

September 2010

AVIATION AND THE ENVIRONMENT

Systematically Addressing Environmental Impacts and Community Concerns Can Help Airports Reduce Project Delays



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Why GAO Did This Study

The Federal Aviation Administration (FAA) estimates that the number of flights in the United States will increase 20 percent by 2024. It also has identified numerous airports that will need to expand to handle more flights. However, increasing airport capacity and operations poses potentially significant impacts on the environment and quality of life for surrounding communities.

This report addresses (1) airports' actions to reduce their environmental impacts, (2) the extent airports believe environmental issues delay development or operational changes, and (3) the strategies airports can adopt to address environmental issues. GAO reviewed pertinent federal laws and regulations; interviewed airport officials, state and local regulatory agencies, metropolitan planning organizations, and community groups for 10 selected airports, as well as federal officials and national industry and advocacy groups; and surveyed the 150 busiest airports as measured by the number of operations. This report does not contain recommendations. A draft was provided to the Department of Transportation, the Environmental Protection Agency, and two organizations representing airports and airport officials. GAO incorporated technical clarifications they provided as appropriate.

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What GAO Found

Almost all the airports GAO surveyed took some actions to address their environmental impacts in four key areas: reducing noise levels, controlling water pollution, reducing emissions, and using environmentally sustainable practices. These include voluntary actions, such as asking pilots and controllers to use aircraft operational procedures that lower noise levels, as well as actions required by federal and state laws, such as in the areas of controlling water and air pollution. Larger airports, which can have more environmental impacts, were more likely than other surveyed airports to take a wider range of actions, such as soundproofing homes or installing loading bridges that supply aircraft with electric power to lower engine usage and emissions. Finally, GAO found that airports were moving toward a more holistic approach to environmental management, including following environmentally sustainable standards and implementing an Environmental Management System (EMS).

Less than half of the surveyed airports believe that addressing environmental issues somewhat or greatly delayed a development project (35 percent) or operational change (42 percent) at their airport over the last 5 years, even though the vast majority had undertaken a capital development project or operational change during this time period. Both the reported delay and the extent and significance of delay were determined by the responding airport. Less than half similarly believe that addressing environmental issues will cause delays in the next 5 years. More airports reported that they had been somewhat delayed than greatly delayed. Larger airports were somewhat less likely than all surveyed airports to believe that addressing environmental issues will cause a delay in development projects (30 percent) or operational changes (36 percent). Addressing water issues and noise issues was the most commonly cited environmental issue that led to delay in implementing development projects and operational changes, respectively.

A number of airports have adopted strategies to systematically address environmental impacts and community concerns, which can help both mitigate environmental impacts and anticipate and reduce problems with communities and other stakeholders that can lead to delays. Airports are integrating environmental considerations into their planning process, including 7 of the 10 airports GAO visited. Some airports are also finding success in streamlining the federal environmental review process and in integrating their EMS processes with the federal environmental review process. Finally, effective community outreach that solicits stakeholder input, fosters interactive communication with local communities, and evaluates its outreach efforts can help airports better anticipate and deal with community opposition.

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Abbreviations

ACRP	Airport Cooperative Research Program
ACI-NA	Airports Council International – North America
AIP	Airport Improvement Program
ANCA	Airport Noise and Capacity Act
ASNA	Aviation Safety and Noise Abatement Act
ATC	Air Traffic Control
AAAE	American Association of Airport Executives
CAA	Clean Air Act
CAEP	Committee on Aviation Environmental Protection
CDA	Continuous Descent Approach
CEQ	Council on Environmental Quality
CFEMS	Compliance-Focused Environmental Management System
CFR	Code of Federal Regulations
CNEL	Community Noise Equivalent Level
CO	carbon monoxide
CWA	Clean Water Act
DNL	day-night level
DOE	Department of Energy
DOT	Department of Transportation
EA	Environmental Assessment
EIS	Environmental Impact Statement
EMS	Environmental Management System
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FACT 2	Future Airport Capacity Task 2
GHG	greenhouse gas
GSE	ground support equipment

HAP	hazardous air pollutants
ICAO	International Civil Aviation Organization
ISO	International Organization for Standardization
JPDO	Joint Planning and Development Office
LED	light-emitting diode
LEED	Leadership in Energy and Environmental Design
Leq	Equivalent Sound Level
Lmax	Maximum Sound Level
MPO	Metropolitan Planning Organization
NAS	National Airspace System
NEPA	National Environmental Policy Act
NextGen	Next Generation Air Transportation System
NOx	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
OEP	Operational Evolution Partnership
Pb	lead
PFC	passenger facility charge
PM	particulate matter
RNP	Required Navigation Performance
SAM	Sustainable Airport Manual
SEL	Sound Exposure Level
SIP	State Implementation Plan
SOx	sulfur oxide
TRB	Transportation Research Board
USGBC	U.S. Green Building Council
VALE	Voluntary Airport Low Emissions

Aviation and the Environment: Survey of Airport Officials on Airport Environmental Issues (GAO-10-748SP, September 2010), an E-supplement to GAO-10-50

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United States Government Accountability Office
Washington, DC 20548

September 13, 2010

The Honorable Gabrielle Giffords
Chairman
The Honorable Pete Olson
Ranking Member
Subcommittee on Space and Aeronautics
Committee on Science and Technology
House of Representatives

The Honorable Jerry F. Costello
Chairman
The Honorable Thomas Petri
Ranking Member
Subcommittee on Aviation
Committee on Transportation and Infrastructure
House of Representatives

The Honorable Mark Udall
United States Senate

Balancing the capacity enhancing needs of the national airspace system (NAS) with the need to protect the environment can be challenging. The Federal Aviation Administration (FAA) estimates that the annual number of passengers traveling by air in the United States will grow from 750 million in 2012 to over 1 billion by 2023. It also forecasts a corresponding 20 percent increase in the number of flights, which could add to existing flight delays and air traffic congestion. We and others have reported that both the NAS and airport capacity will need to expand to handle the projected increase in traffic.¹ Even while the aviation system has grown and continues to grow, airports have sought to limit the environmental impacts generated by their construction and operations—such as noise, water, air, and waste pollution—in part, to meet applicable legal requirements. However, airports' environmental impacts have been a

¹GAO, *National Airspace System: Regional Airport Planning Could Help Address Congestion If Plans Were Integrated with FAA and Airport Decision Making*, [GAO-10-120](#) (Washington, D.C.: Dec. 23, 2009). DOT OIG, *Observations on Short-term Capacity Initiatives*, AV-2008-087 (Washington, D.C.: Sept. 26, 2008). Adie Turner and Robert Puentas, *Expect Delays: An Analysis of Air Travel Trends in the United States*, Metropolitan Policy Program at Brookings (October 2009).

source of friction with neighboring communities. As we have previously reported, community opposition due to concerns about aviation noise and other environmental impacts can arise during the public outreach required by federal law when federally-funded airport expansion projects are proposed and can contribute to project delays at some airports.² We have previously reported that new runway construction from initial planning to completion takes a median of 10 years, but delays from lawsuits or addressing environmental issues can add an additional 4 years to the median time.³ The Joint Planning and Development Office's (JPDO) 2007 Concept of Operations document also projected that, based on current operational trends, environmental impacts, particularly noise, will be the primary constraint on the capacity and flexibility of the Next Generation Air Transportation System (NextGen) unless these impacts are managed and mitigated.

FAA is undertaking several efforts to ensure the safety and efficiency of the NAS, including NextGen—the transformation of the air transportation system by 2025 from the current radar-based system, into a more automated aircraft-centered, satellite-based system. FAA has also undertaken several airspace redesign efforts, including those in the New York/New Jersey/Philadelphia airspace, and Florida's West Coast airspace that will result in changes in aircraft flight paths around airports there. Both efforts are intended to increase efficiency and reduce delays, and are expected to produce substantial environmental benefits, such as reducing emissions growth and decreasing aircraft noise. Their success depends in part on changes to operational procedures undertaken by aircraft during their arrival and departure and airport expansion and improvement projects. According to FAA, environmental and energy issues, such as noise levels in communities surrounding airports, will also significantly influence the future capacity and flexibility of the NAS.⁴

²GAO, *Aviation and the Environment: Impact of Aviation Noise on Communities Presents Challenges for Airport Operations and Future Growth of the National Airspace System*, [GAO-08-216T](#) (Washington, D.C.: Oct. 24, 2007).

³See GAO, *Aviation Infrastructure: Challenges Related to Building Runways and Actions to Address Them*, [GAO-03-164](#) (Washington, D.C.: Jan. 30, 2003).

⁴See Statement of Victoria Cox, Vice President for Operations Planning Services, FAA, Before the House Committee on Transportation and Infrastructure, Subcommittee on Aviation on Air Traffic Control Modernization and NextGen: Near Term Achievable Goals (Mar. 18, 2009).

FAA has identified 35 of the busiest U.S. commercial airports as providing critical services to the NAS either in terms of passengers, cargo, or as connecting airports and which may require additional capacity. These 35 airports are known as Operational Evolution Partnership (OEP) airports.⁵ More than 70 percent of U.S. passengers travel through OEP airports. FAA has also identified 27 airports that it forecasts will be significantly congested by 2025 if currently planned improvements—such as new or extended runways, airspace redesign, and some NextGen improvements (e.g., reduced separation requirements for arrivals and departures)—do not occur at Future Airport Capacity Task 2 (FACT 2) airports.⁶ Nineteen of the 27 FACT 2 airports are OEP airports, and all but 1 of the OEP and FACT 2 airports are among the nation’s 66 large and medium hub airports.⁷ Large and medium hub airports are referred to as larger airports throughout this report. We previously found that larger airports are best able to fund capital development projects.⁸

Given that successfully reducing airports’ environmental impacts is critical to maximizing airport capacity, you asked that we update our work on airports’ actions to address their environmental impacts. This report addresses (1) the actions that airports have taken to reduce environmental

⁵OEP airports are commercial U.S. airports with significant activity. These airports serve major metropolitan areas and also serve as hubs for airline operations. The OEP airports were identified in 2000 based on lists from FAA and Congress, as well as a study that identified the most congested U.S. airports.

⁶FAA’s 2007 report, *Capacity Needs in the National Airspace System 2007–2025: An Analysis of Airports and Metropolitan Area Demand and Operational Capacity in the Future*, (Washington, D.C.: May 2007) (FACT 2), among other things, identifies airports that it predicts will face significant capacity constraints by 2015 and 2025 under two different scenarios: (1) if planned improvements, such as airspace redesign or new or extended runways, are carried out and (2) if planned improvements do not occur. See GAO, *National Airspace System: Regional Airport Planning Could Help Address Congestion If Plans Were Integrated with FAA and Airport Decision Making*, GAO 10-120 (Washington, D.C.: Dec. 23, 2009) for a detailed discussion of the FACT 2 report and its forecasts.

⁷FAA categorizes the nation’s commercial airports into four main groups based on the number of passenger enplanements—large hubs, medium hubs, small hubs, and nonhubs. The categories are based on the number of passengers boarding an aircraft (enplaned) within the United States. A large hub enplanes at least 1 percent of all systemwide passengers, a medium hub at least 0.25 but fewer than 1 percent, a small hub at least 0.05, but fewer than 0.25 percent, and a nonhub less than 0.05 percent. See 49 U.S.C. § 47102. The 66 large and medium hub airports are based on FAA’s 2008 enplanement data.

⁸GAO, *Airport Finance: Observations on Planned Airport Development Costs and Funding Levels and the Administration’s Proposed Changes in the Airport Improvement Program*, GAO-07-885 (Washington, D.C.: June 29, 2007).

impacts of airport operations and development, (2) the extent to which airports believe that environmental issues have or will delay capital projects or operational changes, and (3) the strategies airports can adopt to mitigate delays in implementing capital projects and operational changes and address environmental issues.

To answer our three objectives, we conducted a Web-based survey of knowledgeable officials from the 150 busiest U.S. airports, which include commercial airports and general aviation airports.⁹ The full survey and responses are contained in a separate e-supplement [GAO-10-748SP](#). Of surveyed airports, 141 airports (94 percent) responded, including 63 of 66 larger airports—which include all 35 OEP airports and 26 of 27 FACT 2 airports¹⁰—12 small hubs, 15 non-hubs, and 51 general aviation airports.¹¹ Large and medium hub airports account for about 90 percent of U.S. passengers, 35 percent of operations, and are key to the efficiency of the NAS and have the greatest resources to fund projects, including capital development projects. To determine whether there were any differences in the environmental actions taken by, and perspectives of, these larger airports, we compared the survey results from large and medium hub airports to the data from airports in our survey. We administered our survey only to airport officials. We also interviewed officials from 10 airports, including Chicago O’Hare International Airport in Illinois; Long Beach/Daugherty Field and Los Angeles International Airports in California; Naples Municipal, Palm Beach International, and Southwest Florida International Airports in Florida; John F. Kennedy International Airport in New York; Philadelphia International Airport in Pennsylvania; Portland International Airport in Oregon; and Seattle-Tacoma International Airport in Washington. We selected these airports to include airports that have one or more of the following characteristics: have undertaken efforts to become “green” or more environmentally sustainable; have been identified through FAA’s OEP or FACT 2 as

⁹We surveyed the 150 busiest airports as measured by operations (the number of landings and takeoffs) for calendar year 2008, as reported by FAA.

¹⁰One FACT 2 airport, T.F. Green Airport in Warwick, Rhode Island, was not included in our survey.

¹¹The group of general aviation airports we surveyed includes reliever airports, which according to FAA, are airports designated by FAA to relieve congestion at commercial service airports and to provide improved general aviation access to the overall community. General aviation airports are the largest single group of airports in the U.S. system. This category also includes privately owned, public use airports that enplane 2,500 or more passengers annually and receive scheduled airline service.

needing additional capacity; have community groups involved in environmental issues or have taken steps to reach out to such groups; are in nonattainment areas for identified criteria pollutants;¹² and are located in various regions of the country. See appendix II for a list of the airports that we visited or responded to our survey.

Additionally, we interviewed FAA representatives from headquarters and 5 regional offices; officials from 6 regional EPA offices and 12 relevant state and local environmental regulatory agencies; and 3 aviation environmental experts. We also interviewed representatives from 7 metropolitan planning organizations, 2 environmental advocacy groups, and 10 community groups. We also reviewed literature to determine leading practices in stakeholder and community involvement in environmental issues, notably our past reports, as well as those of the Airport Cooperative Research Program (ACRP), which is sponsored by FAA and managed by the Transportation Research Board (TRB), a unit of the National Research Council within the National Academy of Sciences. Additional information on our scope and methodology appears in appendix I.

