capital costs constant in all years. Once construction is performed and equipment purchased, they become a fixed cost for the purposes of future deicing; neither the number of aircraft deiced in 2005 or 2006, nor the price of the same capital equipment in those years affects capital expenditures (or their annualized value) that were made in 2004. Airports pay the amortized value of those costs over time, but those do not change from year to year, even due to inflation.

The operating and maintenance costs of performing airfield deicing and collecting and treating ADF, however, are likely to vary over time. First, operating costs will vary from year-to-year as the wages, gas, potassium acetate and other component prices change from year-to-year. In addition, the number of aircraft departures and thus the number of aircraft deiced will vary from year to year.[28] To model this, EPA calculated an airport-specific O&M cost per aircraft deiced in the 2004 baseline, and inflated those unit O&M costs to represent deicing operations in 2005 and 2006. To estimate annual O&M costs for those years, the unit deicing costs were multiplied by the number of airport-specific departures for those years. In summary, airport-specific compliance costs for year 200x, were calculated as:

$$Compliance\,Costs_{200x} = Annualized\ Capital\ Costs_{2004} + \left(\frac{Annual\ O\,\&\,M\ Costs_{2004}}{Airport\ Departures_{2004}} \times \frac{PPI_{200x}}{PPI_{2004}}\, x\ Airport\ Departures_{200x} \right)$$

This approach accounts for both changes in the price of components and labor necessary to collect and treat ADF-contaminated stormwater, as well as airport flight operations that affect the demand for those services. This approach implicitly assumes that the winter weather conditions reflected in the *Airport Deicing Questionnaire* are representative of long-term average conditions at each airport.

The results of extrapolating the impact analysis to cover the 2005 through 2009 period are provided in a memorandum to the rule-making record, DCN XXXX.

3.5 Methodology for Estimating Costs and Projecting Impacts to Co-permittee Airlines

In general, airlines are not directly subject to the Airport Deicing ELG. Under the Clean Water Act, EPA determines economic achievability of an ELG based on those entities directly impacted by the rule. Because airlines are not generally subject to the ELG, impacts to airlines are secondary impacts, and thus not generally part of the determination of economic achievability. However, at airports where an airline is a co-permittee on the airport's NPDES permit, that airline is potentially directly subject to the ELG. While EPA does not generally expect airports to require co-permittees to directly pay some share of the cost of meeting the Airport Deicing ELG, neither can it rule out that possibility. Therefore EPA assessed the potential for the ELG to impact airlines when they are co-permittees at airports.

Not all co-permittees at an airport are airlines. EPA found that fixed base operators (FBOs), aircraft and engine service and repair companies, on-demand air transportation providers, Air National Guard units, and even car rental agencies may be co-permittees on a NPDES permit. However, EPA believes airports are unlikely to directly charge such co-permittees compliance costs associated with the deicing ELG. Most of these co-permittees do not use ADF, and those that do (i.e., FBOs) do so only at the behest of airline customers. Therefore, EPA focused on airline co-permittees in this analysis.

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[28] Because airfield deicing is primarily a function of the number and characteristics of weather events rather than aircraft departures, costs associated with ammonia substitution were adjusted to reflect inflation, but not for changes in aircraft departures.

EPA assumed that as the entity with the responsibility for airfield operations, the airport would take the lead in preparing plans and schedules, hiring contractors, arranging financing, and supervising construction, as well as operating collection and treatment. Therefore, we model the cost share passed through to co-permittees based on a percentage of the airport's projected total annualized compliance costs.

Each airline's compliance costs are directly estimated for each airport at which the airline is a co-permittee. EPA assumes airports will charge co-permittee airlines based on their share of business at the airport relative to other co-permittees. EPA estimates each co-permittee airline's share of landed weight at the airport, because this should be highly correlated with the airline's use of deicing services, and therefore the ADF collection and treatment costs attributable to its operations at the airport. However, this share is calculated relative to total landed weight by co-permittee airlines only, not total landed weight by all airlines.

EPA used BTS T-100 database records of airport departures by airline and aircraft type augmented with rated landed weight by aircraft type (in general, obtained from the FAA Aircraft Characteristics Database) to estimate the total landed weight for each co-permittee airline providing service at each airport at which it is a co-permittee. EPA then allocated 50 percent of the airport's total annualized compliance costs to co-permittee airlines based on their share of total co-permittee landed weight at each airport. EPA was unable to find data concerning what percent of costs might be shared with co-permittees through public or industry sources. Therefore EPA assumed 50 percent of compliance costs would be shared with co-permittees as a standard, conservative, assumption.

In summary, for the purpose of this analysis EPA assumes:

- 50 percent of total annualized compliance costs at the 27 airports with co-permittees are borne by the airport;

- 50 percent of total annualized compliance costs at airports with co-permittees are borne collectively by airlines that are co-permittees at that airport;

Total annualized compliance costs to each co-permittee airline are calculated by summing its estimated annualized compliance costs for all airports at which the airline is a co-permittee.

EPA obtained airline operating revenue, operating profit, and net income data from BTS. In performing economic impact analyses for an ELG, EPA has typically used estimated compliance costs and baseline cashflow or net income to perform a "closure" analysis. In such an analysis EPA projects the affected entities' discounted compliance costs and cashflow over the period of analysis; if an entity's pre-regulatory discounted cashflow is positive, and its post-regulatory discounted cashflow is negative (i.e., projected pre-regulatory discounted cashflow less discounted compliance costs), the entity would be projected to close as a result of the effluent guideline. In this context, EPA ideally would analyze each airline's routes associated with airports at which it is a co-permittee, and a "closure" would mean the airline would reduce or eliminate service to that airport. However, this type of analysis is problematic in this case:

- Airline service decisions may incorporate considerations of how a single route fits into the airline's entire route structure; changes at one airport may affect the financial viability of other routes and other airports (Holloway, 2003).

- If the impact of the ELG at a specific airport is large, airlines have alternatives to halting service at that airport; they could use smaller aircraft or otherwise reduce service to that airport without eliminating it.

- Airline operating cost and revenue data are only available at the airline level, not at the level of specific routes or airports.

- Airline profitability is highly cyclical, although, as documented in the Industry Profile, financial performance has been consistently poor over the last decade. Of the 49 U.S.-flag airlines that incur are projected to incur costs as airport co-permittees in 2004:
  - 23 had negative operating profit;
  - 25 had negative net income;
  - financial data were unavailable for three air carriers.

For those airlines with positive operating profit and/or positive net income, the analysis can be treated like a closure analysis:

- If estimated annual compliance costs exceed operating profit, or if estimated annual compliance costs exceed net income: the option is not affordable; essentially the airline would be projected to shutdown as a result of the regulation.

Because 47 to 51 percent of co-permittee airlines could not be evaluated under the more stringent operating profit and net income metrics, EPA also examined the ratio of compliance costs to operating revenues for all co-permittee airlines to determine if they could be characterized as "large" (i.e., exceed 1 percent of operating revenues). Finally, to the extent that costs are split between airports and their co-permittee airlines, EPA evaluated how costs and impacts to airports are reduced if they do require co-permittees to bear some of the compliance costs.

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CHAPTER 4
POLLUTION CONTROL OPTIONS

4.1 Effluent Limitation Guidelines and Standards

The Federal Water Pollution Control Act (commonly known as the Clean Water Act [CWA, 33 U.S.C. §1251 et seq.]) establishes a comprehensive program to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters" (§101(a)). EPA is authorized under sections 301, 304, 306, and 307 of the CWA to establish effluent limitation guidelines and pretreatment standards of performance for industrial dischargers. The standards EPA establishes include:

- Best Practicable Control Technology Currently Available (BPT). Required under section 304(b)(1), these rules apply to existing industrial direct dischargers. EPA establishes BPT effluent limitations based on the average of the best performances of facilities within the industry, grouped to reflect various ages, sizes, processes, or other common characteristics. EPA may promulgate BPT effluent limits for conventional, toxic, and non-conventional pollutants.

- Best Available Technology Economically Achievable (BAT). Required under section 304(b)(2), these rules apply to existing industrial direct dischargers. BAT represents the second level of stringency for controlling direct discharge of toxic and nonconventional pollutants. In general, BAT effluent limitation guidelines represent the best economically achievable performance of facilities in the industrial subcategory or category. The factors considered in assessing BAT include the cost of achieving BAT effluent reductions, the age of equipment and facilities involved, the process employed, potential process changes, and non-water quality environmental impacts including energy requirements, and such other factors as the EPA Administrator deems appropriate.

- Best Conventional Pollutant Control Technology (BCT). Required under section 304(b)(4), these rules apply to existing industrial direct dischargers, and represent an additional level of control, after BPT, for conventional pollutants. BCT limitations must be established in light of a two-part "cost-reasonableness" test.

- Pretreatment Standards for Existing Sources (PSES). Required under section 307. Analogous to BAT controls, these rules apply to existing indirect dischargers, whose discharges flow to publicly owned treatment works (POTWs). PSES are designed to prevent the discharge of pollutants that pass through, interfere with, or are otherwise incompatible with the operation of POTWs.

- New Source Performance Standards (NSPS). Required under section 306(b), these rules apply to new source industrial direct dischargers for all pollutants. NSPS reflect effluent reductions that are achievable based on the "best available demonstrated control technology." New facilities have the opportunity to install the best and most efficient production processes and wastewater treatment technologies. As a result, NSPS should represent the most stringent controls attainable through the application of the best available demonstrated control technology.

- Pretreatment Standards for New Sources (PSNS). Required under section 307. Analogous to NSPS controls, these rules apply to new source indirect dischargers (whose discharges flow to POTWs). Such pretreatment standards must prevent the discharge of any pollutant into a POTW that may interfere with, pass through, or may otherwise be incompatible with the POTW. EPA promulgates PSNS based on best available demonstrated technology for new sources.

In the final regulation for the airport deicing category, EPA is promulgating BAT for airfield deicing discharges and NSPS for aircraft and airfield deicing discharges.

4.2 Technology Basis for Aircraft Deicing Fluid Control

EPA does not mandate technologies when establishing effluent limitations guidelines and standards. However, EPA evaluates various technologies in order to base the ELGs on demonstrated technologies and to evaluate the economic impact of the cost of those technologies on the regulated industry. If airports and/or airlines can find less costly ways to meet the ELGs, as they are free to do, then the analysis based on these technologies will be an overestimate. This section briefly describes the pollution control technologies evaluated for the final airport deicing ELGs.

Most aircraft deicing fluid (ADF) is applied to aircraft through pressurized spraying systems, either mounted on trucks that move around an aircraft, or on large fixed boom devices. Airlines typically purchase ADF in concentrated form and dilute it with water prior to spraying. Most applied ADF is Type I fluid, which predominately does not adhere to aircraft surfaces. Consequently most of Type I ADF is available for discharge due to dripping, overspraying, tracking and shearing during takeoff. Once the ADF has reached the ground, it will then mix with precipitation, as well as other chemicals found in airport stormwater. (These chemicals typically include aircraft fuel, lubricants and solvents, and metals from aircraft and utility vehicles.) This wastestream enters an airport's storm drain system. At many airports, the storm drains discharge directly to waters of the United States with no treatment.

The ADF application process has presented a challenge for airports attempting to manage their deicing stormwater streams. The airlines' process of applying ADF to aircraft through high pressure spraying, combined with their typical practices of spraying the aircraft outdoors in multiple large unconfined spaces, results in pollutants being dispersed over a wide area and entering storm drains at multiple locations. EPA has identified three technologies that are available to collect the ADF wastestream, which are described in Sections 4.2.1 through 4.2.3. After collection, the ADF must be treated prior to direct discharge to surface water; EPA evaluated anaerobic fluidized bed (AFB) biological treatment as the basis for the numerical discharge component of the aircraft deicing discharge requirements (Section 4.2.4). More detailed information about the collection and treatment technologies described here is contained in the Technical Development Document (EPA 2012).

4.2.1 Glycol Collection Vehicle

A glycol collection vehicle (GCV) is a truck or trailer-based device that utilizes a vacuum mechanism to gather stormwater contaminated with ADF resulting from aircraft deicing operations. A GCV is a modular technology, in that collection capacity can be increased by using additional units, without the complicating factors of in-ground construction associated with some other technologies. An airport can easily increase its overall ADF collection capacity by purchasing larger and/or additional units. EPA estimates that GCVs are able to capture 20 percent of the available ADF.

4.2.2 Plug and Pump

The plug-and-pump collection system involves alterations to an airport's existing storm drain system infrastructure in combination with GCVs to contain and collect ADF-contaminated stormwater. Drainage system modifications involve the placement of temporary blocking devices at storm drain inlets, and/or installation of shutoff valves at one or more points in the storm sewer system. Before a deicing event begins, airport personnel activate the blocking devices, which trap the ADF-contaminated stormwater in the collection system. After the deicing activity ceases, vacuum trucks pump deicing stormwater from the storm sewer system. EPA estimates that plug and pump systems which incorporate GCVs are able to capture 40 percent of the available ADF.