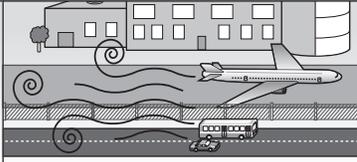
We conducted this performance audit from January 2008 through September 2010 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

¹²The Clean Air Act of 1970, as amended, requires the Environmental Protection Agency (EPA) to set national ambient air quality standards for six air pollutants, known as criteria pollutants, to protect public health and the environment: nitrogen oxides (NO_x), sulfur oxides (SO_x), carbon monoxide (CO), ozone (O₃), particulate matter (PM), and lead (Pb). 42 U.S.C. 7409; 40 C.F.R. part 50. Geographic areas that have levels of a criteria pollutant above those allowed by the standard are called nonattainment areas.

Background

Airports can affect the environment in a number of ways (see fig. 1).¹³

Figure 1: Examples of Possible Airport Environmental Effects

Noise	Emissions	Water pollution	Environmental sustainability
 <p>Aircraft fly over nearby homes and schools during takeoffs and landings</p>	 <p>Emissions come from aircraft as well as from airport vehicles and traffic coming to/from the airport (including rental cars and parking shuttles)</p>	 <p>Runoff from construction activities, aircraft deicing operations, or from spilled fuel pollute local streams</p>	 <ul style="list-style-type: none"> • Airport terminal operations including lights, computer systems, and air conditioning consume large amounts of energy • Garbage from shops, restaurants, on-board food service, etc.

Source: GAO.

- **Noise:** Airports can be a significant source of noise for surrounding communities, particularly from aircraft takeoffs and landings. The impact of aviation noise is usually analyzed in terms of the extent to which noise annoys people by interfering with their normal activities, such as sleep, relaxation, speech, telephone conversations, television viewing, and school. The generally accepted model for assessing the cumulative effects of airport noise exposure is the Integrated Noise Model. FAA requires use of the model, or an FAA approved equivalent, to predict noise levels for its Part 150 noise compatibility programs, which provide federal funding under the Airport Improvement Program (AIP) to airport sponsors that volunteer to mitigate present and future noise impacts.¹⁴ FAA also requires use of the model for environmental analyses to meet requirements under

¹³This report focuses on airport-level sources of pollution, specifically, those environmental impacts we asked about in depth on our survey: noise, water pollution, emissions, and environmental sustainability. Airports can also have other environmental impacts, including those that may affect endangered species, wetlands, cultural sites (such as historic buildings, churches, and cemeteries), and protected lands (such as national and state parks).

¹⁴14 C.F.R. part 150.

the National Environmental Policy Act of 1969 (NEPA).¹⁵ Among other functions, the model provides a correlation of the day-night level (DNL)¹⁶ to the percentage of population highly annoyed by recurring noise sound events. For NEPA purposes, FAA defines a significant aviation noise impact as a DNL 1.5-decibel increase occurring over noise sensitive land uses located at or above a 65-decibel day night level (DNL 65 dB). Perceptions of aviation noise vary from one individual to another, and, as a result, even comparatively low levels of noise exposure can be annoying to some individuals. The Airport Noise and Capacity Act of 1990 (ANCA)¹⁷ required the retirement or modification of older, noisier jet aircraft that could not meet FAA noise standards, and this requirement was enabled by technological advancements to jet aircraft.¹⁸ According to FAA, this contributed to reducing the number of people exposed to significant aviation noise levels by more than a third from 2000 to 2006. Local government decisions that allow communities to expand land uses that are noise sensitive near airports may, however, erode some of the noise reduction gains, according to a 2004 FAA report to Congress.¹⁹ In addition, future increases in air traffic and changes in aircraft flight paths, which can expose neighborhoods to aircraft noise that had not been previously exposed to it or that concentrate more flights on some existing flight paths, could lead to more noise complaints from the community.

¹⁵Pub. L. No. 91-190, 83 Stat. 852, codified, as amended, at 42 U.S.C. § 4321 et seq. According to FAA, *Environmental Impacts: Policies and Procedures* Order 1050.1E, March 20, 2006, all formal actions taken by FAA officials are subject to NEPA review unless statutory law applicable to the FAA's operations expressly prohibits or makes compliance impossible, or are otherwise excepted by NEPA regulations. Actions covered by NEPA review include grants, loans, contracts, leases, construction, research activities, rulemaking and regulatory actions, certifications, licensing, permits, plans submitted to the FAA that require FAA approval, and legislation proposed by FAA.

¹⁶DNL is a noise descriptor or metric that takes into account the magnitude of the sound levels of all individual events that occur during a 24-hour period, the number of events, and an increased sensitivity to noise during typical sleeping hours (between 10:00 p.m. and 7:00 a.m.). Although FAA requires the use of DNL for airport analyses, it also promotes the use of supplemental metrics, which according to the Federal Interagency Committee on Aviation Noise, are also useful in addressing various public noise concerns and helping the public to further understand airport-related noise impacts.

¹⁷Pub. L. No. 101-508, 104 Stat. 1388, 1388-378—384.

¹⁸14 CFR Part 36.

¹⁹FAA, *Aviation and the Environment: A National Vision Statement, Framework for Goals and Recommended Actions* (Washington, D.C.: December 2004).

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- **Emissions:** Aviation-related activities produce about 3 percent of total U.S. greenhouse gas (GHG) emissions and less than 1 percent of air pollutant concentrations nationwide, but these concentrations are expected to increase with forecasted growth in the aviation sector, according to FAA. According to the EPA, in areas with busy airports, aircraft contribute a larger amount of total mobile source emissions.²⁰ Aircraft are a significant source of airport emissions (e.g., idling at the gate, taxiing, takeoffs, and landings).²¹ Airport ground support equipment and passenger vehicles, as well as various stationary sources located on airport grounds, such as boilers, emergency generators, and incinerators, also produce emissions. Together, these sources emit nitrogen oxides and volatile organic compounds, which lead to the formation of ground-level ozone (that is, smog) and other substances that contribute to local air pollution, as well as carbon dioxide and other GHGs that rise into the atmosphere and contribute to climate change. These pollutants can also affect the quality of human life and health. For example, according to a National Research Council panel, ozone can aggravate respiratory ailments, and even short-term exposure is likely to contribute to premature deaths of people with asthma, heart disease, and other preexisting conditions. About 160 commercial service airports²² are located in non-attainment and maintenance areas.²³
 - **Water pollution:** Airports and their tenants can affect water quality through activities such as aircraft and vehicle fueling and maintenance, as well as runway and aircraft deicing and anti-icing activity. Chemicals from

²⁰According to EPA, in 2002, for the 10 non-attainment areas with busy airports, nitrogen oxide emission contributions ranged from 1 percent to 7.1 percent; for volatile organic compounds (which contribute to ozone formation) the range was 0.9 to 2.3 percent and the range for PM (2.5 micrometers) was 0.8 to 3.2 percent. EPA noted that the percentages are expected to increase by a factor of 2 to 3 in the upcoming decade.

²¹An ACRP report estimates that commercial airlines account for 11 percent of U.S. GHG emissions from transportation sources, the third largest source of transportation GHG emissions, behind automobiles and personal trucks. For a discussion of options that airlines and others are taking to reduce aircraft GHG and other emissions, see GAO, *Aviation and Climate Change: Aircraft Emissions Expected to Grow, but Technological and Operational Improvements and Government Policies Can Help Control Emissions*, GAO-09-554 (Washington, D.C.: June 8, 2009).

²²According to FAA, commercial service airports are publicly-owned airports that have at least 2,500 passenger boardings each calendar year and receive scheduled passenger service.

²³Maintenance areas are areas that did not meet the standard for a criteria pollutant in the past but have reached attainment and met certain procedural requirements.

such activities may contaminate groundwater and surface water supplies if allowed to flow from airport facilities to storm drains or waterways. Airports often need to take steps to contain or treat runoff in order to meet federal Clean Water Act²⁴ (CWA) requirements. Fuel spills, which may contaminate soil or groundwater if not contained or diverted to a fuel collection separation system, are another concern, and may result from leaks, improper connections, and improperly monitored storage tanks. Toxic pollutants—such as solvents, dioxins, and metals that can be present in airport runoff—in the water supply can cause immediate short-term human health effects, such as respiratory irritation, and long-term, permanent health problems such as cancer, kidney and liver damage, anemia, and heart failure.

- **Resource and environmental sustainability:** Environmental sustainability refers to sustaining our natural resources and safeguarding our environmental assets for future generations.²⁵ Airports, like other large businesses, can consume large amounts of water and energy to operate lighting, heating and cooling systems, and computers. Airport concession shops and food service operations, as well as airlines, can also generate significant quantities of solid waste, such as cardboard, wooden pallets, aluminum, plastic, glass containers, and leftover food. Airports' and their tenants' activities to address these issues, as well as their activities to address noise, emissions and water pollution, can promote sustainability.

Airports are subject to federal, state, and local laws and regulations designed to protect the environment. FAA, as the lead federal agency for airport development and funding, has the responsibility for analyzing and disclosing potential environmental impacts from proposed airport development. Other federal agencies, such as EPA, are also involved in federal oversight over airport activities that impact the environment. Several federal environmental laws, including the CWA and Clean Air Act (CAA), are generally administered by states' operating programs that EPA has authorized.

Aircraft noise is regulated at the source, that is, engines must meet International Civil Aviation Organization (ICAO) noise standards which

²⁴33 U.S.C. § 1251 et seq.

²⁵See GAO, *Measuring Our Nation's Natural Resources and Environmental Sustainability: Highlights of a Forum Jointly Convened by the Comptroller General of the United States and the National Academy of Science*, [GAO-08-127SP](#) (Washington, D.C.: Oct. 24, 2007).

have been promulgated by regulation by FAA.²⁶ Congress also set phase out requirements for noisier aircraft under the Airport Noise and Capacity Act of 1990 (ANCA).²⁷ In addition, the Aviation Safety and Noise Abatement Act of 1979 (ASNA) established airport noise compatibility planning grants,²⁸ which are administered under and implemented in accordance with FAA's Part 150 noise compatibility regulations—14 C.F.R. part 150. California has also set a somewhat more stringent standard for the acceptable level of noise in the vicinity of airports—65 Community Noise Equivalent Level (CNEL),²⁹ and airports whose operations produce noise that exceeds this standard must obtain a variance from the state that requires that the airport develop a schedule for reducing noise impacts in its vicinity.

The CAA mandates standards for mobile sources of emissions, such as aircraft and the equipment that services them at airports, as well as stationary sources, such as power plants located at airports. EPA sets aircraft emissions standards and has adopted those set by the ICAO. FAA administers and enforces these standards.³⁰ The CAA, as amended, also regulates hazardous air pollutants (HAP), such as benzene, which is found in aviation fuels. Some states and local jurisdictions also have additional

²⁶14 C.F.R. part 36. ICAO is an organization affiliated with the United Nations that aims to promote the establishment of international civilian aviation standards and recommended practices and procedures. FAA, as the U.S. representative to ICAO, in consultation with EPA, works with representatives from other countries to set certain environmental standards, including for noise.

²⁷Pub. L. No. 101-508, 104 Stat. 1388, 1388-378—384. ANCA required the phase-out Stage 2 aircraft (older aircraft that did not meet the ICAO standard existing at the time for aircraft, i.e. Stage 3 aircraft) by December 31, 1999, with certain exceptions. Pursuant to this requirement, specific aircraft operators had to transition from Stage 2 to Stage 3 aircraft. ANCA also resulted in new regulations affecting the airport proprietors, the Part 161 regulations (14 C.F.R. part 161) that limit the ability of airports to impose limits on their operations. Now, regardless of the *nature* of the local Stage 2 restrictions—whether involving aircraft flight procedures or ground restrictions—ANCA requires airports to seek public and FAA comment before instituting any such restrictions.

²⁸Pub. L. No. 96-193, § 103, 94 Stat. 50, 51, codified as amended at 49 U.S.C. § 47505.

²⁹The CNEL, like DNL, is used to characterize average noise levels over a 24-hour period. Both assign additional weight to aircraft sounds occurring between 10:00 p.m. and 7:00 a.m. However, CNEL assigns an additional weight for aircraft sounds occurring between 7:00 p.m. and 10:00 p.m.

³⁰For example, according to FAA, it ensures compliance by reviewing and approving certification test plans, procedures, test reports, and engine emissions certification levels.

requirements pertaining to air pollution. As a result, air pollution control regulations can be site- or area-specific.³¹

The CWA sets the basic structure for regulating discharges of pollutants to waters of the United States. Under the permitting system established under the CWA, airports must obtain a National Pollutant Discharge Elimination System (NPDES) permit from EPA or an authorized state for covered discharges of stormwater or other wastewaters. In addition, under the national pretreatment program, airports are required to pretreat their wastewater before discharging into sewer systems to remove pollutants that may pass through or interfere with the treatment processes at municipal wastewater treatment facilities. Many airports are also subject to regulations that require them to develop programs to prevent and immediately clean up oil and chemical spills.³² EPA has also established reporting requirements for hazardous substance releases.³³

By contrast, there are currently no federal laws or regulations that specifically require airports to make their buildings “green” or act in a more environmentally sustainable manner. Using more environmentally sustainable practices, however, may help airports meet other federal environmental requirements, such as the CAA.

Certain federal actions, including airport expansion and large capital projects that use federal funding, require compliance with NEPA.³⁴ Under NEPA, federal agencies evaluate the potential environmental effects of

³¹Other federal laws may affect airport expansion, such as the National Historic Preservation Act, which requires any agency providing federal assistance to a project, prior to the approval of the expenditure of any federal funds, to take into account the effect of the undertaking on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register. The act may apply when airport operations or airport development projects, including their associated air pollution emissions, affect cultural or historic resources.

³²See 40 C.F.R. part 112.

³³40 C.F.R. part 117.

³⁴42 U.S.C. § 4321 et seq. According to FAA, *Environmental Impacts: Policies and Procedures* Order 1050.1E, March 20, 2006, all formal actions taken by FAA officials are subject to NEPA review unless statutory law applicable to the FAA's operations expressly prohibits or makes compliance impossible, or are otherwise excepted by NEPA regulations. Actions covered by NEPA review include grants, loans, contracts, leases, construction, research activities, rulemaking and regulatory actions, certifications, licensing, permits, plans submitted to the FAA that require FAA approval, and legislation proposed by the FAA.

actions they are proposing or ones for which third parties, such as airports seek federal approval or funding. The agencies can meet the NEPA requirements by categorically excluding the project, using an environmental assessment (EA) or, if actions are likely to significantly affect the environment, preparing a more detailed environmental impact statement (EIS).³⁵ NEPA implementing regulations set forth requirements that federal agencies must adhere to in the EIS process. For example, an EIS must, among other things, (1) describe the environment that will be affected, (2) identify alternatives to the proposed action and identify the agency's preferred alternative(s), (3) present the environmental impacts of the proposed action and alternatives, and (4) identify any adverse environmental impacts that cannot be avoided should the proposed action be implemented. Throughout the EIS process, FAA must make diligent efforts to involve the public, which may involve holding public hearings.³⁶ For additional direction on implementing NEPA and related regulations, FAA developed an order³⁷ that governs, among other things, its EIS process and issued best practices for EIS management.