4.2.3 Centralized Deicing Pads

A centralized deicing pad is a facility on an airfield built specifically for aircraft deicing operations. It is typically a paved area adjacent to a gate area, taxiway, or runway, and constructed with a drainage system separate from the airport's main storm drain system. It is usually constructed of concrete with sealed joints to prevent the loss of sprayed ADF through the joints. A pad is specially graded and captures and routes highly contaminated runoff to storage ponds or tanks, from which the deicing stormwater can be sent to on-site or off-site treatment. Central deicing pads minimize the volume of deicing wastewater by restricting deicing to very small areas, and managing the captured wastewater through a dedicated drain system. EPA estimates that central deicing pads allow airports to capture 60 percent of the available ADF. EPA proposed a 60 percent collection and treatment standard based on pads for some airports.

4.2.4 Anaerobic Fluidized Bed Biological Treatment

An anaerobic fluidized bed (AFB) biological treatment system uses a vertical, cylindrical tank in which the ADF-contaminated stormwater is pumped upwards through a bed of granular activated carbon at a velocity sufficient to fluidize, or suspend, the media. A thin film of microorganisms grows and coats each granular activated carbon particle, providing a vast surface area for biological growth. The anaerobic microorganisms that develop occur naturally in sediment, peat bogs, cattle intestines, and even brewer’s yeast. These microorganisms provide treatment of the ADF-contaminated stormwater. AFB treatment system by-products include methane, carbon dioxide, and new biomass. Effluent from the AFB can be discharged to a local publicly owned treatment works (POTW) or, in most cases, directly to surface water.

4.2.5 Technology Basis for Airfield Deicing Control

EPA is not aware of an available technology to control pollutants in airfield deicing discharges through collection and use of a conventional, end-of-pipe treatment system. It is possible, however, to reduce or eliminate certain pollutants by modifying deicing practices, such as using alternative chemical deicing products. In particular, EPA has identified ammonia and COD from airfield deicing as the primary pollutants of concern, as both of these pollutants are a byproduct of pavement deicers containing urea. EPA identified one candidate technology, product substitution, or discontinuing the use of pavement deicers containing urea and using alternative pavement deicers instead.

4.3 Analyzed Options

Using the technology bases identified above for airfield and aircraft deicing discharges, EPA developed three primary options for existing facilities in today's final rule. All three of these options have the same airfield pavement deicing discharge requirements based on product substitution, but would vary the approach to control aircraft deicing discharges:

- Option 1: 40 percent ADF collection requirement for large and medium ADF users (based on plug and pump with GCVs); numeric COD limitations for direct discharges of collected ADF (based on anaerobic treatment);

- Option 2: 40 percent ADF collection requirement for the large ADF users (based on plug and pump with GCVs) and 20 percent ADF collection requirement for medium ADF users (based on GCVs); numeric COD limitations for direct discharges of collected ADF (based on anaerobic treatment); and

- Option 3: Site-Specific Aircraft Deicing Discharge Controls.

In-scope existing airports that could be required to meet discharge requirements under at least one of these final rule options are primary airports with 1,000 or more departures by non-propeller driven aircraft annually that discharge deicing pollutants. For additional information on the final regulatory options and the applicability, see the TDD and the preamble to the final rul. Table 4-1 summarizes these regulatory options. The first column indicates the option number that appears in the cost and impact tables in the following chapters. The second column describes the criteria for inclusion in that option; the third column describes the discharge requirements; and the last column provides a description of the technology basis.

Table 4-1. Summary of BAT Regulatory Options for Final Rule

BAT Option	Criteria	Discharge Requirement	Technology Basis
1	≥ 60,000 gallons of normalized ADF used annually	Collect40% of available ADF; treat direct discharges of collected ADF to numeric limit; no discharge of airfield pavement deicers containing urea	Plug & Pump with Glycol Collection Vehicles; AFB Biological Treatment; Product substitution
	< 60,000 gallons of normalized ADF used annually	no discharge of airfield pavement deicers containing urea	Product substitution
2	≥ 460,000 gallons of normalized ADF used annually	Collect 40% of available ADF; treat direct discharges of collected ADF to numeric limit; no discharge of airfield pavement deicers containing urea	Plug & Pump with Glycol Collection Vehicles; AFB Biological Treatment; Product substitution
	< 460,000 but ≥ 60,000 gallons of normalized ADF used annually	Collect 20% of available ADF; treat direct discharges of collected ADF to numeric limit; no discharge of airfield pavement deicers containing urea	Glycol Collection Vehicles; AFB Biological Treatment; Product substitution
	< 60,000 gallons of normalized ADF used annually	no discharge of airfield pavement deicers containing urea	Product substitution
3	All in scope airports	no discharge of airfield pavement deicers containing urea	Product substitution

[a] Airports in scope are defined as: primary commercial service airports at which deicing operations are performed and have at least 1,000 annual non-propeller aircraft departures.

4.4 References

U.S. EPA. 2012. Technical Development Document for the Final Effluent Limitation Guidelines and New Source Performance Standards for the Airport Deicing Category. EPA-821-R-12-005.

CHAPTER 5
ECONOMIC IMPACT ANALYSIS RESULTS

This section presents the projected economic impacts on existing airports resulting from complying with the regulatory options analyzed for today's effluent limitations guidelines and standards (ELGs) for the Airport Deicing Category. The impacts are estimated using the methodology outlined in Section 3.

Section 5.1 presents the national costs for the regulatory options described in Section 4. Section 5.2 presents estimated impacts on airports based on airport operating revenues, while Section 5.3 examines airport impacts – and impacts to customers – using cost per enplaned passenger as a metric. Section 5.4 summarizes impacts to airports' Debt Service Coverage Ratio. Section 5.5 describes the analysis performed for airports owned by the state of Alaska. Section 5.6 describes the analysis of incremental compliance costs per available seat mile on the supply of air transportation services to in-scope airports. In Section 5.7, EPA discusses potential impacts should airports share compliance costs with co-permittee airlines. Finally, Section 5.8 refers the reader to documentation on NSPS, and Section 5.9 summarizes the impacts to existing airports under regulatory options evaluated for the final rule. A more detailed analysis of impacts on small business entities within the industry is presented in Section 6.

5.1 National Costs of the Airport Deicing Effluent Limitation Guidelines

Table 5-1 presents projected costs for the three regulatory options examined under for the final rulemaking effort. Capital costs were annualized over 20 years using both a 3 percent and a 7 percent real interest rate. The 3 percent real interest rate represents societal preferences and therefore is used to estimate the aggregate national costs of the final rule. The 7 percent real interest rate represents the private opportunity cost of capital and thus the cost to airports of complying with the rule; all economic impacts to airports are projected using option costs annualized with the 7 percent interest rate.

For the reasons described in the preamble, EPA selected Option 3 as the basis for today's final rule. EPA projects the societal average annualized national cost of today's regulation at $3.43 million per year over 20 years (3 percent real rate); of this, 11 percent are composed of capital costs, while annual operating and maintenance account for 89 percent of the total. In-scope airports are expected to incur a total of $6.83 million in (unannualized) capital costs, with a present value of $5.27 million after discounting replacement capital costs (7 percent real rate) in year 11. Annually, the rule is projected to cost airports an average of $3.50 million per year over 20 years, with annualized capital costs composing 13 percent of the total ($0.46 million), with the remaining 87 percent ($3.04 million) composed of annual operating and maintenance costs.

Table 5-1. National Compliance Costs of Final Regulatory Options, 2004-2005 Deicing Season (millions, 2006 dollars)[a]

Option	Airports in Scope	Aggregate Capital Compliance Costs		Aggregate Annualized Compliance Costs		
		Total	Present Value	Capital	O&M	Total
3 Percent Real Interest Rate						
Option 1						
Number	198	$319.9	$309.0	$20.2	$52.0	$72.1
Percent				*28.0%*	*72.0%*	*100.0%*
Option 2						
Number	198	$250.3	$243.7	$15.9	$28.4	$44.3
Percent				*35.9%*	*64.1%*	*100.0%*
Option 3						
Number	198	$6.83	$6.02	$0.39	$3.04	$3.43
Percent				*11.5%*	*88.5%*	*100.0%*
7 Percent Real Interest Rate						
Option 1						
Number	198	$319.9	$299.0	$26.4	$52.0	$78.4
Percent				*33.7%*	*66.3%*	*100.0%*
Option 2						
Number	198	$250.3	$237.6	$21.0	$28.4	$49.4
Percent				*42.5%*	*57.5%*	*100.0%*
Option 3						
Number	198	$6.83	$5.27	$0.46	$3.04	$3.50
Percent				*13.3%*	*86.7%*	*100.0%*

Table 5-2 projects compliance costs by airport size. Under the selected option, Option 3, about 21 percent of annualized compliance costs will be incurred by large hubs, 21 percent by medium hubs, 37 percent by small hubs, and 20 percent by non-hubs (based on a 7 percent real interest rate).

Table 5-2. National Compliance Costs for Final Regulatory Options, 2004-2005 Deicing Season, by Airport Size (millions, 2006 dollars)

	Airports in Scope	Aggregate Annualized Compliance Costs[a]					
		3 Percent Real Interest Rate			7 Percent Real Interest Rate		
		Capital	O&M	Total	Capital	O&M	Total
Option 1 Total							
Number	198	$20.2	$52.0	$72.1	$26.4	$52.0	$78.4
% of Total	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*
Large Hubs							
Number	28	$11.3	$24.9	$36.1	$14.9	$24.9	$39.8
% of Total	*14%*	*56%*	*48%*	*50%*	*57%*	*48%*	*51%*
Medium Hubs							
Number	35	$7.2	$18.6	$25.8	$9.5	$18.6	$28.1
% of Total	*18%*	*36%*	*36%*	*36%*	*36%*	*36%*	*36%*
Small Hubs							
Number	41	$1.5	$7.8	$9.3	$1.8	$7.8	$9.6
% of Total	*21%*	*7%*	*15%*	*13%*	*7%*	*15%*	*12%*
Non-Hubs							
Number	94	$0.2	$0.7	$0.8	$0.2	$0.7	$0.9
% of Total	*48%*	*1%*	*1%*	*1%*	*1%*	*1%*	*1%*
Option 2 Total							
Number	198	$15.9	$28.4	$44.3	$21.0	$28.4	$49.4
% of Total	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*
Large Hubs							
Number	28	$11.0	$22.4	$33.4	$14.6	$22.4	$36.9
% of Total	*14%*	*69%*	*79%*	*75%*	*70%*	*79%*	*75%*
Medium Hubs							
Number	35	$3.9	$3.7	$7.7	$5.2	$3.7	$8.9
% of Total	*18%*	*25%*	*13%*	*17%*	*25%*	*13%*	*18%*
Small Hubs							
Number	41	$0.8	$1.6	$2.4	$1.0	$1.6	$2.6
% of Total	*21%*	*5%*	*6%*	*5%*	*5%*	*6%*	*5%*
Non-Hubs							
Number	94	$0.2	$0.7	$0.8	$0.2	$0.7	$0.9
% of Total	*48%*	*1%*	*2%*	*2%*	*1%*	*2%*	*2%*
Option 3 Total							
Number	198	$0.39	$3.04	$3.43	$0.46	$3.04	$3.50
% of Total	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*
Large Hubs							
Number	28	$0.04	$0.70	$0.74	$0.05	$0.70	$0.75
% of Total	*14%*	*11%*	*23%*	*22%*	*11%*	*23%*	*21%*
Medium Hubs							
Number	35	$0.03	$0.71	$0.74	$0.03	$0.71	$0.74
% of Total	*18%*	*7%*	*23%*	*21%*	*7%*	*23%*	*21%*

Table 5-2. National Compliance Costs for Final Regulatory Options, 2004-2005 Deicing Season, by Airport Size (millions, 2006 dollars)

	Airports in Scope	Aggregate Annualized Compliance Costs[a]					
		3 Percent Real Interest Rate			7 Percent Real Interest Rate		
		Capital	O&M	Total	Capital	O&M	Total
Small Hubs							
Number	41	$0.17	$1.10	$1.27	$0.20	$1.10	$1.30
% of Total	*21%*	*43%*	*36%*	*37%*	*44%*	*36%*	*37%*
Non-Hubs							
Number	94	$0.15	$0.53	$0.69	$0.18	$0.53	$0.71
% of Total	*48%*	*39%*	*18%*	*20%*	*39%*	*18%*	*20%*

[a] Estimated compliance costs to collect and treat ADF at each airport in category; in Section 5.7 EPA will consider whether some costs are incurred by airlines that are co-permittees on an airport's NPDES permit.

5.2 Airport Revenue Test Analysis

EPA compared the ratio of total annualized compliance costs (costs) to total operating revenues (revenues) for each airport to determine the impact of the regulatory options on airport revenues. Table 5-3 summarizes the results of this analysis for all in-scope airports.

Under the selected option, Option 3, over 95 percent of in-scope airports (189 airports) are projected to incur compliance costs less than 1 percent of total operating revenues, while 1 airport (0.5 percent) is projected to incur costs exceeding 3 percent of operating revenues; 6 airports (3.0 percent) fall into the greater than 1 percent, but less than 3 percent range. However, even for the airport projected to incur compliance costs exceeding 3 percent of revenues, EPA believes those costs should not significantly impact its ability to continue to support air transportation. The revenue test makes no allowance for cost pass-through, and analyses of the industry and industry comments on the proposed rule indicate that airport cost are generally passed through to airlines relatively quickly. In addition, EPA's estimate of compliance costs per enplaned passenger (presented in Section 5.3, below) indicate that on a per passenger basis, compliance cost are relatively small and airlines should be able to be pass these relatively small costs through to passengers.

Table 5-3. Annualized Final Regulatory Option Costs as a Percent of Airport Revenues, 2004-2005 Deicing Season[a]

	Airports in Scope	Compliance Costs as a Percent of Airport Operating Revenues			
		≥ 0% < 1%	≥ 1% < 3%	≥ 3%	Not Analyzable
Option 1					
Number	198	172	13	9	5
Percent	*100%*	*86.6%*	*6.3%*	*4.5%*	*2.5%*
Option 2					
Number	198	176	13	5	5
Percent	*100%*	*88.6%*	*6.3%*	*2.5%*	*2.5%*
Option 3					
Number	198	189	6	1	2
Percent	*100%*	*95.5%*	*3.0%*	*0.5%*	*1.0%*

[a] Airport-specific estimated annualized compliance costs (7 percent real interest rate) deflated to 2004 dollars divided by airport-specific 2004 total operating revenues.

Table 5-4 presents revenue impacts by airport size. One of 41 small hubs is projected to incur costs exceeding 3 percent of airport operating revenue under the option selected as the basis for the final rule.

Table 5-4. Annualized Final Regulatory Option Costs as a Percent of Airport Revenues by Airport Size, 2004-2005 Deicing Season[a]

	Airports in Scope	Compliance Costs as a Percent of Airport Operating Revenues			
		≥ 0% < 1%	≥ 1% < 3%	≥ 3%	Not Analyzable
Option 1					
Large Hubs	28	22	6	0	0
Medium Hubs	35	27	1	7	0
Small Hubs	41	36	3	2	0
Non-Hubs	94	86	3	0	5
Total	*198*	*172*	*13*	*9*	*5*
Option 2					
Large Hubs	28	23	5	0	0
Medium Hubs	35	30	2	3	0
Small Hubs	41	36	3	2	0
Non-Hubs	94	86	3	0	5
Total	*198*	*176*	*13*	*5*	*5*
Option 3					
Large Hubs	28	28	0	0	0
Medium Hubs	35	35	0	0	0
Small Hubs	41	37	3	1	0
Non-Hubs	94	89	3	0	2
Total	*198*	*189*	*6*	*1*	*2*

[a] Airport-specific estimated annualized compliance costs (7 percent real interest rate) deflated to 2004 dollars divided by airport-specific 2004 total operating revenues..

5.3 Cost per Enplaned Passenger

This section reviews potential impacts measured in terms of cost per enplaned passenger, as recommended by industry comments. Results are presented as the incremental cost per enplaned passenger, as well as the incremental cost per enplaned passenger relative to baseline cost per enplaned passenger.

Table 5-5 summarizes the results of the incremental compliance cost per enplaned passenger calculation for the final regulatory options. Under the selected option, Option 3, compliance costs less than $0.25 per passenger at 97.0 percent of in-scope airports (192 of 198 in-scope airports), and less than $0.50 per enplaned passenger at 99.5 percent of in-scope airports. One airport (0.5 percent) is projected to incur compliance costs that exceed $0.50 but less than $0.75 per enplaned passenger. If we interpret the incremental cost per enplaned passenger as a proxy for the cost that must be passed-through to airline passengers to pay the cost of the ELG, then this analysis suggests that at minimum, those costs appear to be reasonable at 97 to 100 percent of in-scope airports.

Table 5-5. Annualized Final Regulatory Option Costs per Enplaned Passenger, 2004-2005 Deicing Season

	Airports in Scope	Annualized Compliance Cost per Enplaned Passenger[a]				
		≥ $0.00 < $0.25	≥ $0.25 < $0.50	≥ $0.50 < $0.75	≥ $0.75 < $1.00	≥ $1.00
Option 1						
Number	198	175	13	4	2	4
Percent	*100%*	*88.5%*	*6.5%*	*2.0%*	*1.0%*	*2.0%*
Option 2						
Number	198	179	13	5	1	0
Percent	*100%*	*90.5%*	*6.5%*	*2.5%*	*0.5%*	*0.0%*
Option 3						
Number	198	192	5	1	0	0
Percent	*100%*	*97.0%*	*2.5%*	*0.5%*	*0.0%*	*0.0%*

[a] Airport-specific estimated annualized compliance costs (7 percent real interest rate) deflated to 2004 dollars divided by 2004 airport-specific enplaned passengers.

Table 5-6 reinforces the conclusions drawn from Table 5-4: the single airport projected to incur costs exceeding $0.50 but less than $0.75 per enplaned passenger is a small hub. All but 3 in-scope non-hubs (97 percent) are projected to incur costs less than $0.25 per enplaned passenger, as are 39 of 41 (95 percent) small hubs.

Table 5-6. Annualized Final Regulatory Option Costs per Enplaned Passenger by Airport Size, 2004-2005 Deicing Season

	Airports in Scope	Annualized Compliance Cost per Enplaned Passenger[a]				
		≥ \$0.00 < \$0.25	≥ \$0.25 < \$0.50	≥ \$0.50 < \$0.75	≥ \$0.75 < \$1.00	≥ \$1.00
Option 1						
Large Hubs	28	23	4	1	0	0
Medium Hubs	35	26	2	2	2	3
Small Hubs	41	38	1	1	0	1
Non-Hubs	94	88	6	0	0	0
Total	*198*	*175*	*13*	*4*	*2*	*4*
Option 2						
Large Hubs	28	24	3	1	0	0
Medium Hubs	35	29	3	3	0	0
Small Hubs	41	38	1	1	1	0
Non-Hubs	94	88	6	0	0	0
Total	*198*	*179*	*13*	*5*	*1*	*0*
Option 3						
Large Hubs	28	28	0	0	0	0
Medium Hubs	35	34	1	0	0	0
Small Hubs	41	39	1	1	0	0
Non-Hubs	94	91	3	0	0	0
Total	*198*	*192*	*5*	*1*	*0*	*0*

[a] Airport-specific estimated annualized compliance costs (7 percent real interest rate) deflated to 2004 dollars divided by 2004 airport-specific enplaned passengers.

Table 5-7 compares the airport-specific cost per enplaned passenger to its baseline cost per enplaned passenger (where available) for the three final regulatory options. As discussed in Section 3.2, simple interpretation of these results is problematic: (1) baseline cost per enplaned passenger ranges from \$1.59 to \$18, (2) there does not appear to be a strong correlation between baseline CPEP and airport characteristics such as size, (3) airports appear to use this benchmark primarily to compare their "attractiveness" to airlines with the CPEP at airports they consider competitors, and (4) there are no well-defined thresholds for absolute values of CPEP or values relative to competitors' CPEP that determine an airport's financial stability.

EPA found baseline CPEP data for 86 in-scope airports, 17 of which are projected to incur compliance costs under the regulatory option selected as the basis for today's final rule. Of these 17airports, 14are projected to incur incremental compliance costs per enplaned passenger that compose less than 3 percent of baseline CPEP under the selected option, while 3 are projected to incur costs that would increase baseline CPEP more than 3 percent but less than 10 percent.

- Of the 112 airports for which baseline CPEP data were not collected, 19 are projected to incur compliance costs under the regulatory option selected as the basis for today's final rule1 is projected to incur annualized costs that are less than \$0.01 per enplaned passenger;
- 5 are projected to incur annualized costs between \$0.01 and \$0.10 per enplaned passenger;

- 11 are projected to incur annualized costs between $0.10 and $0.25 per enplaned passenger;
- 1 is projected to incur annualized costs between $0.25 and $0.50 per enplaned passenger;
- 1 is projected to incur annualized costs between $0.50 and $0.60 per enplaned passenger.

Due to the relatively small cost per enplaned passenger incurred by the majority of these airports, EPA believes the general pattern of impacts would not be substantially worse than shown in Table 5-7 had EPA been able to collect baseline CPEP data for all in-scope airports. For example, if an airport's compliance costs are less than $0.10 per enplaned passenger, then compliance costs will increase CPEP by less than 3 percent if that airport's baseline CPEP is $3.34 or more. Of the 86 airports for which baseline CPEP could be found, only seven had a value below $3.34.

Table 5-7. Annualized Compliance Cost per Enplaned Passenger as Percent of Baseline Airline Cost per Enplaned Passenger, 2004-2005 Deicing Season

		Annualized Compliance Cost per Enplaned Passenger as % of Baseline Cost per Enplaned Passenger[a]					
	Airports in Scope	≥ 0% < 3%	≥ 3% < 10%	≥ 10% < 25%	≥ 25% < 100%	≥ 100%	Not Analyzed[b]
Option 1							
Number	198	67	12	6	0	1	112
Percent	*100%*	*33.7%*	*6.0%*	*3.0%*	*0.0%*	*0.5%*	*56.7%*
Option 2							
Number	198	69	13	4	0	0	112
Percent	*100%*	*34.7%*	*6.6%*	*2.0%*	*0.0%*	*0.0%*	*56.7%*
Option 3							
Number	198	176	3	0	0	0	19
Percent	*100%*	*88.9%*	*1.5%*	*0.0%*	*0.0%*	*0.0%*	*9.6%*

[a] Airport-specific estimated annualized compliance costs (7 percent real interest rate) per enplaned passenger in 2004 dollars divided by 2004 baseline airport-specific airline cost per enplaned passenger (where available). Airline cost per enplaned passenger (CPEP) is equal to airport revenues from airlines divided by the number of enplaned passengers.
[b] Baseline CPEP collected through internet search of publicly available information. Of 112 airports for which baseline CPEP was not collected, 19 are projected to incur costs under the selected option. Of these 19 airports: 1 is projected to incur average annualized costs of $231,000; 14 are projected to incur costs ranging from $27,000 to $60,000; and 4 are projected to incur annualized costs less than $17,000.

Table 5-8 demonstrates that 3 small and non-hub airports incur the largest impacts. In general, impacts measured by incremental CPEP as a percent of baseline CPEP are consistent with the results presented above using revenue and incremental CPEP metrics.

Table 5-8. Annualized Compliance Cost per Enplaned Passenger as Percent of Baseline Airline Cost per Enplaned Passenger by Airport Size, 2004-2005 Deicing Season

	Airports in Scope	Annualized Compliance Cost per Enplaned Passenger as Percent of CPEP[a]					
		≥ 0% < 3%	≥ 3% < 10%	≥ 10% < 25%	≥ 25% < 100%	≥ 100%	Not Analyzed[b]
Option 1							
Large Hubs	28	22	5	0	0	0	1
Medium Hubs	35	25	1	6	0	0	3
Small Hubs	41	20	4	0	0	1	16
Non-Hubs	94	0	2	0	0	0	92
Total	*198*	*67*	*12*	*6*	*0*	*1*	*112*
Option 2							
Large Hubs	28	22	5	0	0	0	1
Medium Hubs	35	27	2	3	0	0	3
Small Hubs	41	20	4	1	0	0	16
Non-Hubs	94	0	2	0	0	0	92
Total	*198*	*69*	*13*	*4*	*0*	*0*	*112*
Option 3							
Large Hubs	28	28	0	0	0	0	0
Medium Hubs	35	34	0	0	0	0	1
Small Hubs	41	35	1	0	0	0	5
Non-Hubs	94	79	2	0	0	0	13
Total	*198*	*176*	*3*	*0*	*0*	*0*	*19*

[a] Airport-specific estimated annualized compliance costs (7 percent real interest rate) per enplaned passenger in 2004 dollars divided by 2004 baseline airport-specific airline cost per enplaned passenger (where available). Airline cost per enplaned passenger (CPEP) is equal to airport revenues from airlines divided by the number of enplaned passengers.
[b] Baseline CPEP collected through internet search of publicly available information. Of 112 airports for which baseline CPEP was not collected, 19 are projected to incur costs under the selected option. Of these 19 airports: 1 is projected to incur average annualized costs of $231,000; 14 are projected to incur costs ranging from $27,000 to $60,000; and 4 are projected to incur annualized costs less than $17,000.

5.4 Debt Service Coverage Ratio Analysis

EPA analyzed the impact of the promulgated option on the ability of airport owners to service debt under EPA's assumption that airports will finance capital by issuing debt. Among the estimated 198 in-scope airports, there are several multi-airport authorities that own more than one potentially affected airport. For these multi-airport authorities, debt is issued at the ownership level, not at the airport level. In these cases, EPA estimated the potential debt incurred by all airports owned by that authority. Table 5-9 presents the multi-airport authorities that own at least one in-scope airport surveyed by EPA, and their airports that received surveys.[1]

[1] Four airports from the Hawaii State Airports Division received surveys, but no airports owned by the State of Hawaii were deemed in-scope, and therefore all are excluded from the list.