During the environmental review process, other substantive environmental laws may also be implicated. For example, under the CAA's conformity provision,³⁸ FAA must determine whether a project will conform to an applicable state implementation plan (SIP); for example, emission increases that result from an airport project must not exceed the SIP's emission forecast or budget for that airport.³⁹ Airports may be

³⁵ According to FAA, approximately 40 percent of airport projects undergo the less rigorous EA, while less than 1 percent of airport projects require an EIS. The remaining 60 percent of projects, according to FAA, are categorically excluded under NEPA. When an agency determines that proposed activities fall within a category of activities the agency has already determined has no significant impact—called a categorical exclusion—then the agency generally need not prepare an environmental assessment or environmental impact statement. A federal action may be categorically excluded—thus exempting it from the federal environmental review process—if, based on agency experience, the proposed action does not individually or cumulatively have a significant effect on the environment. See 40 C.F.R. § 1508.4.

³⁶ 40 C.F.R. § 1506.6 (c).

³⁷ FAA Order 1050.1E, Chg 1, which is the most recent version, was updated on March 20, 2006. FAA Order 5050.4B addresses NEPA requirements specifically for airport actions.

³⁸ 42 U.S.C. § 7506(c)(1) (the Conformity Provision).

³⁹ States are required to submit implementation plans to EPA setting forth the state strategy for eliminating or reducing emissions in areas that fail to meet the National Ambient Air Quality Standards set by EPA under the Clean Air Act for criteria pollutants.

required to obtain environmental permits or approvals from other federal, state, and local agencies before they can begin construction of a proposed project. For example, Section 404 of the CWA generally prohibits the discharge of dredged or fill material into the waters of the United States, including certain wetlands, without a permit from the Corps of Engineers.⁴⁰ State and local agencies may also require permits dealing with air and water quality.

FAA provides guidance and funding for airport development projects, including environmental planning and mitigation. FAA's environmental guidance for airports is contained in a series of orders, advisory circulars, and handbooks.⁴¹ Among these are guidance on environmental planning, noise abatement, water quality, air emissions, and Environmental Management Systems (EMS).⁴² Over the past several years, FAA has provided over \$3.5 billion annually to airports for airport capital projects through its AIP. Part of the cost of project development is the cost for environmental planning, including conducting an EIS, if necessary, and performing environmental mitigation, such as installing stormwater drainage, creating or enhancing wetlands, and noise soundproofing. In addition, 35 percent of FAA's AIP discretionary funds are reserved by FAA for noise-abatement and emissions-reductions projects under FAA's

⁴⁰33 U.S.C. § 1344(a).

⁴¹FAA, *National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions*, Order 5050.4B April 28, 2006; *Desk Reference for Airport Actions*, October 2007; *Environmental Impacts: Policies and Procedures*, Order 1050.1E, Change 1, March 20, 2006; *Environmental Management Systems for Airport Sponsors*, Advisory Circular 150/5050-8, September 26, 2007; and *Air Quality Handbook*, June 2, 2005.

⁴²An EMS is a management tool that enables an organization to identify and control the environmental impact of its activities; improve its environmental performance; and implement a systematic approach to setting environmental goals and demonstrating that they have been achieved.

Voluntary Airport Low Emissions (VALE)⁴³ program if the airport is in a nonattainment or maintenance area.⁴⁴

Surveyed Airports Reported Taking a Variety of Actions to Reduce or Mitigate Their Environmental Impacts

Our survey results and interviews with airport officials show that airports have taken a variety of actions to reduce the environmental impacts resulting from their operations and development. The majority of airports took at least one action in each of the four environmental areas included in our survey during the period 2006-2009. Some of the actions taken help ensure compliance with environmental laws and regulations, while others represent voluntary airport efforts to reduce their environmental impacts.⁴⁵ Although every surveyed airport, regardless of size or geographic location, was asked whether it had taken the same list of actions, it should be noted that some actions are not necessarily appropriate for all airports. For example, smaller airports generally produce less noise, emissions and water pollution than larger airports and may not need to take as many actions to address environmental impacts. In addition, some actions are necessitated by an airport's location so that for instance, airports in areas with high annual rainfall may need to do more to deal with runoff than those airports located in desert climates. Within each environmental area we first describe the actions taken by all surveyed airports and then focus on the actions of the 63 large and medium hub airports (or "larger airports") because of their size and

⁴³Vision 100-Century of Aviation Reauthorization Act, Pub. L. No. 108-176, 177 Stat. 2490, §§ 121, 151, 158, and 159 (2003), established a voluntary program to reduce ground emissions at commercial service airports in air quality nonattainment and maintenance areas. To implement the Vision 100 provisions relating to airport emissions reductions, FAA created and began administering the VALE program in 2005. Consistent with the authorizing legislation, airports eligible for the VALE program can apply for federal AIP funds "set aside" for noise and air quality projects or, with FAA approval, use Passenger Facilities Charges (PFC), which airports can collect from passengers to use for eligible airport development projects, to fund low-emissions projects. See GAO, *Aviation and the Environment: Initial Voluntary Airport Low Emissions Program Projects Reduce Emissions, and FAA Plans to Assess the Program's Overall Performance as Participation Increases*, GAO-09-37 (Washington, D.C.: Nov. 7, 2008).

⁴⁴FAA's VALE program seeks to reduce airport ground emissions by providing financing for low emission vehicles, refueling and recharging stations, gate electrification, and other airport air quality improvements at commercial service airports located in designated air quality nonattainment and maintenance areas.

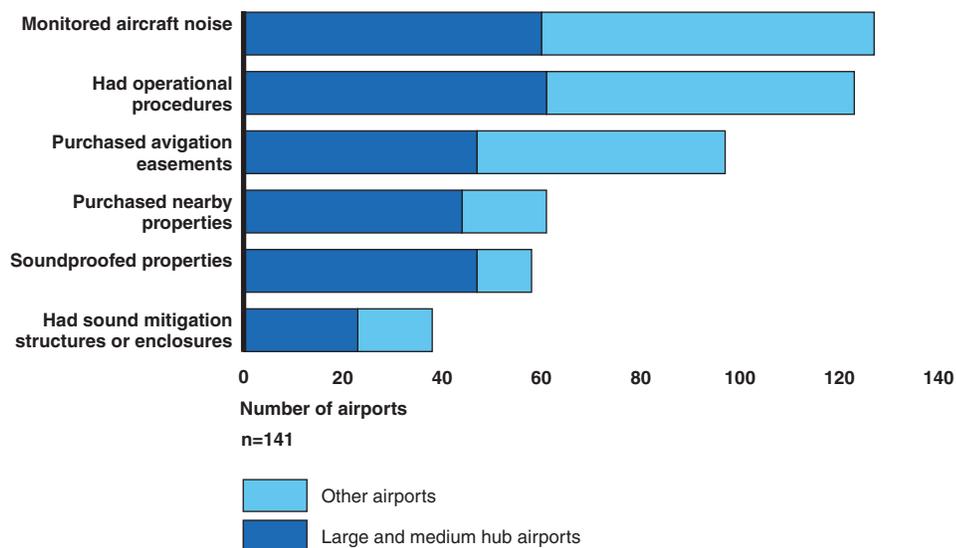
⁴⁵Our survey did not ask airports to distinguish between actions taken to reduce their environmental impacts as part of their day-to-day operations and those taken to mitigate their environmental impacts identified in the NEPA process in connection with an airport project or operational change.

significance to the system and their level of future investments in NextGen and airport improvements.

Most Airports Took Multiple Actions to Address Noise, While Larger Airports Were More Likely to Implement More Costly Measures

Over the 3-year period 2006 through 2009, most responding airports, sometimes in conjunction with airlines and the FAA, had taken a variety of actions to address or reduce or mitigate aircraft noise, most commonly, monitoring noise or developing aircraft operational procedures that reduce the amount of noise affecting nearby communities. (see fig. 2).

Figure 2: Variety of Airport Actions Taken to Address Aircraft Noise



Source: GAO survey.

Most responding airports, regardless of size, reported taking steps to assess their noise impacts on the community, although larger airports were more likely to use noise measurement metrics besides the traditional DNL to measure noise impacts. Of the responding airports that monitored aircraft noise, 127 airports (90 percent) collected noise complaints from the public during the last 3 years,⁴⁶ while 83 airports (59 percent) monitored noise levels in the areas surrounding the airport, including 54 airports that used supplemental noise metrics for this purpose. As we have

⁴⁶The most common methods of complaint collection was by phone hotline (111 airports), Web site (71 airports), and an online complaint form (53 airports).

previously reported, supplemental noise metrics can define noise exposure in ways that the public can understand more readily than the DNL metric required by FAA in noise studies under the Part 150 program. The three most commonly used supplemental metrics were, in descending order, Maximum Sound Level (Lmax), Sound Exposure Level (SEL), and Equivalent Sound Level (Leq).⁴⁷ FAA reports supplemental metrics in an EIS when its NEPA analysis shows a proposed action would cause significant noise impacts on communities. Projects at larger airports are more likely to require such statements, according to FAA. Also, 31 airports voluntarily used supplemental metrics, while 20 airports said they were required to do so.

At the majority of airports we surveyed, including most larger airports, operational procedures that reduce noise levels on surrounding communities were in place, such as noise abatement flight paths (90 airports), preferential runway use (79 airports), or procedures to reduce noise aircraft produce during routine aircraft engine maintenance tests known as ground run ups (77 airports).⁴⁸ At a few surveyed airports, air carriers participated in new flight procedures that are part of FAA's NextGen initiative. For example, Continuous Descent Approach (CDA), which allow aircraft to stay at cruise altitudes longer and use lower power levels as they approach the airport, thereby reducing noise and emissions, was used at 9 airports while at 21 airports Required Navigation Performance (RNP), which permits aircraft to descend on a precise route and thereby potentially avoid noise sensitive areas, was used.⁴⁹ Larger airports were slightly more likely than smaller airports to have CDA and RNP procedures in place, constituting 6 of the 9 and 11 of the 21 airports

⁴⁷Sound Exposure Level (SEL) is a measure of duration and magnitude of a single noise event. Equivalent Sound Level (Leq) is the average noise level over a specified time period, such as during school hours. Maximum Sound Level (Lmax) is commonly used to describe the maximum noise level from a single event.

⁴⁸Although often voluntary, some noise abatement operational procedures may be instituted at airports to mitigate noise problems identified in a NEPA environmental review.

⁴⁹These new flight procedures are currently used only for a limited number of approaches and landings at airports. RNP procedures also can have other environmental benefits including reducing an aircraft's consumption of fuel and lowering its emissions of carbon dioxide and nitrogen oxides. GAO, *Next Generation Air Transportation System: FAA Faces challenges in Responding to Task force Recommendations*, [GAO-10-188T](#) (Washington, D.C.: Oct. 28, 2009) and GAO, *Aviation and the Environment: Impact of Aviation Noise on Communities Presents Challenges for Airport Operations and Future Growth of the National Airspace System*, [GAO-08-216T](#) (Washington, D.C.: Oct. 24, 2007).

that had these procedures in place, respectively. Twenty-seven airports impose curfews on aircraft operations, a number which may not increase significantly in the future given the fact that since 1991, airports are required under FAA's Part 161 regulations, which implement ANCA, to meet more stringent requirements in order to impose a restriction. Only one airport, Naples Airport in Florida, has successfully completed the process since 1991.

Most responding airports, including a majority of larger airports, also took actions to limit the amount of residential property exposed to high levels of aircraft noise, including purchasing or otherwise obtaining avigation easements⁵⁰ (97 airports), purchasing nearby homes (50 airports), purchasing nearby land (47 airports), and erecting sound mitigation structures or enclosures (38 airports). Airports also soundproofed a variety of buildings within the DNL 65 dB contour, most commonly homes (50 airports), but also schools, hospitals, and certain commercial buildings.⁵¹ Airports soundproofed anywhere from two to thousands of homes; 20 of the 21 airports that reported soundproofing 1,000 or more homes were larger airports. Airports often obtain funding for home and land purchases, sound mitigation structures and enclosures, and soundproofing from AIP grants or can use PFC for these purposes. As figure 2 shows, while larger airports, which generally have a larger noise footprint than smaller airports, took many of the actions to address noise, they implemented the majority of the non-operational noise reduction measures reported in our survey. For example, 47 larger airports soundproofed homes, which represented 81 percent of all responding airports that reported doing so. And only 18 larger airports reported that they did not purchase some type of property to address noise issues, while the majority of all responding airports reported not doing so.

Although most airports we surveyed took a variety of actions to reduce or mitigate aircraft noise, only a few airports quantified the impact these actions had on noise levels in surrounding communities. We did not assess

⁵⁰ An avigational easement permits free flights over the land in question. *United States v. Brondum*, 272 F.2d 642, 645 (5th Cir. 1959).

⁵¹ Such commercial buildings include offices, portions of retail stores where the public is received or other noise sensitive areas within commercial buildings.

these quantifications.⁵² Nine airports quantified the impact of their actions on noise, one noting that new departure procedures implemented with the opening of a new runway reduced the number of people within the 60 plus DNL contour by 4,349 and the number of dwellings by 1,926. Some airports cited other non-quantified results of what they viewed as successful noise reduction and mitigation actions, including an improved environment around the airport (49 airports), improved relationships with the community (33 airports), reduced noise complaints (31), and more compatible land use around the airport (17 airports).

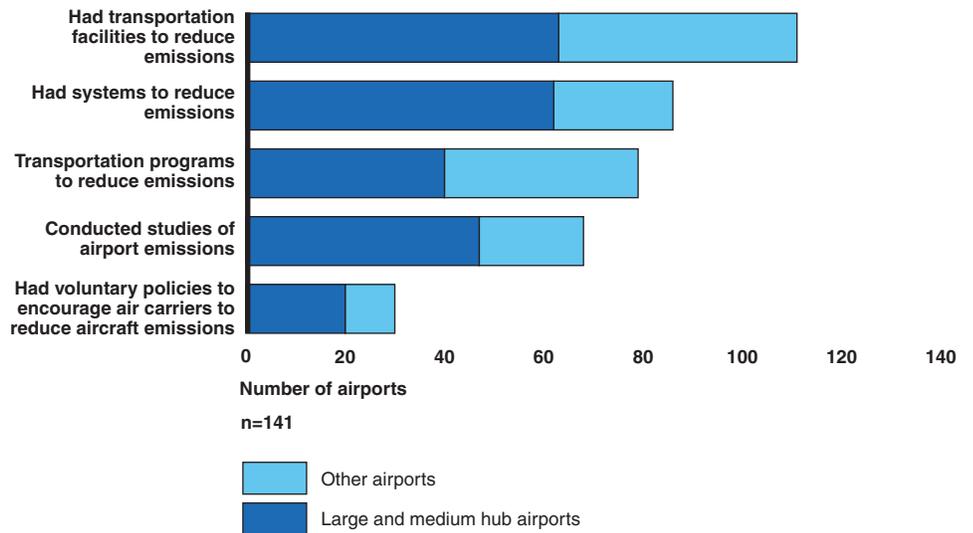
Most Responding Airports Addressed Emissions in Some Way, but Larger Airports Reported Taking a Wider Variety of Actions

Our survey results show that responding airports, often in conjunction with the air carriers that serve them, have taken measures to reduce and quantify emissions from major sources (fig. 3). Most common are providing transportation facilities, followed by having on-airport systems to reduce emissions (like the use of electric vehicles), transportation programs for employees that encourage reducing vehicle emissions, conducting emission studies, and voluntary actions by air carriers to reduce their emissions. Although some airports may be required to mitigate emission increases arising from projects covered by NEPA and the CAA, our previous work indicated that most emission reduction actions are done so voluntarily.⁵³

⁵²Nor did we evaluate airports' self-reported assessments of the reduced environmental impacts of their actions in the three other key environmental areas covered in our survey.