Table 5-9. Multi-Airport Authorities

Owner Name	Airports Owned
City of Chicago	Chicago O'Hare[a]
	Chicago Midway[a]
City of Houston	William P Hobby[a]
	George Bush Intercontinental[a]
Columbus Regional Airport Authority	Port Columbus International[a]
	Rickenbacker International[a]
County of Sacramento[b]	Sacramento International[a]
	Sacramento Mather
Metro Washington Airport Authority	Washington Dulles International[a]
	Ronald Reagan Washington National[a]
Port Authority of NY and NJ	Newark Liberty International[a]
	John F Kennedy International[a]
	La Guardia[a]
	Stewart International[a]
State of Alaska Airport System	Ted Stevens Anchorage International[a]
	Fairbanks International[a]
State of Alaska Rural Aviation[b]	Bethel[a]
	Ketchikan International[a]
	Sitka, Rocky Gutierrez[a, c]
	Nome[a]
	Ralph Wien Memorial[a]
	Aniak
	Deadhorse
	Cold Bay
	Wiley Post-Will Rogers Memorial
Wayne County Airport Authority	Detroit Metropolitan Wayne County[a]
	Willow Run

[a] Airport EPA has estimated will be in-scope of the effluent guideline.
[b] Additional airports are owned by this authority but are not included in the list because they were not surveyed and EPA determined they are unlikely to be in-scope of the proposed regulation.
[c] Sitka, Rocky Gutierrez Airport did not receive an EPA survey, but based on publicly available data EPA believes it will be in-scope and analyzed it based on data for other Alaskan airports.

EPA presents the results of the DSCR analysis separately for multi airport authorities (Table 5-10) and single airport owners (Table 5-11). EPA found that among the 9 multi-airport authorities responsible for 27 airports shown in Table 5-9, 21 airports are in scope of the rule. All results for multiple airport authorities are unweighted because each airport was individually identified and therefore does not represent any other airports but itself with respect to ownership. EPA aggregated projected costs for all in-scope airports under that ownership and analyzed them using the owning organization's debt service coverage ratio obtained from its Comprehensive Annual Financial Report. The remaining 90 (unweighted) in-scope airports (representing 172 airports) were evaluated individually as single-owner airports. For single airport owners, the survey weights cannot be considered statistically reliable because the survey was not stratified on the basis of ownership.

EPA cannot present summary results encompassing the 198 airports determined to be in the scope of this rule because the airport survey was not stratified by airport ownership. That is, EPA cannot use the survey weights to present on a basis completely consistent with the estimated 198 in-scope airports: (1) the number of airports operated by single-airport owners, (2) the number of multi-airport systems, (3) the number of airports operated by those multi-airport systems, and (4) the number of airports that are impacted by the rule. For example, EPA identified both the surveyed airports that belong to multi-airport systems and the total number of airports (and the identity of those airports) belonging to those same systems. Comparing the surveyed airports with the airports known to be owned by the system demonstrates that the survey weights are not entirely representative of multi-airport ownership patterns.[2] However, because of the large number of single airport operators, and the relatively small number of multi-airport authorities, EPA believes the weighted airport results presented in the lower half of Table 5-8 are generally reflective of the relative frequency of single airport ownership. In addition, the combined results of the unweighted multi-airport authority analysis and the weighted results for the single airport owners are broadly representative of impacts under this analysis.

Table 5-10 presents the results of the debt service coverage ratio (DSCR) analysis for multi-airport authorities potentially affected by the airport deicing effluent guideline. A standard DSCR threshold is 1.25; that is, revenues available for debt service must be at least 125 percent of debt service, or the airport owner will be in default on its debt.[3] Therefore, if an airport or multi-airport authority had a pre-regulatory DSCR greater than or equal to 1.25, but a post-regulatory DSCR less than 1.25, EPA projects that the airport or airport authority will be significantly impacted by the regulation. At a minimum, EPA expects the airport's bond rating would be downgraded, making it more difficult for the airport to use debt financing in the future and requiring payment of higher interest rates. The DSCR analysis was performed alternately under the following assumptions: (1) 100 percent of compliance costs will be passed through to airlines in the form of higher rates and charges (which will still affect the owner's DSCR by increasing debt service requirements but not net revenues, see Section 3.2.2); (2) 50 percent of compliance costs will be passed through to airlines; and (3) worst-case scenario, no compliance costs will be passed through to airlines.

[2] For example, the Port Authority of NY and NJ owns four in-scope airports: LaGuardia, John F. Kennedy International, Newark Liberty International (each of which has a survey weight of 1.0), and Stewart International (with a survey weight of 2.9). Clearly the Port Authority does not own the 2.9 airports represented by Stewart, it only owns Stewart International. However, it cannot be determined if the additional 1.9 airports represented by Stewart are owned by multi-airport authorities or single airport operators.

[3] Forbes (2003) documented that no airport has defaulted on a bond issue; EPA has found no reports of airport bond defaults since that date. Thus it is difficult to determine what will happen if an airport defaults on a bond issue. Default on municipal bonds is rare; unlike corporations, municipalities in default (including public authorities) are almost never liquidated, defaulted municipal bonds have high recovery rates, and most bond issuers resume debt payments (see, for example, Moody's 2002; Public Bonds 2004). The most likely result of default appears to be that the airport would receive lower ratings on future bond issues, making it more difficult to sell debt and requiring higher interest rates.

Table 5-10. Projected Impacts to Debt Service Coverage Ratio of Multi-Airport Authorities Incurring Costs for Various Cost Pass-Through Assumptions (unweighted)

Option	Multi-Airport Authorities Incurring Costs[a]	Airports in Scope Incurring Costs[a]	Authorities Incurring Costs that Cannot be Analyzed[b]	Airports Incurring Costs that Cannot be Analyzed[a]	Number of Authorities with Pre-Regulatory DSCR > 1.25 and Post-Regulatory DSCR <1.25		
					100% CPT[c]	50% CPT[c]	0%CPT[c]
1	9	21	1	5	0	0	0
2	9	21	1	5	0	0	0
3	4	6	1	2	0	0	0

[a] A total of 9 multi-airport authorities own 21 airports that are in scope of the rule. These columns present the number of authorities and airports that are projected to incur costs under the final rule. Under Options 1 and 2, all 9 authorities and all 21 airports incur costs; under Option 3, only 4 authorities owning 6 airports incur costs.
[b] One multi-airport authority, the Alaska Department of Transportation and Public Facilities Rural Aviation System, which owns 5 airports projected to incur costs under the proposed option, could not be analyzed.
[c] 100% CPT: 100 percent of airport compliance costs are passed through to airlines in the form of higher rates and charges; 50% CPT: 50 percent of airport compliance costs are passed through to airlines; 0% CPT: no costs are passed through to airlines.

Table 5-11 presents the projected impact of the rule on the ability of the owners of single airports to finance their debt. Under the selected Option 3, no airports are projected to incur compliance costs that would result in their post-regulatory DSCR falling below the default threshold regardless of assumption concerning the percentage of costs passed-through to air carriers.

Table 5-11. Projected Impacts to Debt Service Coverage Ratio of Single Airport Owners Incurring Costs for Various Cost Pass-Through Assumptions

Option	Airports in Scope[a, b]	Airports Incurring Costs Not Analyzed[c]	Owners with Pre-Regulatory DSCR > 1.25 & Post Regulatory DSCR < 1.25		
			100% CPT	50% CPT	0% CPT
Unweighted					
1	90	17	2	2	3
2	90	17	1	2	2
3	90	2	0	0	0
Weighted					
1	172	59	2	2	3
2	172	59	1	2	2
3	172	3	0	0	0

[a] 90 surveyed single-owner airports are in scope with weights representing 172 airports. Survey weights are not statistically reliable for determining number of single airport owners; however, EPA believes the weights generally reflect the relative frequency of potentially affected single airport owners.
[b] Under Options 1 and 2, all 90 airports (172 weighted) incur costs; under Option 3, only 18 airports (29 weighted) incur costs.
[c]Airports are not analyzable either because they did not provide the necessary data in the survey, or their baseline DSCR was less than 1.25.

5.5 Impacts on Airports Owned by the State of Alaska

EPA determined that the impact of projected compliance costs on airports in the state of Alaska should be analyzed separately due to the unique nature of the airport system in the State. The State of Alaska owns and operates two separate airport systems: the International Airport System (IAS) and the Rural Airport System (RAS).[4]

5.5.1 Impacts on the Alaska International Airport System

The IAS consists of Ted Stevens Anchorage International Airport and Fairbanks International Airport. The IAS is considered a separate major enterprise fund of the State of Alaska, and is considered to be a self-sufficient component of the State government. The IAS issues its own debt in the form of revenue bonds. In short, the IAS operates as many other government-run airports in the United States.

Table 5-12 shows the impact of projected option costs on the two airports of the Alaska IAS. Under the selected option, total projected option costs for the Alaska IAS are $808,000, or 23.1 percent of national annualized compliance costs for the option. Ted Stevens Anchorage International Airport incurs projected compliance costs that are 0.8 percent of its total operating revenues, while Fairbanks International Airport incurs projected compliance costs that are 1.9 percent of total operating revenues.

Table 5-12. Impacts on the Alaska International Airport System (IAS), 2004

Option	National Annualized Option Costs (millions of 2006 dollars)	IAS Total Annualized Option Costs (2006 dollars)	IAS Costs as % of National	IAS Airports with Ratio of Compliance Costs to Airport Operating Revenues:		
				≥ 0% < 1%	≥ 1% < 3%	≥ 3%
1	$78.4	$827,000	1.05%	1	1	0
2	$49.4	$827,000	1.67%	1	1	0
3	$3.50	$808,000	23.1%	1	1	0

5.5.2 Impacts on the Alaska Rural Airport System

The RAS consists of 256 rural airports scattered throughout the State (State of Alaska 2008). The RAS is not a self-sufficient government unit, and the rural airports lose money every year. However, due to the nature of transportation in the State of Alaska, it is vital that these airports remain in operation despite not being profitable. Operation of airports within the RAS falls on the Alaska Department of Transportation and Public Facilities (DOT&PF), as well as on local or tribal governments. According to the DOT&PF, airports in AK "are funded through a combination of user fees, state, local, or tribal funds, and federal funds" (DOTPF 2008). However, the rural airports have very limited opportunities for generating revenue, and the system is largely reliant on state subsidies to pay O&M costs at these airports.

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[4] One more Alaskan airport, Juneau International Airport, is expected to be in-scope of the final rule. Juneau is a small hub owned by the City and Borough of Juneau, and operated as a major enterprise fund of the local government. As such, it is considered to be a self-sufficient component of the City/Borough of Juneau (City and Borough of Juneau, 2004). This airport is included in the regular analysis, and is the small hub projected to incur compliance costs exceeding 3 percent of operating revenues.

Table 5-13 presents the impact of projected compliance costs on the 5 rural airports in the Alaska RAS that EPA determined would be in the scope of the rule (Bethel, Ketchikan International, Sitka Rocky Gutierrez, Nome, and Ralph Wien Memorial). Because data on the revenues of individual airports within the RAS could not be obtained, EPA used the estimated yearly contribution of $23 to $24 million by the State of Alaska to cover the operating costs of the RAS (Maggard, 2008) as a proxy to measure economic impacts. Under the selected option, two airports in the RAS are projected to incur compliance costs totaling $60,600 (1.7 percent of national option costs); these costs compose 0.26 percent of the State's contribution to airport operations.[5]

Table 5-13. Impacts on the Alaska Rural Airport System (RAS), 2004

Option	National Annualized Option Costs (millions of 2006 dollars)	RAS Total Annualized Option Costs (2006 dollars)	RAS Costs as % of National Option Costs	Ratio of Compliance Costs to State Operating Costs of RAS Airports:[a]		
				≥ 0% < 1%	≥ 1% < 3%	≥ 3%
1	$78.4	$69,000	0.09%	5	0	0
2	$49.4	$69,000	0.14%	5	0	0
3	$3.50	$60,600	1.73%	2	0	0

[a] Represents the number of airports projected to incur costs under the specified option; however, the RAS as a whole will incur compliance costs exceeding the specified percent of system operating costs.

5.6 Impacts to Airline Cost per Available Seat Mile

Finally, EPA examined projected annualized compliance costs under the promulgated option on the basis of available seat miles (ASM) on flights departing in-scope airports. ASM is perhaps the most basic measure of the supply of air transportation passenger service. Thus, the analysis approximates the impact of the effluent guideline on the supply of air transportation services.

For Options 1 and 2, this analysis is performed on flights departing a subset of in-scope airports. EPA restricted the analysis to 40 of 198 airports (20 percent), excluding 150 airports projected to incur annualized compliance costs less than $20,000, and 8 Alaskan airports. Thus, the analysis focuses primarily on those airports that incur costs for the collection and treatment of ADF and/or urea substitution. For Option 3, EPA included all 32 non-Alaskan airports that incur costs for urea substitution.