⁵³GAO, *Aviation and the Environment: Strategic Framework Needed to Address Challenges Posed by Aircraft Emissions*, [GAO-03-252](#) (Washington D.C.: Feb. 28, 2003).

Figure 3: Variety of Airport Actions Taken to Reduce Emissions



Source: GAO survey.

Most responding airports have taken some actions to reduce emissions from vehicular traffic. For example:

- 101 airports provided access to a public bus stop;
- 84 airports provided a staging area for taxis to reduce idling;
- 62 airports provided a cell phone lot to reduce circling the airport; and
- 47 airports had consolidated rental car facilities to reduce the number of passenger pick up vans at the airport.

While 78 percent of airports reported that voluntary air carrier operational procedures to reduce aircraft emissions were not used at their airport, some airports have encouraged carriers to voluntarily reduce emissions through modified operational procedures. A ground no-idle policy was the most frequently policy cited (17 airports), followed by single-engine taxiing (11 airports). Aircraft ground operational procedures to reduce aircraft emissions are at the discretion of the pilot, and it is unknown to what extent such procedures are used at airports that have them.

The widest variety of emissions reducing actions reported in our survey were undertaken by larger airports, which tend to produce more emissions

and which may have more funding and staff available to address them than smaller airports. Almost all larger airports provided public bus access and taxi staging areas, while about 40 to 50 percent of larger airports also provided consolidated rental car facilities and access to rail stations. Most of the airports that reported encouraging air carriers to use modified operational procedures to reduce emissions were larger airports. In addition, the vast majority of larger airports had invested in emissions reducing systems, which are expensive and possibly more cost effective for larger airports than for smaller airports, which have limited numbers of commercial operations. These systems include:

- loading bridges that supply aircraft with electricity (59 airports) and pre-conditioned air (55 airports), which eliminate the need for aircraft to run their auxiliary engines to power and cool the aircraft at the gate;
- underground hydrant systems (47 airports), which reduce the need for fueling trucks and thus the emissions they produce; and
- fueling or charging stations for alternative fuel vehicles, including those using compressed natural gas, bio-diesel, electric, or hybrid technology (43 airports). Larger airports made up 54 of the 94 airports that reported having alternative fuel vehicles, including 21 of the 29 airports with vehicle fleets made up of at least 50 percent alternative fuel vehicles.

Airports in air quality nonattainment and maintenance areas can apply for funding from FAA's VALE program for the purchase of emissions reducing systems, as well as for alternative fuel vehicles. As of April 2010, 17 airports had qualified for a total of about \$49 million in VALE funding.

Larger airports also represented 42 of the 53 airports that undertook general emissions inventories, which estimate the amounts of emissions produced by airport sources (e.g., ground support equipment (GSE), and aircraft) in tons and may be required for environmental reviews of proposed airport projects. However, few larger airports conducted a more detailed analysis to determine the concentration of various pollutants in the airport vicinity—e.g., hazardous air pollutant analyses (17 airports) and air pollutant measurements (9 airports)—or conducted studies that assess the human health risks, such as the incidence of pollution related health effects in the airport vicinity, from emissions (3 airports).⁵⁴ These

⁵⁴According to EPA, approximately 29 million people live within 10 kilometers of a commercial service airport located in a nonattainment area.

types of detailed analyses and studies can be complex and resource intensive to conduct. In addition, according to FAA there is no clear federal guidance on conducting human health risk assessments.

Of the 92 airports that reported taking some action to reduce emissions, 9 provided estimates of reductions. For example, one airport estimated that providing electricity and preconditioned air at its gates reduced aircraft auxiliary engine usage and thus nitrogen oxide emissions by up to 10 tons per year. Another airport reported that it had constructed a compressed natural gas fueling station and converted its fleet of buses to natural gas, which eliminated 76 tons of emissions per year.⁵⁵

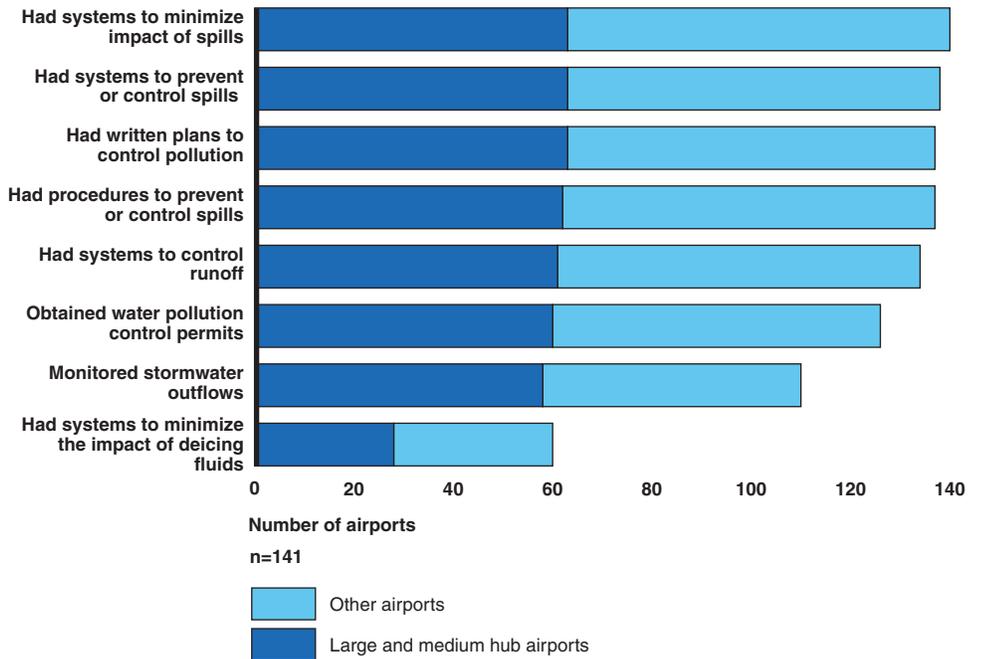
Almost All Responding Airports Took Multiple Steps to Control Water Pollution, Many of Which Were Required

Over 90 percent of responding airports have multiple systems and procedures in place to address water pollution. Many of these systems and procedures are those generally required to meet various environmental laws and regulations, such as those required to obtain National Pollution Discharge Elimination System (NPDES) permits.⁵⁶ For example, nearly all the airports we surveyed had Stormwater Pollution Prevention Plans, and a large majority had Spill Prevention, Control and Countermeasure Plans, which, as noted, many airports are required to develop in order to prevent and immediately clean up oil, chemical, and fuel spills. The vast majority of the airports we surveyed also had individual systems and procedures in place to prevent or control spills, which can be part of the aforementioned plans, as well as systems in place to minimize the impact of such spills (see fig. 4).

⁵⁵Estimates such as these do not take into account the full lifecycle costs of a particular technology or all of the relevant pollutants and their effects.

⁵⁶The Clean Water Act generally prohibits the discharge of pollutants into waters of the United States without a permit. 33 U.S.C. § 1342(a). In most cases, states administer the NPDES program, which regulates the discharge of pollutants from industrial, municipal, and other facilities.

Figure 4: Variety of Airport Actions Taken to Address Water Pollution



Source: GAO survey.

Likewise, most of the airports in our survey had obtained discharge permits such as a state issued NPDES permit, and 69 airports have state government water discharge permits, as appropriate. Surveyed airports have installed a variety of systems to control storm water runoff, many of which may have been necessary to meet their permit requirements, with the most common being catch basins (99 airports), detention ponds (96 airports), and vegetative filter strips, which are constructed areas of vegetation that remove sediment and other pollutants from surface water runoff by filtration, absorption, and decomposition (59 airports).⁵⁷ Most of the airports we surveyed (110) also monitored the water quality of storm water outflows.

Our survey indicates that larger airports are more likely to have systems in place to minimize the use and impact of runway and aircraft deicing fluids.

⁵⁷Such water quality measures must be designed to minimize their attraction to birds and wildlife that can collide with aircraft. See FAA Advisory Circular 150.5200-33B, *Hazardous Wildlife Attractions on or Near Airports*.

Deicing fluids are mainly used at commercial airports in colder climates,⁵⁸ and our survey shows that deicing is done at 82 (58 percent) of the total airports in our survey as compared to 53 (84 percent) of the larger airports. As indicated in figure 4, significantly higher percentages of larger airports that deice made greater use of practices and systems to minimize the use and impact of deicing fluids. As noted later in this report, effluent limit guidelines addressing airport deicing that EPA has proposed may require more airports to implement systems and practices to minimize the use and impact of deicing fluids.

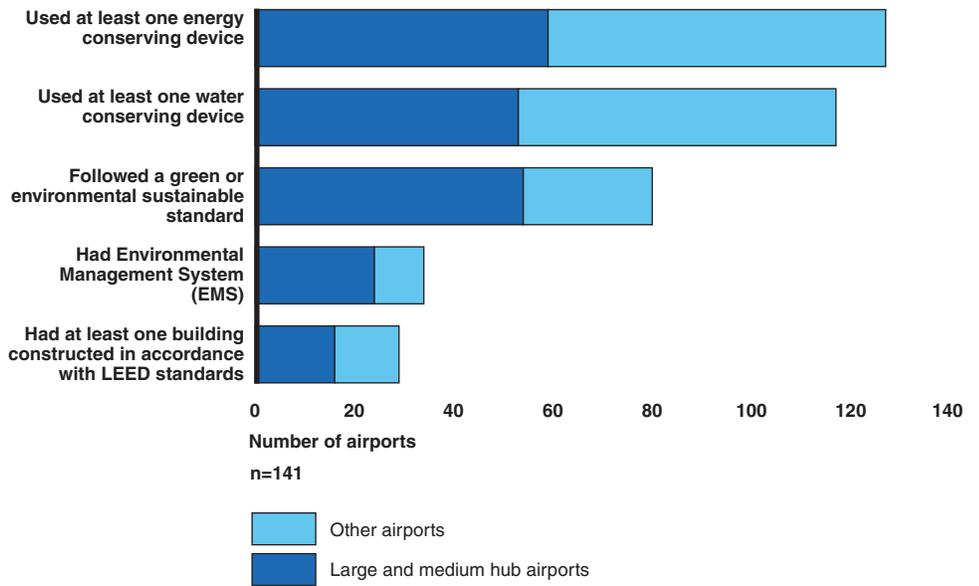
Well over half of the airports responding to our survey cited accomplishments resulting from their actions to control water pollution. Seventy-five airports said that their actions had a positive environmental impact, while 25 said that their actions helped improve compliance with water quality regulations. However, only two airports provided quantitative data on the impact of their actions. According to one of these airports, the installation of a large-scale deicing pad where much of the aircraft deicing was performed prevented 250,000 gallons of deicing fluid from contaminating nearby streams.

Most Airports Have Undertaken Various Conservation Practices, and an Increasing Number Intend to Make These Part of a More Holistic Approach to Environmental Management

Most surveyed airports reported using at least one “green” or environmentally sustainable practice. Based on the survey of airports, more intend to move toward a more holistic approach to environmental management, which involves a broader or more systematic approach to managing environmental impacts, such as following environmental sustainable standards or implementing an Environmental Management System (EMS) (see fig. 5).

⁵⁸See GAO, *Aviation Safety: Preliminary Information on Aircraft Icing and Winter Operations*, [GAO-10-441T](#) (Washington, D.C.: Feb. 24, 2010).

Figure 5: Variety of Actions Taken to Become More Environmentally Sustainable



Source: GAO survey.

The greatest number of airports reported relatively simple steps like using energy conserving devices. For example, 127 surveyed airports used at least one energy conservation device, and 117 airports used at least one water conservation device. Four energy conservation devices—Light-Emitting Diode (LED) airfield lights,⁵⁹ energy-efficient lighting, room occupancy sensors, and light-colored roofs to reflect sunlight—were used by at least 49 percent of larger airports. Three water conservation devices—both automatic shutoff and low-flow restroom plumbing fixtures and landscaping with native plants to reduce irrigation—were used by at least 42 larger airports. Between 50 to 80 percent of all surveyed airports reported recycling or reusing five of the six recyclable materials included in our survey, with paper, plastic, and aluminum recycled or reused by more airports than glass and building materials. By contrast, de-icing materials were reported as being recycled or reused for non aviation purposes by 12 of 82 surveyed airports that reported using de-icing or