EPA excluded Alaskan airports from this analysis because those airports operate in a distinctly different financial environment, and are used by an almost completely different set of airlines. Although the airports in this analysis for Options 1 and 2 compose a minority of all in-scope airports, they account for almost 98 percent of all projected compliance costs under the promulgated rule. The primary purpose of excluding the airports with the lowest projected compliance costs is to ensure that average impacts are not somewhat misleadingly deflated by including airports with large ASM and small costs in the calculations.

Table 5-14 presents the distribution of the cost per ASM under all three options, distinguishing domestic departures from total departures. Under Option 3, no airports are projected to incur compliance costs exceeding 1/10th of one cent per ASM on either domestic or total departures, while 8 airports incur costs

[5] The fiscal year 2006 budget for the entire Alaska Department of Transportation and Public Facilities was $407.2 million (State of Alaska 2005).

exceeding 1/20th of one cent but less than 1/10th of one cent per ASM. Table 5-15 shows that these 8 airports are non-hubs.

Table 5-14. Annualized Compliance Cost per Available Seat Mile, 2004-2005 Deicing Season[a]

	Airports in Scope	Annualized Compliance Cost per Available Seat Mile					
		≥ $0.0000 < $0.0001	≥ $0.0001 < $0.00025	≥ $0.00025 < $0.0005	≥ $0.0005 < $0.001	≥ $0.001	Not Analyzed[b]
Option 1 **Domestic Departures**							
Number	198	4	9	11	10	6	158
Percent	*100%*	*2.0%*	*4.5%*	*5.5%*	*5.0%*	*3.0%*	*80%*
Total Departures							
Number	198	4	10	10	10	6	158
Percent	*100%*	*2.0%*	*5.0%*	*4.9%*	*5.0%*	*3.0%*	*80%*
Option 2 **Domestic Departures**							
Number	198	8	8	12	11	1	158
Percent	*100%*	*4.0%*	*4.0%*	*6.0%*	*5.5%*	*0.5%*	*80%*
Total Departures							
Number	198	8	9	11	11	1	158
Percent	*100%*	*4.0%*	*4.5%*	*5.5%*	*5.5%*	*0.5%*	*80%*
Option 3 **Domestic Departures**							
Number	198	12	5	6	8	0	167
Percent	*100%*	*6.1%*	*2.5%*	*3.0%*	*4.0%*	*0.0%*	*84.4%*
Total Departures							
Number	198	12	5	6	8	0	167
Percent	*100%*	*6.1%*	*2.5%*	*3.0%*	*4.0%*	*0.0%*	*84.4%*

[a] Analysis includes airports in lower 48 states that incur compliance costs for urea substitution and/or ADF collection and treatment.
[b] The 158 airports not analyzed under Option 1 and Option 2 account for 2.1 percent of total national annualized compliance costs; on average, each of these airports incur less than $10,000 annualized compliance costs. The 167 airports not analyzed under the selected Option 3 include 161 airports that do not incur compliance costs, 5 Alaskan airports that incur $869,000 in annualized compliance costs, and 1 non-Alaskan airport that incurs $6,600 in annualized compliance costs but for which no ASM data are available.

Table 5-15. Annualized Compliance Cost per Available Seat Mile by Airport Size, 2004-2005 Deicing Season[a]

	Airports in Scope	Annualized Compliance Cost per Available Seat Mile					
		≥ $0.0000 < $0.0001	≥ $0.0001 < $0.00025	≥ $0.00025 < $0.0005	≥ $0.0005 < $0.001	≥ $0.001	Not Analyzed[b]
Option 1							
Domestic Departures							
Large Hub	28	2	2	4	0	0	20
Medium Hub	35	0	0	1	2	5	27
Small Hub	41	2	4	4	0	1	30
Non-Hub	94	0	3	2	8	0	81
Total	*198*	*4*	*9*	*11*	*10*	*6*	*158*
Total Departures							
Large Hub	28	2	3	3	0	0	20
Medium Hub	35	0	0	1	2	5	27
Small Hub	41	2	4	4	0	1	30
Non-Hub	94	0	3	2	8	0	81
Total	*198*	*4*	*10*	*10*	*10*	*6*	*158*
Option 2							
Domestic Departures							
Large Hub	28	3	1	4	0	0	20
Medium Hub	35	3	0	2	3	0	27
Small Hub	41	2	4	4	0	1	30
Non-Hub	94	0	3	2	8	0	81
Total	*198*	*8*	*8*	*12*	*11*	*1*	*158*
Total Departures							
Large Hub	28	3	2	3	0	0	20
Medium Hub	35	3	0	2	3	0	27
Small Hub	41	2	4	4	0	1	30
Non-Hub	94	0	3	2	8	0	81
Total	*198*	*8*	*9*	*11*	*11*	*1*	*158*
Option 3							
Domestic Departures							
Large Hub	28	4	0	0	0	0	24
Medium Hub	35	3	0	0	0	0	32
Small Hub	41	5	2	4	0	0	30
Non-Hub	94	0	3	2	8	0	81
Total	*198*	*12*	*5*	*6*	*8*	*0*	*167*
Total Departures							
Large Hub	28	4	0	0	0	0	24
Medium Hub	35	3	0	0	0	0	32
Small Hub	41	5	2	4	0	0	30
Non-Hub	94	0	3	2	8	0	81
Total	*198*	*12*	*5*	*6*	*8*	*0*	*167*

[a] Analysis includes airports in lower 48 states that incur compliance costs for urea substitution and/or ADF collection and treatment.

[b] The 158 airports not analyzed under Option and Option 2 account for 2.1 percent of total national annualized compliance costs; on average, each of these airports incur less than $10,000 annualized compliance costs. The 167 airports not analyzed under the selected Option 3 include 161 airports that do not incur compliance costs, 5 Alaskan airports that incur $869,000 in annualized compliance costs, and 1 non-Alaskan airport that incurs $6,600 in annualized compliance costs but for which no ASM data are available.

Table 5-16 shows the calculation of average incremental cost per total ASM for the 31 airports included in this analysis under the option selected for the final rule, as well as cost per ASM by airport size (1 airport did not have ASM data available). These range from a high of $0.00042 per ASM among non-hubs to $0.00001 per ASM among medium hubs, with an overall average of $0.00004 per ASM. Inclusion of additional in-scope airports in this analysis would result in a lower cost per ASM in all airport categories.

Table 5-16 also presents EPA's estimated baseline airline operating cost per ASM for the 2004-2005 deicing season. EPA downloaded system-wide 2004 ASM by airline from BTS (2010), as well as each airline's operating cost for the same period, where available. EPA collected both pieces of data for 77 of 154 airlines. EPA then edited the list of airlines to remove those that:

- primarily operate in Alaska;
- primarily operate in Hawaii, Caribbean, and Micronesia,
- predominantly provide cargo services, or are
- niche airlines that offer high cost service to relatively small numbers of passengers.

Alaskan airports were excluded from this analysis, thus it was appropriate to exclude those airlines that operate almost exclusively from Alaskan airports from this analysis as well. Furthermore, airlines such as Continental Micronesia appear unlikely to provide significant traffic at airports in the scope of the rule. Finally, airlines that offer primarily cargo services, and niche passenger airlines operate at a high cost per ASM that is not representative of most passenger airlines, and were therefore excluded from the analysis. EPA included 43 airlines in the baseline calculation, with a cost per ASM ranging from $0.1593 (Horizon Air) to $0.0376 (Pan American Airways) that account for almost 95 percent of total ASM flown in the U.S. in 2004.

Using EPA's estimated baseline cost per ASM, this effluent limitations guideline is projected to increase airline cost per ASM on total departures by:

- 0.008 percent at 3 medium hubs,
- 0.012 percent at 4 large hubs,
- 0.138 percent at 10 small hubs, and
- 0.371 percent at 13 non-hubs.

The overall average increase in cost per ASM at all 31 airports included in the analysis is 0.030 percent.

Table 5-16. Incremental Annualized Compliance Cost per Available Seat Mile as Percent of Baseline Airline Cost per ASM by Airport Size, Final Regulatory Option, 2004-2005 Deicing Season[a]

	Annualized Option Costs (thousands, 2004 dollars)		Available Seat Miles (millions), Airports in ASM Analysis		Average Incremental Cost per ASM		Baseline Cost per ASM (system-wide)	Percent Increase Cost per ASM, Airports in ASM Analysis	
	Airports In-scope	Airports in ASM Analysis	Domestic	Total	Domestic	Total		Domestic	Total
Total	$3,288	$2,248	56,843	65,538	$0.00004	$0.00003	$0.1134	0.035%	0.030%
By Airport Size									
Large	$701	$701	42,516	50,846	$0.00002	$0.00001	$0.1134	0.015%	0.012%
Medium	$697	$73	7,371	7,735	$0.00001	$0.00001	$0.1134	0.009%	0.008%
Small	$1,221	$862	5,497	5,498	$0.00016	$0.00016	$0.1134	0.138%	0.138%
NonHub	$670	$613	1,460	1,460	$0.00042	$0.00042	$0.1134	0.371%	0.371%

[a] Analysis includes 31 airports in lower 48 states that incur compliance costs for urea substitution.

EPA also performed this analysis for in-scope Alaskan airports. To summarize:

- In 2004, 5.10 billion ASM were flown from the eight in-scope Alaskan airports (including Juneau) on domestic flights only, while 6.23 billion ASM were flown on total flights.
- The 5 in-scope Alaskan airports are projected to incur annualized compliance costs of $1.03 million (2004 dollars).
- Thus the expected incremental cost per ASM for Alaskan airports is $0.00017 for all flights ($0.0002 for domestic flights only).
- The baseline cost per ASM for Alaska Airlines in 2004 was $0.1023 (EPA believes this is a lower bound cost per ASM for airlines that operate in Alaska, because most operate much smaller aircraft with higher cost per ASM).

Therefore EPA projects that the incremental cost per ASM attributable to the airport deicing effluent guideline is less than 0.2 percent of baseline cost.

5.7 Results of Co-permittee Airline Impact Analysis

In general, airlines are not directly subject to the airport deicing rule. However, because airlines are co-permittees on some airports' NPDES permits, EPA examined potential impacts to such airlines should compliance costs be shared between co-permittee airports and airlines using the methodology described in Section 3.5. The impacts to co-permittee airlines presented here are not in addition to the impacts to airports. To the extent that airports and co-permittee airlines share compliance costs according to EPA assumptions, the costs and impacts to airports are reduced.

The EPA Airport Deicing Questionnaire asked airports to list all co-permittees on the airport's NPDES permit. Based on questionnaire data, EPA found:

- 27 of 198 in-scope airports (14 percent) have co-permittees; 6 of these airports are projected to incur costs under the selected option.

- At the 27 in-scope airports with co-permittees:
  - 297 (73 percent) co-permittees are airlines, and
  - 109 (27 percent) co-permittees are not airlines.

- At the 6 airports with co-permittees that incur costs under the selected option:
  - 54 (57 percent) co-permittees are airlines, and
  - 40 (43 percent) co-permittees are not airlines.

Table 5-17 summarizes the number and type of co-permittees at each of the 27 airports.

Table 5-17. Airports with Co-permittees, 2004

Airport			Co-permittee Type		
ID	Name	State	Non-Airline	Airline	Total
ABQ	Albuquerque Intl Sunport	NM	6	12	18
ATL	Hartsfield - Jackson Atlanta Intl	GA	1	13	14
AUS	Austin-Bergstrom Intl	TX	0	9	9
COS	City of Colorado Springs Muni	CO	5	9	14
DAL	Dallas Love Field	TX	6	1	7
DFW	Dallas/Fort Worth International	TX	3	9	12
DSM	Des Moines Intl	IA	2	9	11
EWR	Newark Liberty Intl	NJ	13	41	54
GSO	Piedmont Triad International[a]	NC	9	11	20
IAD	Washington Dulles International	DC	2	15	17
IAH	George Bush Intercontinental Arpt/Houston	TX	1	6	7
JNU	Juneau Intl[a, b]	AK	5	5	10
MEM	Memphis Intl	TN	0	10	10
MHT	Manchester[a]	NH	2	8	10
MKE	General Mitchell International	WI	5	11	16
OKC	Will Rogers World	OK	2	9	11
OME	Nome	AK	0	1	1
ONT	Ontario Intl	CA	1	1	2
ORF	Norfolk Intl	VA	1	10	11
OTZ	Ralph Wien Memorial[a]	AK	0	1	1
PDX	Portland Intl	OR	10	27	37
PHX	Phoenix Sky Harbor Intl	AZ	4	18	22
RDU	Raleigh-Durham Intl[a]	NC	18	16	34
RNO	Reno/Tahoe International[a]	NV	6	13	19
SAT	San Antonio Intl	TX	6	9	15
SJC	Norman Y. Mineta San Jose International	CA	0	17	17
TUS	Tucson Intl	AZ	1	6	7
Totals	***27 Airports***		***109***	***297***	***406***

[a] Airport incurs costs under the selected option.
[b] Airport is small by SBA standards.
Source: EPA Airport Deicing Questionnaire.

Twenty-two of these 27 airports with co-permittees have nonairline co-permittees, including 5 of the 6 airports that incur costs under the option selected for the final rule. In general, nonairline co-permittees are composed of fixed base operators (FBOs), pilot training, companies that provide aeronautical services such as aircraft and engine service and repairs, and on-demand transportation providers such as air taxi, sightseeing, and small executive and charter services. At two airports, the state Air National Guard is a co-permittee. In addition, car rental agencies are listed as co-permittees on the NPDES permit at two airports. EPA believes airports are unlikely to directly charge such co-permittees costs associated with deicing operations. Most of these co-permittees do not use ADF, and those that do (i.e., FBOs) do so only at the behest of airline customers.

The 27 in-scope airports with co-permittees have from one to 41 airlines listed as co-permittees. The upper end of the range is an outlier: 25 airports have 18 or fewer airlines listed as co-permittees (and 16 of these have 10 or fewer airline co-permittees), Portland International has 27 airline co-permittees, and Newark Liberty International has 41 airlines listed as co-permittees. Among the six airports projected to incur costs, the number of co-permittee airlines ranges from 16 (Raleigh-Durham International) to one (Ralph Wien Memorial) .

However, many airlines are co-permittees at more than one airport, and the number of directly affected airlines is much smaller than 297.

- The 297 airline co-permittees at 27 airports consist of 76 distinct airlines, of which:
  - 26 are foreign-flag carriers, and
  - 50 are U.S.-flag carriers.

- The 54 airline co-permittees at the 6 airports with co-permittees projected to incur costs under the selected consist of 28 distinct airlines, of which:
  - 1 is a foreign-flag carrier, and
  - 27 are U.S.-flag carriers;
    - 11 are major airlines.
    - 4 are cargo-only airlines.

If an airport chooses to apportion co-permittees with some share of the cost of complying with the effluent guideline, it is likely that the foreign-flag air carriers will incur costs as well as the U.S.-flag air carriers. EPA did not, however, project impacts to foreign carriers because it has neither data to project impacts to foreign carriers, nor is it required to under the Clean Water Act.

The number of airports at which an airline is co-permittee varies widely.

- Of the 50 U.S.-flag carriers:
  - 19 are co-permittees at one airport only,
  - 14 are co-permittees at 2 to 4 airports,
  - 5 are co-permittees at 5 to 9 airports,
  - 8 are co-permittees at 10 to 19 airports,
  - 3 are co-permittees at 20 or 21 airports.

- Of the 26 foreign-flag carriers
  - 23 are co-permittees at one airport only,
  - 3 are co-permittees at 2 or 3 airports.

The 11 U.S.-flag airlines that are co-permittees at 10 or more airports are all major airlines. A list of airlines and the number of airports at which they are co-permittees is presented in Table 5-18.At the subset of in-scope airports with co-permittees that are expected to incur costs, the pattern is more homogeneous:

- Of the 27 U.S.-flag carriers:
  - 13 are co-permittees at one airport only,
  - 5 are co-permittees at 2 airports,
  - 6 are co-permittees at 3 airports,
  - 3 are co-permittees at 4 airports.

- The single foreign carrier is a co-permittee at 1 airport.

Table 5-18. Airlines and Number of Airports at which they are Co-permittees, 2004

Airline		Co-permittee at Airports[d]		Airline		Co-permittee at Airports[d]	
U.S. Flag Air Carriers				UA	United Air Lines[c]	18	(3)
17	Piedmont Airlines[c]	1	(1)	US	US Airways[c]	10	(3)
5X	United Parcel Service[c]	14	(3)	WI	Tradewinds Airlines[a, c]	1	(1)
8C	Air Transport International[a]	3		WN	Southwest Airlines[c]	13	(3)
9E	Pinnacle Airlines	1		WO	World Airways	1	
AA	American Airlines[c]	17	(2)	WRD	Ward Air[a, c]	1	(1)
ABX	ABX Air[c]	15	(4)	XJ	Mesaba Airlines	1	
AL	Skyway Airlines[a]	1		XP	Casino Express[a]	1	
AQ	Aloha Airlines[c]	1	(1)	YV	Mesa Airlines	6	
AS	Alaska Airlines[c]	7	(2)	YX	Midwest Airline[a]	4	
AX	Trans States Airlines[a]	1		ZK	Great Lakes Aviation[a]	1	
B6	JetBlue Airways	3		ZW	Air Wisconsin Airlines[c]	2	(1)
CO	Continental Air Lines[c]	21	(4)	**Foreign-Flag Air Carriers**			
DH	Independence Air[c]	2	(1)	5D	Aerolitoral	1	
DL	Delta Air Lines[c]	20	(3)	AC	Air Canada[c]	3	(1)
EM	Empire Airlines[a]	1		AF	Compagnie Nat'l Air France	1	
EV	Atlantic Southeast Airlines	2		AI	Air-India	1	
EZ	Evergreen Int'l	1		AZ	Alitalia	1	
F9	Frontier Airlines[c]	7	(1)	BA	British Airways	2	
FL	AirTran Airways[c]	4	(1)	BR	Eva Airways	1	
FX	Federal Express[c]	17	(4)	CA	Air China	1	
G4	Allegiant Air[a, c]	3	(1)	CEQ	All Canada Express	1	
GQ	Big Sky Airlines[a, b]	0		JM	Air Jamaica	1	
HA	Hawaiian Airlines	2		KE	Korean Air Lines	1	
HP	America West Airlines[c]	11	(2)	LH	Lufthansa German Airlines	2	
J5	Alaska Seaplane Service[a, c]	1	(1)	LX	Swiss International Airlines	1	
K5	Wings Of Alaska[a, c]	1	(1)	LY	El Al Israel Airlines	1	
KAQ	Kalitta Air[a]	1		MH	Malaysian Airline System	1	
KR	Kitty Hawk Aircargo[a]	3		MX	Compania Mexicana De Aviaci	3	
MQ	American Eagle Airlines[c]	7	(2)	NH	All Nippon Airways	1	
N5	Skagway Air Service[a, c]	1	(1)	OK	Czech Airlines	1	
NW	Northwest Airlines[c]	20	(3)	QK	Air Canada Regional	1	
OH	Comair[c]	5	(2)	SK	Scandinavian Airlines	1	
OO	Skywest Airlines[c]	3	(1)	SQ	Singapore Airlines	1	
PCQ	Pace Airlines[a]	1		SV	Saudi Arabian Airlines	1	
QX	Horizon Air	2		TA	Taca Int'l Airlines	1	
RP	Chautauqua Airlines	1		TP	Tap-Portuguese Airlines	1	
SY	Sun Country Airlines[a]	2		VS	Virgin Atlantic Airways	2	
TZ	ATA Airlines	2		WS	Westjet	1	

[a] Airline is small by SBA standards.
[b] Airline was listed as a co-permittee in survey but does not appear to have operated from that airport in 2004.
[c] Airline operates from airport projected to incur costs under the promulgated option.
[d] The number in parentheses indicates the number of airports at which the airline is a co-permittee and the airport is projected to incur costs under the selected option.

EPA allocated 50 percent of compliance costs at airports with co-permittees collectively to the airlines listed in Table 5-18 based on share of landed weight among co-permittee airlines at that airport.

Based on the EPA's assumptions for modeling impacts to co-permittees:

- 50 percent of total annualized cost at the airports with co-permittees are borne by the airport;

- 50 percent of total annualized cost at airports with co-permittees are borne collectively by airlines that are co-permittees at that airport; costs to co-permittee airlines are distributed in proportion to their share of landed weight among co-permittee airlines at each airport;

If airports with co-permittee airlines apportion those airlines 50 percent of the cost of the regulation, EPA projects that about 5 percent of annualized compliance costs ($0.18 million) will be passed through to co-permittee airlines under the promulgated option, almost all of which is attributed to U.S.-flag air carriers (see Table 5-19). The 192in-scope airports that do not have both co-permittees and costs are projected to incur $3.15 million.

Table 5-19. Compliance Costs Attributed to Co-permittees by Type, 2004-2005 Deicing Season (millions, 2006 dollars)

Affected Entities	Aggregate Annualized Compliance Costs					
	Number	Option 1	Number	Option 2	Number	Option 3
Airports						
Airports with no Co-permittees[a]	171	$39.4	171	$33.3	192	$3.15
Percent		*50.2%*		*67.5%*		*90.0%*
Airports with Co-permittees	27	$19.5	27	$8.0	6	$0.18
Percent		*24.9%*		*16.2%*		*5.0%*
Subtotal, Airports	*198*	*$58.9*	*198*	*$41.4*	*198*	*$3.33*
Percent		*75.1%*		*83.8%*		*95.0%*
Air Carriers						
U.S.-flag Air Carrier Co-permittees[b]	49	$18.8	49	$7.4	27	$0.18
Percent		*24.0%*		*15.0%*		*5.0%*
Foreign-flag Air Carrier Co-permittees	26	$0.7	26	$0.6	1	$0.00[c]
Percent		*0.9%*		*1.3%*		*0.0%*
Subtotal, Airlines	*75*	*$19.5*	*75*	*$8.0*	*28*	$0.18
Percent		*24.9%*		*16.2%*		*5.0%*
Total		$78.4		$49.4		$3.50[d]

[a] Under Option 3, 27 in-scope airports have co-permittees, but only six of those airports are projected to incur costs.
[b] One U.S.-flag air carrier listed as a co-permittee on the Airport Deicing Questionnaire was not projected to incur costs in the 2004-2005 deicing season.
[c] About $120; less than 0.01 percent of total.
[d] Numbers in this column do not sum to total due to rounding.

EPA projects that under the assumptions set for this analysis, 1 of 27 (3.7 percent) co-permittee airlines might incur compliance cost exceeding $100,000 annually (2006 dollars) under the selected option; the remaining 26 airlines (61 percent) are projected to incur annualized costs less than $10,000 each. The single foreign-flag carrier is expected to incur compliance costs that are less than $120.

Table 5-20. U.S-flag Air Carriers Projected to Incur Co-permittee Compliance Costs by Cost Range, 2004-2005 Deicing Season

Projected Compliance Cost Range	Number of U.S.-flag Air Carriers		
	Option 1	Option 2	Option 3
annualized compliance costs < $100,000	30	36	26
$100,000 ≤ annualized compliance costs < $350,000	6	6	1
$350,000 ≤ annualized compliance costs < $1 million	6	6	0
$1 million ≤ annualized compliance costs < $2 million	4	0	0
$2 million ≤ annualized compliance costs < $3.2 million	3	1	0

Tables 5-21 and 5-22 show potential impacts to co-permittee airlines based on operating profit and net income measures. Based on the assumption of 50 percent cost-sharing between airports and co-permittee airlines, EPA found that under the selected Option 3, no airlines are projected to incur costs exceeding 2 percent of operating profit or net income (of 10 and 9 airlines respectively than can be analyzed using these measures). The key threshold for these measures is 100 percent: if compliance costs exceed operating profit or net income (i.e., if compliance costs are greater than 100 percent of these measures), then the airline is projected to close as a result of this rule. Therefore these tables demonstrate that no airline remotely approaches that threshold based on the assumption that airports share 50 percent of compliance costs with co-permittee airlines.

Table 5-23 shows that under Option 3, assuming 50 percent cost-sharing between airports and co-permittee airlines, none of the 25 U.S.-flag co-permittee air carriers with revenue data available are projected to incur compliance costs that exceed 0.25 percent of operating revenues.

Table 5-21. Co-permittee Airlines Incurring Costs Exceeding 2 Percent of Operating Profit, 2004-2005 Deicing Season

Option	Co-permittee U.S.-flag Air Carriers Incurring Costs within Specified Range of Operating Profit			
	≤ 2%	> 2%	Negative Operating Profit[a]	NA
Option 1	22	1	23	3
Percent	*44.9%*	*2.0%*	*46.9%*	*6.1%*
Option 2	23	0	23	3
Percent	*46.9%*	*0.0%*	*46.9%*	*6.1%*
Option 3	10	0	15	2
Percent	*37.0%*	*0.0%*	*55.6%*	*7.4%*

[a] Airlines with negative operating profit in the baseline cannot be analyzed.
NA: Data not available.

Table 5-22. Co-permittee Airlines Incurring Costs Exceeding 2 Percent of Net Income, 2004-2005 Deicing Season

Option	Co-permittee U.S.-flag Air Carriers Incurring Costs within Specified Range of Net Income			
	≤ 2%	> 2%	Negative Net Income[a]	NA
Option 1	20	1	25	3
Percent	*40.8%*	*2.0%*	*51.0%*	*6.1%*
Option 2	21	0	25	3
Percent	*42.9%*	*0.0%*	*51.0%*	*6.1%*
Option 2	9	0	16	2
Percent	*33.3%*	*0.0%*	*59.3%*	*7.4%*

[a] Airlines with negative net income in the baseline cannot be analyzed.
NA: Data not available.