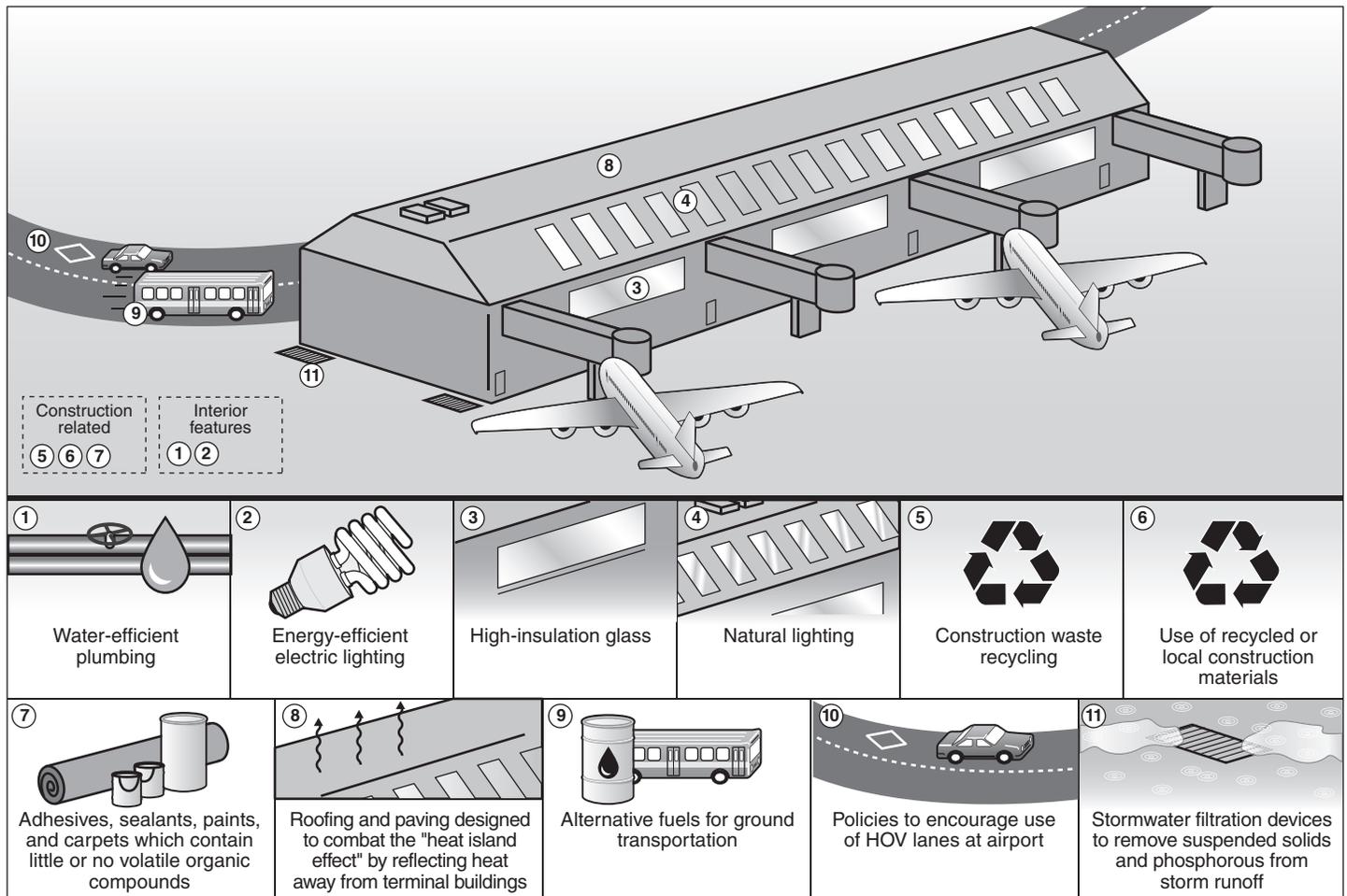
⁵⁹ According to an Airports Council International-North America (ACI-NA) official, LED lights may not melt ice and snow that accumulate on them and are, therefore, not used at some airports in colder climates.

anti-icing materials, although some of the airports may not use large quantities of these materials.

About 71 percent of larger airports, as compared to 57 percent overall, reported following “green” or environmental sustainability standards. These standards can assist airports in implementing practical and measurable green building design, construction, and operations and maintenance solutions, such as those shown in figure 6. Following such a standard is generally voluntary; 34 airports, however, said that compliance with such a standard was a state or local requirement. The Leadership in Energy and Environmental Design (LEED) Green Building Rating Systems was the most followed “green” standard, used by 54 surveyed airports (38 percent).⁶⁰ A LEED certified building indicates that an independent, third-party, has verified that the building project meets the highest green building and performance measures, as determined by the U.S. Green Building Council (USGBC).

⁶⁰LEED standards promote a whole-building approach to sustainability by recognizing performance in nine key areas of human and environmental health: sustainable site development, water savings, energy efficiency, materials selection, indoor environmental quality, location linkages, awareness and education, innovation in design, and regional priority.

Figure 6: Example of Features from a LEED-Certified Terminal



Source: GAO.

More airports reported plans to build in accordance with LEED standards than those that had already done so. For example, 29 airports had constructed a building in accordance with LEED standards, and 12 airports had at least one LEED-certified building.⁶¹ Fifty-five airports reported plans to build in accordance with LEED standards. While an

⁶¹Boston's Logan International Airport opened the world's first LEED-certified terminal in 2006. In late 2009, it also opened the nation's first runway repaved with "warm-mix" asphalt, which requires less energy to make, produces fewer GHG emissions when applied, and uses a higher percentage of recycled asphalt pavement.

airport official noted that LEED certification can raise the profile of a project for sustainable construction and operation within the community, about half of the 51 surveyed airports that had or planned to build in accordance with LEED standards cited cost as the reason why they had not or will not seek LEED certification. According to the USGBC, LEED standards are flexible enough to apply to all building types. Some airport officials we interviewed, however, said that LEED standards are difficult to adapt to airports. Surveyed airports reported following one of three airport-specific “green” standards.⁶² One of these three standards is outlined in Chicago O’Hare International Airport’s Sustainable Airport Manual (SAM), which was completed in 2009. It expanded on the airport’s predecessor manual, the 2003 Chicago O’Hare Modernization Program’s Sustainable Design Manual, by including lessons learned, new technologies, and best environmental practices used by airports worldwide. According to the Chicago Department of Aviation, SAM is intended to be an international model for airport sustainability and involved approximately 160 participants, including FAA, EPA, airports, and industry experts.

Survey responses to questions about voluntary EMSs also suggest that more airports are moving toward a more holistic, sustainable approach to operations and development.⁶³ An EMS is a set of procedures and policies used to systematically identify, evaluate, and manage the environmental impacts of an organization’s ongoing activities in order to improve environmental performance and regulatory compliance.⁶⁴ Thirty-four airports had adopted an EMS, while 35 airports planned to do so. Although the International Organization for Standardization (ISO) 14001 standards

⁶²Four large and medium hubs reported using the O’Hare Modernization Program’s Sustainable Design Manual. In addition, nine surveyed airports followed the Clean Airport Partnership’s Green Airports Initiative, including seven large and medium hubs, and two large and medium hubs used the Los Angeles Airports Sustainability Plan. Another 37 airports, including 23 large and medium hubs, reported using an environmental sustainability standard other than one listed in our survey.

⁶³A 2008 Airport Cooperative Research Program Report also noted that airports are moving toward a more holistic, sustainable approach to operations and development. *See* Transportation Research Board, *Airport Cooperative Research Program Synthesis 10 Report: Airport Sustainability Practices* (Washington, D.C.: Oct. 23, 2008).

⁶⁴See CEQ guidance. According to an FAA advisory, the EMS process to address environmental matters includes identifying and meeting environmental goals, determining progress, and making changes to ensure continual improvement. *See* FAA, Advisory Circular 150/5050-8, *Environmental Management Systems for Airport Sponsors* (Sept. 26, 2007).

for EMS require that an EMS identifies all environmental impacts, only 8 of the 34 surveyed airports that had an EMS said it covered all their airport operations.⁶⁵

As with all responding airports, more larger airports planned to build in accordance with LEED standards than those that reported having done so. Sixteen larger airports had built in accordance with LEED standards, and 32 planned to do so. Twenty-four larger airports had an EMS, while 22 planned having one. Larger airports comprised 70 percent of surveyed airports that had an EMS and 63 percent of those that plan to develop an EMS. In 2007 FAA expanded AIP funding eligibility for developing—although not maintaining—an EMS to large and medium hub airports.⁶⁶ As a condition of receiving AIP funding, the airport must submit a self-certification that its EMS is compliant with a recognized EMS standard. Larger airports comprised 15 of the 19 airports that reported their EMS followed ISO 14001 standards, EPA’s compliance-focused EMS (CFEMS) standards, or another recognized EMS standard.

⁶⁵According to FAA, most EMS frameworks are based on the ISO 14001 EMS model. Ten airports (about 23 percent of responding airports that had an EMS) reported following this standard. Seven airports reported using EPA’s standards, and two used other EMS standards. Four airports, including one large and medium hub, also reported that their EMS was third-party certified.

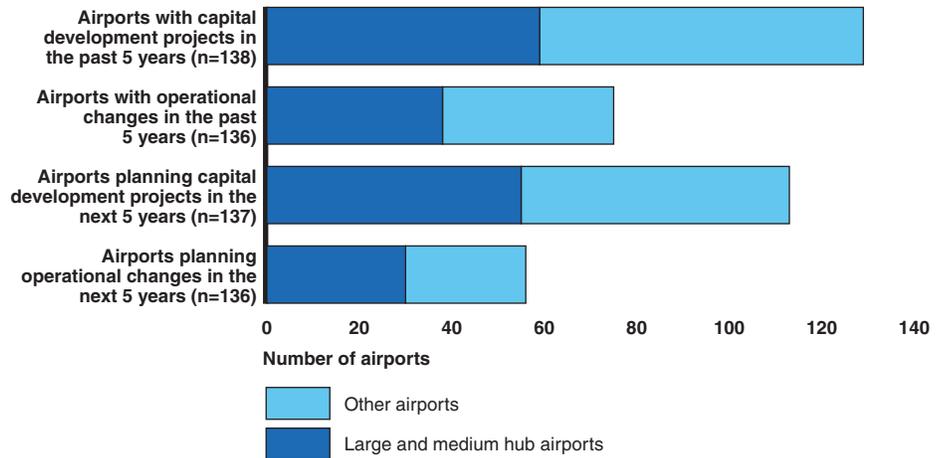
⁶⁶FAA Advisory Circular No.150/5050-8. As a condition of receiving AIP funding for the development of an EMS, an airport must maintain environmental records, conduct internal audits to ensure that the EMS is kept current, and annually submit to FAA management reviews of its EMS to demonstrate its continued currency. To date, one medium hub received grant funding in 2009 for a maximum \$1,250,000 to develop an EMS, another medium hub airport has applied for \$500,000 in fiscal year 2010 AIP funding for its EMS development.

**Less Than Half of
Airports That
Undertook or Will
Undertake Capital
Projects or
Operational Changes
Believed Addressing
an Environmental
Objective Resulted in
Delays**

**Almost All Surveyed
Airports Have Undertaken
or Will Undertake Capital
Development Projects or
Operational Changes**

Almost all of the nation's 150 busiest airports have faced in the 5-year period 2004-2009, or expect to face in the next 5 years, the challenge of implementing a timely and environmentally sound capital development project or operational change. As figure 7 shows, the vast majority of responding airports reported that (1) they undertook or considered undertaking a capital development project in the past 5 years, and that (2) they will undertake or are considering undertaking such a project in the next 5 years. The incidence is even higher for larger airports, where 59 of the 63 larger airports had undertaken a capital project in the last 5 years and 55 expect to do so over the next 5 years. About a third of responding airports reported that they implemented or considered implementing an operational change in the past 5 years, or will do so in the next 5 years.

Figure 7: Number of Airports That Have Undertaken or Will Undertake a Capital Development Project or Operational Change



Source: GAO survey.

Less than Half of Surveyed Airports Implementing Capital Development Projects or Operational Changes Believe Environmental Issues Delayed Their Efforts

In our survey, we asked airports to estimate how much, if at all, addressing a specified environmental objective delayed implementation of a capital project or an operational change at their airport in the past 5 years or will delay implementation in either of those categories in the next 5 years.⁶⁷ Both the reported delay and the extent and significance of delay were determined by the responding airport. During survey pre-testing, airport officials interpreted delay as meaning a change or deviation from the project or operational change’s original implementation timeline. For example, an airport’s concept of delay may include underestimating the time needed to comply with the NEPA process as well as unanticipated delay, such as delays resulting from litigation.⁶⁸ When asked how

⁶⁷Specifically, responding airports could indicate that implementation was not delayed, somewhat delayed, or greatly delayed.

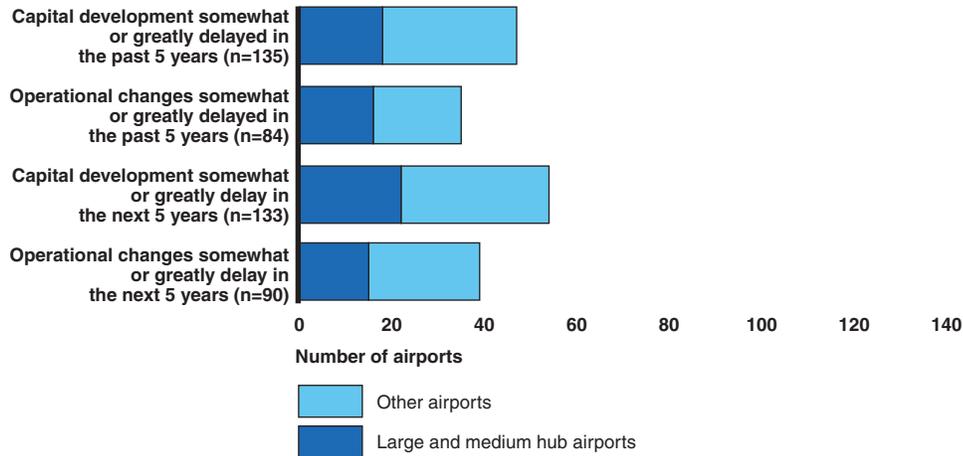
⁶⁸As previously discussed, FAA and airports are required under NEPA to identify and consider environmental issues for, among other things, airport construction projects that receive federal funding or operational changes that require FAA approval. DOT has explained that the NEPA environmental review process cannot be cleanly segregated from a project’s overall planning process. DOT, *Report to the U.S. Congress on Environmental Review of Airport Improvement Projects* (May 2001). As noted new runway construction from initial planning to completion takes a median of 10 years, but delays from lawsuits or addressing environmental issues can add an additional 4 years to the median time.

addressing an environmental objective delayed or will delay implementation, airports cited the time it takes to do necessary environmental studies, obtain permits, implement the necessary environmental systems, and take mitigating actions required for approval. Also, airports said that delays can arise because of community opposition or disputes over requirements or regulations with federal, state, or local regulators, or conflicting interpretations of requirements among these regulators. Airports face the challenge of managing the proposed projects and operational changes throughout the environmental review and implementation process, and according to a 2009 ACRP report, delays can significantly increase the costs or benefits of specific projects.⁶⁹

Thirty-five percent of airports that had considered or undertaken a capital project, and 42 percent of those that had considered or undertaken an operational change, over the last 5 years reported that addressing environmental issues somewhat or greatly delayed their implementation (see fig. 8). Forty-seven airports (35 percent) that have undertaken or considered undertaking a capital project over the last 5 years believe the project was greatly or somewhat delayed as a result of addressing an environmental objective. While fewer airports reported undertaking operational changes over the last 5 years, 35 airports (42 percent) believe that environmental issues greatly or somewhat delayed doing so. Of those airports that reported a delay, far fewer airports believed that their project was “greatly delayed” as opposed to “somewhat delayed.” For both capital projects and operational procedures, larger airports were slightly less likely to report a delay (30 percent and 36 percent, respectively). Looking to the future, about 40 percent of surveyed airports that reported implementing or considering implementing a capital development project or an operational change in the next 5 years believe that addressing an environmental objective will delay implementation. Larger airports were again slightly less likely than other airports to predict a delay.

⁶⁹Transportation Research Board of the National Research Council, *Airport Cooperative Research Program Report 15, Aircraft Noise: A Toolkit for Managing Community Expectations* (Washington, D.C.: 2009).