Table 5-23. Co-permittee Airlines Incurring Costs Exceeding 0.25 Percent of Operating Revenues, 2004-2005 Deicing Season

Option	Co-permittee U.S.-flag Air Carriers Incurring Costs within Specified Range of Operating Revenues		
	≤ 0.25%	> 0.25%	NA
Option 1	45	1	3
Percent	*91.9%*	*2.0%*	*6.1%*
Option 2	46	0	3
Percent	*93.9%*	*0.0%*	*6.1%*
Option 3	25	0	2
Percent	*92.6%*	*0.0%*	*7.4%*

NA: Data not available.

Finally, sharing costs with co-permittee airlines reduces impacts to airports. Table 5-24 shows projected impacts to in-scope airports if airports with co-permittee airlines share 50 percent of those costs with the airlines. When using this assumption, no airports are projected to incur costs exceeding 3 percent of airport revenues under the promulgated option. As shown in Table 5-3 above, 1 airport is projected to exceed that threshold if no costs are shared with co-permittee airlines.

Table 5-24. Airport Impacts with Co-permittee Airlines Incurring Costs Exceeding 3 Percent of Operating Revenue, 2004-2005 Deicing Season

Option	Airports In-scope	Compliance Costs as a Percent of Airport Revenues		
		≤ 3%	> 3%	NA
Option 1	198	189	4	5
Percent	*100%*	*95.5%*	*2.0%*	*2.5%*
Option 2	198	191	2	5
Percent	*100%*	*96.5%*	*1.0%*	*2.5%*
Option 3	198	193	0	5
Percent	*100%*	*97.5%*	*0.0%*	*2.5%*

Assumes airports with co-permittee airlines share 50 percent of compliance costs with those airlines.
NA: Data not available.

5.8 New Source Performance Standards

Under this rule, the Agency is promulgating new source performance standards (NSPS). Details of the economic impact analysis of NSPS may be found in the docket.

5.9 Summary of Projected Impacts for Final Regulatory Options

Table 5-25 summarizes the projected national annualized compliance costs and the number and percent of in-scope airports projected to incur compliance costs greater than 3 percent of operating revenues under the three analyzed final regulatory options.

Table 5-25. Summary of Impacts under Analyzed Options

Option	National Annualized Compliance Costs (millions of 2006 dollars)[a]	In-Scope Airports	In-Scope Airports with Projected Compliance Costs Exceeding 3% of Operating Revenues[b, c]	
			Number	Percent
1	$72.1	198	9	4.5%
2	$44.3	198	5	2.5%
3	$3.43	198	1	0.5%

[a.] National compliance costs annualized using a 3 percent real interest rate.
[b] Assuming zero percent cost pass-through.
[c] Impacts were not projected for 5 airports are owned by the Alaska Department of Transportation and Public Facilities; impacts to these airports could not be projected because the airport owner does not maintain airport-specific revenue figures.

Based on the analyses presented in this chapter, EPA has determined that all three options are economically achievable. In particular, EPA's selected Option 3 is economically achievable both when airports are assumed to incur 100 percent of compliance costs, and when airports and their applicable airline co-permittees are assumed to share compliance costs.

Under previous rulemaking efforts that directly impose compliance costs on government agencies, EPA used the revenue test to evaluate impacts to these agencies; when projected compliance costs exceed 3 percent of operating revenues, the rule is judged to be unaffordable for a facility. As shown in Table 5–3, under the option EPA selected for the final rule, Option 3, only 1 airport, which composes 0.5 percent of the airports subject to BAT, is projected to incur costs exceeding 3 percent of operating revenue when airports are assumed to incur 100 percent of compliance costs. In reaching this conclusion, EPA used several conservative assumptions in evaluating impacts to airports: costs were annualized using a real 7 percent interest rate, which is significantly higher than airports typically pay for debt financing. At the 7 percent real interest rate, EPA demonstrated that airports' ability to service debt would not, in general, be negatively affected by the rule. EPA also did not take into account airports' ability access other funding for capital expenditure, such as AIP grants or PFCs. Also, EPA performed its analysis of airport impacts without distributing any costs to co-permittee airlines. As such, the estimates of impacts at airports with co-permittees may be overstated.

With respect to airlines that are NPDES co-permittees, none of these airlines are shown to incur a demonstrable impact on three airline income measures: operating revenue, operating profit, or net income under either option. Therefore EPA find that the scenario of costs shared between co-permittee airports and airlines is also economically achievable under any of the options considered for the promulgated rule.

Finally, EPA also assumed these costs would not be passed through to airlines and/or their passengers in the form of higher rates and charges. (As explained above, EPA did assume costs would be shared by co-permittee airlines.) This is a conservative assumption and EPA believes that airports and, ultimately, airlines will use some or all of the above to reduce the cost and impact of the rule, which is further support for EPA's conclusion that the final rule is economically achievable.

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CHAPTER 6
IMPACTS ON SMALL ENTITIES

This chapter analyzes the projected effects of the three regulatory options EPA assessed for the final rule on small entities engaged in airport deicing operations. This analysis is required by the Regulatory Flexibility Act as amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA), hereafter jointly referred to as the RFA. The RFA acknowledges that small entities have limited resources and makes regulating federal agencies responsible for avoiding unnecessary burden on such entities. In response to the RFA, EPA has prepared an analysis of the impacts on small entities. Section 6.1 provides the initial assessment. Section 6.2 presents the analysis of economic impacts to small entities within the air transportation industry; section 6.2.1 reviews projected impacts to small airports, while section 6.2.2 considers potential impacts to small airlines should airports share compliance costs with co-permittee airlines. Section 6.3 summarizes the steps EPA has taken to minimize small business impacts under the promulgated rule.

6.1 Initial Assessment

For this rulemaking, EPA developed a profile of affected small entities in the airport deicing industry. This profile, provided in Chapter 2, includes all affected operations, as well as small businesses. Chapter 5 of this EA presents the analysis of projected economic impacts to the industry as a whole, including both small and large businesses. Much of the information covered in these chapters applies to small businesses.

Also, EPA's assessment provides a determination on whether the rule affects small entities, as well as whether the rule would have an adverse economic impact on small entities. EPA has determined that some small entities may incur costs for incremental pollution control as a result of the promulgated. EPA examines the impacts of these additional costs in Section 6.2.

The RFA defines a "small entity" as a: (1) small not-for-profit organization, (2) small governmental jurisdiction, or (3) small business. EPA expects the principal impact of the rule on small entities will fall on small airports that are primarily small governmental jurisdictions. A small governmental jurisdiction is defined as the government of a city, county, town, township, village, school district, or special district with a population of less than 50,000. EPA estimates that 20 of 198 in-scope airports (10 percent) are owned by small governmental jurisdictions.

However, to the extent that airports with airline co-permittees share costs with those airlines, it is possible some small airlines might be affected under the ELG. As privately-owned, for-profit businesses, airlines are subject to the small business definitions as determined by Small Business Administration's (SBA) size standards. SBA set standards that entities with 1,500 employees or less will be considered small for the Scheduled Passenger and Freight Air Transportation categories (NAICS 481111 and 481112). Based on these size standards, EPA found that 18 of the 49 airlines that are co-permittees at in-scope airports are considered small for the purposes of this analysis.

EPA undertook a number of steps to minimize the impact of this rule on small entities. According to the FAA National Plan of Integrated Airport Systems (2007 – 2011), there are approximately 2,800 public use general aviation and reliever airports in the U.S., some of which have substantial cargo service. Many, if not most, of these airports are likely to be owned by small government entities. Also likely to be owned by small governmental entities are approximately 135 non-primary commercial service airports. EPA has chosen not to regulate any general aviation, reliever, or non-primary commercial service airports under the promulgated regulation. In addition to the 20 small government-owned primary commercial service airports, EPA also estimates that another 53 primary commercial service airports are owned by small government entities, but are out-of-scope of the rule because little deicing is performed at those airports.

6.2 Small Business Analysis

This section presents the projected economic impacts on small entities resulting from compliance with the three regulatory options EPA evaluated for the Airport Deicing category ELG. The impacts are estimated using the methodology outlined in Chapter 3.

6.2.1 Impacts to Small Airports

6.2.1.1 Estimated Number of Small Airports

Small airports are defined according to the size of the population served by the governmental jurisdiction that owns the airport. To determine airport ownership, EPA downloaded the Federal Aviation Administration (FAA) Airport Data (5010) and Contact Information data file for National Flight Data Center (NFDC) facilities. This database lists the owner of each airport as of December 20, 2007. Using the airport code, city, and state, EPA matched the 198 in-scope airports to their owners and determined whether the owner was public or private. Airport ownership is composed of:

- States
- Counties
- Cities
- Airport Authorities
- Multipurpose Port Authorities

Thus, the size of in-scope airports for RFA purposes is determined by the population of the state, county, or city that owns the airport.

In general, airport and multi-purpose port authorities are quasi-governmental agencies that maintain and usually operate airports, shipping ports, and other government owned facilities such as bridges. The authorities are legal entities created by legislation. Many of these authorities have the ability to issue debt, as well as charge fees for the use of the properties.

As quasi-governmental organizations, EPA considers airport and port authorities as owned by the relevant government, and the airport is considered small for the purposes of RFA if the government that created the authority has a population of less than 50,000 people. For example: the owner of the Williamsport, PA airport is listed in the NFDC database as the Williamsport Municipal Airport Authority. Williamsport, PA has a population of 29,900, and is therefore a “small” government for the purposes of RFA. Conversely, Port Columbus International Airport is listed in the NFDC database as owned by Columbus Regional Airport Authority. Because Columbus, OH has a population of 728,000, the airport is not considered “small.”

Based on this analysis, EPA found 20 in-scope airports are owned by small governmental jurisdictions. Of these 20 airports, 3 are small hubs, and 17 are non-hubs by FAA designation. All remaining 178 in-scope airports are non-small for the purposes of the RFA. This includes five Alaskan airports that might otherwise be considered “small” when judged by most standards, such as departures or passengers enplaned. Because the governmental jurisdiction that owns the airports is the state of Alaska, they are therefore designated “non-small” even though they serve sparsely populated areas.

6.2.1.2 Projected Compliance Costs for Small Airports

Table 6-1 summarizes national annualized compliance costs attributed to small and non-small airports (i.e., annualized using a 3 percent real interest rate) for the three final regulatory options. EPA projects that of the expected $3.43 million annualized compliance costs of the promulgated rule under the selected option, $0.29 million (8.6 percent) will be incurred by the 20 small airports.

EPA incorporated incremental recordkeeping and reporting requirements in this analysis; details of these requirements are described in the Technical Development Document, Section 12: Technology Costs (EPA 2012). Incremental recordkeeping and reporting costs are generally already incorporated in the option costs used as the basis for the economic impact analysis (Chapter 5 of this document) and this RFA. A brief summary of treatment technologies that will meet the effluent guidelines is presented in Chapter 4 of this document.

Table 6-1. National Annualized Final Regulatory Option Compliance Costs by Small Business Category (2006 dollars)[a, b]

	Airports In-scope	National Aggregate Annualized Compliance Costs (in millions)[b, c]		
		Capital	O&M	Total
Option 1 Total				
Number	198	$20.1	$52.0	$72.1
% of Total	*100%*	*100%*	*100%*	*100%*
Small				
Number	20	$0.07	$0.25	$0.33
% of Total	*10%*	*0.4%*	*0.5%*	*0.5%*
NonSmall				
Number	179	$20.1	$51.7	$71.8
% of Total	*90%*	*99.6%*	*99.5%*	*99.6%*
Option 2 Total				
Number	198	$15.9	$28.4	$44.3
% of Total	*100%*	*100%*	*100%*	*100%*
Small				
Number	20	$0.07	$0.25	$0.33
% of Total	*10%*	*0.5%*	*0.9%*	*0.7%*
NonSmall				
Number	179	$15.8	$28.2	$44.0
% of Total	*90%*	*99.5%*	*99.1%*	*99.3%*
Option 3 Total				
Number	198	$0.39	$3.04	$3.43
% of Total	*100%*	*100%*	*100%*	*100%*
Small				
Number	20	$0.07	$0.22	$0.29
% of Total	*10%*	*19.1%*	*7.2%*	*8.6%*
NonSmall				
Number	179	$0.32	$2.82	$3.13
% of Total	*90%*	*80.9%*	*92.8%*	*91.4%*

[a] An airport is considered small for the purposes of the Regulatory Flexibility Analysis if owned by a government with a jurisdiction with a of less than 50,000 people; if the airport is owned an independent quasi-governmental authority the airport is considered small if the jurisdiction of the government that created the authority has a population of less than 50,000 people.
[b] Compliance costs annualized using a 3 percent real interest rate to represent the national costs of the rule.
[c] Estimated compliance costs to collect and treat ADF at each airport in category; in Section 6.2.2 EPA will consider whether some costs are incurred by small airlines that are co-permittees on an airport's NPDES permit.

6.2.1.3 Projected Revenue Impacts to Small Airports

Table 6-2 summarizes the results of the revenue test as applied to small and non-small airports in-scope of this effluent guideline. Only one of 20 small airports is projected to incur compliance costs exceeding 3 percent of revenues. Therefore, EPA has determined that a substantial number of small entities are not significantly affected by the promulgated rule.