Figure 8: Number of Airports Reporting That Addressing Environmental Issues Somewhat or Greatly Delay Implementation of a Capital Development Project or an Operational Change in the Past 5 Years and Next 5 Years



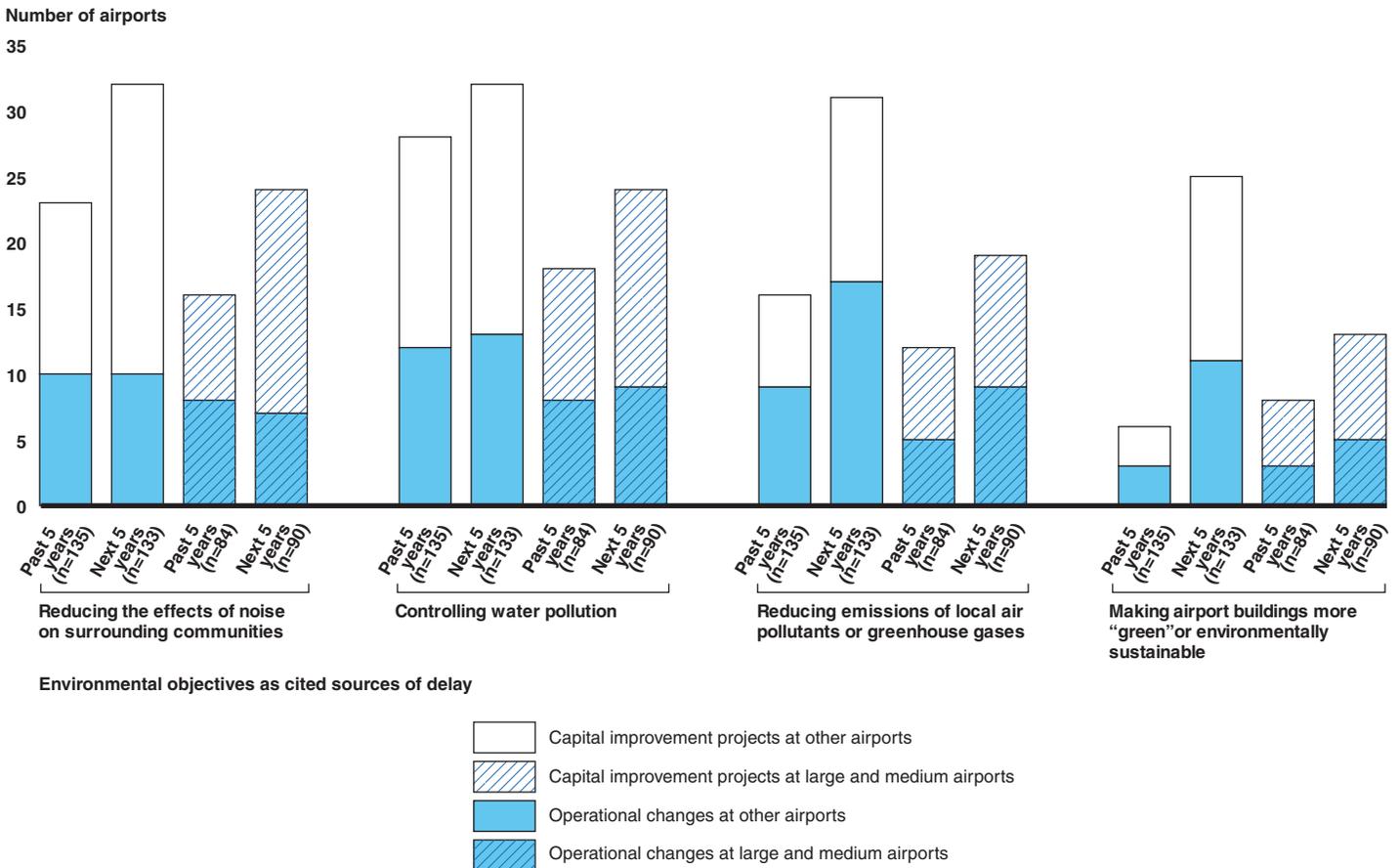
Source: GAO survey.

Addressing Noise and Water Issues Were the Most Frequently Cited Sources of Past Delay

Airports that believed they had experienced delay in the past most often associated the delay with addressing noise and water pollution, whereas airports appear to be increasingly concerned that addressing GHG emissions and “green” building standards will be a potential source of delay. Of the four environmental objectives listed in our survey, reducing noise impacts and controlling water pollution were consistently the two most frequently cited sources of past delay—by all responding airports and by larger airports—for both capital development projects and operational changes (see fig. 9).⁷⁰ As previously discussed, noise has traditionally been the environmental area of greatest concern to communities near airports, and airports are subject to a number of environmental requirements—including permitting requirements—with respect to controlling water pollution.

⁷⁰Airports were also asked to predict the extent to which addressing environmental issues other than those specified in our survey had caused or would cause a delay.

Figure 9: Environmental Objectives Cited as Sources of Delay in Implementation of Capital Development Projects and Operational Changes in the Past and Next 5 Years



Source: GAO survey.

When asked about potential delays in the next 5 years, airports generally believed that addressing water pollution and noise would remain the two top environmental sources of delay.⁷¹ Substantially more airports predicted that controlling air pollution and making buildings more “green” or more environmentally sustainable may cause a delay in the next 5 years than those issues did in the past 5 years (see fig. 9). Of the air issues,

⁷¹We have previously reported that according to a California air quality official, many of the same communities that have interacted with airports over aviation noise have more recently recognized that they could also be affected by emissions from airport sources. See [GAO-08-706T](#).

several airports expressed concern about controlling GHG emissions. This may reflect the increased attention that these other environmental issues have received in recent years. For example, when asked if addressing environmental objectives might delay the implementation of future projects and operational procedures, several airports said they anticipated increased scrutiny of environmental impacts or mentioned new or more stringent regulations, including the following.

- *Deicing*: EPA already requires that deicing fluid runoff that reaches navigable waters be subject to a NPDES permit. EPA's proposed effluent limitations rule would require primary commercial airports with annual departures of at least 10,000, and over 1,000 annual jet departures, to collect a specified minimum percentage of the amount of deicing fluid sprayed and treat it or send it off site for treatment.⁷² According to a recent ACRP report, because many large airports already have been working to address deicing discharges, the proposed rule may have its greatest affect on medium and smaller airports, where environmental regulators may previously have considered deicing operations and runoff too small to be of significant concern.
- *GHG*: EPA issued a rule effective December 29, 2009, requiring the reporting of greenhouse gas emissions from all sectors of the economy.⁷³ The rule applies to, among others, large facilities emitting 25,000 metric tons or more of CO₂ equivalent GHG emissions per year. According to an ACI-NA representative, approximately 10 airports may need to submit an annual GHG report to EPA. Unlike for noise and local air quality computations, the first specific guidance for airports in developing and computing GHG emission inventories was only issued in 2009.
- *Ozone*: In January 2010, EPA proposed more stringent ground-level ozone standards. Sixty-six responding airports are currently either in nonattainment and maintenance areas. The proposed standards will, according to EPA and FAA, increase the number of U.S. counties, and hence airports, that would be in nonattainment areas or maintenance areas and thus required to tighten controls on nitrogen oxides and some types of volatile organic compounds that also contribute to ozone formation.

⁷²*Effluent Limitation Guidelines and New Source Performance Standards for the Airport Deicing Category*, 74 Fed. Reg. 44676 (proposed August 2009).

⁷³74 Fed. Reg. 56260 (October 2009).

Several Environmental Strategies and Community Outreach Practices Can Help Airports Mitigate Delays and Address Environmental Issues

Some Airports Have Proactively Integrated Environmental Considerations into the Airport Planning Process

Incorporating environmental considerations early on in the planning process can help airports anticipate and address environmental impacts, as well as navigate the NEPA process. Such a holistic approach to managing environmental impacts, as opposed to an issue-by-issue approach to environmental issues, may also help airports address the broader range of environmental issues that a number of surveyed airports predicted could potentially affect implementation of capital projects and operational changes. We have previously reported on the benefits of conducting long-range environmental planning for federal highway projects.⁷⁴ For example, in 2008 we reported on legislative changes to the planning and environmental processes required of state and local transportation agencies for federally funded transportation projects. Several of these changes required early stakeholder participation, including (1) requiring plans for coordinating the participation of the public and federal and state agencies responsible for natural resources, environmental protection, and historic preservation; (2) obtaining public and resource agency participation in, and comment on, environmental reviews of projects; and (3) involving participating agencies and the public in defining a project's purpose and need and developing project alternatives. According to state departments of transportation,

⁷⁴GAO, *Highways and Environment: Transportation Agencies Are Acting to Involve Others in Planning and Environmental Decisions*, [GAO-08-512R](#) (Washington, D.C.: Apr. 25, 2008); GAO, *Surface Transportation: Many Factors Affect Investment Decisions*, [GAO-04-744](#) (Washington, D.C.: June 30, 2004); GAO, *Highway Infrastructure: Stakeholders' Views on Time to Conduct Environmental Reviews of Highway Projects*, [GAO-03-534](#) (Washington, D.C.: May 23, 2003); and GAO, *Highway Infrastructure: Perceptions of Stakeholders on approaches to Reduce Highway Project Completion Time*, [GAO-03-398](#) (Washington, D.C.: Apr. 9, 2003).

participating agencies, and other transportation stakeholders we contacted, these requirements may help improve project management, increase the likelihood of weeding out flawed alternatives early, and better inform and involve resource agencies.⁷⁵

Seven of the 10 airports we visited have incorporated long-range environmental planning into their airport master planning process. FAA has issued best practices for preparing EISs which stress the need for airports to consider environmental factors as early as possible in planning projects in order to successfully complete the environmental review process in the least amount of time,⁷⁶ and FAA noted it has conducted numerous workshops and conferences that encourage airports to integrate environmental issues into the planning process. According to Portland International Airport officials, expanding their 2000 airport master plan to include sections devoted to environmental planning and citizen involvement and communications reduced opposition to airport projects. A recent ACRP report also found that early stakeholder coordination and consultation generally facilitated the transition from the planning process to the environmental review process, and ultimately to the initiation of project construction.⁷⁷ Some airport officials and an aviation environmental expert also told us that early stakeholder engagement in the planning phase can improve stakeholder relationships and facilitate project implementation.⁷⁸ City of Chicago officials, for example, told us that their decision to conduct extensive outreach and coordination early in the planning process for a major expansion of O'Hare International Airport helped them address environmental concerns early, get resource agencies

⁷⁵GAO, *Highways and Environment: Transportation Agencies Are Acting to Involve Others in Planning and Environmental Decisions*, GAO-08-512R (Washington, D.C.: Apr. 25, 2008). Because the requirements were relatively new at the time of our report, stakeholders identified potential, rather than actual, benefits.

⁷⁶FAA recommends airports consider environmental factors early in airport planning, but notes that if an EIS is prepared long after an airport master plan, the planning data and environmental inventories prepared as part of the master planning may be outdated. FAA, *Best Practices for Environmental Impact Statement (EIS) Management* (Washington, D.C.: January 2002).

⁷⁷Transportation Research Board of the National Research Council, *Airport Cooperative Research Program Synthesis 17: Approaches to Integrating Airport Development and Federal Environmental Review Processes*, (Washington, D.C.: 2009). The report findings were based on 17 case studies, where airports used various practices to integrate airport development and the NEPA review processes.

⁷⁸Stakeholders can include contractors, tenants, metropolitan planning organizations (MPO), state environmental agencies, communities, and passengers.

and contractors on board in order to prevent potential delays and litigation, and gain project support from numerous communities surrounding the airport.

According to FAA, a number of airports have expressed interest in a new FAA pilot program that allows AIP funds to be used to support long-term airport environmental planning, be it in an airport master plan or a stand-alone sustainability document. Two airports (Ithaca Tompkins Regional Airport in New York and St. Augustine Airport in Florida) participated in the pilot program, and in April 2010, another eight airports were selected to participate. Selected airports must complete their long-term environmental plans within 2 years of receiving funding. FAA officials said they intend to track costs closely and ask airports for lessons learned to determine, among other things, (1) if there are differences in approaching environmental planning through an airport master plan, which most pilot participants are doing, or through a separate sustainability document; and (2) whether to require sustainability as a critical element in airport master plans.

Streamlining the Environmental Review Process for Capacity Enhancement Projects at Congested Airports May Reduce Delays

The Aviation Streamlining Approval Process Act of 2003, enacted as part of Vision 100, introduced environmental streamlining for three types of projects, including capacity enhancement projects at congested airports.⁷⁹ The environmental streamlining process enables FAA to better coordinate and expedite the environmental review process for such projects while complying with NEPA. According to FAA officials, three projects have successfully completed the streamlining process—projects at Chicago O’Hare International Airport, Philadelphia International Airport, and Ft Lauderdale-Hollywood International Airport—while three projects are currently being streamlined, and one or two new projects will likely begin

⁷⁹Pub. L. No. 108-176, §§ 302, 304, 308, 117 Stat. 2490, 2533-2540, codified at 49 U.S.C. § 47171 et seq. Under the act, a “congested airport” is an airport that accounted for at least 1 percent of all delayed aircraft operations in the United States in the most recent year for which such data is available and an airport listed in table 1 of the FAA Airport Capacity Benchmark Report 2001. An “airport capacity enhancement project” is a project for construction or extension of a runway, including any land acquisition, taxiway, or safety area associated with the runway or runway extension; and such other airport development projects as the Secretary of Transportation may designate as facilitating a reduction in air traffic congestion and delays. Pub. L. No. 108-176, § 304, 117 Stat. 2490, 2538, codified at 49 U.S.C. § 47175. Environmental streamlining can also be used for aviation safety and aviation security projects, but according to FAA officials, has yet to be used for these types of projects because the regular environmental review process seems to be working well.

the streamlining process in the next year. FAA and EPA officials underscored that streamlining of capacity projects is reserved for airports where expansion is critical for handling the growth of air traffic; can mandate only federal—and not state—participation in the coordinated and expedited review process, which according to FAA does not diminish the process, but makes it more efficient; and requires more staff resources than traditional environmental reviews.

According to FAA officials, airports have had limited interest in environmental streamlining, believing that it may add time to the environmental review process. While these officials acknowledged that the streamlining process requires more up-front time—agencies, for example, may initially negotiate a multiagency agreement that specifies each agency's roles and responsibilities and establishes review and permitting decision deadlines—they believe it expedites the overall review process. Both FAA and EPA officials, for example, said that streamlining expedited the EIS review for Chicago O'Hare's major modernization project. FAA officials noted that while a reviewing agency has occasionally fallen behind a decision deadline set forth in a multiagency streamlining agreement because of limited resources, FAA has used a liaison to help elevate the issue and obtain a relatively quick resolution. FAA officials also noted that state participation, which is encouraged by the act, is key to effective streamlining. They pointed to the EIS review at Philadelphia International Airport, which involved the cooperation of approximately 18 federal and state agencies. FAA officials said the Ft. Lauderdale-Hollywood International Airport streamlining process was not quite as smooth because FAA had to work separately with federal and state agencies. Several officials from federal agencies involved in the streamlined review process indicated that while they have met deadlines for completing their reviews, the reviews required more staff than usual and some stated that the reviews were not as detailed as they would have liked because their agency lacked the staff to dedicate someone full time to the endeavor.

FAA and EPA officials we interviewed generally agreed that weak planning by airports, which are responsible for planning projects at their facilities, can complicate the review process, even if the EIS the FAA is

required to prepare was slated for environmental streamlining.⁸⁰ The EIS for one environmental project, for example, has been through the streamlining process, but to date FAA has not issued its record of decision. According to FAA and EPA officials, the project was not a good candidate for streamlining because the airport was not far along enough in the environmental process to warrant federal agencies reviewing its documentation. Specifically, the airport had not fully determined the proposed project's benefits (e.g., reducing congestion or increasing operational efficiency) at the time when those benefits needed to be assessed against environmental impacts. As a result, the airport was suggesting project alternatives that were not fully vetted.

Integrating the EMS Processes and the NEPA Process Can Help Airports Mitigate and Reduce Their Environmental Impacts

In addition to helping airports better manage their day-to-day environmental impacts, an EMS's continuous self-monitoring cycle can help airports prepare for and address environmental issues that may arise during the NEPA process. As discussed above, about 80 surveyed airports have or plan to have an EMS. Both EPA and FAA endorse EMSs, and EPA has encouraged organizations to adopt them, underscoring that such systems have produced environmental benefits.⁸¹ In addition, ACI-NA has also set goals for its member airports to institute an EMS. Several airport officials we interviewed or who responded to our survey said that their EMSs had produced environmental benefits. Officials from one airport, for example, said that their EMS helped them establish pollution prevention, waste reduction, and energy efficiency goals for years, reduce the airport's environmental effects, and raise environmental awareness. Officials from another airport cited reduced disposal costs, emissions, and regulatory violations and penalties, and improved public opinion and relations with regulatory agencies. No airport official, however, mentioned their EMS in connection with preparing for the environmental review process.

⁸⁰According to these officials, other factors that may delay the environmental review process include the extent of public comments received, local politics, and limited resources of other federal and state environmental agencies that FAA coordinates with during the EIS process.

⁸¹See EPA Position Statement on Environmental Management Systems (EMS), Dec. 13, 2005 and FAA Order 5050.4B on the value of EMS. The International Civil Aviation Organization's (ICAO) Committee on Aviation Environmental Protection (CAEP) is preparing a report on the use of EMS and will recommend how the committee could promote the use of EMS within the aviation system. That report will be based on the results of a questionnaire on EMS use, which was distributed to member states and other organizations.

FAA, the Council on Environmental Quality (CEQ), and EPA, in conjunction with the Department of Energy (DOE), have each recognized the complementary nature—and encouraged the alignment—of the processes used in an EMS and the NEPA process. According to FAA, aligning the processes can, among other things, improve the quality of environmental analyses and decision-making.⁸² For example, FAA states that an EMS’s continuous evaluation of environmental aspects of operations may provide a compilation of information for analyzing the cumulative environmental effects of a proposed project. Similarly, EPA’s EMS Primer notes that integrating the two processes can help ensure that the right information gets to top decision makers in a timely manner.⁸³ CEQ guidance details how elements of the two processes, such as communicating with stakeholders, can be better aligned.⁸⁴

Effective Community Outreach Could Help to Mitigate Delays and Shape Environmental Actions

Airports that anticipate and effectively address community concerns about the environmental impacts of their daily operations, capital development projects, and operational changes during planning efforts are better positioned both to reduce the environmental impacts that are of most concern to the community and to minimize the likelihood of project implementation delays. In our survey, 21 airports said that a project was delayed because the community, environmental groups, or politicians opposed it on environmental grounds. Effective community outreach efforts by airports during their planning efforts and by FAA during the environmental process are critical. These efforts can enhance community members’ understanding of the roles of airport managers and FAA in airport operations and development and the competing demands that most

⁸²See FAA, Environmental Management Systems (EMS) and NEPA Adaptive Management (May 2004). FAA’s guidance focuses on how an EMS can improve the NEPA process by supporting an adaptive management approach for projects that face uncertain or unforeseen conditions during implementation. We have previously reported on the benefits of using an adaptive management approach. GAO, *FAA Airspace Redesign: An Analysis of the New York/New Jersey/Philadelphia Project*, [GAO-08-786](#) (Washington, D.C.: July 31, 2008).

⁸³DOE and EPA, Environmental Management Systems Primer for Federal Facilities (1998). According to the Primer, the systematic nature of the EMS allows for a more inclusive and proactive view of environmental protection. In turn, demonstrating improved environmental performance and making the environmental management structure and procedure more visible can lead to improved relations with regulators, stakeholders, and the public.

⁸⁴See CEQ, Aligning National Environmental Policy Act Processes With Environmental Management Systems, *A Guide for NEPA and EMS Practitioners* (April 2007).

airports must balance. This understanding can help manage community expectations and facilitate community and airport cooperative efforts to address environmental concerns while meeting operational needs. ACRP's Community Toolkit predicts that community attitudes toward expanded and new airports will become an even more important element of airport system planning in light of anticipated increases in air travel demand.

Our survey asked airports about certain aspects of their community outreach efforts, including what environmental information they made available to the public, how they conducted community outreach, and whether they evaluated the effectiveness of their community outreach efforts. As discussed below, their responses, along with interviews with airport and FAA staff and community group members, show that many airports are using some community outreach practices that we and others have identified as effective.⁸⁵ However, our survey results and interviews also suggest that a number of airports could incorporate more effective community outreach practices, particularly with respect to evaluating their outreach efforts.

Actively solicit stakeholder input and make key information readily available and understandable to all. Airports during their planning efforts should seek input from all community members that could potentially be affected by an airport decision or airport operations to ensure that all viewpoints are considered. A majority of responding airports used each of the following outreach methods identified in our survey—airport Web sites, local newspapers, and mail or e-mail—to notify community members of meetings, events, or news, while only 9 percent used social media, such as Facebook or Twitter. Community members should also have access to and understand airport environmental and planning information in order to meaningfully participate in the process. Over half of responding surveyed airports—and about 70 percent of larger airports—used at least one of the methods identified in our survey to make airport-related information readily available to community members.

⁸⁵We have previously identified seven core principles for effective stakeholder participation based on our review of participation literature and policies from leading federal agencies in stakeholder participation, including the three discussed in this report which are applicable to airports. See *Fisheries Management: Core Principles and a Strategic Approach Would Enhance Stakeholder Participation in Developing Quota-Based Programs*, [GAO-06-289](#) (Washington, D.C.: February 2006). ACRP's Community Toolkit also identifies strategies for effective community engagement programs, many of which substantively mirror the effective stakeholder participation practices we identified.

Noise issues have often been the focus of airport efforts to make information understandable to the public.

In the future, airports may need to extend their outreach efforts to communities that they have not worked with in the past in order to reach all community members that could potentially be affected by airport operations, capital development projects, and new operational procedures. For example, with the changes in aircraft flight paths that will accompany NextGen and airspace redesign efforts, some communities that were previously unaffected by noise will be exposed to noise and may have concerns about those higher noise levels. We have also reported that noise complaints and demands for action to address noise are coming increasingly from outside the DNL contours where homes are not eligible for federal soundproofing assistance.⁸⁶

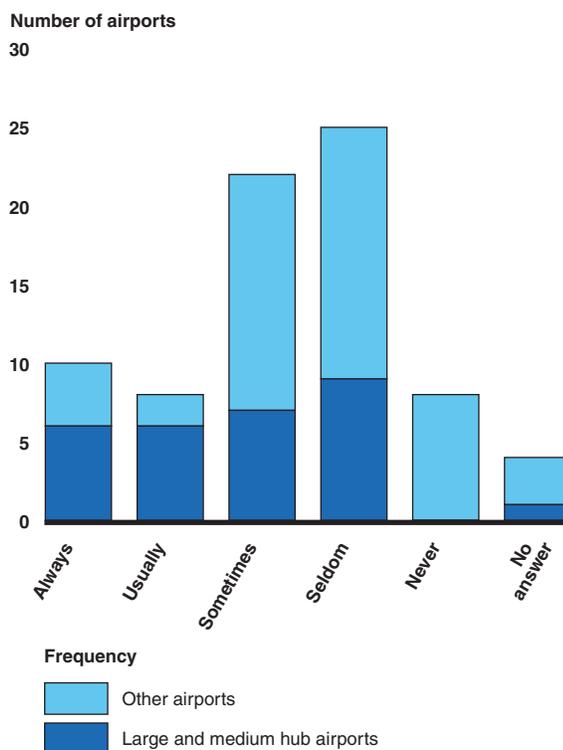
Actively foster responsive, interactive communications. Interactive communication—both through formal forums, such as hearings, and informal meetings, which tend to provide a more collegial atmosphere—promotes understanding between community members and decision makers.⁸⁷ The results of our survey, which focused on more formal community participation methods, show that 109 airports, including 49 larger airports—or just over 75 percent of all airports—reported holding public meetings. Several airport officials also told us they hosted informal meetings and other informal community events. In addition, 79 surveyed airports (56 percent), including 30 larger airports (48 percent) reported that their airport had a community roundtable or advisory committee that meets on a regularly-scheduled, ongoing basis. Our survey asked airports how often FAA officials, community group representatives, the general public, airport staff, air carrier staff, and consultants, attend community roundtable or community advisory committee meetings. As shown in figure 10, the 79 airports that had community roundtables and advisory committees reported varying levels of participation by FAA officials. Furthermore, of the six stakeholder groups identified in the survey, airports said FAA officials were the least likely group to “always” or “usually” attend and the most likely group to “seldom” or “never” attend.

⁸⁶ GAO, *Aviation and the Environment: Impact of Aviation Noise on Communities Presents Challenges for Airport Operations and Future Growth of the National Airspace System*, [GAO-08-216T](#) (Washington, D.C.: October 2007).

⁸⁷ *Ibid.* According to the ACRP Community Toolkit, two-way airport-community communications is critical for effective community outreach.

Our survey did not ask the extent to which airports invited these stakeholder groups to attend community roundtables or advisory meetings.⁸⁸

Figure 10: Surveyed Airports Responses to How Often FAA Officials Attend Community Roundtable or Advisory Committee Meetings



Source: GAO survey.

Note: Of 141 surveyed airports, 79 airports responded to this question.

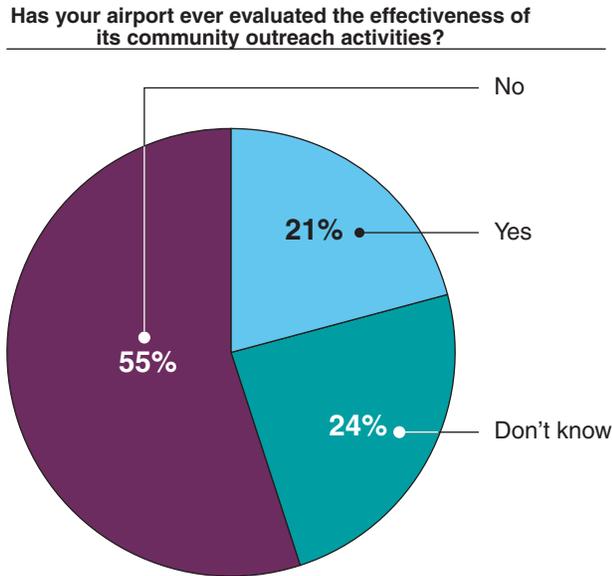
Because FAA plays a critical role in everyday airport operations, as well as in development projects and operational changes, its involvement in airport community forums can also enhance the effectiveness of community outreach efforts. FAA’s Best Practices for EIS Management acknowledges that community confidence in FAA’s commitment to

⁸⁸Our survey asked about community roundtable and advisory committee meetings that are regularly-scheduled and ongoing. These meetings may include, but are not limited to meetings and workshops that take place during the environmental review process.

effective environmental mitigation, as well as reasonable access to FAA staff to answer questions, help build local consensus and address community opposition. Accordingly, it recommends that knowledgeable people, “usually a combination of airport proprietor staff, EIS consultants, and FAA,” attend informal community workshops during the environmental review process. Several airports we visited indicated that these roundtables or advisory committees were their most effective airport community participation program.

Evaluate outreach efforts to enhance strategic community outreach. Both our previous work and ACRP’s Community Toolkit underscore the importance of approaching community outreach strategically. We previously reported that a strategic approach requires that an airport identify all potentially affected or interested community members, define participation goals, create a plan for community participation, evaluate the results of its strategic approach, and make adjustments as needed. ACRP’s Community Toolkit recommends that airports evaluate their community outreach program, including conducting a self-assessment of their program at least annually. Few airports responding to our survey, however, indicated that they had ever evaluated the effectiveness of their community outreach activities (see fig. 11). Larger airports were not more likely to evaluate the effectiveness of their community outreach activities: Of the 29 airports (21 percent) that had done so, 11 were larger airports (17 percent). Airports that do not evaluate the effectiveness of their outreach efforts may be missing opportunities to identify and address weaknesses from their community participation efforts. For example, after surveying local communities, one of the airports we surveyed focused its outreach around those issues the public said they did not fully understand.

Figure 11: Surveyed Airport Responses to Question about Evaluating Effectiveness of Community Outreach Activities



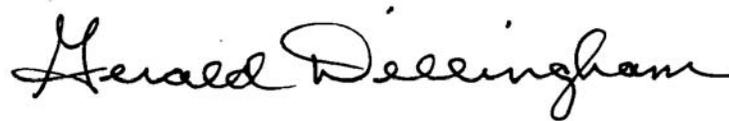
Source: GAO survey.

Agency Comments

We provided a draft of this report to the Department of Transportation (DOT) and EPA for review and comment. We also provided a draft to the American Association of Airport Executives (AAAE) and ACI-NA in order to obtain comments reflecting the perspectives of airports and airport officials. DOT, EPA, and ACI-NA provided technical clarifications, which we incorporated into the report as appropriate.

As agreed with your office, unless you publicly announce the contents of this report earlier, we plan no distribution of this report until 8 days from the report date. At that time, we will send copies of this report to the Administrators of FAA and EPA and appropriate congressional committees. In addition, the report is available at no charge on the GAO Web site at <http://www.gao.gov>.

If you or your staff have any questions concerning this report, please contact me at (202) 512-2834 or dillingham@gao.gov. Contact points for our offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff that made major contributions to this report are listed in appendix IV.

A handwritten signature in black ink that reads "Gerald Dillingham". The signature is written in a cursive style with a large, prominent "G" and "D".

Gerald L. Dillingham, Ph.D.
Director, Physical Infrastructure Issues

Appendix I: Objectives, Scope, and Methodology

This report addressed the following objectives: (1) the actions that airports have taken to reduce environmental impacts of airport operations and development, (2) the extent to which airports believe that environmental issues have or will delay capital projects or operational changes, and (3) the strategies airports can adopt to mitigate delays in implementing capital projects and operational changes and address environmental issues.