Table 6-2. Annualized Compliance Costs as a Percent of Airport Operating Revenues by Small Business Category[a, b, c]

	Airports In-scope[c]	Compliance Costs as a Percent of Airport Revenues[c]			
		≥ 0% < 1%	≥ 1% < 3%	≥ 3%	Not Analyzable
Option 1 Total					
Number	198	172	13	9	5
Percent	*100%*	*100%*	*100%*	*100%*	*100%*
Small					
Number	20	19	0	1	0
Percent	*10%*	*11%*	*0%*	*11%*	*0%*
NonSmall					
Number	179	153	13	8	5
Percent	*90%*	*89%*	*100%*	*89%*	*100%*
Option 2 Total					
Number	198	176	13	5	5
Percent	*100%*	*100%*	*100%*	*100%*	*100%*
Small					
Number	20	19	0	1	0
% of Total	*10%*	*11%*	*0%*	*20%*	*0%*
NonSmall					
Number	179	157	13	4	5
% of Total	*90%*	*89%*	*100%*	*80%*	*100%*
Option 3 Total					
Number	198	190	6	1	2
Percent	*100%*	*100%*	*100%*	*100%*	*100%*
Small					
Number	20	19	0	1	0
Percent	*10%*	*11%*	*0%*	*100%*	*0%*
NonSmall					
Number	179	171	6	0	2
Percent	*90%*	*89%*	*100%*	*0%*	*100%*

[a] Airport-specific estimated annualized compliance costs deflated to 2004 dollars divided by airport-specific 2004 revenues.
[b] Estimated compliance costs to collect and treat ADF at each airport in category; in Section 6.2.2 EPA will consider whether some costs are incurred by small airlines that are co-permittees on an airport's NPDES permit.
[c] Component numbers may not sum to totals due to rounding.

6.2.2 Impacts to Small Co-permittee Airlines

6.2.2.1 Estimated Number of Small Co-permittee Airlines

SBA defined airlines with fewer than 1,500 employees as small. Available employment data for airlines is limited to that provided by the Bureau of Transportation Statistics (BTS) in their Employment Statistics – Certificated Carriers report. Unfortunately, this data does not contain records for all airlines that are co-permittees at airports in scope of the rule. EPA obtained employment figures from the airlines' individual annual reports or the annual report of the Regional Airline Association for some of the airlines that were missing data. Finally, EPA examined departure and enplanement data for in-scope airlines for 2004 through 2006 to find a proxy for determining the size classification of the remaining airlines with missing data. Comparing departures and employment for those airlines with both pieces of information available, EPA determined that airlines with fewer than 20,000 annual departures are a reasonable proxy for airlines with fewer than 1,500 employees. Therefore EPA classified airlines with fewer than 20,000 annual departures as small for the purpose of this analysis.

Where employment data was available, it was used as the determinant of small airline status. Where employment data was not available, departures were used. Any airline with no employment data and fewer than 20,000 annual departures was considered to be small for purposes of this analysis.

The airlines defined as small for this analysis are also listed in Table 6-3. Of the 18 airlines that are considered small, 5 are cargo-only airlines. Seven passenger airlines are commuter and small-certificated airlines. The remaining 6 passenger carriers are national and regional carriers.

Table 6-3. Small Airlines and Number of Airports at which they are Co-permittees, 2004[a]

Airline		Co-permittee at Airports		Airline		Co-permittee at Airports[c]	
8C	Air Transport International	3		KR	Kitty Hawk Aircargo	3	
AL	Skyway Airlines	1		N5	Skagway Air Service	1	(1)
AX	Trans States Airlines	1		PCQ	Pace Airlines	1	
EM	Empire Airlines	1		SY	Sun Country Airlines	2	
G4	Allegiant Air	3	(1)	WI	Tradewinds Airlines	1	(1)
GQ	Big Sky Airlines[b]	0		WRD	Ward Air	1	(1)
J5	Alaska Seaplane Service	1	(1)	XP	Casino Express	1	
K5	Wings Of Alaska	1	(1)	YX	Midwest Airline	4	
KAQ	Kalitta Air	1		ZK	Great Lakes Aviation	1	
EM	Empire Airlines	1					

[a] An airline is considered small for the purposes of the Regulatory Flexibility Analysis if it employees fewer than 1,500 workers.
[b] Airline was listed as a co-permittee in survey but does not appear to have operated from that airport in 2004.
[c] The number in parentheses indicates the number of airports at which the airline is a co-permittee and the airport is projected to incur costs under the promulgated option.

6.2.2.2 Projected Compliance Costs for Small Co-permittee Airlines

Using the method and assumptions for attributing costs to co-permittee airlines described in Section 3.5, EPA estimates that less than $10,000 in compliance costs will be collectively incurred by small co-permittee airlines under the option selected for the final rule (see Table 6-4). This composes 22 percent of all costs projected to be incurred by co-permittee airlines.

Table 6-4. Compliance Costs Attributed to Airline Co-permittees by Size, 2004-2005 Deicing Season (millions, 2006 dollars)[a]

	Small	NonSmall	Total
Option 1			
Airlines[b]	18	31	49
Percent	*36.7%*	*63.3%*	*100.0%*
Costs	$345,000	$18,464,000	$18,809,000
Percent	*1.8%*	*98.2%*	*100.0%*
Option 2			
Airlines[b]	18	31	49
Percent	*36.7%*	*63.3%*	*100.0%*
Costs	$159,000	$7,224,000	$7,383,000
Percent	*2.2%*	*97.8%*	*100.0%*
Option 3			
Airlines[b]	6	21	27
Percent	*22.2%*	*77.8%*	*100.0%*
Costs	$9,600	$166,000	$176,000
Percent	*5.4%*	*94.6%*	*100.0%*

[a] Assuming airports with co-permittees apportion 50 percent of compliance costs with co-permittee airlines.
[b] Excluding foreign-flag air carriers.

6.2.2.3 Projected Revenue Impacts to Small Co-permittee Airlines

EPA found that of the 18 co-permittee airlines considered small by SBA standards; 16 had financial data available. Six co-permittee airlines considered small by SBA standards operate from airports projected to incur costs under the promulgated rule, 5 of which had financial data available. When comparing compliance costs with operating profits and net income, 8 small co-permittee airlines that might incur costs under options 1 and 2 had positive baseline operating profits and net income, and therefore can be analyzed here. Under the selected option, 3 small co-permittee airlines that might incur costs had positive baseline operating profits and net income and can be analyzed. All three of the 6 small airlines with analyzable net income and operating profit are projected to incur compliance costs that compose less than 2 percent of operating profit or net income under Option 3. This is well short of the 100 percent threshold that would indicate a closure. None of the 5 small co-permittee airlines that might incur compliance costs under option 3 is projected to incur costs exceeding 1 percent of operating revenues (Table 6-7).

Table 6-5. Co-permittee Airlines Incurring Costs Exceeding 2 Percent of Operating Profit by Size, 2004-2005 Deicing Season[a]

AirlineSize &Option	Co-permittee Airlines Operating at In-scope Airportswith Compliance Costs/Operating Profit				
	Total	≤ 2%	> 2%	Negative Profit	NA
Option 1					
Small	18	7	1	8	2
Percent	*100.0%*	*38.9%*	*5.6%*	*44.4%*	*11.1%*
NonSmall	31	15	0	15	1
Percent	*100.0%*	*48.4%*	*0.0%*	*48.4%*	*3.2%*
Option 2					
Small	18	8	0	8	2
Percent	*100.0%*	*44.4%*	*0.0%*	*44.4%*	*11.1%*
NonSmall	31	15	0	15	1
Percent	*100.0%*	*48.4%*	*0.0%*	*48.4%*	*3.2%*
Option 3					
Small	6	3	0	2	1
Percent	*100.0%*	*50.0%*	*0.0%*	*33.3%*	*16.7%*
NonSmall	21	7	0	13	1
Percent	*100.0%*	*33.3%*	*0.0%*	*61.9%*	*4.8%*

[a] Assumes airports with co-permittee airlines share 50 percent of compliance costs with those airlines.

Table 6-6. Co-permittee Airlines Incurring Costs Exceeding 2 Percent of Net Income by Size, 2004-2005 Deicing Season[a]

Airline Size & Option	Co-permittee Airlines Operating at In-scope Airports with Compliance Costs/Net Income				
	Total	≤ 2%	> 2%	Negative Net Income	NA
Option 1					
Small	18	8	1	7	2
Percent	*100.0%*	*44.4%*	*5.6%*	*38.9%*	*11.1%*
NonSmall	31	12	0	18	1
Percent	*100.0%*	*38.7%*	*0.0%*	*58.1%*	*3.2%*
Option 2					
Small	18	9	0	7	2
Percent	*100.0%*	*50.0%*	*0.0%*	*38.9%*	*11.1%*
NonSmall	31	12	0	18	1
Percent	*100.0%*	*38.7%*	*0.0%*	*58.1%*	*3.2%*
Option 3					
Small	6	3	0	2	1
Percent	*100.0%*	*50.0%*	*0.0%*	*33.3%*	*16.7%*
NonSmall	21	6	0	14	1
Percent	*100.0%*	*28.6%*	*0.0%*	*66.7%*	*4.8%*

[a] Assumes airports with co-permittee airlines share 50 percent of compliance costs with those airlines.

Table 6-7. Co-permittee Airlines Incurring Costs Exceeding 0.25 Percent of Operating Revenues, 2004-2005 Deicing Season[a]

Airline Size & Option	Co-permittee Airlines Operating at In-scope Airports with Compliance Costs/Operating Revenues			
	Total	≤ 0.25%	> 0.25%	NA
Option 1				
Small	18	15	1	2
Percent	*100.0%*	*83.3%*	*5.6%*	*11.1%*
NonSmall	31	30	0	1
Percent	*100.0%*	*96.8%*	*0.0%*	*3.2%*
Option 2				
Small	18	16	0	2
Percent	*100.0%*	*88.9%*	*0.0%*	*11.1%*
NonSmall	31	30	0	1
Percent	*100.0%*	*96.8%*	*0.0%*	*3.2%*
Option 3				
Small	6	5	0	1
Percent	*100.0%*	*83.3%*	*0.0%*	*16.7%*
NonSmall	*21*	20	0	1
Percent	*100.0%*	*95.2%*	*0.0%*	*4.8%*

[a] Assumes airports with co-permittee airlines share 50 percent of compliance costs with those airlines.

Finally, one airport with airline co-permittees on its NPDES permit is considered small by SBA standards. This airport's projected compliance costs exceed 3 percent of airport revenue if it does not share compliance costs with its co-permittee airlines (see Table 6-2). Its costs do not exceed 3 percent of revenue if it does share compliance costs with its co-permittee airlines. Thus, impacts to small airports are reduced if airports share compliance costs with co-permittee airlines (Table 6-8).

Table 6-8. Airports Impacts with Co-permittee Airlines Incurring Costs Exceeding 3 Percent of Operating Revenue by Size, 2004-2005 Deicing Season [a, b]

	Airports In-scope	Compliance Costs as a Percent of Airport Revenues		
		< 3%	≥ 3%	Not Analyzable
Option 1 Total				
Number	198	189	4	5
Percent	*100%*	*100%*	*100%*	*100%*
Small				
Number	20	20	0	0
Percent	*10%*	*11%*	*0%*	*0%*
NonSmall				
Number	178	169	4	5
Percent	*90%*	*89%*	*100%*	*100%*
Option 2 Total				
Number	198	191	2	5
Percent	*100%*	*100%*	*100%*	*100%*
Small				
Number	20	20	0	0
% of Total	*10%*	*10%*	*0%*	*0%*
NonSmall				
Number	178	171	2	5
% of Total	*90%*	*90%*	*100%*	*100%*
Option 3 Total				
Number	198	196	0	2
Percent	*100%*	*100%*	*100%*	*100%*
Small				
Number	20	20	0	0
Percent	*10%*	*10%*	*0%*	*0%*
NonSmall				
Number	178	176	0	2
Percent	*90%*	*90%*	*100%*	*100%*

[a] Airport-specific estimated annualized compliance costs deflated to 2004 dollars divided by airport-specific 2004 revenues.
[b] Assumes airports with co-permittee airlines share 50 percent of compliance costs with those airlines.
NA: Data not available.

6.3 Regulatory Flexibility

EPA has chosen to minimize the impact of this rule on small entities by choosing to require only product substitution for airports that currently use urea to deice airport pavement; EPA does not require collection and treatment of ADF under the promulgated rule. EPA chose not to include any general aviation, reliever, or non-primary commercial service airports under the scope of the rule. In addition, another 53 primary commercial service airports owned by small government entities are out-of-scope of the regulation because little or no deicing fluid/chemicals are used at those airports. Based on the results presented in Section 6.2, one small airport incurs projected compliance costs greater than three percent of operating revenues under the final rule.

6.4 References

FAA. 2006. Report to Congress: National Plan of Integrated Airport Systems (NPIAS) 2007-2011. http://www.faa.gov/airports/planning_capacity/npias/reports/index.cfm?sect=2007.

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