To address all of these objectives, we used a variety of methods and sources of information. We reviewed and synthesized information from relevant literature and our body of work on airport-related environmental issues. We interviewed officials from the Federal Aviation Administration (FAA), the Environmental Protection Agency (EPA), associations representing major airports in the United States, and selected environmental advocacy groups. We also interviewed officials from 10 airports (see app. II), selected to include airports that have one or more of the following characteristics: have undertaken efforts to become “green” or more environmentally sustainable; have participated in FAA’s Voluntary Airport Low Emissions (VALE) program; have been identified by FAA’s Operational Evolution Partnership (OEP) or Future Airport Capacity Task 2 (FACT 2) studies as needing additional capacity; have community groups involved in environmental issues or have taken steps to reach out to such groups; are located in nonattainment or maintenance areas for identified criteria pollutants; and are dispersed in various regions of the country. As part of our work regarding these airports, we also interviewed FAA representatives from headquarters and 5 regional offices, officials from 6 regional EPA offices, 12 relevant state and local environmental regulatory agencies, 2 environmental advocacy groups, 7 metropolitan planning organizations, 3 aviation environmental experts, and 10 community groups.

We also conducted a Web-based survey of knowledgeable airport officials from the 150 busiest U.S. airports in terms of the number of operations (departures or arrivals) from FAA’s 2008 Air Carrier Activity Information System database. The survey and its results are available on the GAO Web site at [GAO-10-748SP](#). Since responses to surveys are often subject to non-sampling errors, we attempted to minimize these errors by taking several precautions during the questionnaire design. To structure and gather expert opinions from the airport officials for the survey, we employed a pilot survey and obtained opinions from 19 airport officials using questionnaires administered over the Internet, which ran from September 28 to October 10, 2008. We asked the airport officials to respond to 16 open-ended questions about the actions they take to reduce or control

noise problems, water pollution, airport emissions and other environmental problems, and about the factors that help and that hinder airports in doing so. We performed a content analysis of the responses to these open-ended questions in order to help us design a comprehensive airport environmental survey consisting of both close-ended and open-ended questions on the environmental impacts associated with the development and operations of airports and the actions airports are taking to balance these concerns. We pre-tested the comprehensive airport environmental survey with seven airports to ensure that the questionnaire was clear and unambiguous, and did not place undue burden on individuals completing it. We made relevant changes to the content and format of the final questionnaire as a result of these pretests. The questionnaire was administered on the Internet to the 150 busiest U.S. airports from March 25 to June 8, 2009. We received responses from 141 airports, resulting in a 94 percent response rate. Appendix II provides the complete list of airports that responded to our survey.

We conducted this performance audit from January 2008 through September 2010 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Appendix II: List of Airports That Responded to Our Survey and We Visited

Airport, location, and type								
Name	ID	City	State	Type	OEP	FACT 2	VALE	Nonattainment
Acadiana Regional	ARA	New Iberia	LA	GA				
Addison	ADS	Dallas	TX	R				
Albuquerque International Sunport	ABQ	Albuquerque	NM	MH			2009	X
Arlington Municipal	GKY	Arlington	TX	R				
Austin-Bergstrom International	AUS	Austin	TX	MH				
Baltimore/Washington International Thurgood Marshall	BWI	Baltimore	MD	LH	X			X
Barnstable Municipal-Boardman /Polando Field	HYA	Hyannis	MA	NP				X
Bob Hope	BUR	Burbank	CA	MH				X
Boeing Field/King County International	BFI	Seattle	WA	NP				X
Brackett Field	POC	La Verne	CA	R				
Bradley International	BDL	Windsor Locks	CT	MH				X
Buffalo Niagara International	BUF	Buffalo	NY	MH				X
Camarillo	CMA	Camarillo	CA	R				
Castle	MER	Merced	CA	GA				
Centennial	APA	Denver	CO	R				
Charlotte/Douglas International	CLT	Charlotte	NC	LH	X	X		
Chicago Midway International	MDW	Chicago	IL	LH	X	X		
Chicago O'Hare International*	ORD	Chicago	IL	LH	X	X		
Chino	CNO	Chino	CA	R				
Cincinnati/Northern Kentucky International	CVG	Covington	KY	MH	X		2009	X
City of Colorado Springs Municipal	COS	Colorado Springs	CO	SH				X
Cleveland-Hopkins Municipal	CLE	Cleveland	OH	MH	X			X
Craig Municipal	CRG	Jacksonville	FL	R				
Dallas Love Field	DAL	Dallas	TX	MH				X
Dallas/Fort Worth International	DFW	Dallas/Ft Worth	TX	LH	X			X
Daytona Beach International	DAB	Daytona Beach	FL	NP				
Dekalb-Peachtree	PDK	Atlanta	GA	R				
Denver International	DEN	Denver	CO	LH	X			X
Detroit Metropolitan Wayne County	DTW	Detroit	MI	LH	X		2007	X
Eppley Airfield	OMA	Omaha	NE	MH				X
Ernest A. Love Field	PRC	Prescott	AZ	NH				

**Appendix II: List of Airports That Responded
to Our Survey and We Visited**

Airport, location, and type								
Name	ID	City	State	Type	OEP	FACT 2	VALE	Nonattainment
Executive	ORL	Orlando	FL	R				
Falcon Field	FFZ	Mesa	AZ	R				
Flying Cloud	FCM	Eden Prairie	MN	R				
Fort Lauderdale Executive	FXE	Fort Lauderdale	FL	R				
Fort Lauderdale/Hollywood International	FLL	Fort Lauderdale	FL	LH	X	X		
Fort Worth Meacham International	FTW	Fort Worth	TX	R				
General Edward Lawrence Logan International	BOS	Boston	MA	LH	X	X		X
General Mitchell International	MKE	Milwaukee	WI	MH				X
George Bush Intercontinental/Houston	IAH	Houston	TX	LH	X	X	2005	X
Gillespie Field	SEE	San Diego/El Cajon	CA	R				
Glendale Municipal	GEU	Glendale	AZ	R				
Grand Forks International	GFK	Grand Forks	ND	NP				
Hartsfield-Jackson Atlanta International	ATL	Atlanta	GA	LH	X	X		X
Hayward Executive	HWD	Hayward	CA	R				
Honolulu International	HNL	Honolulu	HI	LH	X			
Indianapolis International	IND	Indianapolis	IN	MH				X
John F. Kennedy International*	JFK	New York	NY	LH	X	X		X
John Wayne Airport-Orange County	SNA	Santa Ana	CA	MH		X		X
Kahului	OGG	Kahului	HI	MH				
Kansas City International	MCI	Kansas City	MO	MH				
Kendall-Tamiami Executive	TMB	Miami	FL	R				
Kissimmee Gateway	ISM	Orlando	FL	R				
Kona International at Keahole	KOA	Kailua/Kona	HI	SH				
LaGuardia	LGA	New York	NY	LH	X	X		X
Lakeland Linder Regional	LAL	Lakeland	FL	R				
Lambert-St. Louis International	STL	St. Louis	MO	MH	X			X
Laurence G. Hanscom Field	BED	Bedford	MA	NP				X
Lehigh Valley International	ABE	Allentown	PA	SH				X
Livermore Municipal	LVK	Livermore	CA	R				
Long Beach/Daugherty Field*	LGB	Long Beach	CA	SH		X		X
Long Island MacArthur	ISP	Islip	NY	SH				X
Los Angeles International*	LAX	Los Angeles	CA	LH	X	X		X

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Name	ID	City	State	Type	OEP	FACT 2	VALE	Nonattainment
Louis Armstrong New Orleans International	MSY	New Orleans	LA	MH				
Louisville International –Standiford Field	SDF	Louisville	KY	MH				X
Luis Munoz Marin International	SJU	San Juan	PR	MH				
McCarran International	LAS	Las Vegas	NV	LH	X	X		X
McClellan-Palomar	CRQ	Carlsbad	CA	NP				X
McGhee Tyson	TYS	Knoxville	TN	SH				X
Meadows Field	BFL	Bakersfield	CA	NP				X
Melbourne International	MLB	Melbourne	FL	NP				
Memphis International	MEM	Memphis	TN	MH	X			X
Merrill Field	MRI	Anchorage	AK	NP				X
Metropolitan Oakland International	OAK	Oakland	CA	MH		X	2010	X
Miami International	MIA	Miami	FL	LH	X			
Minneapolis-St Paul International/Wold Chamberlain	MSP	Minneapolis	MN	LH	X	X		X
Montgomery Field	MYF	San Diego	CA	R				
Morristown Municipal	MMU	Morristown	NJ	R				
Nantucket Memorial	ACK	Nantucket	MA	NP				X
Napa County	APC	Napa	CA	R				
Naples Municipal*	APF	Naples	FL	NP				
Nashville International	BNA	Nashville	TN	MH				
Newark Liberty International	EWR	Newark	NJ	LH	X	X		X
Norman Y. Mineta San Jose International	SJC	San Jose	CA	MH			2009	X
North Las Vegas	VGT	Las Vegas	NV	NP				X
North Perry	HWO	Hollywood	FL	R				
Oakland County International	PTK	Pontiac	MI	R				
Ontario International	ONT	Ontario	CA	MH				X
Orlando International	MCO	Orlando	FL	LH	X			
Orlando Sanford International	SFB	Orlando	FL	SH				
Ormond Beach Municipal	OMN	Ormond Beach	FL	R				
Palm Beach International*	PBI	West Palm Beach	FL	MH		X		
Palo Alto Airport of Santa Clara County	PAO	Palo Alto	CA	R				
Philadelphia International*	PHL	Philadelphia	PA	LH	X	X	2008	X
Phoenix Deer Valley	DVT	Phoenix	AZ	R				
Phoenix Goodyear	GYR	Goodyear	AZ	R				

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Name	ID	City	State	Type	OEP	FACT 2	VALE	Nonattainment
Phoenix Sky Harbor International	PHX	Phoenix	AZ	LH	X	X		X
Phoenix-Mesa Gateway	IWA	Phoenix	AZ	R				X
Pittsburgh International	PIT	Pittsburgh	PA	MH	X			X
Pompano Beach Airpark	PMP	Pompano Beach	FL	GA				
Port Columbus International	CMH	Columbus	OH	MH				X
Portland International*	PDX	Portland	OR	MH	X			X
Portland-Hillsboro	HIO	Portland	OR	R				
Pueblo Memorial	PUB	Pueblo	CO	CS				
Raleigh-Durham International	RDU	Raleigh/Durham	NC	MH				X
Ramona	RNM	Ramona	CA	R				
Reid-Hillview of Santa Clara County	RHV	San Jose	CA	R				
Reno-Tahoe International	RNO	Reno	NV	MH				X
Republic	FRG	Farmingdale	NY	R				
Richard Lloyd Jones Jr	RVS	Tulsa	OK	R				
Rocky Mountain Metropolitan	BJC	Denver	CO	R				
Ronald Reagan Washington National	DCA	Arlington	VA	LH	X			X
Ryan Field	RYN	Tucson	AZ	R				
Sacramento International	SMF	Sacramento	CA	MH				X
Salt Lake City International	SLC	Salt Lake City	UT	LH	X			X
San Antonio International	SAT	San Antonio	TX	MH		X		
San Carlos	SQL	San Carlos	CA	R				
San Diego International	SAN	San Diego	CA	LH	X	X		X
San Francisco International	SFO	San Francisco	CA	LH	X	X	2009	X
Santa Monica Municipal	SMO	Santa Monica	CA	R				
Sarasota/Bradenton International	SRQ	Sarasota/Bradenton	FL	SH				
Scottsdale	SDL	Scottsdale	AZ	R				
Seattle-Tacoma International*	SEA	Seattle	WA	LH	X	X		X
Snohomish County (Paine Field)	PAE	Everett	WA	R				
Space Coast Regional	TIX	Titusville	FL	GA				
St. Lucie County International	FPR	Fort Pierce	FL	GA				
St. Petersburg-Clearwater International	PIE	St. Petersburg-Clearwater	FL	NP				
Stinson Municipal	SSF	San Antonio	TX	R				
Tampa International	TPA	Tampa	FL	LH	X			

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Airport, location, and type								
Name	ID	City	State	Type	OEP	FACT 2	VALE	Nonattainment
Ted Stevens Anchorage International	ANC	Anchorage	AK	MH				X
Teterboro	TEB	Teterboro	NJ	NP				X
Tucson International	TUS	Tucson	AZ	MH		X		X
Tulsa International	TUL	Tulsa	OK	SH				
Van Nuys	VNY	Van Nuys	CA	R				
Vero Beach Municipal	VRB	Vero Beach	FL	GA				
Washington Dulles International	IAD	Chantilly	VA	LH	X	X		X
Westchester County	HPN	White Plains	NY	SH			2008	X
Wichita Mid-Continent	ICT	Wichita	KS	SH				
Will Rogers World	OKC	Oklahoma City	OK	SH				
William P. Hobby	HOU	Houston	TX	MH		X	2006	X
Zamperini Field	TOA	Torrance	CA	R				

Source: GAO analysis of FAA data.

Notes:

An asterisk beside an airport indicates we visited that airport. We also visited but did not survey Southwest Florida International Airport (RSW) in Fort Myers, Fl., for a total of 10 airports.

Airport categories based on passenger boardings:

LH=large hub commercial service airport with 1 percent or more of total annual passenger boardings

MH=medium hub commercial service airport with at least 0.25 percent but less than 1 percent of total annual passenger boardings

SH=small hub commercial service airport with at least 0.05 percent but less than 0.25 percent of total annual passenger boardings

NH=nonhub commercial service airport with at least 10,000 boardings but less than 0.05 percent of total annual passenger boardings

CS=nonprimary commercial service airport with more than 2,500 boardings but less than 10,000 enplanements

GA=general aviation airport

R=reliever airport, an airport designated by the FAA to relieve congestion at a commercial service airport and to provide improved general aviation access to the overall community. A reliever airport may be publicly or privately-owned.

Large and medium hub airports are from FAA's 2008 Enplanement Data.

The Future Airport Capacity Task 2 (FACT 2) airports are airports and metropolitan areas needing additional capacity in 2025 without planned improvements.

VALE = Voluntary Airport Lower Emissions program and the year the airport first participated.

Nonattainment and maintenance = If the airport resided within this EPA designated area as of January 23, 2009

Appendix III: GAO Contact and Staff Acknowledgments

GAO Contact

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Staff Acknowledgments

In addition to the contact named above, Paul Aussendorf (Assistant Director), Ed Laughlin (Assistant Director), Mark Braza, Lauren Calhoun, Jim Geibel, Brandon Haller, Nick Jepson, Delwen Jones, Kirsten Lauber, Rosa Leung, Jessica Lucas-Judy, Heather May, Kelly Rubin, and Jerry Sandau made key contributions to this report.

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